

ANNEX 6

**RESOLUTION MSC.461(101)
(adopted on 13 June 2019)**

**AMENDMENTS TO THE INTERNATIONAL CODE ON THE ENHANCED PROGRAMME
OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS
AND OIL TANKERS, 2011 (2011 ESP CODE)**

THE MARITIME SAFETY COMMITTEE,

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

RECALLING ALSO resolution A.1049(27), by which the Assembly adopted the International Code on the Enhanced Programme of Inspections during Surveys of Bulk Carriers and Oil Tankers, 2011 ("2011 ESP Code"), which has become mandatory under chapter XI-1 of the International Convention for the Safety of Life at Sea, 1974 ("the Convention"),

RECALLING FURTHER Article VIII(b) and regulation XI-1/2 of the Convention concerning the procedure for amending the 2011 ESP Code,

HAVING CONSIDERED, at its 101st session, amendments to the 2011 ESP Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the 2011 ESP Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2020 unless, prior to that date, more than one third of the Contracting Governments to the Convention, or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified the Secretary-General of their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2021 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, for the purposes of article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 REQUESTS ALSO the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

**AMENDMENTS TO THE INTERNATIONAL CODE ON THE ENHANCED PROGRAMME
OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS
AND OIL TANKERS, 2011 (2011 ESP CODE)**

The complete text of the 2011 ESP Code is replaced by the following:

"Preamble

The ESP Code has been developed to provide a consistent survey standard for the regular and safe survey of the cargo and ballast areas of oil tankers and bulk carriers. The intention of the Code is to ensure that an appropriate level of review of plans and documents is conducted and consistency in application is attained. Such review of survey reports, survey programmes and planning documents should be carried out at the managerial level of the Administration or organization recognized by the Administration (hereinafter both are referred to as "the Administration").

Parts A and B of annex A of the Code provide the requirements for bulk carriers with single-side skin and double-side skin construction respectively. Parts A and B of annex B of the Code provide the requirements for oil tankers with double-hull and non-double-hull construction respectively. The requirements of part A of annex B are also applicable to existing double hull tankers not complying with MARPOL regulation I/19, but which have a U-shaped midship section. For single-side skin combination carriers (ore and oil carriers) requirements are specified in the Code set out in part A of annex A and part B of annex B. For double-side skin combination carriers (ore and oil carriers) requirements are specified in the Code set out in part B of annex A and part A of annex B.

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CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING THE SURVEYS OF BULK CARRIERS

Part A

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING SINGLE-SIDE SKIN CONSTRUCTION

1 General

1.1 *Application*

1.1.1 The Code shall apply to all self-propelled bulk carriers of 500 gross tonnage and above other than double-side skin bulk carriers as defined in paragraph 1.2.1 of part B of annex A.

1.1.2 The Code shall apply to surveys of hull structure and piping systems in way of cargo holds, cofferdams, pipe tunnels, void spaces, fuel oil tanks, within the cargo length area and all ballast tanks.

1.1.3 The Code contains the minimum extent of examination, thickness measurements and tank testing. The survey shall be extended when substantial corrosion and/or structural defects are found and include additional close-up survey when necessary.

1.1.4 Ships subject to compliance with regulation XII/6.1 of the Convention should be subject to the additional thickness measurement guidance contained in annex 11.

1.1.5 Ships subject to compliance with resolution MSC.168(79) shall be subject to the additional thickness measurement guidance contained in annex 15.

1.1.6 For bulk carriers with hybrid cargo hold arrangements, e.g. with some cargo holds of single-side skin and others of double-side skin, the requirements of part B of annex A shall apply to cargo holds of double-side skin and associated wing spaces.

1.1.7 The surveys shall be carried out during the surveys prescribed by regulation I/10 of the Convention, unless expressly provided otherwise in this Code.

1.2 *Definitions*

1.2.1 *Bulk carrier* is a ship which is constructed generally with single deck, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk and includes combination carriers.

1.2.2 *Ballast tank* is a tank which is used primarily for salt water ballast, or, where applicable, a space which is used for both cargo and salt water ballast will be treated as a ballast tank when substantial corrosion has been found in that space.

1.2.3 *Spaces* are separate compartments including holds, tanks, cofferdams and void spaces bounding cargo holds, decks and the outer hull.

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

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

1.2.6 *Transverse section* is the cross section of the hull perpendicular to the ship's centreline and includes all longitudinal members such as plating, longitudinals and girders at the deck, side and bottom, inner bottom and hopper side plating, longitudinal bulkheads, and bottom plating in top wing tanks. For transversely framed bulk carriers, a transverse section includes adjacent frames and their end connections in way of transverse sections.

1.2.7 *Representative spaces* are those which are expected to reflect the condition of other spaces of similar type and service and with similar corrosion prevention systems. When selecting representative spaces account shall be taken of the service and repair history on board and identifiable critical structural areas and/or suspect areas.

1.2.8 *Suspect areas* are locations showing substantial corrosion and/or are considered by the surveyor to be prone to rapid wastage.

1.2.9 *Substantial corrosion* is an extent of corrosion such that assessment of corrosion pattern indicates wastage in excess of 75% of allowable margins, but within acceptable limits. For ships built under the IACS Common Structural Rules, substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{ren} + 0.5$ mm and t_{ren} . Renewal thickness (t_{ren}) is the minimum allowable thickness, in mm, below which renewal of structural members shall be carried out.

1.2.10 A *corrosion prevention system* is normally considered a full hard protective coating. Hard protective coating should usually be epoxy coating or equivalent. Other coating systems, which are neither soft nor semi-hard coatings, may be considered acceptable as alternatives provided that they are applied and maintained in compliance with the manufacturer's specifications.

1.2.11 *Coating condition* is defined 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; and

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

1.2.12 *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 applicable, to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

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

1.2.14 *Intermediate survey* is a survey carried out either at the second or third annual survey or between these surveys.

1.2.15 A *prompt and thorough repair* is a permanent repair completed at the time of survey to the satisfaction of the surveyor, therein removing the need for the imposition of any associated condition of classification or recommendation.

1.2.16 *Convention* means the International Convention for the Safety of Life at Sea, 1974, as amended.

1.2.17 *Special consideration or specially considered* (in connection with close-up surveys and thickness measurements) means sufficient close-up inspection and thickness measurements are taken to confirm the actual average condition of the structure under the coating.

1.2.18 *Pitting corrosion* is defined as scattered corrosion spots/areas with local material reductions which are greater than the general corrosion in the surrounding area. Pitting intensity is defined in figure 1.

1.2.19 *Edge corrosion* is defined as local material loss at the free edges of plates, stiffeners, primary support members and around openings. An example of edge corrosion is shown in figure 2.

1.2.20 *Grooving corrosion* is typically local material loss adjacent to weld joints along abutting stiffeners and at stiffener or plate butts or seams. An example of groove corrosion is shown in figure 3.

1.2.21 *Administration* means the Administration or organization recognized by the Administration.

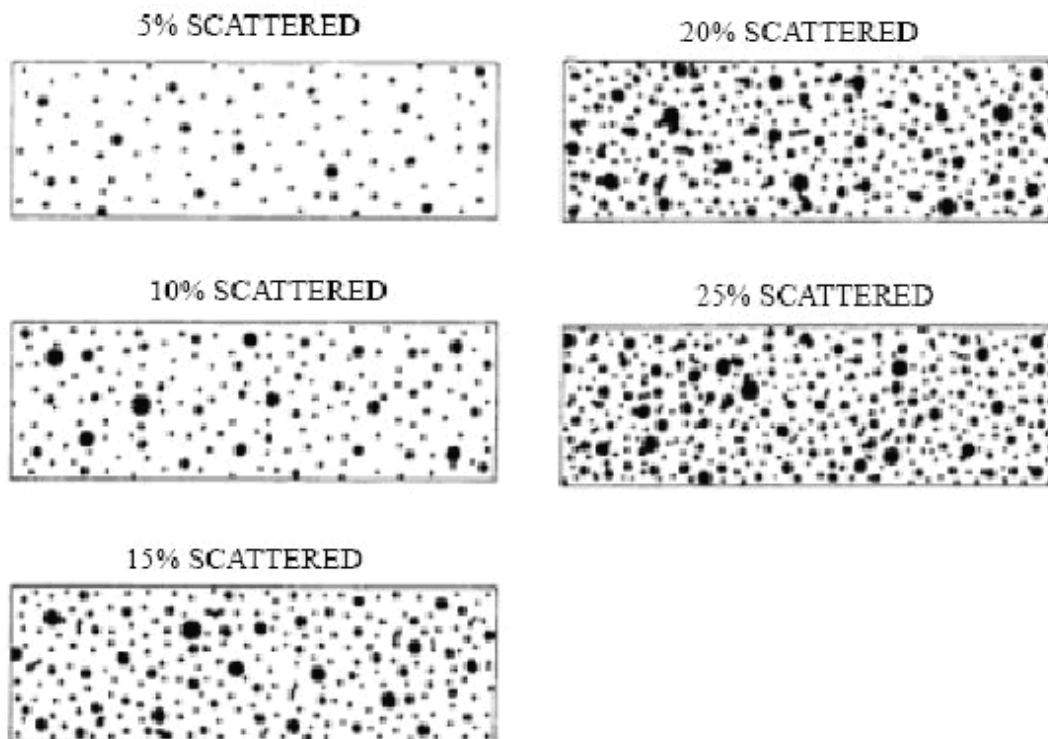


Figure 1: Pitting intensity diagrams

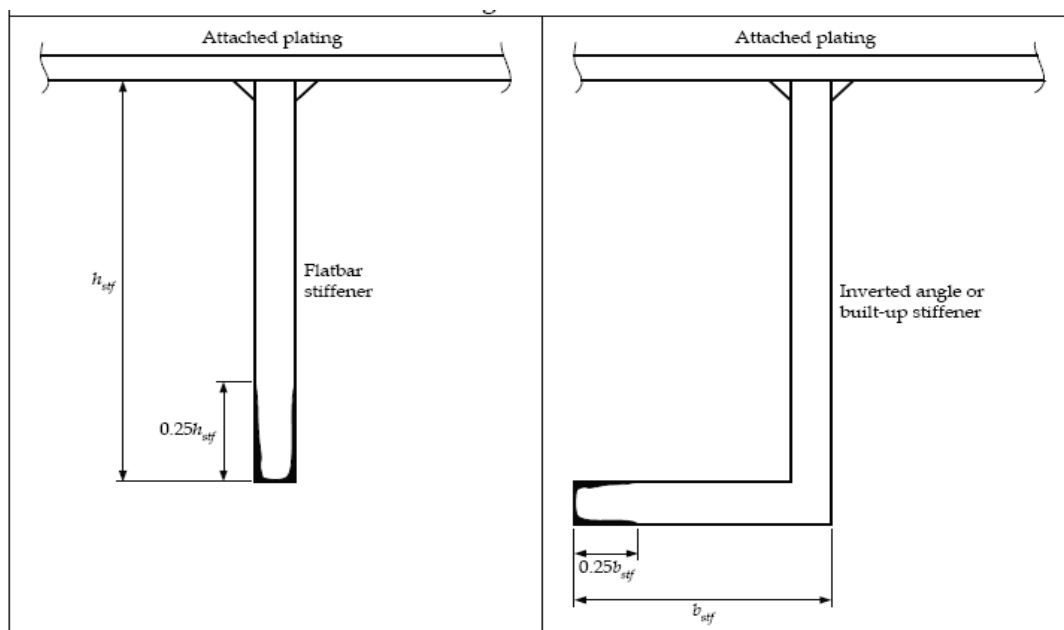


Figure 2: Edge corrosion

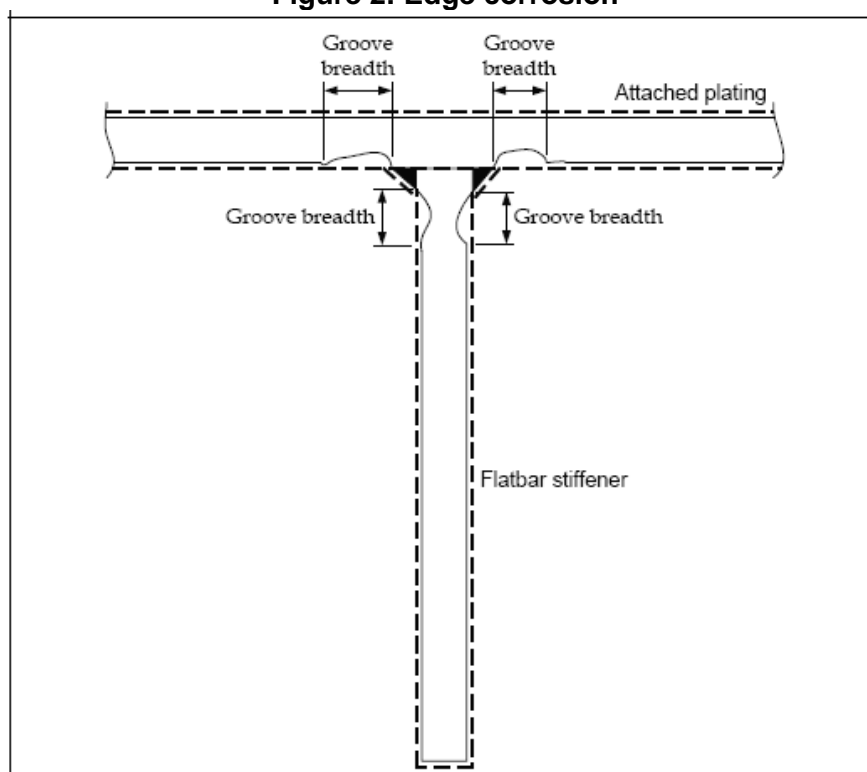


Figure 3: Grooving corrosion

1.3 Repairs

1.3.1 Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Administration, will affect the ship's structural, watertight or weathertight integrity, shall be promptly and thoroughly (see 1.2.15) repaired. Areas to be considered include:

- .1 side structure and side plating;
- .2 deck structure and deck plating;
- .3 bottom structure and bottom plating;
- .4 inner bottom structure and inner bottom plating;
- .5 inner side structure and inner side plating;
- .6 watertight or oiltight bulkheads;
- .7 hatch covers or hatch coamings; and
- .8 items in 3.3.10.

For locations where adequate repair facilities are not available, the Administration may allow the ship to proceed directly to a repair facility. This may require discharging the cargo and/or temporary repairs for the intended voyage.

1.3.2 Additionally, when a survey results in the identification of corrosion or structural defects, either of which, in the opinion of the Administration, will impair the ship's fitness for continued service, remedial measures shall be implemented before the ship continues in service.

1.3.3 Where the damage found on the structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity after evaluation of the surrounding structure and impose an associated condition or recommendation with a specific time limit in order to complete the permanent repair and retain the validity of the relevant statutory certification.

1.4 Surveyors*

1.4.1 On bulk carriers of 20,000 tonnes deadweight (dwt) and above starting with renewal survey No.3, at renewal and intermediate hull surveys, the survey of hull structure and piping systems to which this Code applies shall be carried out by at least two surveyors of an Administration. On bulk carriers of 100,000 dwt and above of single-side skin construction at the intermediate hull survey between 10 and 15 years of age, the survey of hull structure and piping systems to which this Code applies shall be performed by at least two surveyors.

1.4.2 This requires that at least two surveyors attend on board at the same time to perform the required survey. Though each attending surveyor is not required to perform all aspects of the required survey, they shall consult with each other and do joint overall and close-up surveys to the extent necessary to determine the condition of the vessel areas to which this Code applies. The extent of these surveys shall be sufficient for the surveyors to agree on actions required to complete the survey with respect to renewals, repairs, and other recommendations or conditions. Each surveyor shall co-sign the survey report or indicate their concurrence in an equivalent manner.

1.4.3 The following surveys may be witnessed by a single surveyor:

* Refer to paragraph 4.2.4 of part 2 of the Code for recognized organizations (RO Code), adopted by resolution MSC.349(92).

- .1 thickness measurements;
- .2 tank testing; and
- .3 repairs carried out in association with intermediate and renewal hull surveys, the extent of which have been agreed upon by the required two surveyors during the course of the surveys.

1.5 *Thickness measurements and close-up surveys*

In any kind of survey, i.e. renewal, intermediate, annual or other surveys having the scope of the foregoing ones, for structures in areas where close-up surveys are required, thickness measurements, when required by annex 2, shall be carried out simultaneously with close-up surveys.

2 Renewal survey

2.1 *General*

2.1.1 The renewal survey may be commenced at the fourth annual survey and be progressed during the succeeding year with a view to completion by the fifth anniversary date. When the renewal survey is commenced prior to the fourth annual survey, the entire survey shall be completed within 15 months if such work is to be credited to the renewal survey.

2.1.2 As part of the preparation for the renewal survey, the survey programme shall be dealt with in advance of the survey. The thickness measurement shall not be held before the fourth annual survey.

2.1.3 The survey shall include, in addition to the requirements of the annual survey, examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 2.1.5, is in a satisfactory condition and is fit for its intended purpose for the new period of validity of the Cargo Ship Safety Construction Certificate, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

2.1.4 All cargo holds, ballast tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull shall be examined, and this examination shall be supplemented by thickness measurement and testing as required by 2.6 and 2.7, to ensure that the structural integrity remains effective. The examination shall be sufficient to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

2.1.5 All piping systems within the above spaces shall be examined and operationally tested to working pressure to the attending surveyor's satisfaction to ensure that the tightness and condition remain satisfactory.

2.1.6 The survey extent of ballast tanks converted to void spaces shall be specially considered in relation to the requirements for ballast tanks.

2.1.7 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

2.2 Dry-dock survey

2.2.1 A survey in dry-dock shall be a part of the renewal survey. There shall be a minimum of two inspections of the outside of the ship's bottom during the five-year period of the certificate. In all cases, the maximum interval between bottom inspections shall not exceed 36 months.

2.2.2 For ships of 15 years of age and over, inspection of the outside of the ship's bottom shall be carried out with the ship in dry-dock. For ships of less than 15 years of age, alternate inspections of the ship's bottom not conducted in conjunction with the renewal survey may be carried out with the ship afloat. Inspection of the ship afloat shall only be carried out when the conditions are satisfactory and the proper equipment and suitably qualified staff are available.

2.2.3 If a survey in dry-dock is not completed in conjunction with the renewal survey or if the 36 month maximum interval referred to in 2.2.1 is not complied with, the Cargo Ship Safety Construction Certificate shall cease to be valid until a survey in dry-dock is completed.

2.2.4 The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks shall be carried out in accordance with the applicable requirements for renewal surveys, if not already performed.

Note: Lower portions of the cargo holds and ballast tanks are considered to be the parts below the light ballast water line.

2.3 Space protection

2.3.1 Where provided, the condition of the corrosion prevention system of ballast tanks shall be examined. For ballast tanks, excluding double-bottom tanks, where a hard protective coating is found in POOR condition as defined in 1.2.11, and it is not renewed, or where a soft or semi-hard coating has been applied, or where a hard protective coating has not been applied from the time of construction, the tanks in question shall be examined at annual intervals. Thickness measurements shall be carried out as deemed necessary by the surveyor. When such breakdown of hard protective coating is found in water ballast double-bottom tanks and it is not renewed, where a soft or semi-hard coating has been applied or where a hard protective coating has not been applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the surveyor, or where extensive corrosion exists, thickness measurements shall be carried out.

2.3.2 Where a hard protective coating is provided in cargo holds and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

2.3.3 For bulk carriers built under IACS Common Structural Rules (CSR), the identified substantial corrosion areas may be:

- .1 protected by a 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
- .2 required to be measured at annual intervals.

2.4 Hatch covers and coamings

The hatch covers and coamings shall be surveyed as follows:

2.4.1 A thorough inspection of the items listed in 3.3 shall be carried out in addition to all hatch covers and coamings.

2.4.2 Checking of the satisfactory operation of all mechanically operated hatch covers shall be made, including:

- .1 stowage and securing in open condition;
- .2 proper fit and efficiency of sealing in closed condition; and
- .3 operational testing of hydraulic and power components, wires, chains, and link drives.

2.4.3 The effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent shall be checked.

2.4.4 Close up survey and thickness measurement of the hatch cover and coaming plating and stiffeners shall be carried out as given in annexes 1 and 2. For cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/thickness measurements shall be done of accessible parts of hatch covers' structures.

2.5 *Extent of overall and close-up surveys*

2.5.1 An overall survey of all tanks and spaces shall be carried out at the renewal survey. Fuel oil tanks in the cargo length area shall be surveyed as follows:

Renewal survey No.1	Renewal survey No.2	Renewal survey No.3	Renewal survey No.4 and subsequent
Age ≤ 5	5 < Age ≤ 10	10 < Age ≤ 15	15 < Age
None	One	Two	Half, minimum two
<p>Notes:</p> <ol style="list-style-type: none"> 1. These requirements apply to tanks of integral (structural) type. 2. If a selection of tanks is accepted to be examined, then different tanks shall be examined at each renewal survey, on a rotational basis. 3. Peak tanks (all uses) shall be examined internally at each renewal survey. 4. At renewal survey No.3 and subsequent renewal surveys, one deep tank for fuel oil in the cargo area shall be included, if fitted. 			

2.5.2 The minimum requirements for close-up surveys at renewal survey are given in annex 1.

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

2.5.4 For areas in spaces where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to annex 1 may be specially considered (refer also to 2.3.2).

2.6 *Extent of thickness measurements*

2.6.1 The minimum requirements for thickness measurements at the renewal survey are given in annex 2. Annex 11 provides additional thickness measurement guidelines applicable to the vertically corrugated transverse watertight bulkhead between cargo holds No.1 and No.2 on ships subject to compliance with regulation XII/6.1 of the Convention. For additional thickness measurement guidelines applicable to the side shell frames and brackets on ships subject to compliance with resolution MSC.168(79), reference is made to 1.1.5 and annex 15.

2.6.2 Representative thickness measurements to determine both general and local levels of corrosion in the shell frames and their end attachments in all cargo holds and ballast tanks shall be carried out. Thickness measurements shall also be carried out to determine the corrosion levels on the transverse bulkhead plating. The extent of thickness measurements may be specially considered provided the surveyor is satisfied by the close-up examination, that there is no structural diminution, and the hard protective coating where applied remains efficient.

2.6.3 Provisions for extended measurements for areas with substantial corrosion as defined in 1.2.9 are given in annex 10 and may be additionally specified in the survey programme as required in 5.1. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken.

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

2.6.5 For areas in tanks where hard protective coatings are found to be in GOOD condition as defined in 1.2.11, the extent of thickness measurements according to annex 2 may be specially considered by the Administration.

2.6.6 Transverse sections shall be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

2.7 *Extent of tank pressure testing*

2.7.1 All boundaries of water ballast tanks, deep tanks and cargo holds used for water ballast within the cargo length area shall be pressure tested. For fuel oil tanks, only representative tanks shall be pressure tested.

2.7.2 The surveyor may extend the tank testing as deemed necessary.

2.7.3 Boundaries of ballast tanks shall be tested with a head of liquid to the top of the air pipes.

2.7.4 Boundaries of ballast holds shall be tested with a head of liquid to near the top of hatches.

2.7.5 Boundaries of fuel oil tanks shall be tested with a head of liquid to the highest point that liquid will rise under service conditions. Tank testing of fuel oil tanks may be specially considered based on a satisfactory external examination of the tank boundaries and a confirmation from the master stating that the pressure testing has been carried out according to the requirements with satisfactory results.

2.7.6 The testing of double-bottom tanks and other spaces not designed for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tank top is carried out.

2.8 Additional renewal survey requirements after determining compliance with regulations XII/12 and XII/13 of the Convention

2.8.1 For ships complying with the requirements of regulation XII/12 of the Convention for hold, ballast and dry space water level detectors, the renewal survey shall include an examination and a test of the water ingress detection system and of their alarms.

2.8.2 For ships complying with the requirements of regulation XII/13 of the Convention for the availability of pumping systems, the renewal survey shall include an examination and a test of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

3 Annual survey

3.1 General

Annual surveys shall be held within three months before or after the anniversary date from the date of the initial survey or of the date credited for the last renewal survey. The annual survey shall consist of an examination for the purpose of ensuring, as far as practicable, that the hull, weather decks, hatch covers, coamings and piping are maintained in a satisfactory condition and shall take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

3.2 Examination of the hull

3.2.1 An examination of the hull plating and its closing appliances shall be carried out as far as can be seen.

3.2.2 An examination of watertight penetrations shall be carried out as far as practicable.

3.3 Examination of weather decks, hatch covers and coamings

3.3.1 It shall be confirmed that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

3.3.2 A thorough survey of cargo hatch covers and coamings is only possible by examination in the open as well as closed positions and shall include verification of proper opening and closing operations. As a result, the hatch cover sets within the forward 25% of the ship's length and at least one additional set, such that all the sets on the ship are assessed at least once in every five-year period, shall be surveyed open, closed and in operation to the full extent in each direction at each annual survey, including:

- .1 stowage and securing in open condition;
- .2 proper fit and efficiency of sealing in closed condition; and
- .3 operational testing of hydraulic and power components, wires, chains and link drives.

The closing of the covers shall include the fastening of all peripheral, and cross joint cleats or other securing devices. Particular attention shall be paid to the condition of hatch covers in the forward 25% of the ship's length, where sea loads are normally greatest.

3.3.3 If there are indications of difficulty in operating and securing hatch covers, additional hatch cover sets above those required by 3.3.2, at the discretion of the surveyor, shall be tested in operation.

3.3.4 Where the cargo hatch securing system does not function properly, repairs shall be carried out under the supervision of the Administration. Where hatch covers or coamings undergo substantial repairs, the strength of securing devices shall be upgraded to comply with annex 13.

3.3.5 For each cargo hatch cover set, at each annual survey, the following items shall be surveyed:

- .1 cover panels, including side plates, and stiffener attachments that are accessible in the open position by close-up survey (for corrosion, cracks, deformation);
- .2 sealing arrangements of perimeter and cross joints (gaskets for condition and permanent deformation, flexible seals on combination carriers, gasket lips, compression bars, drainage channels and non-return valves);
- .3 clamping devices, retaining bars, cleating (for wastage, adjustment, and condition of rubber components);
- .4 closed cover locating devices (for distortion and attachment);
- .5 chain or rope pulleys;
- .6 guides;
- .7 guiderails and track wheels;
- .8 stoppers;
- .9 wires, chains, tensioners and gypsies;
- .10 hydraulic system, electrical safety devices and interlocks; and
- .11 end and interpanel hinges, pins and stools where fitted.

3.3.6 At each hatchway, at each annual survey, the coamings, with plating, stiffeners and brackets shall be checked for corrosion, cracks and deformation, especially of the coaming tops including close-up survey.

3.3.7 Where considered necessary, the effectiveness of sealing arrangements shall be confirmed and may be proved by hose or chalk testing supplemented by dimensional measurements of seal compressing components.

3.3.8 Where portable covers, wooden or steel pontoons are fitted, the satisfactory condition of the following shall be confirmed, where applicable:

- .1 wooden covers and portable beams, carriers or sockets for the portable beam, and their securing devices;
- .2 steel pontoons, including close-up survey of hatch cover plating;

- .3 tarpaulins;
 - .4 cleats, battens and wedges;
 - .5 hatch securing bars and their securing devices;
 - .6 loading pads/bars and the side plate edge;
 - .7 guide plates and chocks; and
 - .8 compression bars, drainage channels and drain pipes (if any).
- 3.3.9 The flame screens on vents to all bunker tanks shall be examined.
- 3.3.10 Bunker and vent piping systems, including ventilators, shall be examined.
- 3.4 Examination of cargo holds**
- 3.4.1 For bulk carriers of 10 to 15 years of age, the following shall be carried out:
- .1 overall survey of all cargo holds;
 - .2 close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately lower one-third length of side frame at side shell and side frame end attachment and the adjacent shell plating in the forward cargo hold. Where this level of survey reveals the need for remedial measures, the survey shall be extended to include a close-up survey of all of the 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;
 - .3 when considered necessary by the surveyor or where extensive corrosion exists, thickness measurements shall be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with annex 10. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under the IACS Common Structural Rules, 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;
 - .4 where hard protective coating is fitted in cargo holds and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered; and
 - .5 all piping and penetrations in cargo holds, including overboard piping, shall be examined.
- 3.4.2 For bulk carriers over 15 years of age, the following shall be carried out:
- .1 overall survey of all cargo holds;

- .2 close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately lower one-third length of side frame at side shell and side frame end attachment and the adjacent shell plating in the forward cargo hold and one other selected cargo hold. Where this level of survey reveals the need for remedial measures, the survey shall be extended to include a close-up survey of all of the 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;
- .3 when considered necessary by the surveyor, or when extensive corrosion exists, thickness measurements shall be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with annex 10. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under the IACS Common Structural Rules, 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;
- .4 where hard protective coating is fitted in cargo holds and is found in GOOD condition, the extent of the close-up surveys and thickness measurements may be specially considered; and
- .5 all piping and penetrations in cargo holds, including overboard piping, shall be examined.

3.5 Examination of ballast tanks

Examination of ballast tanks shall be carried out when required as a consequence of the results of the renewal survey and intermediate survey. When considered necessary by the Administration, or when extensive corrosion exists, thickness measurements shall be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with annex 10. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under the IACS Common Structural Rules, 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.

3.6 Additional annual survey requirements for the foremost cargo hold of ships subject to regulation XII/9 of the Convention in accordance with the requirements of annex 12

3.6.1 Ships subject to regulation XII/9 of the Convention are those meeting all of the following conditions:

- .1 bulk carriers of 150 m in length and upwards of single-side skin construction;
- .2 carrying solid bulk cargoes having a density of 1,780 kg/m³ and above;
- .3 constructed before 1 July 1999; and

- .4 constructed with an insufficient number of transverse watertight bulkheads to enable them to withstand flooding of the foremost cargo hold in all loading conditions and remain afloat in a satisfactory condition of equilibrium as specified in regulation XII/4.4 of the Convention.

3.6.2 In accordance with regulation XII/9 of the Convention, for the foremost cargo hold of such ship the additional survey requirements listed in annex 12 shall be applied.

3.7 Additional annual survey requirements after determining compliance with regulations XII/12 and XII/13 of the Convention

3.7.1 For ships complying with the requirements of regulation XII/12 of the Convention for hold, ballast and dry space water level detectors, the annual survey shall include an examination and a test, at random, of the water ingress detection systems and of their alarms.

3.7.2 For ships complying with the requirements of regulation XII/13 of the Convention for the availability of pumping systems, the annual survey shall include an examination and a test, of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

4 Intermediate survey

4.1 General

4.1.1 Items that are additional to the requirements of the annual survey may be surveyed either at the second or third annual survey or between these surveys.

4.1.2 The extent of survey is dependent upon the age of the ship as specified in 4.2, 4.3 and 4.4.

4.1.3 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

4.2 Single-side skin bulk carriers 5 to 10 years of age

4.2.1 Ballast tanks

4.2.1.1 For tanks used for water ballast, an overall survey of representative tanks selected by the surveyor shall be carried out. The selection shall include fore and aft peak tanks and a number of other tanks, taking into account the total number and type of ballast tanks. If such overall survey reveals no visible structural defects, the examination may be limited to verification that the corrosion prevention system remains efficient.

4.2.1.2 Where POOR condition, corrosion or other defects are found in water ballast tanks or where hard protective coating was not applied from the time of construction, the examination shall be extended to other ballast tanks of the same type.

4.2.1.3 In ballast tanks other than double-bottom tanks, where a hard protective coating is found in POOR condition and it is not renewed, or where a soft or semi-hard coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question shall be examined and thickness measurements carried out as considered necessary at annual intervals. When such breakdown of a hard protective coating is found in ballast double-bottom tanks, where a soft or semi-hard coating has been applied, or where a hard protective coating has not been applied, the tanks in question may be examined at annual

intervals. When considered necessary by the surveyor, or where extensive corrosion exists, thickness measurements shall be carried out.

4.2.1.4 In addition to the requirements above, suspect areas identified at previous surveys shall be subject to overall and close-up survey.

4.2.2 *Cargo holds*

4.2.2.1 An overall survey of all cargo holds, including close-up survey of sufficient extent, minimum 25% of frames, shall be carried out to establish the condition of:

- .1 shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads in the forward cargo hold and one other selected cargo hold; and
- .2 areas found to be suspect areas at previous surveys.

4.2.2.2 Where considered necessary by the surveyor as a result of the overall and close-up survey as described in 4.2.2.1, the survey shall be extended to include a close-up survey of all of the 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.

4.2.3 *Extent of thickness measurements*

4.2.3.1 Thickness measurements shall be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey as described in 4.2.2.1. The minimum requirement for thickness measurements at the intermediate survey are suspect areas identified at previous surveys.

4.2.3.2 The extent of thickness measurement may be specially considered provided the surveyor is satisfied by the close-up survey, that there is no structural diminution and the hard protective coatings are found to be in a GOOD condition.

4.2.3.3 Where substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with the requirements of annex 10. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under IACS Common Structural Rules, the identified substantial corrosion areas shall be:

- .1 protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition; or alternatively
- .2 required to be measured at annual intervals.

Explanatory note:

For existing bulk carriers, where owners elect to coat or recoat cargo holds as noted above, consideration may be given to the extent of the close-up surveys and thickness measurement. Prior to the coating of cargo holds of existing ships, scantlings shall be ascertained in the presence of a surveyor.

4.2.3.4 Where hard protective coating is fitted in cargo holds and is found in GOOD condition, the extent of the close-up surveys and thickness measurements may be specially considered.

4.3 Single-side skin bulk carriers 10 to 15 years of age

4.3.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey as required in 2 and 5.1. However, internal examination of fuel oil tanks and pressure testing of all tanks shall not be required unless deemed necessary by the attending surveyor.

4.3.2 In application of 4.3.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

4.3.3 In application of 4.3.1, an underwater survey may be considered in lieu of the requirements of 2.2.

4.4 Single-side skin bulk carriers exceeding 15 years of age

4.4.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey required in 2 and 5.1. However, internal examination of fuel oil tanks and pressure testing of all tanks shall not be required unless deemed necessary by the attending surveyor.

4.4.2 In application of 4.4.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

4.4.3 In application of 4.4.1, a survey in dry-dock shall be part of the intermediate survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and water ballast tanks shall be carried out in accordance with the applicable requirements for intermediate surveys, if not already performed.

Note: Lower portions of the cargo holds and ballast tanks are considered to be the parts below the light ballast water line.

5 Preparations for survey

5.1 Survey programme

5.1.1 The owner in cooperation with the Administration shall work out a specific survey programme prior to the commencement of any part of the renewal survey and, for single-side skin bulk carriers over 10 years of age, the intermediate survey. The survey programme shall be in a written format based on the information in annex 4A. The survey shall not commence until the survey programme has been agreed.

5.1.1.1 Prior to the development of the survey programme, the survey planning questionnaire shall be completed by the owner based on the information set out in annex 4B, and forwarded to the Administration.

5.1.1.2 The survey programme at intermediate survey may consist of the survey programme at the previous renewal survey supplemented by the condition evaluation report (executive hull summary report) of that renewal survey and later relevant survey reports.

5.1.1.3 The survey programme shall be worked out taking into account any amendments to the survey requirements after the last renewal survey was carried out.

5.1.2 In developing the survey programme, the following documentation shall be collected and consulted upon with a view to selecting tanks, holds, areas and structural elements to be examined:

- .1 survey status and basic ship information;
- .2 documentation on board, as described in 6.2 and 6.3;
- .3 main structural plans (scantlings drawings), including information regarding use of high-tensile steels (HTS);
- .4 relevant previous survey and inspection reports from both the Administration and the owner;
- .5 information regarding the use of ship's holds and tanks, typical cargoes and other relevant data;
- .6 information regarding corrosion prevention level on the new building; and
- .7 information regarding the relevant maintenance level during operation.

5.1.3 The submitted survey programme shall account for, and comply, as a minimum, with the provisions of 2.7 and annexes 1 and 2 for tank testing, close-up survey and thickness measurement, respectively, and shall include relevant information including at least:

- .1 basic ship information and particulars;
- .2 main structural plans (scantling drawings), including information regarding use of high-tensile steels (HTS);
- .3 plan of holds and tanks;
- .4 list of holds and tanks with information on use, protection and condition of coating;
- .5 conditions for survey (e.g. information regarding hold and tank cleaning, gas-freeing, ventilation, lighting, etc.);
- .6 provisions and methods for access to structures;
- .7 equipment for surveys;
- .8 nomination of holds and tanks and areas for close-up survey (see 2.5);
- .9 nomination of sections for thickness measurement (see 2.6);
- .10 nomination of tanks for testing (see 2.7); and
- .11 damage experience related to ship in question.

5.1.4 The Administration shall advise the owner of the maximum acceptable structural corrosion diminution levels applicable to the ship.

5.1.5 Use should also be made of the Guidelines for technical assessment in conjunction with the planning of enhanced surveys for single-side skin bulk carriers contained in annex 9. These Guidelines are a recommended tool which may be invoked at the discretion of the Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme. These Guidelines shall not be used to reduce the requirements of annexes 1 and 2 and paragraph 2.7, which shall, in all cases, be complied with as a minimum.

5.2 Conditions for survey

5.2.1 The owner shall provide the necessary facilities for a safe execution of the survey.

5.2.2 In order to enable the attending surveyors to carry out the survey, provisions for proper and safe access shall be agreed between the owner and the Administration, based on recommendations developed by the Organization.*

5.2.3 Details of the means of access shall be provided in the survey planning questionnaire.

5.2.4 In cases where the provisions of safety and required access are judged by the attending surveyor(s) not to be adequate, the survey of the spaces involved shall not proceed.

5.2.5 Cargo holds, tanks and spaces shall be safe for access. Cargo holds, tanks and spaces shall be gas free and properly ventilated. Prior to entering a tank, void or enclosed space, it shall be verified that the atmosphere in the tank is free from hazardous gas and contains sufficient oxygen.

5.2.6 In preparation for survey and thickness measurements and to allow for a thorough examination, all spaces shall be cleaned including removal from surfaces of all loose accumulated corrosion scale. Spaces shall 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 coating. However, those areas of structure whose renewal has already been decided by the owner need only be cleaned and descaled to the extent necessary to determine the limits of the areas to be renewed.

5.2.7 Sufficient illumination shall be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the coating.

5.2.8 Where soft or semi-hard coatings have been applied, safe access shall 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 shall be removed.

5.2.9 The surveyor(s) shall always be accompanied by at least one responsible person, assigned by the owner, experienced in tank and enclosed space inspection.

* Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

5.3 Access to structures*

5.3.1 For overall surveys, means shall be provided to enable the surveyor to examine the structure in a safe and practical way.

5.3.2 For close-up surveys of the hull structure, other than cargo hold shell frames, one or more of the following means for access, acceptable to the surveyor, shall be provided:

- .1 permanent staging and passages through structures;
- .2 temporary staging and passages through structures;
- .3 hydraulic arm vehicles such as conventional cherry pickers, lifts and moveable platforms;
- .4 portable ladders;
- .5 boats or rafts; and/or
- .6 other equivalent means.

5.3.3 For close-up surveys of the cargo hold shell frames of single-side skin bulk carriers less than 100,000 dwt, one or more of the following means for access, acceptable to the surveyor, shall be provided:

- .1 permanent staging and passages through structures;
- .2 temporary staging and passages through structures;
- .3 portable ladder restricted to not more than 5 m in length may be accepted for surveys of lower section of a shell frame including bracket;
- .4 hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms;
- .5 boats or rafts provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water; and/or
- .6 other equivalent means.

5.3.4 For close-up surveys of the cargo hold shell frames of single-side skin bulk carriers of 100,000 dwt and above, the use of portable ladders shall not be accepted and one or more of the following means for access, acceptable to the surveyor, shall be provided:

Annual surveys, intermediate survey under 10 years of age and first renewal survey:

- .1 permanent staging and passages through structures;
- .2 temporary staging and passages through structures;

* Refer to *Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers* (MSC/Circ.686).

- .3 hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms;
- .4 boats or rafts provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water; and/or
- .5 other equivalent means.

Subsequent intermediate surveys and renewal surveys:

- .1 either permanent or temporary staging and passages through structures for close-up survey of at least the upper part of hold frames;
- .2 hydraulic arm vehicles such as conventional cherry pickers for surveys of lower and middle part of shell frames as alternative to staging;
- .3 lifts and movable platforms;
- .4 boats or rafts provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water; and/or
- .5 other equivalent means.

5.3.5 Notwithstanding the above requirements, the use of a portable ladder fitted with a mechanical device to secure the upper end of the ladder is acceptable for the "close-up examination of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames, including approximately lower one third length of side frame at side shell and side frame and attachment and the adjacent shell plating of the forward cargo hold" at annual survey, required in 3.4.1.2 and the "one other selected cargo hold" required in 3.4.2.2.

5.3.6 The use of hydraulic arm vehicles or aerial lifts ("cherry pickers") may be accepted by the attending surveyor for the close-up survey of the upper part of side shell frames or other structures in all cases where the maximum working height is not more than 17 m.

5.4 *Equipment for survey*

5.4.1 Thickness measurements shall normally be carried out by means of ultrasonic test equipment. The accuracy of the equipment shall be proven to the surveyor as required.

5.4.2 One or more of the following fracture detection procedures shall be required if deemed necessary by the surveyor:

- .1 radiographic equipment;
- .2 ultrasonic equipment;
- .3 magnetic particle equipment; and/or
- .4 dye penetrant.

5.4.3 Explosimeter, oxygen-meter, breathing apparatus, lifelines, riding belts with rope and hook and whistles together with instructions and guidance on their use shall be made available during the survey. A safety checklist shall be provided.

5.4.4 Adequate and safe lighting shall be provided for the safe and efficient conduct of the survey.

5.4.5 Adequate protective clothing shall be made available and used (e.g. safety helmet, gloves, safety shoes, etc.) during the survey.

5.5 Rescue and emergency response equipment

If breathing apparatus and/or other equipment is used as "Rescue and emergency response equipment", then the equipment shall be suitable for the configuration of the space being surveyed.

5.6 Surveys at sea or at anchorage

5.6.1 Surveys at sea or at anchorage may be accepted provided the surveyor is given the necessary assistance from the personnel on board. Necessary precautions and procedures for carrying out the survey shall be in accordance with 5.1, 5.2, 5.3 and 5.4.

5.6.2 A communication system shall be arranged between the survey party in the spaces and the responsible officer on deck. This system shall also include the personnel in charge of ballast pump handling if boats or rafts are used.

5.6.3 Surveys of tanks or applicable holds by means of boats or rafts shall only be undertaken with the agreement of the surveyor, who shall take into account the safety arrangements provided, including weather forecasting and ship response under foreseeable conditions and provided the expected rise of water within the tank does not exceed 0.25 m.

5.6.4 When rafts or boats will be used for close-up survey the following conditions shall be observed:

- .1 only rough duty, inflatable rafts or boats, having satisfactory residual buoyancy and stability even if one chamber is ruptured, shall be used;
- .2 the boat or raft shall be tethered to the access ladder and an additional person shall be stationed down the access ladder with a clear view of the boat or raft;
- .3 appropriate lifejackets shall be available for all participants;
- .4 the surface of water in the tank or hold shall be calm (under all foreseeable conditions the expected rise of water within the tank shall not exceed 0.25 m) and the water level stationary. On no account shall the level of the water be rising while the boat or raft is in use;
- .5 the tank, hold or space shall contain clean ballast water only. Even a thin sheen of oil on the water shall not be acceptable; and
- .6 at no time shall the water level 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 or hold access. Filling to levels above the deck transverses shall only 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.

5.6.5 Rafts or boats alone may be allowed for inspection of the under deck areas for tanks or spaces, if the depth of the webs is 1.5 m or less.

5.6.6 If the depth of the webs is more than 1.5 m, rafts or boats alone shall be allowed only:

- .1 when the coating of the under-deck structure is in GOOD condition and there is no evidence of wastage; or
- .2 if a permanent means of access is provided in each bay to allow safe entry and exit. This means:
 - .1 access direct from the deck via a vertical ladder and a small platform fitted approximately 2 m below the deck in each bay; or
 - .2 access to deck from a longitudinal permanent platform having ladders to deck in each end of the tank. The platform shall, for the full length of the tank, be arranged level with, or above, the maximum water level needed for rafting of under deck structure. For this purpose, the ullage corresponding to the maximum water level shall be assumed not more than 3 m from the deck plate measured at the midspan of deck transverses and the middle length of the tank.

If neither of the above conditions are met, then staging or other equivalent means shall be provided for the survey of the under-deck areas.

5.6.7 The use of rafts or boats alone in 5.6.5 and 5.6.6 does not preclude the use of boats or rafts to move about within a tank during a survey.

5.7 Survey planning meeting

5.7.1 Proper preparation and the close cooperation between the attending surveyor(s) and the owner's representatives on board prior to and during the survey are an essential part in the safe and efficient conduct of the survey. During the survey on board safety meetings shall be held regularly.

5.7.2 Prior to commencement of any part of the renewal or intermediate survey, a survey planning meeting shall be held between the attending surveyor(s), the owner's representative in attendance, the thickness measurement firm representative, where involved, and the master of the ship or an appropriately qualified representative appointed by the master or company; for the purpose to ascertain that all the arrangements envisaged in the survey programme are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out (see also 7.1.2).

5.7.3 The following is an indicative list of items that shall be addressed in the meeting:

- .1 schedule of the ship (i.e. the voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operations, etc.);
- .2 provisions and arrangements for thickness measurements (i.e. access, cleaning/descaling, illumination, ventilation, personal safety);

- .3 extent of the thickness measurements;
- .4 acceptance criteria (refer to the list of minimum thicknesses);
- .5 extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion;
- .6 execution of thickness measurements;
- .7 taking representative readings in general and where uneven corrosion/pitting is found;
- .8 mapping of areas of substantial corrosion; and
- .9 communication between attending surveyor(s), the thickness measurement firm operator(s) and owner representative(s) concerning findings.

6 Documentation on board

6.1 General

6.1.1 The owner shall obtain, supply and maintain on board the ship documentation as specified in 6.2 and 6.3, which shall be readily available for the surveyor. The condition evaluation report (executive hull summary report) referred to in 6.2 shall include a translation into English.

6.1.2 The documentation shall be kept on board for the lifetime of the ship.

6.1.3 For bulk carriers subject to SOLAS regulation II-1/3-10, the owner shall arrange the updating of the Ship Construction File (SCF) throughout the ship's life whenever a modification of the documentation included in the SCF has taken place. Documented procedures for updating the SCF shall be included within the Safety Management System.

6.1.4 For bulk carriers with coatings of dedicated seawater ballast tanks subject to PSPC standards (MSC.215(82)), the owner shall arrange the updating of the Coating Technical File (CTF) throughout the ship's life whenever a maintenance, repair, or recoating activity to these coatings has taken place. Documented procedures for updating the CTF shall be included within the Safety Management System.

6.2 Survey report file

6.2.1 A survey report file shall be a part of the documentation on board consisting of:

- .1 reports of structural surveys (annex 6);
- .2 condition evaluation report (executive hull summary report) (annex 7); and
- .3 thickness measurement reports (annex 8A/annex 8B).

6.2.2 The survey report file shall be available also in the owner's and the Administration's offices.

6.3 Supporting documents

6.3.1 The following additional documentation shall be available on board:

- .1 survey programme as required under 5.1 until such time as the renewal survey, or intermediate survey, as applicable, has been completed;
- .2 main structural plans of cargo holds and ballast tanks (for bulk carriers built under the IACS Common Structural Rules, these plans shall include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition shall also be clearly indicated on the plans. The midship section plan supplied on board the ship shall include the minimum allowable hull girder sectional properties for hold transverse section in all cargo holds);
- .3 previous repair history;
- .4 cargo and ballast history;
- .5 inspections by ship's personnel with reference to:
 - .1 structural deterioration in general;
 - .2 leakages in bulkheads and piping;
 - .3 condition of corrosion prevention system, if any. Guidance for reporting is shown in annex 3; and
- .6 any other information that would help to identify critical structural areas and/or suspect areas requiring inspection.

6.3.2 For bulk carriers subject to SOLAS regulation II-1/3-10, the Ship Construction File (SCF), limited to the items to be retained on board, shall be available on board.

6.3.3 For bulk carriers with coatings of dedicated seawater ballast tanks subject to PSPC standards (MSC.215(82)), the Coating Technical File (CTF) shall be available on board.

6.4 Review of documentation on board

6.4.1 Prior to survey, the surveyor shall examine the completeness of the documentation on board, and its contents as a basis for the survey.

6.4.2 For bulk carriers subject to SOLAS regulation II-1/3-10, on completion of the survey, the surveyor shall verify that the update of the Ship Construction File (SCF) has been done whenever a modification of the documentation included in the SCF has taken place.

6.4.2.1 For the SCF stored on board ship, the surveyor shall examine the information on board ship. In cases where any major event takes place, including, but not limited to, substantial repair and conversion, or any modification to the ship structures; the surveyor shall also verify that the updated information is kept on board the ship. If the updating of the SCF on board is not completed at the time of survey, the surveyor shall record it and require confirmation at the next periodical survey.

6.4.2.2 For the SCF stored in an onshore archive, the surveyor shall examine the list of information included in the onshore archive. In cases where any major event takes place, including, but not limited to, substantial repair and conversion, or any modification to the ship structures; the surveyor shall also verify that the updated information is stored in the onshore archive by examining the list of information included in the onshore archive kept on board the ship. In addition, the surveyor shall confirm that the service contract with the archive centre is

valid. If the updating of the SCF Supplement ashore is not completed at the time of survey, the surveyor shall record it and require confirmation at the next periodical survey.

6.4.3 For bulk carriers subject to SOLAS regulation II-1/3-10, on completion of the survey, the surveyor shall verify any addition and/or renewal of materials used for the construction of the hull structure are documented within the Ship Construction File's list of materials.

6.4.4 For bulk carriers with coatings of dedicated seawater ballast tanks subject to PSC standards (MSC.215(82)), on completion of the survey, the surveyor shall verify any maintenance, repair or recoating activities to these coatings are documented within the Coating Technical File (CTF).

7 Procedures for thickness measurements

7.1 General

7.1.1 The required thickness measurements, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The surveyor shall be on board to the extent necessary to control the process.

7.1.2 The thickness measurement firm shall be part of the survey planning meeting to be held prior to commencing the survey.

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

7.1.4 In all cases the extent of the thickness measurements shall be sufficient as to represent the actual average condition.

7.1.5 Procedural requirements for thickness measurements are set out in annex 14.

7.2 Certification of thickness measurement firm

The thickness measurements shall be carried out by a qualified firm certified by the Administration according to the principles stated in annex 5.

7.3 Number and locations of measurements

7.3.1 Application

This section only applies to ships built under the IACS Common Structural Rules* (CSR). For ships not built under IACS CSR requirements for the number and locations of measurements shall be according to the requirements of the classification society recognized by the Administration depending on the ship's age and structural elements concerned.

7.3.2 Number of measurements

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

* IACS Common Structural Rules mean IACS Common Structural Rules for Bulk Carriers (IACS CSR for Bulk carriers) or IACS Common Structural Rules for Bulk Carriers and Oil Tankers (IACS CSR BC&OT).

7.3.3 *Locations of measurements*

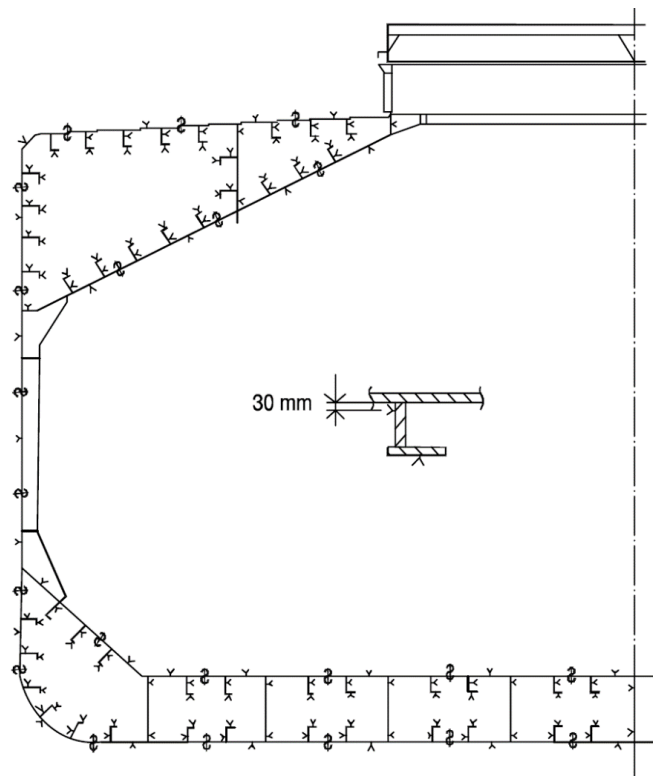
7.3.3.1 Table 1 provides explanations and/or interpretations for the application of those requirements indicated in IACS CSR, which refer to both systematic thickness measurements related to the calculation of global hull girder strength and specific measurements connected to close-up surveys.

7.3.3.2 Figures 4 to 9 are provided to facilitate the explanations and/or interpretations given in table 1, to show typical arrangements of single-side skin bulk carriers.

Table 1 – Interpretations of requirements for the locations and number of points to be measured for CSR bulk carriers (single-side skin)

Item	Interpretation	Figure reference
Selected plates on deck, tank top, bottom, double bottom and wind-and-water area	"Selected" means at least a single point on one out of three plates, which shall be chosen on representative areas of average corrosion	
All deck, tank top and bottom plates and wind-and-water strakes	At least two points on each plate which shall be taken either at each 1/4 extremity of plate or at representative areas of average corrosion	
Transverse section	A transverse section includes all longitudinal members such as plating, longitudinals and girders at the deck, side, bottom, inner bottom and hopper side plating, longitudinal bulkhead and bottom plating in top wing tanks	Figure 4
All cargo hold hatch covers and coamings	Including plates and stiffeners	Locations of points are given in figure 5
Transverse section of deck plating outside line of cargo hatch openings	Two single points on each deck plate (which shall be taken either at each 1/4 extremity of plate or at representative areas of average corrosion) between the ship sides and hatch coamings in the transverse section concerned	
All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches	<p>"All deck plating" means at least two points on each plate shall be taken either at each 1/4 extremity of plate or at representative areas of average corrosion</p> <p>"Under deck structure": at each short longitudinal girder: three points for web plating (fwd/middle/aft), single point for face plate, one point for web plating and one point for face plating of transverse beam in way. At each end of transverse beams, one point for web plating and one point for face plating</p>	<p>Extent of areas is shown in appendix 3 to annex 8B</p> <p>Locations of points are given in figure 9</p>

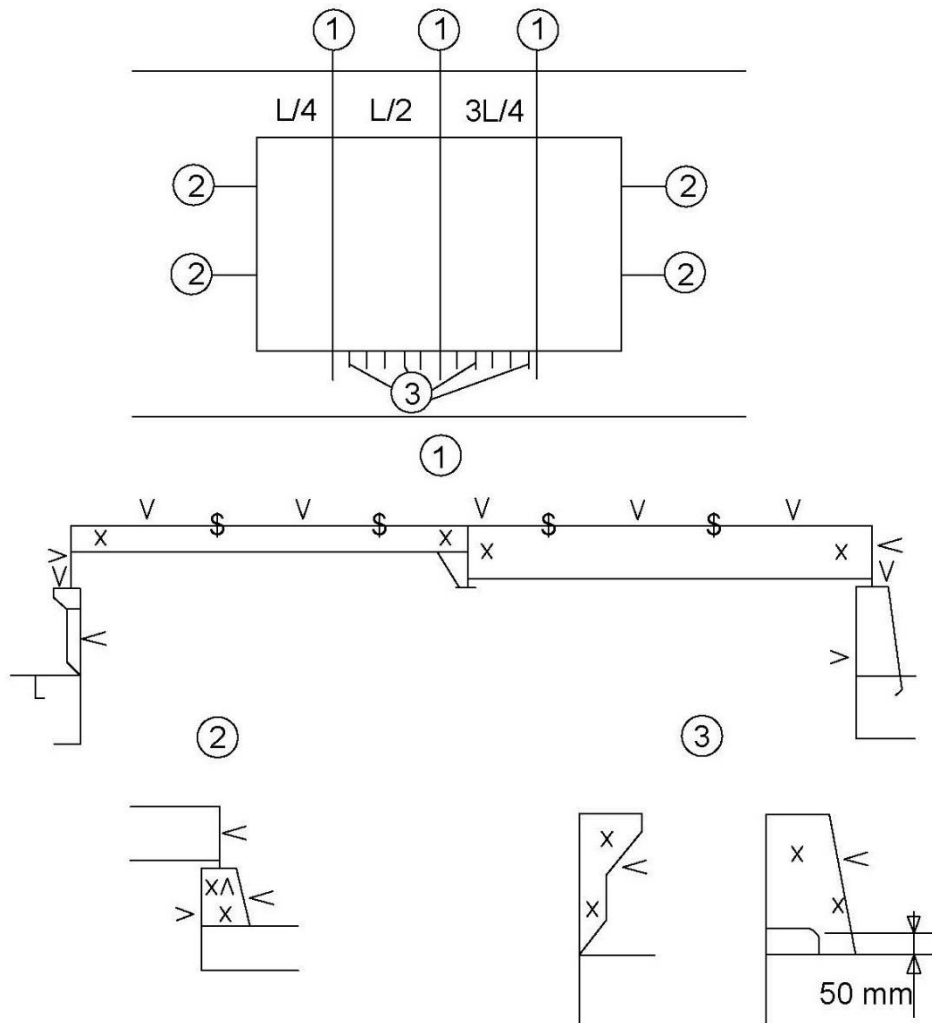
Item	Interpretation	Figure reference
Selected side shell frames in cargo holds	Includes side shell frame, upper and lower end attachments and adjacent shell plating. 25% of frames: one out of four frames should preferably be chosen throughout the cargo hold length on each side. 50% of frames: one out of two frames should preferably be chosen throughout the cargo hold length on each side. "Selected frames" means at least three frames on each side of cargo holds	Extent of areas is shown in appendix 3 to annex 8B Locations of points are given in figure 6
Transverse bulkheads in cargo holds	Includes bulkhead plating, stiffeners and girders, including internal structure of upper and lower stools, where fitted. Two selected bulkheads: one shall be the bulkhead between the two foremost cargo holds and the second may be chosen in other positions	Areas of measurements are shown in appendix 3 to annex 8B Locations of points are given in figure 7
One transverse bulkhead in each cargo hold	This means that the close-up survey and related thickness measurements shall be performed on one side of the bulkhead; the side shall be chosen based on the outcome of the overall survey of both sides. In the event of doubt, the surveyor may also require (possibly partial) close-up survey on the other side	Areas of measurements are shown in appendix 3 to annex 8B Locations of points are given in figure 7
Transverse bulkheads in one topside, hopper and double bottom ballast tank	Includes bulkhead and stiffening systems The ballast tank shall be chosen based on the history of ballasting among those prone to have the most severe conditions	Locations of points are given in figure 8
Transverse webs in ballast tanks	Includes web plating, face plates, stiffeners and associated plating and longitudinals One of the representative tanks of each type (i.e. topside or hopper or side tank) shall be chosen in the forward part	Areas of measurements are shown in appendix 3 to annex 8B Locations of points are given in figure 6



Single side bulk carriers

Note: Measurements shall be taken on both port and starboard sides of the selected transverse section.

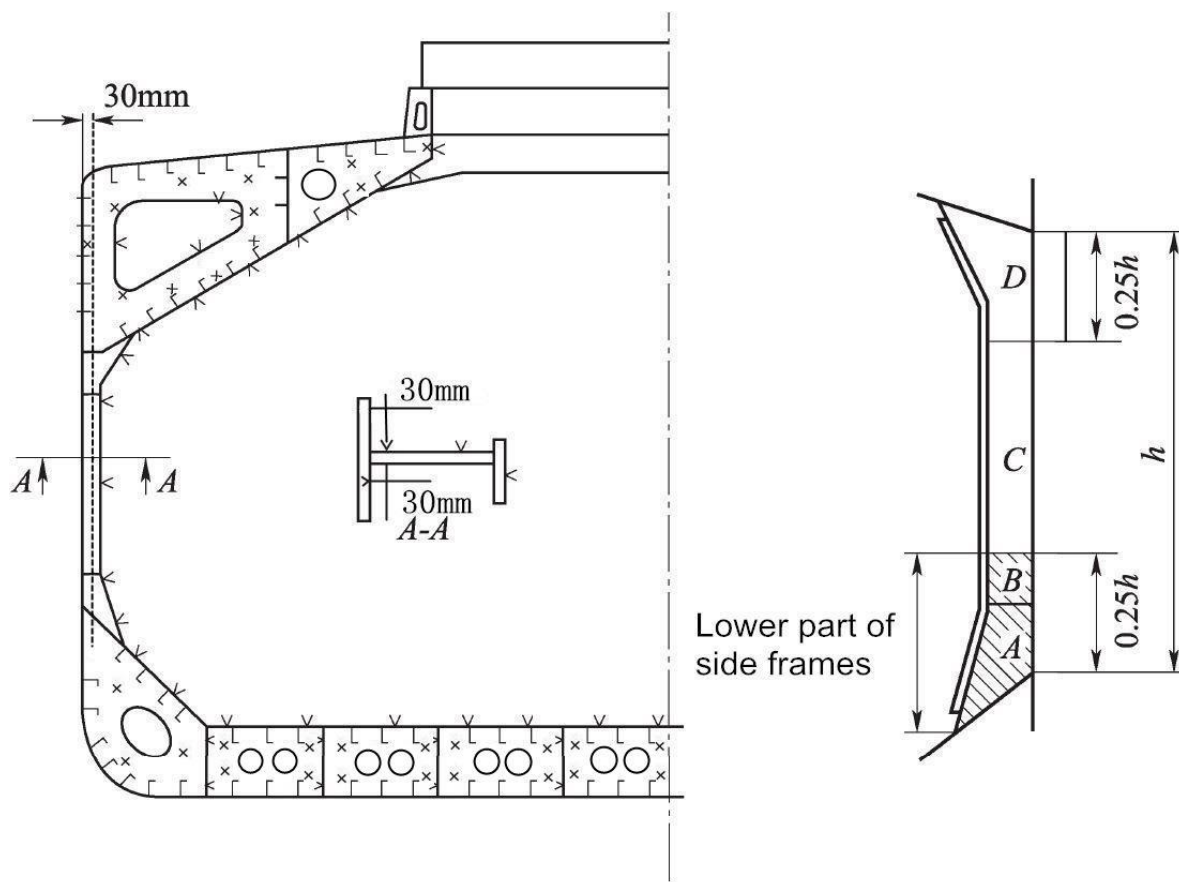
Figure 4: Transverse section of a single-side skin bulk carrier



Notes:

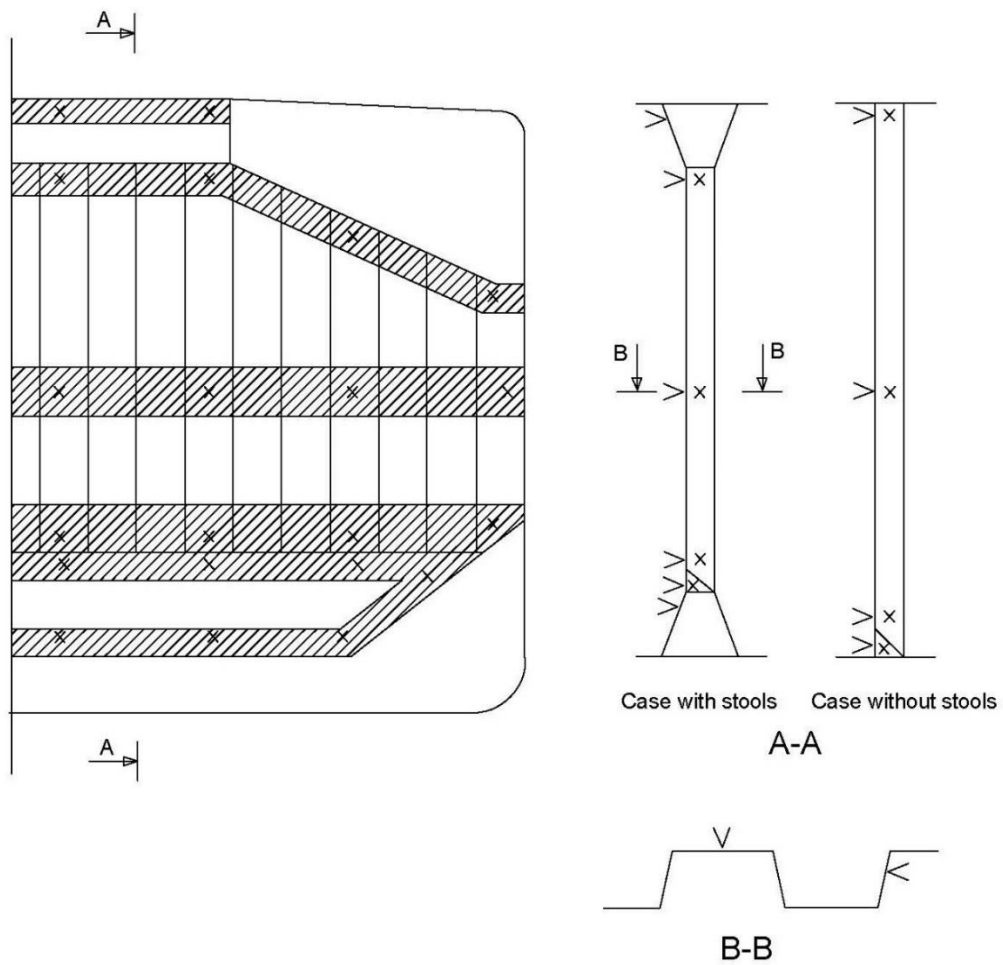
- 1 Three sections at $L/4$, $L/2$, $3L/4$ of hatch cover length, including:
 - .1 one measurement of each hatch cover plate and skirt plate;
 - .2 measurements of adjacent beams and stiffeners; and
 - .3 one measurement of coaming plates and coaming flange, each side.
- 2 Measurements of both ends of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

Figure 5: Locations of measurements on hatch covers and coamings



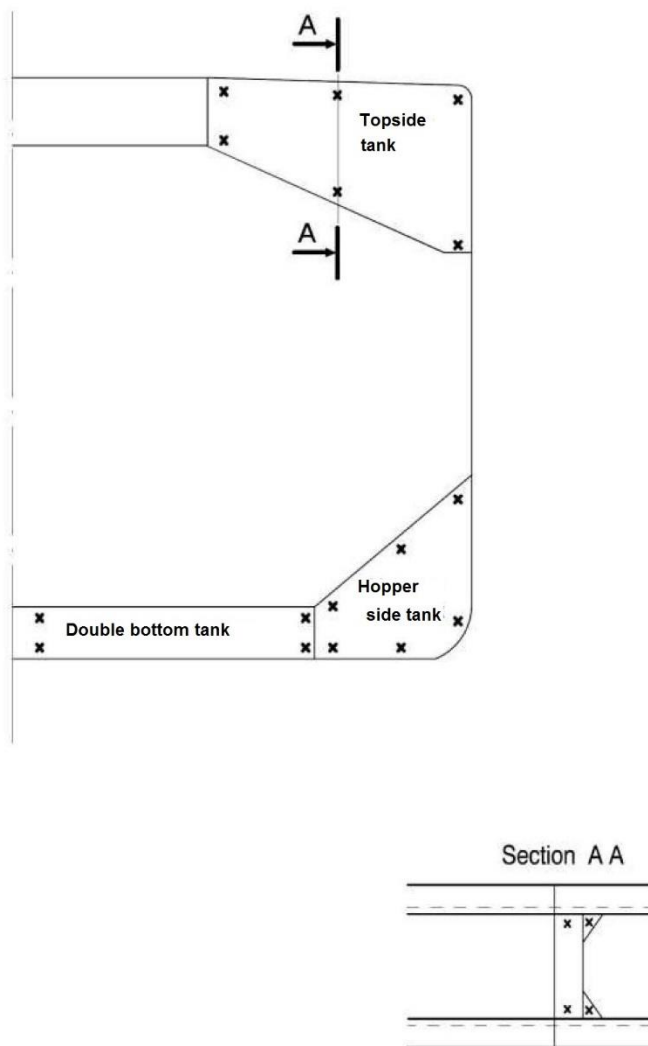
Note: The gauging pattern for web plating shall be a three point pattern for zones A, C and D, and a two point pattern for zone B (see figure). The gauging report shall reflect the average reading. The average reading shall be compared with the allowable thickness. If the web plating has general corrosion then this pattern shall be expanded to a five-point pattern.

Figure 6: Locations of measurements on structural members in cargo holds and ballast tanks of single-side skin bulk carriers



Note: Measurements shall be taken in each shaded area as per views A-A and B-B. Additional measurements to internal structure of upper and lower stools shall be added, e.g. two points in the upper and two points in the lower stools indicated in section A-A.

Figure 7: Locations of measurements on cargo hold transverse bulkheads



Note: Measurements shall be taken in each vertical section as per view A–A.
Two additional measurements to internal structure of double bottom tank shall be added at midspan

Figure 8: Locations of measurements on transverse bulkheads of topside, hopper and double bottom tanks

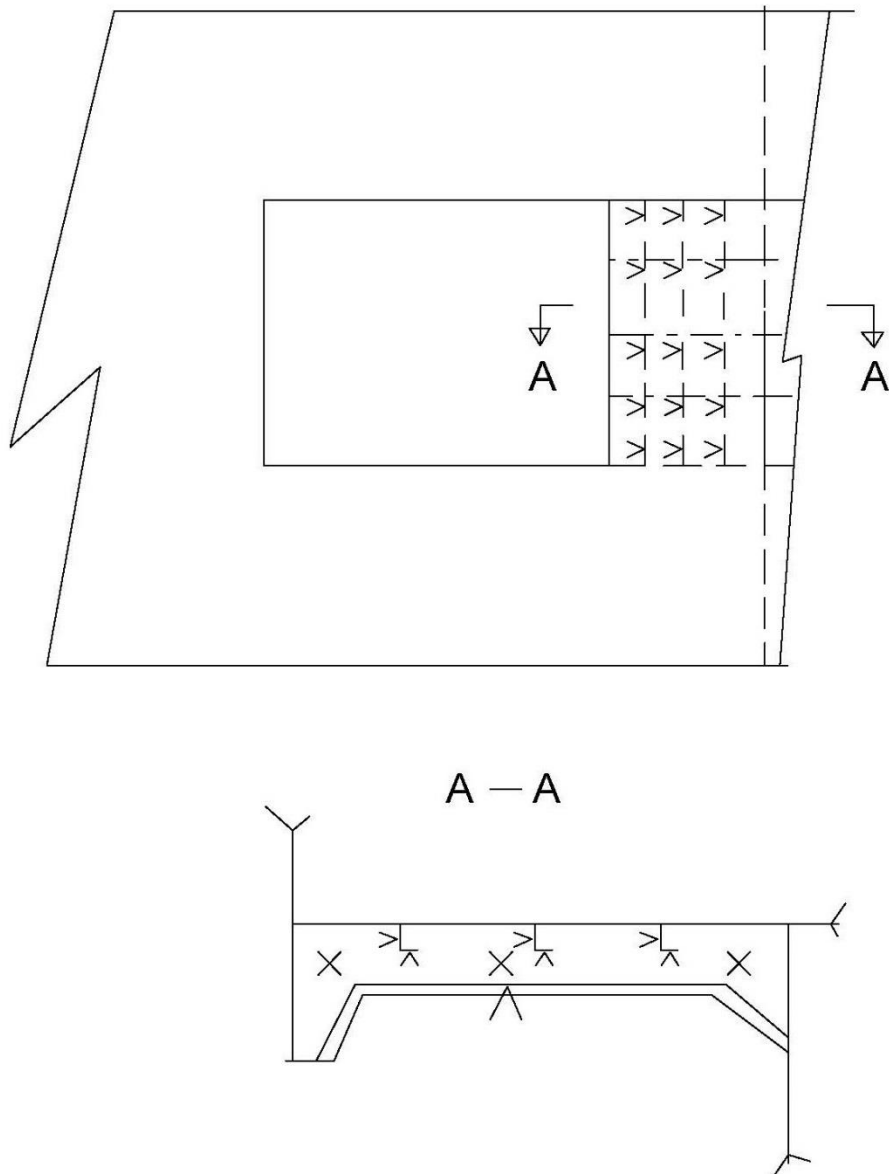


Figure 9: Locations of measurements on underdeck structure

7.4 Reporting

7.4.1 A thickness measurement report shall be prepared and submitted to the Administration. The report shall give the location of measurements, the thickness measured as well as the corresponding original thickness. Furthermore, the report shall give the date when the measurements were carried out, type of measuring equipment, names of personnel and their qualifications and be signed by the operator. The thickness measurement report should follow the principles as specified in the recommended procedures for thickness measurements set out in annex 8A/annex 8B.

7.4.2 The surveyor shall review the final thickness measurement report and countersign the cover page.

8 Acceptance criteria

8.1 General

8.1.1 For ships built under the IACS Common Structural Rules, the acceptance criteria shall be according to the IACS Common Structural Rules*, as applicable, and as specified in sections 8.2, 8.3 and 8.4.

8.1.2 For ships not built under the IACS Common Structural Rules, the acceptance criteria shall be according to the requirements of the classification society depending on the ship's age and structural elements concerned.

8.2 Acceptance criteria for pitting corrosion for ships built under the IACS Common Structural Rules

8.2.1 Side structures

8.2.1.1 If the pitting intensity in an area where coating is required, according to the IACS Common Structural Rules⁺, as applicable, is higher than 15% (see figure 1), thickness measurements shall be performed to check the extent of pitting corrosion. The 15% is based on pitting or grooving on only one side of a plate.

8.2.1.2 In cases where the pitting intensity is exceeding 15%, as defined above, an area of 300 mm diameter or more, at the most pitted part of the plate, shall 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 shall be taken as the thickness to be recorded.

8.2.1.3 The minimum remaining thickness in pits, grooves or other local areas shall be greater than the following without being greater than the renewal thickness (t_{ren}):

- .1 75% of the as-built thickness, in the frame and end brackets webs and flanges; and
- .2 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.

8.2.2 Other structures

8.2.2.1 For plates with a pitting intensity less than 20%, see figure 1 above, the measured thickness, t_m , of any individual measurement shall meet the lesser of the following criteria:

$$t_m \geq 0.7 (t_{as-built} - t_{vol add}) \text{ (mm); and}$$

$$t_m \geq t_{ren} - 1 \text{ (mm),}$$

where:

$t_{as-built}$	as-built thickness of the structural member, in mm;
$t_{vol add}$	voluntary thickness addition; thickness, in mm, voluntarily added as the owner's extra margin for corrosion wastage in addition to t_c ;

* Chapter 13 of IACS CSR for Bulk Carriers or Chapter 13 of Part 1 of IACS CSR BC & OT.

+ Section 5 of Chapter 3 of IACS CSR for Bulk Carriers or Section 4 of Chapter 3 of Part 1 of IACS CSR BC & OT.

t_{ren}	renewal thickness; minimum allowable thickness, in mm, below which renewal of structural members shall be carried out;
t_c	total corrosion addition, in mm, defined in IACS CSR*, as applicable; and
t_m	measured thickness, in mm, on one item, i.e. average thickness on one item using the various measurements taken on this same item during periodical surveys of ships in service.

8.2.2.2 The average thickness across any cross section of the plating shall not be less than the renewal criteria for general corrosion given in the IACS Common Structural Rules+, as applicable.

8.3 Acceptance criteria for edge corrosion for ships built under the IACS Common Structural Rules

8.3.1 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%, see figure 2 above, of the stiffener flange breadth or web height, as applicable, the measured thickness, t_m , shall meet the lesser of the following criteria:

$$t_m \geq 0.7 (t_{as-built} - t_{vol add}) \text{ (mm); and}$$

$$t_m \geq t_{ren} - 1 \text{ (mm).}$$

8.3.2 The average measured thickness across the breadth or height of the stiffener shall not be less than that defined in the IACS Common Structural Rules+, as applicable.

8.3.3 Plate edges at openings for manholes, lightening holes etc. may be below the minimum thickness given in the IACS Common Structural Rules+, as applicable, provided that:

- .1 the maximum extent of the reduced plate thickness, from the opening edge, below the minimum, shall not be more than 20% of the smallest dimension of the opening and shall not exceed 100 mm; and
- .2 rough or uneven edges may be cropped-back provided that the maximum dimension of the opening shall not be increased by more than 10% and the remaining thickness of the new edge shall not be less than $t_{ren} - 1$ mm.

8.4 Acceptance criteria for grooving corrosion for ships built under the IACS Common Structural Rules

8.4.1 Where the groove breadth is a maximum of 15% of the web height, but not more than 30 mm, see figure 3 above, the measured thickness, t_m , in the grooved area shall meet the lesser of the following criteria:

$$t_m \geq 0.75 (t_{as-built} - t_{vol add}) \text{ (mm);}$$

$$t_m \geq t_{ren} - 0.5 \text{ (mm); and}$$

$$t_m \geq 6 \text{ mm.}$$

* Section 3 of Chapter 3 of IACS CSR for Bulk Carriers or Section 3 of Chapter 3 of Part 1 of IACS CSR BC & OT.

+ Chapter 13 of IACS CSR for Bulk Carriers or Chapter 13 of Part 1 of IACS CSR BC&OT.

8.4.2 Structural members with areas of grooving greater than those in 8.4.1 above shall be assessed based on the criteria for general corrosion as defined in the IACS Common Structural Rules*, as applicable, using the average measured thickness across the plating/stiffener.

9 Reporting and evaluation of survey

9.1 Evaluation of survey report

9.1.1 The data and information on the structural condition of the ship collected during the survey shall be evaluated for acceptability and continued structural integrity of the ship.

9.1.1.1 For bulk carriers built under the IACS Common Structural Rules, the ship's longitudinal strength shall be evaluated by using the thickness of structural members measured, renewed and reinforced, as appropriate, during the renewal surveys carried out after the ship reached 15 years of age (or during the renewal survey No.3, if this is carried out before the ship reaches 15 years) in accordance with the criteria for longitudinal strength of the ship's hull girder for bulk carriers, specified in the IACS Common Structural Rules.

9.1.1.2 The final result of the evaluation of the ship's longitudinal strength required in paragraph 9.1.1.1, after renewal or reinforcement work of structural members, if carried out as a result of initial evaluation, shall be reported as a part of the condition evaluation report (executive hull summary report).

9.1.2 The analysis of data shall be carried out and endorsed by the Administration and the conclusions of the analysis shall form a part of the condition evaluation report (executive hull summary report).

9.2 Reporting

9.2.1 Principles for survey reporting are shown in annex 6.

9.2.2 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items examined and/or tested (pressure testing, thickness measurements, etc.) and an indication of whether the item has been credited, shall be made available to the next attending surveyor(s), prior to continuing or completing the survey.

9.2.3 A condition evaluation report (executive hull summary report) of the survey and results shall be issued to the owner as shown in annex 7 and placed on board the ship for reference at future surveys. The condition evaluation report (executive hull summary report) shall be endorsed by the Administration.

* Chapter 13 of IACS CSR for Bulk Carriers or Chapter 13 of Part 1 of IACS CSR BC&OT.

ANNEX 1

MINIMUM REQUIREMENTS FOR CLOSE-UP SURVEY AT RENEWAL SURVEYS OF SINGLE-SIDE SKIN BULK CARRIERS

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3	Renewal Survey No.4 and subsequent
<p>(A) 25% of shell frames in the forward cargo hold at representative positions</p> <p>(A) Selected frames in remaining cargo holds</p> <p>(B) One transverse web with associated plating and longitudinals in two representative water ballast tanks of each type (i.e. topside, or hopper side tank)</p> <p>(C) Two selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted</p> <p>(D) All cargo hold hatch covers and coamings (plating and stiffeners)</p>	<p>(A) All shell frames in the forward cargo hold and 25% of shell frames in each of the remaining cargo holds including upper and lower end attachments and adjacent shell plating</p> <p>(A) For bulk carriers of 100,000 dwt and above, all shell frames in the forward cargo hold and 50% of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating.</p> <p>(B) One transverse web with associated plating and longitudinals in each water ballast tank</p> <p>(B) Forward and aft transverse bulkhead in one ballast tank, including stiffening system</p> <p>(C) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted</p> <p>(D) All cargo hold hatch covers and coamings (plating and stiffeners)</p> <p>(E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches</p>	<p>(A) All shell frames in the forward and one other selected cargo hold and 50% of frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating</p> <p>(B) All transverse bulkheads in ballast tanks, including stiffening system</p> <p>(B) All transverse webs with associated plating and longitudinals in each water ballast tank</p> <p>Areas (C), (D), and (E) as for renewal survey No.2</p>	<p>(A) All shell frames in all cargo holds including upper and lower end attachments and adjacent shell plating. Areas (B)–(E) as for renewal survey No.3</p>

- (A) Cargo hold transverse frame.
- (B) Transverse web or watertight transverse bulkhead in water ballast tanks.
- (C) Cargo hold transverse bulkhead platings, stiffeners and girders.
- (D) Cargo hold hatch covers and coamings. For 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.
- (E) Deck plating and underdeck structure inside line of hatch openings between cargo hold hatches.

See sketches of appendices 3 to annexes 8A and 8B for areas corresponding to (A), (B), (C), (D) and (E).

See also sketch in annex 15 for zones of side shell frames for ships subject to compliance with resolution MSC.168(79).

Note: Close-up survey of transverse bulkheads shall 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 tank.

ANNEX 2

MINIMUM REQUIREMENTS FOR THICKNESS MEASUREMENTS AT RENEWAL SURVEYS OF SINGLE-SIDE SKIN BULK CARRIERS

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3	Renewal Survey No.4 and subsequent
1 Suspect areas	1 Suspect areas 2 Within the cargo length area: two transverse sections of deck plating outside line of cargo hatch openings 3 Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1 4 Wind and water strakes in way of transverse sections considered under point 2 above 5 Selected wind and water strakes outside the cargo length area 6 See 1.1.5 and annex 15 for additional thickness measurement guidelines applicable to the side shell frames and brackets on ships subject to compliance with resolution MSC.168(79)	1 Suspect areas 2 Within the cargo length area: .1 each deck plate outside line of cargo hatch openings .2 two transverse sections, one of which shall be in the amidship area, outside line of cargo hatch openings .3 all wind and water strakes within the cargo length area 3 Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1 4 Selected wind and water strakes outside the cargo length area 5 See 1.1.5 and annex 15 for additional thickness measurement guidelines applicable to the side shell frames and brackets on ships subject to compliance with resolution MSC.168(79) 6 As required by annex 12 for ships subject to compliance with regulation XII/6.1 of the Convention	1 Suspect areas 2 Within the cargo length area: .1 each deck plate outside line of cargo hatch openings .2 three transverse sections, one of which shall be in the amidship area, outside line of cargo hatch openings .3 each bottom plate 3 Point 3 referred to in Renewal Survey No.3 4 All wind and water strakes, full length 5 See 1.1.5 and annex 15 for additional thickness measurement guidelines applicable to the side shell frames and brackets on ship subject to compliance with resolution MSC.168(79) 6 As required by annex 12 for ships subject to compliance with regulation XII/6.1 of the Convention

ANNEX 3

OWNER'S INSPECTION REPORT

Structural condition

Ship's name:
IMO number:
Port of registry:
Owner:

TANK/HOLD	Grade of steel	Cracks	Corrosion	Buckles	Coating condition	Pitting	Modification/repair	Other
TANK/HOLD No.....								
Deck								
Bottom								
Side								
Side framing								
Longitudinal bulkheads								
Transverse bulkheads								
Repairs carried out due to:								
Thickness measurements carried out (dates):								
Results in general:								
Overdue surveys:								
Outstanding conditions of class:								
Comments:								

Inspected by			
	<i>Name</i>	<i>Date of inspection</i>	<i>Signature</i>

ANNEX 4A

SURVEY PROGRAMME

Basic information and particulars

Ship's name:
IMO number:
Flag State:
Port of registry:
Gross tonnage:
Deadweight (metric tonnes):
Length between perpendiculars (m):
Shipbuilder:
Hull number:
Recognized organization (RO):
RO ship identity:
Date of build of the ship:
Owner:
Thickness measurement firm:

1 Preamble

1.1 Scope

1.1.1 The present survey programme covers the minimum extent of overall surveys, close-up surveys, thickness measurements and pressure testing within the cargo length area, cargo holds, ballast tanks, including fore and aft peak tanks, required by the Code.

1.1.2 The arrangements and safety aspects of the survey shall be acceptable to the attending surveyor(s).

1.2 Documentation

All documents used in the development of the survey programme shall be available on board during the survey as required by section 6.

2 Arrangement of cargo holds, tanks and spaces

This section of the survey programme shall provide information (either in the form of plans or text) on the arrangement of cargo holds, tanks and spaces that fall within the scope of the survey.

3 List of cargo holds, tanks and spaces with information on their use, extent of coatings and corrosion prevention system

This section of the survey programme shall indicate any changes relating to (and shall update) the information on the use of the holds and tanks of the ship, the extent of coatings and the corrosion prevention system provided in the survey planning questionnaire.

4 Conditions for survey

This section of the survey programme shall provide information on the conditions for survey, e.g. information regarding cargo hold and tank cleaning, gas freeing, ventilation, lighting, etc.

5 Provisions and method of access to structures

This section of the survey programme shall indicate any changes relating to (and shall update) the information on the provisions and methods of access to structures provided in the survey planning questionnaire.

6 List of equipment for survey

This section of the survey programme shall identify and list the equipment that will be made available for carrying out the survey and the required thickness measurements.

7 Survey requirements

7.1 Overall survey

This section of the survey programme shall identify and list the spaces that shall undergo an overall survey for this ship in accordance with 2.5.1.

7.2 Close-up survey

This section of the survey programme shall identify and list the hull structures that shall undergo a close-up survey for this ship in accordance with 2.5.2.

8 Identification of tanks for tank testing

This section of the survey programme shall identify and list the cargo holds and tanks that shall undergo tank testing for this ship in accordance with 2.7.

9 Identification of areas and sections for thickness measurements

This section of the survey programme shall identify and list the areas and sections where thickness measurements shall be taken in accordance with 2.6.1.

10 Minimum thickness of hull structures

This section of the survey programme shall specify the minimum thickness for hull structures of this ship that are subject to survey (indicate either (a) or preferably (b) if such information is available):

- (a) Determined from the attached wastage allowance table and the original thickness on the hull structure plans of the ship;
- (b) Given in the following table(s):

Area or location	Original as-built thickness (mm)	Minimum thickness (mm)	Substantial corrosion thickness (mm)
Deck			
Plating			
Longitudinals			
Longitudinal girders			
Cross deck plating			
Cross deck stiffeners			
Bottom			
Plating			
Longitudinals			
Longitudinal girders			
Inner bottom			
Plating			
Longitudinals			
Longitudinal girders			
Floors			
Ship side in way of topside tanks			
Plating			
Longitudinals			
Ship side in way of hopper side tanks			
Plating			
Longitudinals			
Ship side in way of tanks (if applicable)			
Plating			
Longitudinals			
Longitudinal stringers			
Ship side in way of cargo holds			
Plating			
Side frames webs			
Side frames flanges			
Upper brackets webs			
Upper brackets flanges			
Lower brackets webs			
Lower brackets flanges			
Longitudinal bulkhead (if applicable)			
Plating			
Longitudinals (if applicable)			
Longitudinal girders (if applicable)			
Transverse bulkheads			
Plating			
Stiffeners (if applicable)			
Upper stool plating			
Upper stool stiffeners			
Lower stool plating			
Lower stool stiffeners			

Area or location	Original as-built thickness (mm)	Minimum thickness (mm)	Substantial corrosion thickness (mm)
Transverse web frames in topside tanks			
Plating			
Flanges			
Stiffeners			
Transverse web frames in hopper tanks			
Plating			
Flanges			
Stiffeners			
Hatch covers			
Plating			
Stiffeners			
Hatch coamings			
Plating			
Stiffeners			

Note: The wastage allowance tables shall be attached to the survey programme. For ships built under the IACS Common Structural Rules, the renewal thickness of the hull structure elements shall be indicated in the appropriate drawings.

11 Thickness measurement firm

This section of the survey programme shall identify changes, if any, relating to the information on the thickness measurement firm provided in the survey planning questionnaire.

12 Damage experience related to the ship

This section of the survey programme shall provide details of the hull damages for at least the last three years in way of the cargo holds, ballast tanks and void spaces within the cargo length area, using the tables provided below. These damages shall be subject to survey.

Hull damages sorted by location for this ship

Cargo hold, tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

Hull damages for sister or similar ships (if available) in the case of design-related damage

Cargo hold, tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

13 Areas identified with substantial corrosion from previous surveys

This section of the survey programme shall identify and list the areas of substantial corrosion from previous surveys.

14 Critical structural areas and suspect areas

This section of the survey programme shall identify and list the critical structural areas and the suspect areas, when such information is available.

15 Other relevant comments and information

This section of the survey programme shall provide any other comments and information relevant to the survey.

Appendices

Appendix 1 – List of plans

The provisions of 5.1.3.2 require that main structural plans of cargo holds and ballast tanks (scantling drawings), including information regarding use of high tensile steel (HTS), shall be available. This appendix of the survey programme shall identify and list the main structural plans which form part of the survey programme.

Appendix 2 – Survey planning questionnaire

The survey planning questionnaire (annex 4B), which has been submitted by the owner, shall be appended to the survey programme.

Appendix 3 – Other documentation

This part of the survey programme shall identify and list any other documentation that forms part of the plan.

Prepared by the owner in cooperation with the Administration for compliance with 5.1.3:

Date:

(name and signature of authorized owner's representative)

Date:

(name and signature of authorized representative of the Administration)

ANNEX 4B

SURVEY PLANNING QUESTIONNAIRE

The following information will enable the owner in cooperation with the Administration to develop a survey programme complying with the requirements of the Code. It is essential that the owner provides, when completing the present questionnaire, up-to-date information. The present questionnaire, when completed, will provide all the information and material required by the Code.

1 Particulars

Ship's name:

IMO number:

Flag State:

Port of registry:

Owner:

Recognized organization:

RO Ship identity:

Gross tonnage:

Deadweight (metric tonnes):

Date of build:

2 Information on access provision for close-up surveys and thickness measurement

The owner shall indicate, in the table below, the means of access to the structures subject to close-up survey and thickness measurement. A close-up survey is an examination where the details of structural components are within the close visual inspection range of the attending surveyor, i.e. normally within reach of hand.

Hold/Tank No.	Structure	Permanent means of access	Temporary staging	Rafts	Ladders	Direct access	Other means (please specify)
F.P.	Fore peak						
A.P.	Aft peak						
Cargo holds	Hatch side coamings						
	Topside sloping plate						
	Upper stool plating						
	Cross deck						
	Side shell, frames and brackets						
	Transverse bulkhead						
	Hopper tank plating						
	Lower stool						
	Tank top						
Topside tanks	Under deck structure						
	Side shell and structure						
	Sloping plate and structure						
	Webs and bulkheads						
Hopper tanks	Hopper sloping plate and structure						
	Side shell and structure						
	Bottom structure						
	Webs and bulkheads						
	Double-bottom structure						
	Upper stool internal structure						
	Lower stool internal structure						

History of bulk cargoes of a corrosive nature (e.g. high sulphur content)

3 Owner's inspections

Using a format similar to that of the table below (which is given as an example), the owner shall provide details of the results of their inspections, for the last 3 years – in accordance with the Code – on all CARGO holds and BALLAST tanks and VOID spaces within the cargo area.

Tank/Hold No.	Corrosion protection (1)	Coating extent (2)	Coating condition (3)	Structural deterioration (4)	Hold and tank history (5)
Cargo holds					
Topside tanks					
Hopper tanks					
Double-bottom tanks					
Upper stools					
Lower stools					
Fore peak					
Aft peak					
Miscellaneous other spaces:					

Note:

Indicate tanks which are used for oil/ballast.

- 1) HC = hard coating; SC = soft coating;
SH = semi-hard coating; NP = no protection
- 2) U = upper part; M = middle part;
L = lower part; C = complete
- 3) G = good; F = fair; P = poor;
RC = recoated (during the last three years)
- 4) N = no findings recorded; Y = findings recorded, description of findings shall be attached to this questionnaire
- 5) DR = Damage & Repair; L = Leakages;
CV = Conversion (description shall be attached to this questionnaire)

Name of owner's representative: Signature: Date:

Reports of port State control inspections

List the reports of port State control inspections containing hull structural related deficiencies and relevant information on rectification of the deficiencies:

Safety management system

List non-conformities related to hull maintenance including the associated corrective actions:

Name and address of the approved thickness measurement firm

ANNEX 5

PROCEDURES FOR APPROVAL AND CERTIFICATION OF A FIRM ENGAGED IN THICKNESS MEASUREMENT OF HULL STRUCTURES

1 Application

This guidance applies for certification of a firm which intends to engage in the thickness measurement of hull structures of ships.

2 Procedures for approval and certification

Submission of documents

- 2.1 The following documents shall be submitted to the Administration for approval:
- .1 outline of the firm, e.g. organization and management structure;
 - .2 experience of the firm on thickness measurement of hull structures of ships;
 - .3 technicians' careers, i.e. experience of technicians as thickness measurement operators, technical knowledge and experience of hull structure, etc. Operators shall be qualified according to a recognized industrial non-destructive test (NDT) Standard;
 - .4 equipment used for thickness measurement such as ultrasonic testing machines and their maintenance/calibration procedures;
 - .5 a guide for thickness measurement operators;
 - .6 training programmes for technicians for thickness measurement; and
 - .7 measurement record format taking into account the recommended procedures for thickness measurements (see annex 8A/annex 8B).

Auditing of the firm

2.2 Upon reviewing the documents submitted with satisfactory results, the firm shall be audited in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted, and eventually is capable of conducting thickness measurement of the hull structure of ships.

2.3 Certification shall be conditional upon an on board demonstration of thickness measurement as well as satisfactory reporting.

3 Certification

3.1 Upon satisfactory results of both the audit of the firm referred to in 2.2 and the demonstration tests referred to in 2.3, the Administration shall issue a certificate of approval as well as a notice to the effect that the thickness measurement operation system of the firm has been certified.

3.2 Renewal/endorsement of the certificate shall be carried out at intervals not exceeding

three years by verification that original conditions are maintained.

4 Information about any alteration to the certified thickness measurement operation system

In cases where any alteration to the certified thickness measurement operation system of the firm is made, such an alteration shall be immediately informed to the Administration. A re-audit shall be carried out where deemed necessary by the Administration.

5 Cancellation of approval

Approval may be cancelled and the certification withdrawn in the following cases:

- .1 where the measurements were improperly carried out or the results were improperly reported;
- .2 where the surveyor found any deficiencies in the approved thickness measurement operation systems of the firm; and
- .3 where the firm failed to inform any alteration referred to in 4 to the Administration as required.

ANNEX 6

SURVEY REPORTING PRINCIPLES

As a principle, for bulk carriers subject to this Code, the surveyor(s) shall include the following contents in the report for survey of hull structure and piping systems, as relevant for the survey. The structure of the report content may be different, depending on the reporting system of the Administration.

1 General

1.1 A survey report shall be generated in the following cases:

- .1 in connection with commencement, continuation and/or completion of periodical hull surveys, i.e. annual, intermediate and renewal surveys, as relevant;
- .2 when structural damages/defects have been found;
- .3 when repairs, renewals or modifications have been carried out; and
- .4 when a condition of class (recommendation) has been imposed or has been deleted.

1.2 The reporting shall provide:

- .1 evidence that prescribed surveys have been carried out in accordance with applicable requirements;
- .2 documentation of surveys carried out with findings, repairs carried out and condition of class (recommendation) imposed or deleted;
- .3 survey records, including actions taken, which shall form an auditable documentary trail. Survey reports shall be kept in the survey report file required to be on board;
- .4 information for planning of future surveys; and
- .5 information which may be used as input for maintenance of classification requirements and instructions.

1.3 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items surveyed, relevant findings and an indication of whether the item has been credited, shall be made available to the next attending surveyor, prior to continuing or completing the survey. Thickness measurement and tank testing carried out shall also be listed for the next surveyor.

2 Extent of the survey

2.1 Identification of compartments where an overall survey has been carried out.

2.2 Identification of locations, in each ballast tank and cargo hold including hatch covers and coamings, where a close-up survey has been carried out, together with information on the means of access used.

2.3 Identification of locations, in each ballast tank and cargo hold including hatch covers and coamings, where thickness measurement has been carried out.

Note: As a minimum, the identification of location of close-up survey and thickness measurement shall include a confirmation, with description of individual structural members, corresponding to the extent of requirements stipulated in annex A based on type of periodical survey and the ship's age.

Where only a partial survey is required, i.e. 25% of shell frames, one transverse web, two selected cargo hold transverse bulkheads, the identification shall include the location within each ballast tank and cargo hold by reference to frame numbers.

2.4 For areas in ballast tanks and cargo holds where the protective coating is found to be in GOOD condition and the extent of close-up survey and/or thickness measurement has been specially considered, structures subject to special consideration shall be identified.

2.5 Identification of tanks subject to tank testing.

2.6 Identification of piping systems on deck and within cargo holds, ballast tanks, pipe tunnels, cofferdams and void spaces where:

- .1 examination including internal examination of piping with valves and fittings and thickness measurement, as relevant, has been carried out; and
- .2 operational test to working pressure has been carried out.

3 Result of the survey

3.1 Type, extent and condition of protective coating in each tank, as relevant (rated GOOD, FAIR or POOR).

3.2 Structural condition of each compartment with information on the following, as relevant:

- .1 identification of findings, such as:
 - .1 corrosion with description of location, type and extent;
 - .2 areas with substantial corrosion;
 - .3 cracks/fractures with description of location and extent;
 - .4 buckling with description of location and extent; and
 - .5 indents with description of location and extent;
- .2 identification of compartments where no structural damages/defects are found. The report may be supplemented by sketches/photos; and

- .3 thickness measurement report shall be verified and signed by the surveyor witnessing the measurements on board.

4 Actions taken with respect to findings

4.1 Whenever the attending surveyor is of the opinion that repairs are required, each item to be repaired shall be identified in a survey report. Whenever repairs are carried out, details of the repairs effected shall be reported by making specific reference to relevant items in the survey report.

4.2 Repairs carried out shall be reported with identification of:

- .1 compartment;
- .2 structural member;
- .3 repair method (i.e. renewal or modification), including:
 - .1 steel grades and scantlings (if different from the original); and
 - .2 sketches/photos, as appropriate;
- .4 repair extent; and
- .5 non-destructive tests (NDT)/tests.

4.3 For repairs not completed at the time of survey, a condition of class/recommendation shall be imposed with a specific time limit for the repairs. In order to provide correct and proper information to the surveyor attending for survey of the repairs, the condition of class/recommendation shall be sufficiently detailed with identification of each item to be repaired. For identification of extensive repairs, reference may be given to the survey report.

ANNEX 7

CONDITION EVALUATION REPORT (EXECUTIVE HULL SUMMARY REPORT)

Issued upon completion of renewal survey

General particulars

Ship's name: Administration/recognized organization identity number:
IMO number:
Port of registry: National flag:
Deadweight Gross tonnage:
(metric tonnes): National:
ITC (1969):
Date of build: Classification notation:
Date of major conversion:
Type of conversion:

- 1 The survey reports and documents listed below have been reviewed by the undersigned and found to be satisfactory.
- 2 A summary of the survey is attached herewith on sheet 2.
- 3 The renewal survey has been completed in accordance with the present Code on (date)

Condition evaluation report (executive hull summary report) completed by	Name Signature	Title
Office	Date	
Condition evaluation report (executive hull summary report) verified by	Name Signature	Title
Office	Date	

Attached reports and documents:

- 1)
- 2)
- 3)
- 4)
- 5)

Contents of condition evaluation report (executive hull summary report)

- Part 1 – General particulars: - See front page
- Part 2 – Report review: - Where and how survey was done
- Part 3 – Close-up survey: - Extent (which tanks/holds)
- Part 4 – Thickness measurements: - Reference to thickness measurement report
 - Summary of where measured
 - Separate form indicating the spaces/areas with substantial corrosion, and corresponding:
 - thickness diminution
 - corrosion pattern
- Part 5 – Tank/hold corrosion prevention system: - Separate form indicating:
 - location of coating
 - condition of coating (if applicable)
- Part 6 – Repairs: - Identification of spaces/areas
- Part 7 – Condition of class (recommendations)/flag State requirements:
- Part 8 – Memoranda:
 - Acceptable defects
 - Any points of attention for future surveys, e.g. for suspect areas
 - Extended annual/intermediate survey due to coating breakdown
- Part 9 – Conclusion: - Statement on evaluation/verification of survey report

Extract of thickness measurements for ships not built under the IACS Common Structural Rules

Reference is made to the thickness measurement report:

Position of substantially corroded tanks/areas ¹ or areas with deep pitting ³	Thickness diminution [%]	Corrosion pattern ²	Remarks: (e.g. reference to attached sketches)

Notes:

- 1 Substantial corrosion, i.e. 75 to 100% of acceptable margins wasted.
- 2 P = Pitting
C = Corrosion in general
- 3 Any bottom plating with a pitting intensity of 20% or more, with wastage in the substantial corrosion range or having an average depth of pitting of 1/3 or more of actual plate thickness shall be noted.

Extract of thickness measurements for ships built under the IACS Common Structural Rules

Reference is made to the thickness measurements report:

Position of substantially corroded tanks/areas ¹ or areas with deep pitting	$t_m - t_{ren}$ (mm)	Corrosion pattern ²	Remarks (e.g. reference to attached sketches)

Notes:

- 1 Substantial corrosion, an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{ren} + 0.5$ mm and t_{ren} .
- 2 P = Pitting
C = Corrosion in general
Areas with deep pitting assessed according to section 8.2 shall be recorded in this column.

Tank/hold corrosion prevention system

Tank/hold Nos. ¹	Tank/hold corrosion prevention system ²	Coating condition ³	Remarks

Notes:

- 1 All ballast tanks and cargo holds shall be listed.
- 2 C = Coating
NP = No protection
- 3 Coating condition according to the following standard:
 - 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.

If coating condition POOR is given, extended annual surveys shall be introduced. This shall be noted in part 8 of the contents of the condition evaluation report (executive hull summary report).

ANNEX 8A

**RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS OF SINGLE-SIDE
SKIN BULK CARRIERS NOT BUILT UNDER THE IACS COMMON STRUCTURAL
RULES***

General

1 These procedures should be used for recording thickness measurements as required by part A of annex A.

2 Reporting forms TM1-BC, TM2-BC(i), TM2-BC(ii) TM3-BC, TM4-BC, TM5-BC, TM6-BC, TM7-BC(i) and TM7-BC(ii), set out in appendix 2 should be used for recording thickness measurements and the maximum allowance diminution should be stated. The maximum allowable diminution could be stated in an attached document.

3 Appendix 3 contains guidance diagrams and notes relating to the reporting forms and the requirements for thickness measurement.

4 The reporting forms should, where appropriate, be supplemented by data presented on structural sketches.

* This annex is recommendatory.

Appendix 1

GENERAL PARTICULARS

Ship's name:
IMO number:
Class/Administration identity number:
Port of registry:
Gross tonnage:
Deadweight:
Date of build:
Classification society:

Name of firm performing thickness measurement:
.....
Thickness measurement firm certified by:
Certificate number:
Certificate valid from: to
Place of measurement:
First date of measurement:
Last date of measurement:
Renewal survey/intermediate survey* due:
Details of measurement equipment:
Qualification of operator:

Report number:	consisting of pages
Name of operator:	Name of surveyor:
Signature of operator:	Signature of surveyor:
Firm official stamp:	Administration:

Official stamp

* Delete as appropriate.

Appendix 2

REPORTS ON THICKNESS MEASUREMENT

TM1-BC

Reports on thickness measurement of all deck plating, all bottom shell plating or side shell plating*

Ship's name..... IMO number..... Class identity No..... Report No.....

PLATE POSITION	No. or letter	Orig. thk. (mm)	Forward reading						Aft reading						Mean diminution (%)		Maximum allowable diminution (mm)
			Gauged		Diminution P		Diminution S		Gauged		Diminution P		Diminution S		P	S	
			P	S	mm	%	mm	%	P	S	mm	%	mm	%			
12th forward																	
11th																	
10th																	
9th																	
8th																	
7th																	
6th																	
5th																	
4th																	
3rd																	
2nd																	
1st																	
Amidships																	
1st aft																	
2nd																	
3rd																	
4th																	
5th																	
6th																	
7th																	
8th																	
9th																	
10th																	
11th																	
12th																	

Operator's signature.....

Notes – see following page

* Delete as appropriate.

Notes to report TM1-BC:

- 1 This report should be used for recording the thickness measurement of:
 - .1 All strength deck plating within the cargo length area.
 - .2 Keel, bottom shell plating and bilge plating within the cargo length area.
 - .3 Side shell plating that is all wind and water strakes within the cargo length area.
 - .4 Side shell plating that is selected wind and water strakes outside the cargo length area.
- 2 The strake position should be clearly indicated as follows:
 - .1 For strength deck, indicate the number of the strake of plating inboard from the stringer plate.
 - .2 For bottom plating, indicate the number of the strake of plating outboard from the keel plate.
 - .3 For side shell plating, give number of the strake of plating below sheer strake and letter as shown on shell expansion.
- 3 Only the deck plating strakes outside line of openings should be recorded.
- 4 Measurements should be taken at the forward and aft areas of all plates.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The maximum allowable diminution could be stated in an attached document.

Notes to report TM2-BC(i):

- 1 This report should be used for recording the thickness measurement of strength deck plating and sheer strake plating transverse sections:

One, two or three sections within the cargo length area, comprising of the structural items (1), (2) and (3) as shown on the diagram of typical transverse sections (appendix 3).
- 2 Only the deck plating strakes outside the line of openings should be recorded.
- 3 The topside area comprises deck plating, stringer plate and sheer strake (including rounded gunwales).
- 4 The exact frame station of measurement should be stated.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The maximum allowable diminution could be stated in an attached document.

TM2-BC(ii)

Report on thickness measurement of shell and deck plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

SHELL PLATING																												
STRAKE POSITION	FIRST TRANSVERSE SECTION AT FRAME NUMBER								SECOND TRANSVERSE SECTION AT FRAME NUMBER								THIRD TRANSVERSE SECTION AT FRAME NUMBER											
	No. or letter	Org. thk.	Max. alwb. dim.	Gauged		Diminution P		Diminution S		No. or letter	Org. thk.	Max. alwb. dim.	Gauged		Diminution P		Diminution S		No. or letter	Org. thk.	Max. alwb. dim.	Gauged		Diminution P		Diminution S		
				P	S	mm	%	mm	%				P	S	mm	%	mm	%				P	S	mm	%	mm	%	
1st below sheer strake																												
2nd																												
3rd																												
4th																												
5th																												
6th																												
7th																												
8th																												
9th																												
10th																												
11th																												
12th																												
13th																												
14th																												
15th																												
16th																												
17th																												
18th																												
19th																												
20th																												
keel strake																												
BOTTOM TOTAL																												

Operator's signature.....

Notes – see following page

Notes to report TM2-BC(ii):

- 1 This report should be used for recording the thickness measurements of shell plating at transverse sections:

One, two or three sections within the cargo length area comprising of the structural items (4), (5), (6), and (7) as shown on the diagram of typical transverse sections (appendix 3).
- 2 The bottom area comprises keel, bottom and bilge plating.
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The maximum allowable diminution could be stated in an attached document.

Notes to report TM3-BC:

- 1 This report should be used for recording the thickness measurement of longitudinal members at transverse sections:

One, two or three sections within the cargo length area, comprising of the appropriate structural items (8) to (20) as shown on the diagram of typical transverse sections (appendix 3).
- 2 The exact frame station of measurement should be stated.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

Notes to report TM4-BC:

- 1 This report should be used for recording the thickness measurement of transverse structural members, comprising of the appropriate structural items (23) to (25) as shown on the diagram of typical transverse sections (appendix 3).
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM5-BC

Report on thickness measurement of cargo hold transverse bulkheads

Ship's name..... IMO number..... Class identity No..... Report No.....

LOCATION OF STRUCTURE:	FRAME NO.:
------------------------	------------

STRUCTURAL COMPONENT (PLATING/STIFFENER)

	Original thickness mm	Max. alwb. dim. mm	Gauged		Diminution P		Diminution S	
			Port	Starboard	mm	%	mm	%

Operator's signature.....

Notes – see following page

Notes to report TM5-BC:

- 1 This report form should be used for recording the thickness measurement of cargo hold transverse bulkheads.
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM6-BC

Report on thickness measurement of miscellaneous structural members

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER:						SKETCH			
LOCATION OF STRUCTURE:									
Description	Org. thk. mm	Max. alwb. dim. mm	Gauged		Diminution P		Diminution S		
			P	S	mm	%	mm	%	

Operator's signature.....

Notes – see following page

Notes to report TM6-BC:

- 1 This report should be used for recording the thickness measurement of miscellaneous structural members including structural items (28), (29) and (30) as shown on the diagram of typical transverse sections (appendix 3).
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM7-BC(i)

Report on thickness measurement of cargo hold transverse frames

Ship's name..... IMO number..... Class identity No..... Report No.....

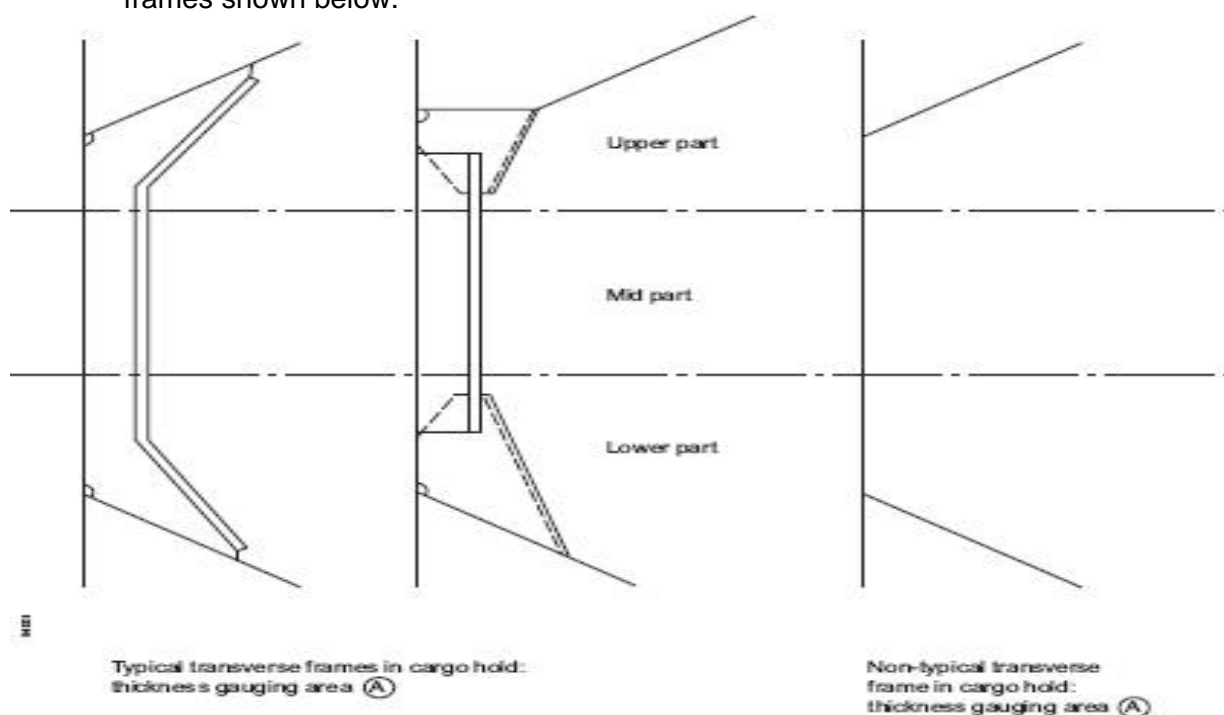
CARGO HOLD NO.																								
FRAME NUMBER	UPPER PART								MID PART								LOWER PART							
	Org. thk.	Max. alwb. dim.	Gauged		Diminution P		Diminution S		Org. thk.	Max. alwb. dim.	Gauged		Diminution P		Diminution S		Org. thk.	Max. alwb. dim.	Gauged		Diminution P		Diminution S	
	mm	mm	P	S	mm	%	mm	%	mm	mm	P	S	mm	%	mm	%	mm	mm	P	S	mm	%	mm	%

Operator's signature.....

Notes – see following page

Notes to report TM7-BC(i):

- 1 This report should be used for recording the thickness measurement of:
 - cargo hold transverse frames; and
 - structural item number (34) as shown on the diagram of typical transverse section indicating longitudinal and transverse members (appendix 3).
- 2 Guidance for areas of measurement is indicated in appendix 3. The single measurements recorded should represent the average of multiple measurements.
- 3 The location and pattern of measurements is to be indicated on the sketches of hold frames shown below.



- 4 The maximum allowable diminution could be stated in an attached document.

TM7-BC(ii)

Report on thickness measurement of cargo hold side shell frames

Ship's name..... IMO number..... Class identity No..... Report No.....

	CARGO HOLD NO.:										Side:				(Port / stb.)									
	ZONE A					ZONE B					ZONE C				ZONE D									
FRAME NO	Org. thk.	t _{REN}	t _{COAT}	t _M	Diminution		Org. thk.	t _{REN}	t _{COAT}	t _M	Diminution		Org. thk.	t _{REN}	t _{COAT}	t _M	Diminution		Org. thk.	t _{REN}	t _{COAT}	t _M	Diminution	
	mm	mm	mm	mm	mm	%	mm	mm	mm	mm	mm	%	mm	mm	mm	mm	mm	%	mm	mm	mm	mm	mm	%

Operator's signature.....

Notes – see following page

Notes on report TM7-BC(ii):

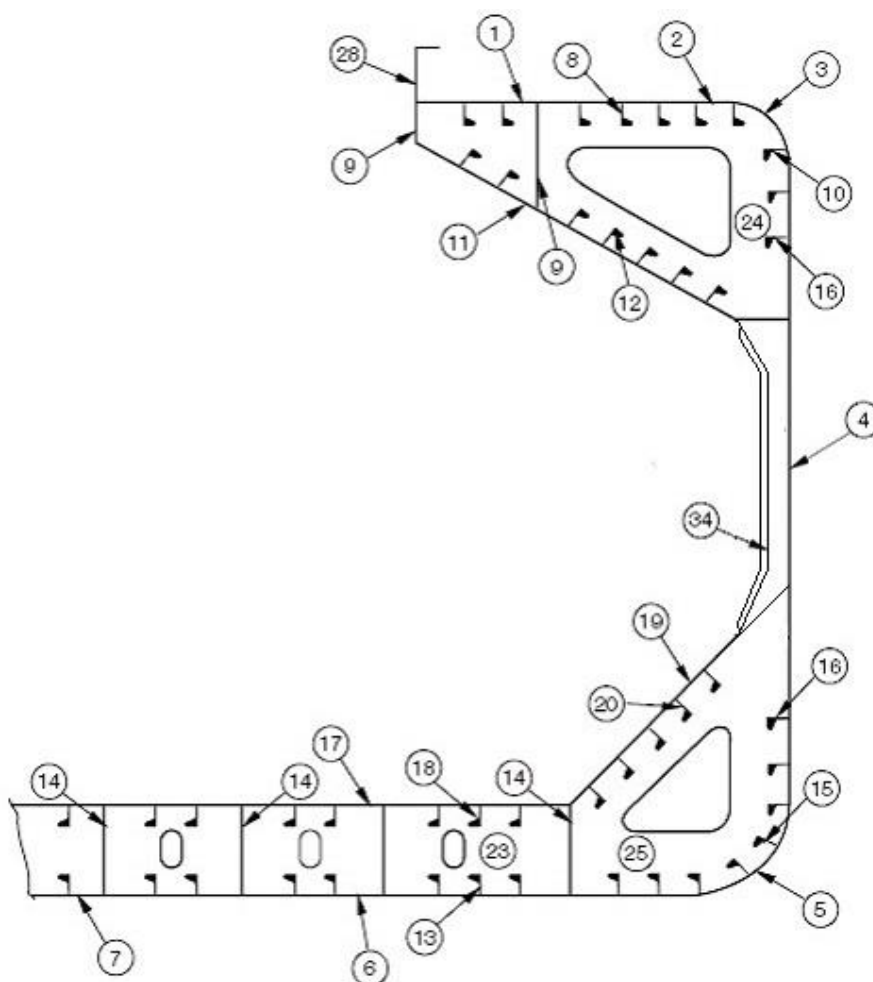
- 1 This report should be used for recording the thickness measurement of Cargo hold transverse frames for application of resolution MSC.168(79).
- 2 Guidance for areas of measurement is provided in annex 15.
- 3 Symbols should be applied as follows:

t_M	=	thickness as measured, in mm
t_{REN}	=	thickness at which renewal is required in accordance with paragraph 2.1.2 of annex 2 to resolution MSC.168(79)
t_{COAT}	=	$0.75 \cdot$ (thickness, in mm, as required by annex 1 to resolution MSC.168(79), in paragraph 3 for frame webs and in paragraph 4 for upper and lower brackets).
- 4 The maximum allowable diminution could be stated in an attached document.

Appendix 3

GUIDANCE ON THICKNESS MEASUREMENT – SINGLE-SIDE SKIN BULK CARRIERS NOT BUILT UNDER IACS CSR

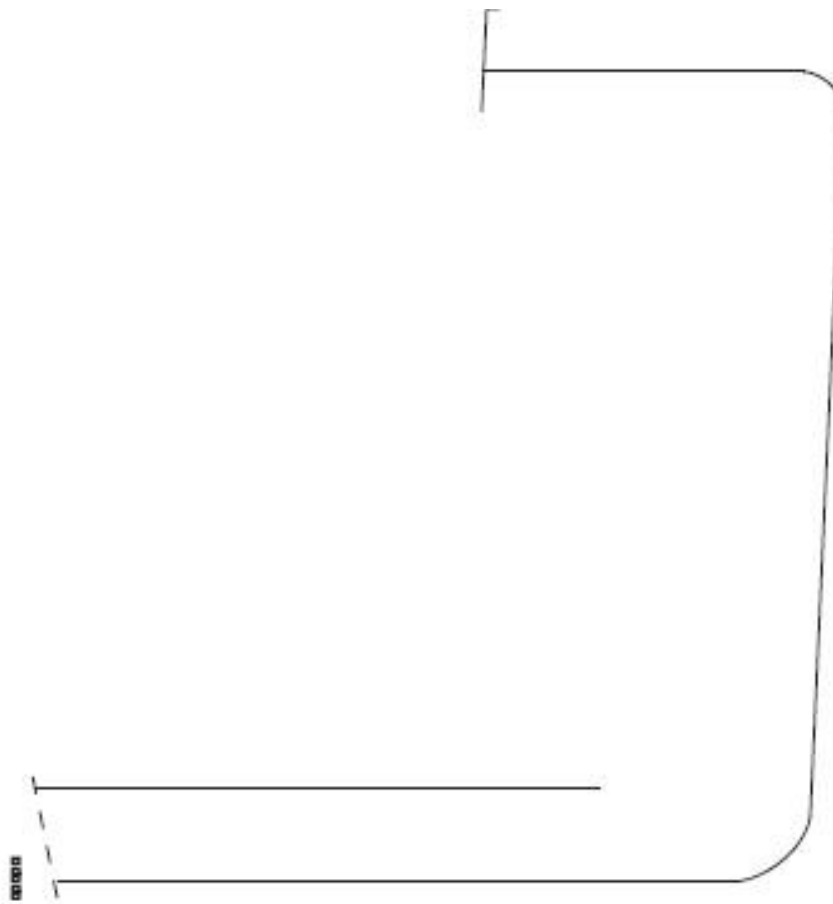
Typical transverse section indicating longitudinal and transverse members



Reports TM2-BC(i) and TM2-BC(ii)		Report TM3-BC	
1	Strength deck plating	8	Deck longitudinals
2	Stringer plate	9	Deck girders
3	Sheer strake	10	Sheer strake longitudinals
4	Side shell plating	11	Topside tank sloping plate
5	Bilge plating	12	Topside tank sloping plate longitudinals
6	Bottom shell plating	13	Bottom longitudinals
7	Keel plate	14	Bottom girders
		15	Bilge longitudinals
		16	Side shell longitudinals, if any
		17	Inner bottom plating
		18	Inner bottom longitudinals
		19	Hopper side plating
		20	Hopper side longitudinals
Report TM4-BC		Report TM6-BC	
23	Double bottom tank floors	28	Hatch coamings
24	Topside tank transverses	29	Deck plating between hatches
25	Hopper side tank transverses	30	Hatch covers
		Report TM7-BC	
		34	Hold frames or diaphragms

Transverse section outline

The diagram may be used for those ships where the typical transverse sections are not suitable.



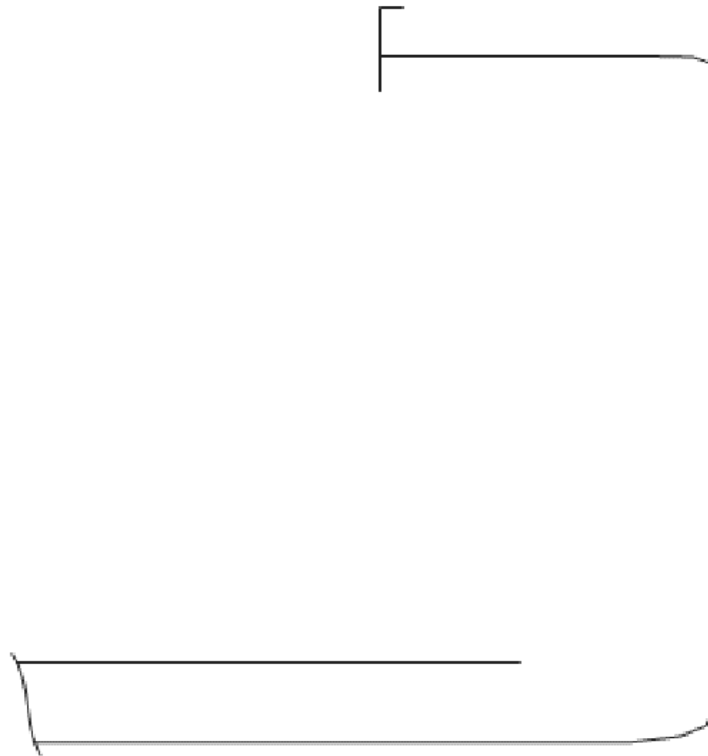
REPORT ON TM2-BC	
①	Strength deck plating
②	Stringer plate
③	Sheerstrake
④	Side shell plating
⑤	Bilge plating
⑥	Bottom shell plating
⑦	Keel plate

REPORT ON TM3-BC	
⑧	Deck longitudinals
⑨	Deck girders
⑩	Sheerstrake longitudinals
⑪	Topside tank sloping plating
⑫	Topside tank sloping plating longitudinals
⑬	Bottom longitudinals
⑭	Bottom girders
⑮	Bilge longitudinals
⑯	Side shell longitudinals
⑰	Inner bottom plating
⑱	Inner bottom longitudinals
⑲	Hopper side plating
⑳	Hopper side longitudinals
㉑	
㉒	

REPORT ON TM4-BC	
㉓	Double-bottom tank floors
㉔	Topside tank transverses
㉕	Hopper side tank transverses
㉖	
㉗	

REPORT ON TM6-BC	
㉘	Hatch coamings
㉙	Deck plating between hatches
㉚	Hatch covers
㉛	Inner bulkhead plating
㉜	
㉝	

REPORT ON TM7-BC	
㉞	Hold frames or diaphragms



Reports TM2-BC(i) and TM2-BC(ii)	
1	Strength deck plating
2	Stringer plate
3	Sheer strake
4	Side shell plating
5	Bilge plating
6	Bottom shell plating
7	Keel plate

Report TM3-BC			
8	Deck longitudinals	17	Inner bottom plating
9	Deck girders	18	Inner bottom longitudinals
10	Sheer strake longitudinals	19	Hopper side plating
11	Topside tank sloping plate	20	Hopper side longitudinals
12	Topside tank sloping plate longitudinals		
13	Bottom longitudinals		
14	Bottom girders		
15	Bilge longitudinals		
16	Side shell longitudinals, if any		

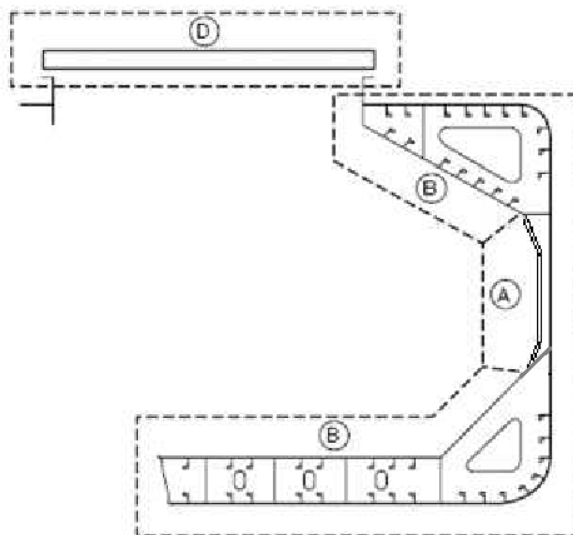
Report TM4-BC	
23	Double bottom tank floors
24	Topside tank transverses
25	Hopper side tank transverses

Report TM6-BC	
28	Hatch coamings
29	Deck plating between hatches
30	Hatch covers

Close-up survey and thickness measurement areas

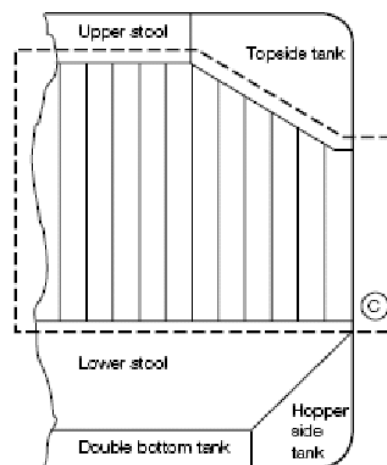
Areas subject to close-up survey and thickness measurement – areas (A) to (E), as defined in annex 1. The thickness measurements should be reported in forms TM3-BC, TM4-BC, TM5-BC, TM6-BC and TM7-BC, as appropriate.

Typical transverse section
Areas A, B and D



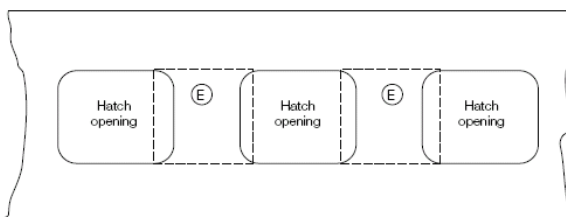
Thickness should be reported in forms TM3-BC, TM4-BC, TM6-BC and TM7-BC, as appropriate

A cargo hold, transverse bulkhead Area C



Thickness should be reported in form TM5-BC

Typical areas of deck plating inside the line of hatch openings between cargo hold hatches
Area E



Thickness should be reported on TM6-BC

ANNEX 8B

**RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS OF
SINGLE-SKIN BULK CARRIERS BUILT UNDER THE IACS COMMON STRUCTURAL
RULES***

General

1 These procedures should be used for recording thickness measurements of ships built under the IACS Common Structural Rules.

2 Reporting forms TM1-BC(CSR), TM2-BC(CSR)(i), TM2-BC(CSR)(ii), TM3-BC(CSR), TM4-BC(CSR), TM5-BC(CSR), TM6-BC(CSR) and TM7-BC(CSR) (see appendix 2) should be used for recording thickness measurements. The as-built thickness and the voluntary thickness addition and renewal thickness should be stated in the aforementioned forms.

3 Appendix 3 contains guidance diagrams and notes clarifying the areas for thickness measurement and the respective reporting forms.

4 The reporting forms should, where appropriate, be supplemented by data presented on structural sketches.

* This annex is recommendatory.

Appendix 1

GENERAL PARTICULARS

Ships name:
IMO number:
Class/Administration identity number:
Port of registry:
Gross tons:
Deadweight:
Date of build:
Classification society:

Name of the firm performing thickness measurement:
Thickness measurement firm certified by:
Certificate No:
Certificate valid from.....to.....
Place of measurement:
First date of measurement:
Last date of measurement:
Renewal survey/intermediate* survey due:
Details of measurement equipment:
Qualification of operators:

Report number:	consisting of.....pages
Name of operator:	Name of surveyor:
Signature of operator:	Signature of surveyor:
Firm official stamp:	Administration:

Official Stamp

* Delete as appropriate.

Appendix 2

REPORTS ON THICKNESS MEASUREMENT

TM1-BC(CSR)

Report on thickness measurement of all deck plating, all bottom plating or side shell plating*

Ship's name..... IMO number..... Class identity No..... Report No.....

STRAKE POSITION															
	PLATE POSITION	No. or letter	As-built thk. mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Forward reading				Aft reading				Mean remaining corr. addition, mm [(c1)+(c2)]/2	
						Gauged thk. mm (b1)		Remaining corr. addition, mm (c1)=(b1)-(a)		Gauged thk. mm (b2)		Remaining corr. addition, mm (c2)=(b2)-(a)			
						P	S	P	S	P	S	P	S	P	S
12th forward															
11th															
10th															
9th															
8th															
7th															
6th															
5th															
4th															
3rd															
2nd															
1st															
Amidships															
1st aft															
2nd															
3rd															
4th															
5th															
6th															
7th															
8th															
9th															
10th															
11th															
12th															

Operator's signature.....

Notes – see following page

* Delete as appropriate.

Notes to report TM1-BC(CSR)

- 1 This report should be used for recording the thickness measurement of:
 - .1 all strength deck plating within cargo length area;
 - .2 keel, bottom shell plating and bilge plating within the cargo length area;
 - .3 side shell plating that is all wind and water strakes within the cargo length area; and
 - .4 side shell plating that is selected wind and water strakes outside the cargo length area.
- 2 The strake position should be clearly indicated as follows:
 - .1 for strength deck indicate the number of the strake of plating inboard from the stringer plate;
 - .2 for bottom plating indicate the number of the strake of plating outboard from the keel plate; and
 - .3 for side shell plating give number of the strake of plating sheer strake and letter as shown on shell expansion.
- 3 Only the deck plating strakes outside line of openings should be recorded.
- 4 Measurements should be taken at the forward and aft areas of all plates and the single measurements recorded should represent the average of multiple measurements.
- 5 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM2-BC(CSR)(i)

Report on thickness measurement of shell and deck plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

STRENGTH DECK AND SHEER STRAKE PLATING

STRAKE POSITION	FIRST TRANSVERSE SECTION AT FRAME NUMBER						SECOND TRANSVERSE SECTION AT FRAME NUMBER						THIRD TRANSVERSE SECTION AT FRAME NUMBER											
	No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)	
					P	S	P	S					P	S	P	S					P	S	P	S
Stringer Plate																								
1st strake inboard																								
2nd																								
3rd																								
4th																								
5th																								
6th																								
7th																								
8th																								
9th																								
10th																								
11th																								
12th																								
13th																								
14th																								
centre strake																								
sheer strake																								
TOPSIDE TOTAL																								

Operator's signature.....

Notes – see following page

Notes to report TM2-BC(CSR)(i)

- 1 This report should be used for recording the thickness measurement of strength deck plating and sheer strake plating transverse sections (one, two or three sections within the cargo length area, comprising of the structural items (1), (2) and (3) as shown on the diagram of typical transverse section (appendix 3)).
- 2 Only the deck plating strakes outside the line of openings should be recorded.
- 3 The topside area comprises deck plating, stringer plate and sheer strake (including rounded gunwales).
- 4 The exact frame station of measurement should be stated.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM2-BC(CSR)(ii)

Report on thickness measurement of shell plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

SHELL PLATING

STRAKE POSITION	FIRST TRANSVERSE SECTION AT FRAME NUMBER						SECOND TRANSVERSE SECTION AT FRAME NUMBER						THIRD TRANSVERSE SECTION AT FRAME NUMBER											
	No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)	
					P	S	P	S					P	S	P	S					P	S		
1 st below sheer strake																								
2 nd																								
3 rd																								
4 th																								
5 th																								
6 th																								
7 th																								
8 th																								
9 th																								
10 th																								
11 th																								
12 th																								
13 th																								
14 th																								
15 th																								
16 th																								
17 th																								
18 th																								
19 th																								
20 th																								
Keel strake																								
BOTTOM TOTAL																								

Operator's signature.....

Notes – see following page

Notes to report TM2-BC(CSR)(ii)

- 1 This report should be used for recording the thickness measurement of shell plating transverse sections (one, two or three sections within cargo length area comprising of the structural items (4), (5), (6) and (7) as shown on the diagram of typical transverse section (appendix 3)).
- 2 The bottom area comprises keel, bottom and bilge plating.
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM3-BC(CSR)

Report on thickness measurement of longitudinal members (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

	FIRST TRANSVERSE SECTION AT FRAME NUMBER							SECOND TRANSVERSE SECTION AT FRAME NUMBER							THIRD TRANSVERSE SECTION AT FRAME NUMBER									
STRUCTURAL MEMBER	Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)	
					P	S	P	S					P	S	P	S					P	S	P	S

Operator's signature.....

Notes – see following page

Notes to report TM3-BC(CSR)

- 1 This report should be used for recording the thickness measurement of longitudinal members at transverse sections (one, two, or three sections within the cargo length area, comprising of the appropriate structural items (8) to (20) as shown on diagram of typical transverse section (appendix 3)).
- 2 The exact frame station of measurement should be stated.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM4-BC(CSR)

**Report on thickness measurement of transverse structural members in the double bottom,
hopper side and topside water ballast tanks**

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK DESCRIPTION:									
LOCATION OF STRUCTURE									
STRUCTURAL MEMBER	ITEM	As-built thickness mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm		Remaining corr. addition mm		
					(b)		(b)-(a)		
					P	S	P		S

Operator's signature.....

Notes – see following page

Notes to report TM4-BC(CSR)

- 1 This report should be used for recording the thickness measurement of transverse structural members, comprising of the appropriate structural items (23) to (25) as shown on diagram of typical transverse section (appendix 3).
- 2 Guidance for areas of measurement is indicated on the diagrams shown in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM5-BC(CSR)

Report on thickness of cargo hold transverse bulkheads

Ship's name..... IMO number..... Class identity No..... Report No.....

HOLD DESCRIPTION:									
LOCATION OF STRUCTURE:					FRAME NO.:				
STRUCTURAL COMPONENT (PLATING/STIFFENER)	As-built thickness mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm		Remaining corr. addition mm			
				(b)		(b)-(a)			
				P	S	P		S	

Operator's signature.....

Notes – see following page

Notes to report TM5-BC(CSR)

- 1 This report form should be used for recording the thickness measurement of cargo hold transverse bulkheads.
- 2 Guidance for areas of measurement is indicated on the diagrams shown in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM6-BC(CSR)

Report on thickness measurement of miscellaneous structural members

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER:						SKETCH							
LOCATION OF STRUCTURE:													
Description	As-built thk. mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm						Remaining corr. addition mm			
				(b)						(b)-(a)			
				P	S					P	S	P	S

Operator's signature.....

Notes – see following page

Notes to report TM6-BC(CSR)

- 1 This report should be used for recording the thickness measurement of miscellaneous structural members including the structural items (28), (29) and (30) as shown on diagram of typical transverse section (appendix 3).
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM7-BC(CSR)

Report on thickness measurement of cargo hold transverse frames

Ship's name..... IMO number..... Class identity No..... Report No.....

CARGO HOLD NO.																				
FRAME NUMBER	UPPER PART						MID PART						LOWER PART							
	As-built thk	Volun. thk. add.	Renewal thickness	Gauged thickness mm		Remaining corr. addition mm	As-built thk	Volun. thk. add.	Renewal thickness	Gauged thickness mm		Remaining corr. addition mm	As-built thk	Volun. thk. add.	Renewal thickness	Gauged thickness mm		Remaining corr. addition mm		
			(a)	(b)		(b)-(a)			(a)	(b)		(b)-(a)			(a)	(b)		(b)-(a)		
	mm	mm	mm	P	S	P	S	mm	mm	mm	P	S	P	S	mm	mm	mm	P	S	P

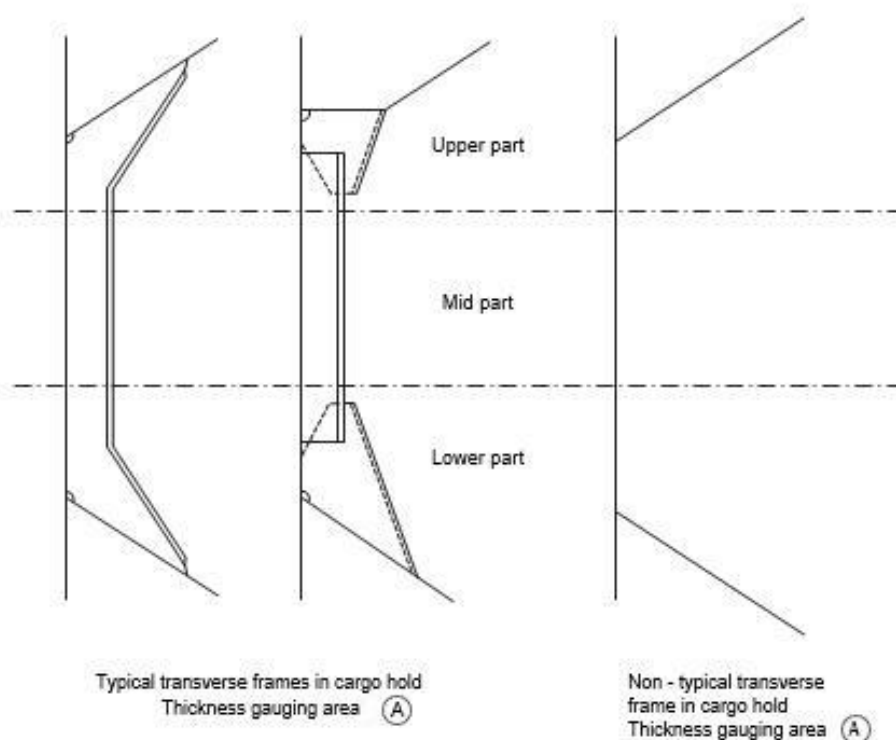
Operator's signature.....

Notes – see following page

Notes to report TM7-BC(CSR)

This report should be used for recording the thickness measurement of:

- 1 Cargo hold transverse frames, i.e. structural item (34) as shown on the diagram of typical transverse section in appendix 3.
- 2 Guidance for areas of measurement is indicated on the diagrams shown in appendix 3.
- 3 The single measurement recorded should represent the average of multiple measurements.
- 4 The location and pattern of measurements should be indicated on the sketches of hold frames shown below.

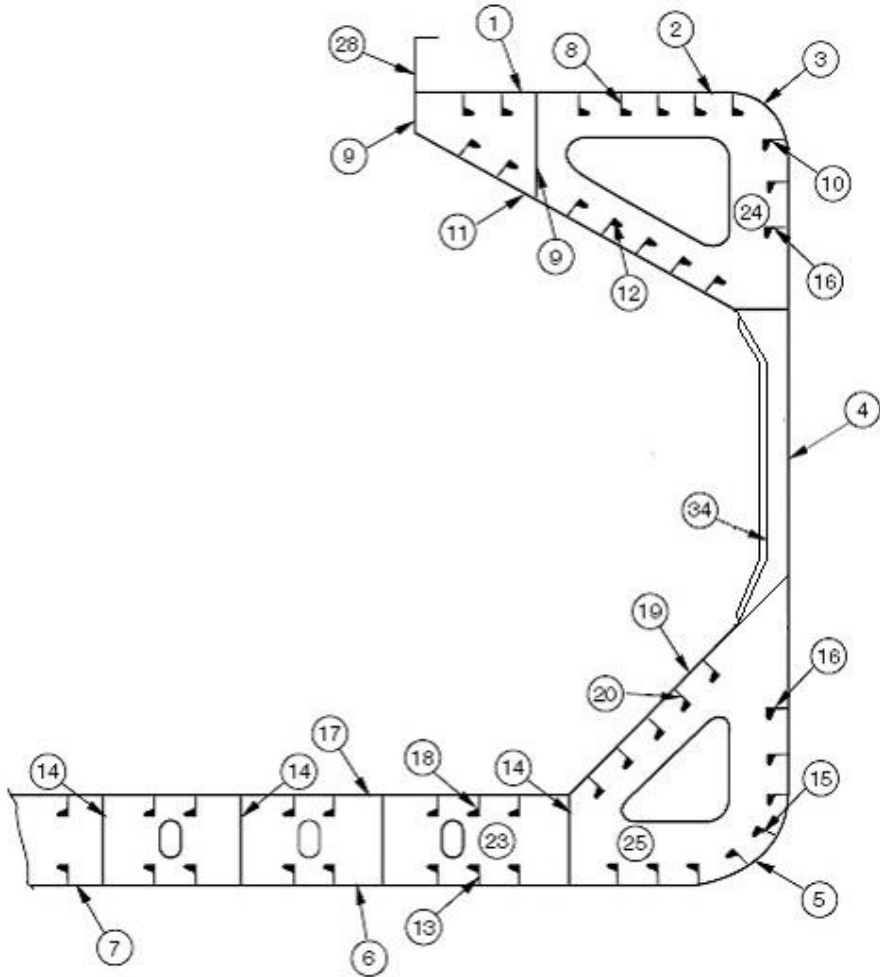


- 5 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

Appendix 3

GUIDANCE ON THICKNESS MEASUREMENT – SINGLE-SIDE SKIN BULK CARRIERS BUILT UNDER THE IACS COMMON STRUCTURAL RULES

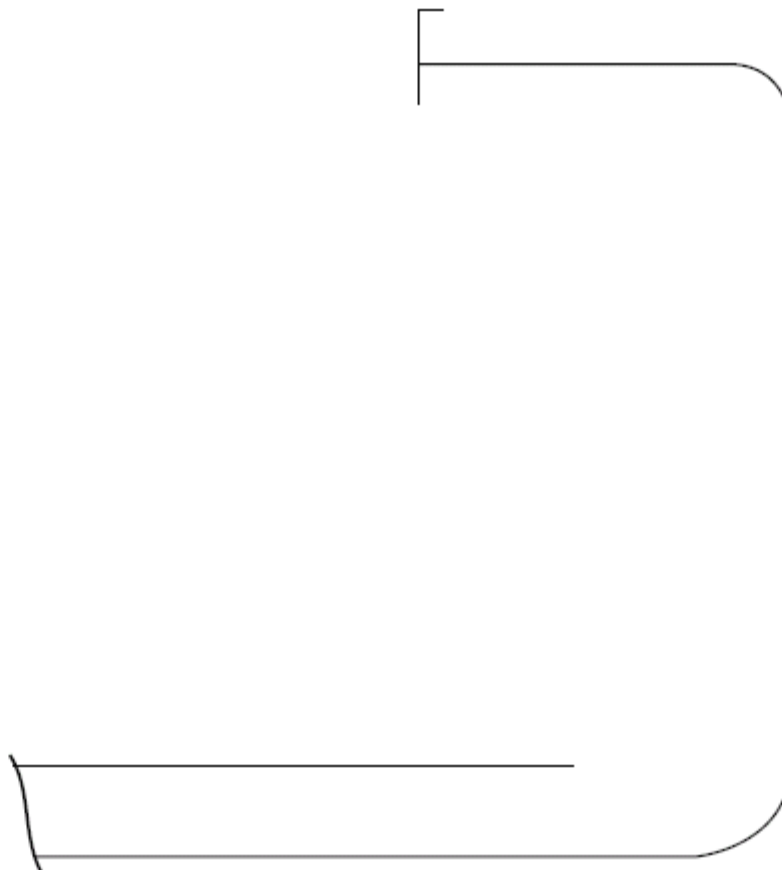
Typical transverse section indicating longitudinal and transverse member



Reports TM2-BC(CSR)(i) and TM2-BC(CSR)(ii)		Report TM3-BC(CSR)	
1	Strength deck plating	8	Deck longitudinals
2	Stringer plate	9	Deck girders
3	Sheer strake	10	Sheer strake longitudinals
4	Side shell plating	11	Topside tank sloping plate
5	Bilge plating	12	Topside tank sloping plate longitudinals
6	Bottom shell plating	13	Bottom longitudinals
7	Keel plate	14	Bottom girders
		15	Bilge longitudinals
		16	Side shell longitudinals, if any
		17	Inner bottom plating
		18	Inner bottom longitudinals
		19	Hopper side plating
		20	Hopper side longitudinals
Report TM4-BC(CSR)		Report TM6-BC(CSR)	
23	Double bottom tank floors	28	Hatch coamings
24	Topside tank transverses	29	Deck plating between hatches
25	Hopper side tank transverses	30	Hatch covers
		Report TM7-BC(CSR)	
		34	Hold frames or diaphragms

Transverse section outline

The diagram may be used for those ships where the typical transverse sections are not suitable.



Reports TM2-BC(CSR)(i) and TM2-BC(CSR)(ii)	
1	Strength deck plating
2	Stringer plate
3	Sheer strake
4	Side shell plating
5	Bilge plating
6	Bottom shell plating
7	Keel plate

Report TM3-BC(CSR)			
8	Deck longitudinals	17	Inner bottom plating
9	Deck girders	18	Inner bottom longitudinals
10	Sheer strake longitudinals	19	Hopper side plating
11	Topside tank sloping plate	20	Hopper side longitudinals
12	Topside tank sloping plate longitudinals		
13	Bottom longitudinals		
14	Bottom girders		
15	Bilge longitudinals		
16	Side shell longitudinals, if any		

Report TM4-BC(CSR)	
23	Double bottom tank floors
24	Topside tank transverses
25	Hopper side tank transverses

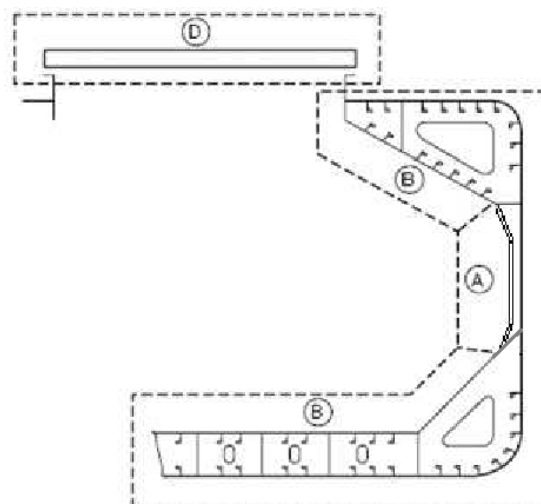
Report TM6-BC(CSR)	
28	Hatch coamings
29	Deck plating between hatches
30	Hatch covers

Report TM7-BC(CSR)	
34	Hold frames or diaphragms

Close-up survey and thickness measurement areas

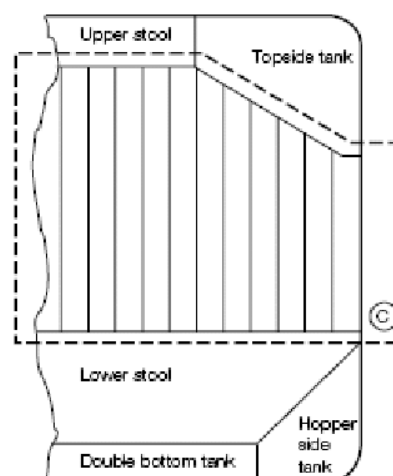
Areas subject to close-up survey and thickness measurement - areas (A) to (E), as defined in annex 1. The thickness measurements should be reported in forms TM3-BC(CSR), TM4-BC(CSR), TM5-BC(CSR), TM6-BC(CSR) and TM7-BC(CSR), as appropriate.

Typical transverse section
Areas A, B and D



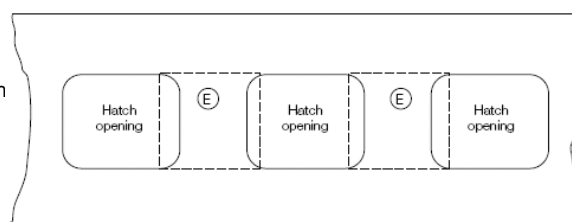
Thickness should be reported in forms TM3-BC(CSR), TM4-BC(CSR), TM6-BC(CSR) and TM7-BC(CSR), as appropriate

A cargo hold, transverse bulkhead
Area C



Thickness should be reported in form TM5-BC(CSR)

Typical areas of deck plating inside the line of hatch openings between cargo hold hatches
Area E



Thickness should be reported on TM6-BC(CSR)

ANNEX 9

GUIDELINES FOR TECHNICAL ASSESSMENT IN CONJUNCTION WITH THE PLANNING OF ENHANCED SURVEYS FOR SINGLE-SIDE SKIN BULK CARRIERS – RENEWAL SURVEY HULL*

1 Introduction

These Guidelines contain information and suggestions concerning technical assessments which may be of use in conjunction with the planning of enhanced renewal surveys of bulk carriers. As indicated in 5.1.5 of the Code, the Guidelines are a recommended tool which may be invoked at the discretion of an Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme.

2 Purpose and principles

2.1 Purpose

2.1.1 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.

2.1.2 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.

2.2 Timing

As with other aspects of survey planning, the technical assessments described in these Guidelines should be carried out by the owner or operator in cooperation with the Administration 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.

2.3 Aspects to be considered

2.3.1 Technical assessments, which may include quantitative or qualitative evaluation of relative risks of possible deterioration, of the following aspects of a particular ship should 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; and
- .3 information with respect to types of cargo carried, protection of tanks, and condition of coating, if any, of holds and tanks.

* This annex is recommendatory.

2.3.2 Technical assessments of the relative risks of susceptibility to damage or deterioration of various structural elements and areas should be judged and decided on the basis of recognized principles and practices, such as may be found in reference 3.

3 Technical assessment

3.1 General

3.1.1 There are three basic types of possible failure which should 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 plan since indents are usually noted in memoranda and assumed to be dealt with as a normal routine by surveyors.

3.1.2 Technical assessments performed in conjunction with the survey planning process should, in principle, be as shown schematically in figure 1. The approach is basically an evaluation of the risk based on the knowledge and experience related to design and corrosion.

3.1.3 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.

3.1.4 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.

3.2 Methods

3.2.1 Design details

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

3.2.1.2 Typical damage experience which should be considered will consist of:

- .1 number, extent, location and frequency of cracks; and
- .2 location of buckles.

3.2.1.3 This information should 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.

3.2.1.4 In addition, general experience should be utilized. For example, figure 2 shows typical locations in bulk carriers which experience has shown may be susceptible to structural damage. Also, reference should be made to reference 3 which contains a catalogue of typical damages and proposed repair methods for various bulk carrier structural details.

3.2.1.5 Such figures should be used together with a review of the main drawings, in order to compare with the actual structure and search for similar details which may be susceptible to damage. An example is shown in figure 3.

3.2.1.6 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. The factors contributing to damage should be carefully considered.

3.2.1.7 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, is utilized. 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.

3.2.1.8 In this respect, stress calculations of typical and important components and details, in accordance with relevant methods, may prove useful and should be considered.

3.2.1.9 The selected areas of the structure identified during this process should be recorded and marked on the structural drawings which should be included in the survey programme.

3.2.2 *Corrosion*

3.2.2.1 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.

3.2.2.2 Reference 2 gives definitive examples which may be used for judging and describing coating condition, using typical pictures of conditions.

3.2.2.3 For bulk carriers, reference 3 should be used as the basis for the evaluation, together with the age of the ship and relevant information on the anticipated condition of the ship as derived from the information collected in order to prepare the survey programme.

3.2.2.4 The various tanks, holds and spaces should be listed with the corrosion risks nominated accordingly.

3.2.3 *Locations for close-up survey and thickness measurement*

3.2.3.1 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) should be nominated.

3.2.3.2 The sections subject to thickness measurement should normally be nominated in tanks, holds and spaces where corrosion risk is judged to be highest.

3.2.3.3 The nomination of tanks, holds and spaces for close-up survey should, initially, be based on where the corrosion risk is judged to be highest, and should always include ballast

tanks. The principle for the selection should be that the extent is increased with age or where information is insufficient or unreliable.

References

- 1 TSCF, Guidance Manual for the Inspection and Condition Assessment of Tanker Structures, 1986.
- 2 TSCF, Condition Evaluation and Maintenance of Tanker Structures, 1992.
- 3 IACS, Bulk Carriers: Guidelines for Surveys, Assessment and Repair of Hull Structures, 2007.

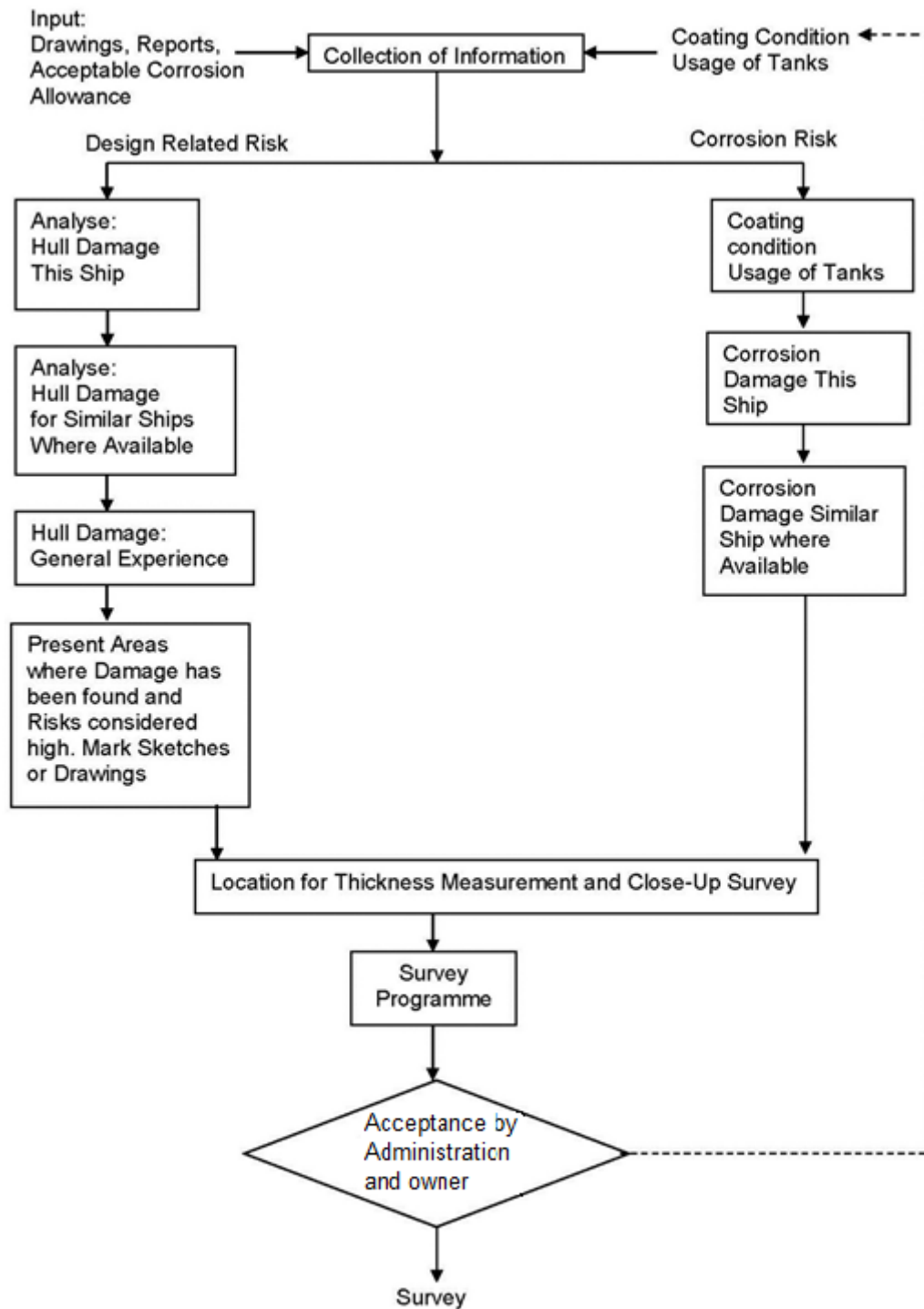


Figure 1: Technical Assessment and the Survey Planning Process

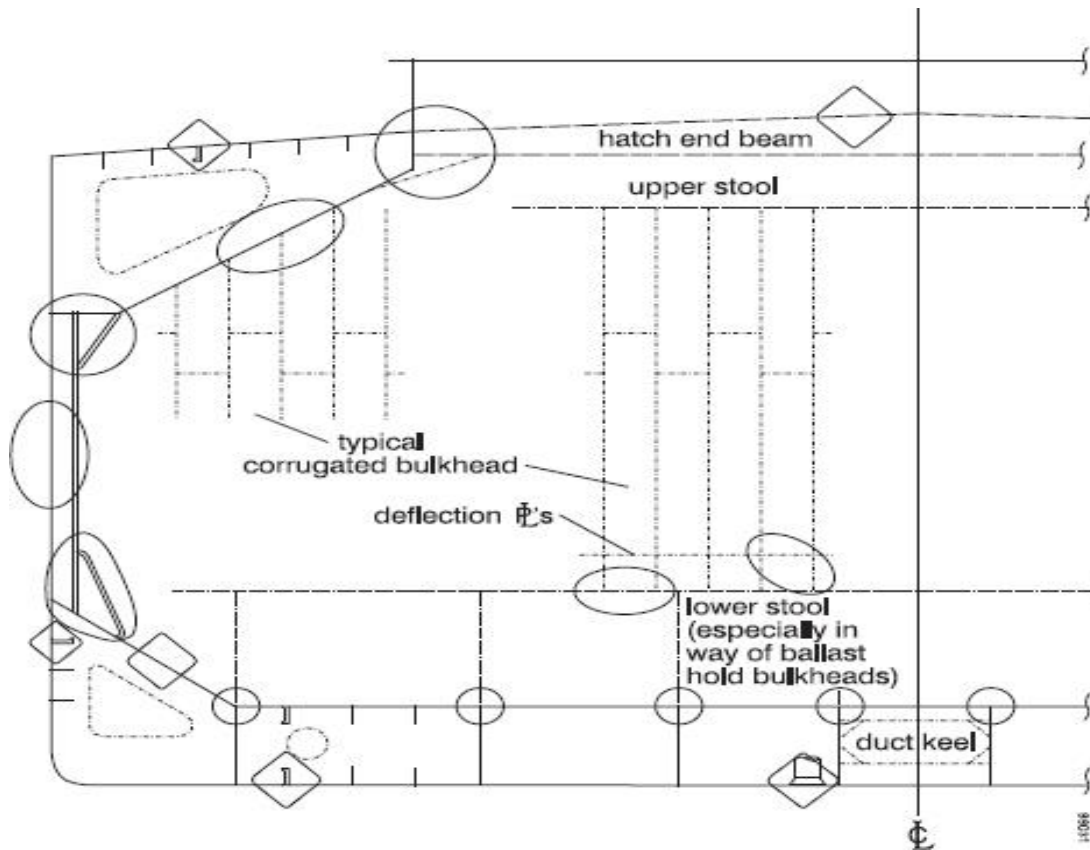


Figure 2 – Typical locations susceptible to structural damage or corrosion

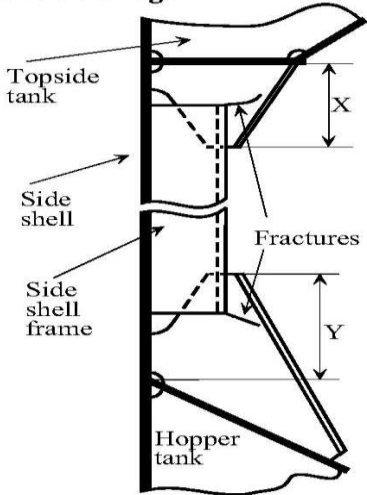
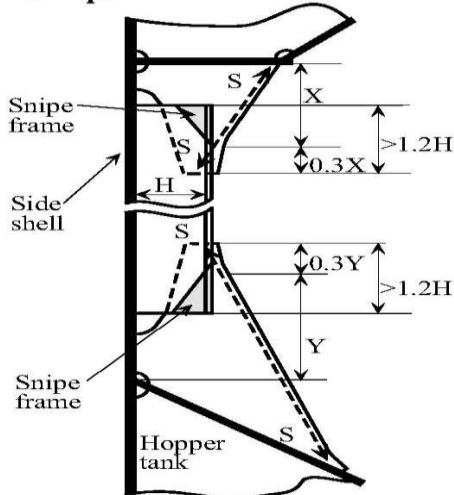
BULK CARRIERS		Guidelines for Surveys, Assessment and Repair of Hull Structure	
Part 1	Cargo hold region	Example No.	
Area 3	Cargo hold side structure	1-a	
Detail of damage		Fractures in brackets at termination of frame	
<p>Sketch of damage</p>  <p>Separate bracket configuration</p>		<p>Sketch of repair</p>  <p>S=Snipped end</p>	
<p>Notes on possible cause of damage</p> <ol style="list-style-type: none"> 1. This type of damage is caused due to stress concentration. 		<p>Notes on repairs</p> <ol style="list-style-type: none"> 1. For small fractures, e. g. hairline fractures, the fracture can be veed-out, ground, examined by NDT for fractures, and rewelded. 2. For larger/significant fractures consideration is to be given to cropping and partly renewing/renewing the frame brackets. If renewing the brackets, end of frames can be snipped to soften them. 3. If felt prudent, soft toes are to be incorporated at the boundaries of the bracket to the hopper plating. 4. Attention to be given to the structure in wing tanks in way of the extended bracket arm. i.e. reinforcement provided in line with the bracket. 	

Figure 3 – Typical damage and repair example (reproduced from reference 3)

ANNEX 10

**REQUIREMENTS FOR EXTENT OF THICKNESS MEASUREMENT AT AREAS
OF SUBSTANTIAL CORROSION OF SINGLE-SIDE SKIN BULK CARRIERS**

Renewal survey of bulk carriers within the cargo area

Shell structures

Structural member	Extent of measurement	Pattern of measurement
Bottom and side shell plating	Suspect plate, plus four adjacent plates See other tables for particulars on gauging in way of tanks and cargo holds	Five-point pattern for each panel between longitudinals
Bottom/side shell longitudinals	Minimum of three longitudinals in way of suspect areas	Three measurements in line across web Three measurements on flange

Transverse bulkheads in cargo holds

Structural member	Extent of measurement	Pattern of measurement
Lower stool	Transverse band within 25 mm of welded connection to inner bottom Transverse band within 25 mm of welded connection to shelf plate	Five-point pattern between stiffeners over 1 m length
Transverse bulkhead	Transverse band at approximately mid-height Transverse band at part of bulkhead adjacent to upper deck or below upper stool shelf plate (for those ships fitted with upper stools)	Five-point pattern over 1 m ² of plating

Deck structure including cross strips, main cargo hatchways, hatch covers, coamings and topside tanks

Structural member	Extent of measurement	Pattern of measurement
Cross-deck strip plating	Suspect cross-deck strip plating	Five-point pattern between under deck stiffeners over 1 m length
Under-deck stiffeners	Transverse members Longitudinal member	Five-point pattern at each end and mid-span Five-point pattern on both web and flange
Hatch covers	Side and end skirts, each three locations Three longitudinal bands, outboard strakes (2) and centreline strake (1)	Five-point pattern at each location Five-point measurement each band
Hatch coamings	Each side and end of coaming, one band lower third, one band upper two-thirds of coaming	Five-point measurement each band, i.e. end or side coaming
Topside water ballast tanks	Watertight transverse bulkheads i lower third of bulkhead ii upper two-thirds of bulkhead iii stiffeners Two representative swash transverse bulkheads i lower third of bulkhead ii upper two-thirds of bulkhead iii stiffeners Three representative bays of slope plating i lower third of tank ii upper two-thirds of tank	i Five-point pattern over 1 m ² of plating ii Five-point pattern over 1 m ² of plating iii Five-point pattern over 1 m length i Five-point pattern over 1 m ² of plating ii Five-point pattern over 1 m ² of plating iii Five-point pattern over 1 m length i Five-point pattern over 1 m ² of plating ii Five-point pattern over 1 m ² of plating
	Longitudinals, suspect and adjacent	Five-point pattern both web and flange over 1 m length
Main deck plating	Suspect plates and adjacent (4)	Five-point pattern over 1 m ² of plating
Main deck longitudinals	Minimum of three longitudinals where plating measured	Five-point pattern on both web and flange over 1 m length
Web frames/transverses	Suspect plates	Five-point pattern over 1 m ²

Double-bottom and hopper structure

Structural member	Extent of measurement	Pattern of measurement
Inner/double-bottom plating	Suspect plate plus all adjacent plates	Five-point pattern for each panel between longitudinals over 1 m length
Inner/double-bottom longitudinals	Three longitudinals where plates measured	Three measurements in line across web, and three measurements on flange
Longitudinal girders or transverse floors	Suspect plates	Five-point pattern over about 1 m ²
Watertight bulkheads (WT floors)	Lower third of tank Upper two thirds of tank	Five-point pattern over 1 m ² of plating Five-point pattern alternate plates over 1 m ² of plating
Web frames	Suspect plate	Five-point pattern over 1 m ² of plating
Bottom/side shell longitudinals	Minimum of three longitudinals in way of suspect areas	Three measurements in line across web, and three measurements on flange

Cargo holds

Structural member	Extent of measurement	Pattern of measurement
Side shell frames	Suspect frame and each adjacent	At each end and mid span: five-point pattern of both web and flange Five-point pattern within 25 mm of welded attachment to both shell and lower slope plate

ANNEX 11

GUIDELINES FOR THE GAUGING OF THE VERTICALLY CORRUGATED TRANSVERSE WATERTIGHT BULKHEAD BETWEEN HOLDS NOS. 1 AND 2*

1 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 the bulk carrier bulkhead and double-bottom strength standards, defined in regulation XII/1.7 of the Convention.

2 Taking into account the buckling model specified in the bulk carrier bulkhead and double-bottom strength standards, defined in regulation XII/1.7 of the Convention, 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 of this annex.

3 The gauging should 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 should 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.

4 Where the thickness changes within the horizontal levels, the thinner plate should be gauged.

5 Steel renewal and/or reinforcement should comply with the bulk carrier bulkhead and double-bottom strength standards, defined in regulation XII/1.7 of the Convention.

* This annex is recommendatory.

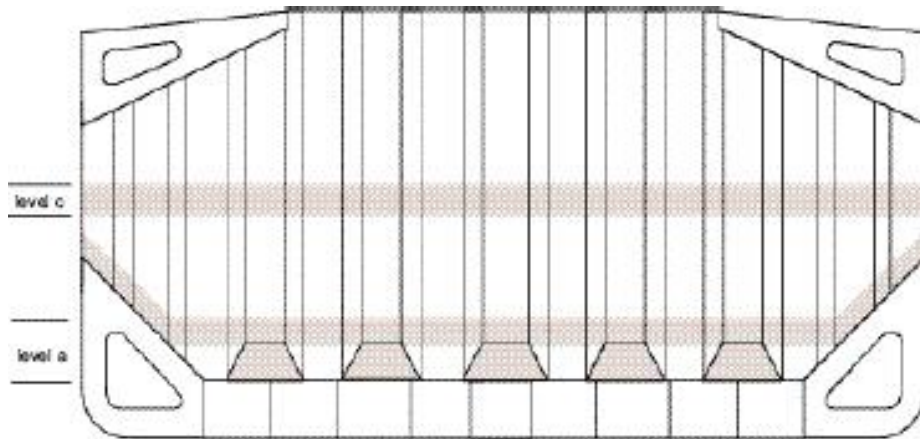


Figure 1 – Ships without lower stool

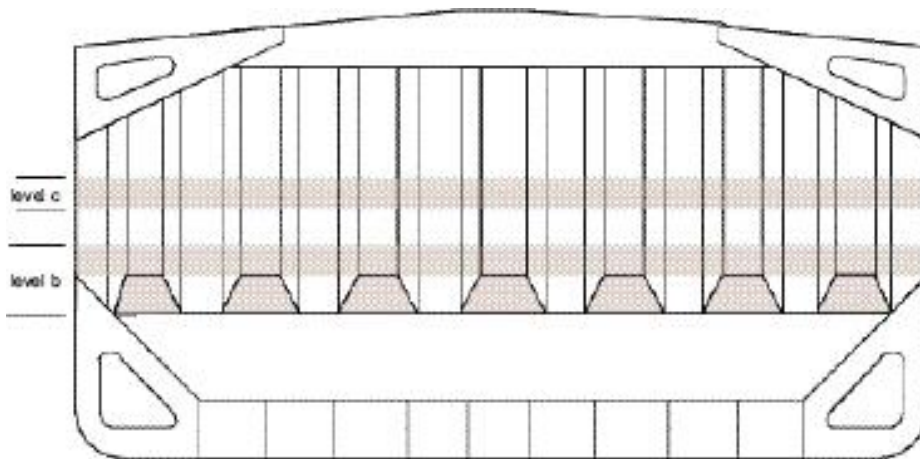


Figure 2 – Ships with lower stool

ANNEX 12

ADDITIONAL ANNUAL SURVEY REQUIREMENTS FOR THE FOREMOST CARGO HOLD OF SHIPS SUBJECT TO REGULATION XII/9 OF THE CONVENTION

1 General

In the case of bulk carriers over five years of age, the annual survey shall include, in addition to the requirements of the annual surveys prescribed in chapter 3 of the present Code, an examination of the following items.

2 Extent of survey

2.1 For bulk carriers of 5 to 15 years of age

2.1.1 An overall survey of the foremost cargo hold, including close-up survey of sufficient extent, minimum 25% of frames, shall be carried out to establish the condition of:

- .1 shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads; and
- .2 suspect areas identified at previous surveys.

2.1.2 Where considered necessary by the surveyor as a result of the overall and close-up survey as described in 2.1.1 above, the survey shall be extended to include a close-up survey of all of the shell frames and adjacent shell plating of the cargo hold.

2.2 For bulk carriers exceeding 15 years of age

An overall survey of the foremost cargo hold, including close-up survey shall be carried out to establish the condition of:

- .1 all shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads; and
- .2 suspect areas identified at previous surveys.

3 Extent of thickness measurement

3.1 Thickness measurement shall be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey, as described in 2.1 and 2.2 above. The minimum requirement for thickness measurements are suspect areas identified at previous surveys. Where substantial corrosion is found, the extent of thickness measurements shall be increased with the requirements of annex 10.

3.2 The thickness measurement may be dispensed with provided the surveyor is satisfied by the close-up survey, there is no structural diminution and the protective coating, where applied, remains effective.

4 Special consideration

Where the protective coating, as referred to in the explanatory note below, in the foremost cargo hold is found to be in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

Explanatory note:

For existing bulk carriers, where owners elect to coat or recoat cargo holds as noted above, consideration may be given to the extent of the close-up and thickness measurement surveys. Prior to the coating of cargo holds of existing ships, scantlings shall be ascertained in the presence of a surveyor.

ANNEX 13

**STRENGTH OF CARGO HATCH COVER SECURING ARRANGEMENTS
FOR SINGLE-SIDE SKIN BULK CARRIERS**

1 Securing devices

The strength of securing devices shall comply with the following requirements:

- .1 Panel hatch covers shall be secured by appropriate devices (bolts, wedges or similar) suitably spaced alongside the coamings and between cover elements. The arrangement and spacing shall be determined with due attention to the weathertight effectiveness, depending upon the type and the size of the hatch cover, as well as on the stiffness of the cover edges between the securing devices.

- .2 The net sectional area of each securing device shall not be less than:

$$A = 1.4 a / f (\text{cm}^2)$$

where:

a = spacing between securing devices shall not be taken as less than 2 m

$$f = (\sigma_Y / 235)^e$$

σ_Y = specified minimum upper yield stress in N/mm² of the steel used for fabrication, shall not be taken greater than 70% of the ultimate tensile strength

$$e = \begin{cases} 0.75 & \text{for } \sigma_Y > 235 \\ 1.0 & \text{for } \sigma_Y \leq 235. \end{cases}$$

Rods or bolts shall have a net diameter not less than 19 mm for hatchways exceeding 5 m² in area.

- .3 Between cover and coaming and at cross-joints, a packing line pressure sufficient to obtain weathertightness shall be maintained by the securing devices. For packing line pressures exceeding 5 N/mm, the cross section area shall be increased in direct proportion. The packing line pressure shall be specified.

- .4 The cover edge stiffness shall be sufficient to maintain adequate sealing pressure between securing devices. The moment of inertia, I , of edge elements shall not be less than:

$$I = 6 p a^4 (\text{cm}^4)$$

where:

p = packing line pressure in N/mm, minimum 5 N/mm

a = spacing in metres of securing devices.

- .5 Securing devices shall be of reliable construction and securely attached to the hatchway coamings, decks or covers. Individual securing devices on each cover shall have approximately the same stiffness characteristics.
- .6 Where rod cleats are fitted, resilient washers or cushions shall be incorporated.
- .7 Where hydraulic cleating is adopted, a positive means shall be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.

2 Stoppers

2.1 Nos. 1 and 2 hatch covers shall be effectively secured, by means of stoppers, against the transverse forces arising from a pressure of 175 kN/m².

2.2 No.2 hatch cover shall be effectively secured, by means of stoppers, against the longitudinal forces acting on the forward end arising from a pressure of 175 kN/m².

2.3 No.1 hatch cover shall be effectively secured, by means of stoppers, against the longitudinal forces acting on the forward end arising from a pressure of 230 kN/m². This pressure may be reduced to 175 kN/m² if a forecastle is fitted.

2.4 The equivalent stress in stoppers and their supporting structures and calculated in the throat of the stopper welds shall not exceed the allowable value of $0.8 \sigma_y$.

3 Materials and welding

Where stoppers or securing devices are fitted to comply with this annex, they shall be manufactured of materials, including welding electrodes, to the satisfaction of the Administration.

ANNEX 14

PROCEDURAL REQUIREMENTS FOR THICKNESS MEASUREMENTS

1 General

Thickness measurements required in the context of hull structural surveys, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The attendance of the surveyor shall be recorded. This also applies to thickness measurements taken during voyages.

2 Survey meeting

2.1 Prior to commencement of the renewal or intermediate survey, a meeting shall be held between the attending surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) in attendance and the thickness measurement firm's representative(s) so as to ensure the safe and efficient execution of the surveys and thickness measurements to be carried out on board.

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

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

2.3 When thickness measurements are taken in association with intermediate or renewal surveys, a documented record indicating where and when the meeting took place and who attended (the name of the surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) and the representative(s) of the thickness measurement firm(s)) shall be maintained.

3 Monitoring of the thickness measurement process on board

3.1 The surveyor shall decide the final extent and location of thickness measurements after overall survey of representative spaces on board.

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

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

3.4 Thickness measurements taken mainly to evaluate the extent of corrosion, which may affect the hull girder strength, shall be carried out in a systematic manner such that all longitudinal structural members are gauged, as required.

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

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

4 Review and verification

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

4.2 If, where special consideration is allowed by this Code, the extent of thickness measurements is reduced, the surveyor's special consideration shall be reported.

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

ANNEX 15

**THICKNESS MEASUREMENTS OF SIDE SHELL FRAMES
AND BRACKETS IN SINGLE-SIDE SKIN BULK CARRIERS REQUIRED
TO COMPLY WITH RESOLUTION MSC.168(79)**

1 General

Thickness measurements shall be conducted to determine the general condition of the structure and to define the extent of possible steel renewals or other measures for the webs and flanges of side shell frames and brackets for verification of the compliance with resolution MSC.168(79).

2 Zones of side shell frames and brackets

2.1 For the purpose of steel renewal, sand blasting and coating, four zones A, B, C and D are defined as shown in figure 1.

2.2 Zones A and B shall be considered the most critical zones.

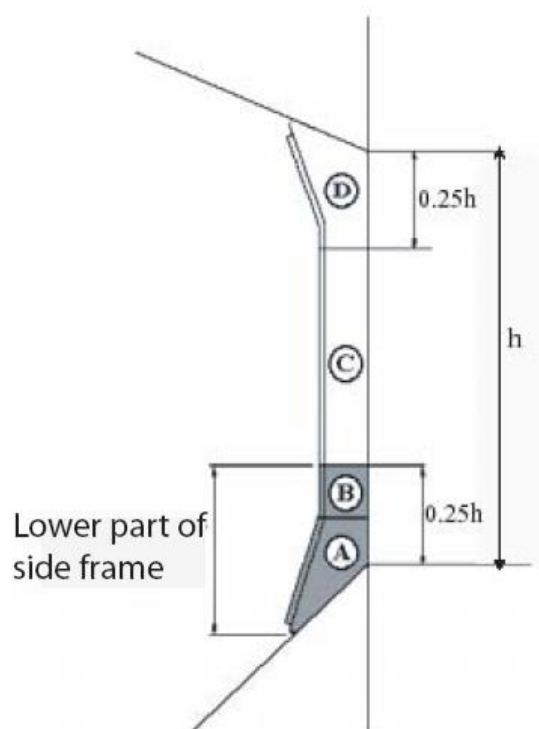


Figure 1 – Zones of side shell frames and brackets

3 Pitting and grooving

3.1 Pits can grow in a variety of shapes, some of which shall be ground before assessment.

3.2 Pitting corrosion may be found under coating blisters, which shall be removed before inspection.

3.3 To measure the remaining thickness of pits or grooving the normal ultrasonic transducer (generally 10 mm diameter) will not suffice. A miniature transducer (3 to 5 mm diameter) shall be used. Alternatively the firm conducting the thickness measurement shall use a pit gauge to measure the depth of the pits and grooving and calculate the remaining thickness.

Assessment based upon area

3.4 This is the method specified in paragraph 2.5 of annex 2 to resolution MSC.168(79) and is based upon the intensity determined from figure 2 below.

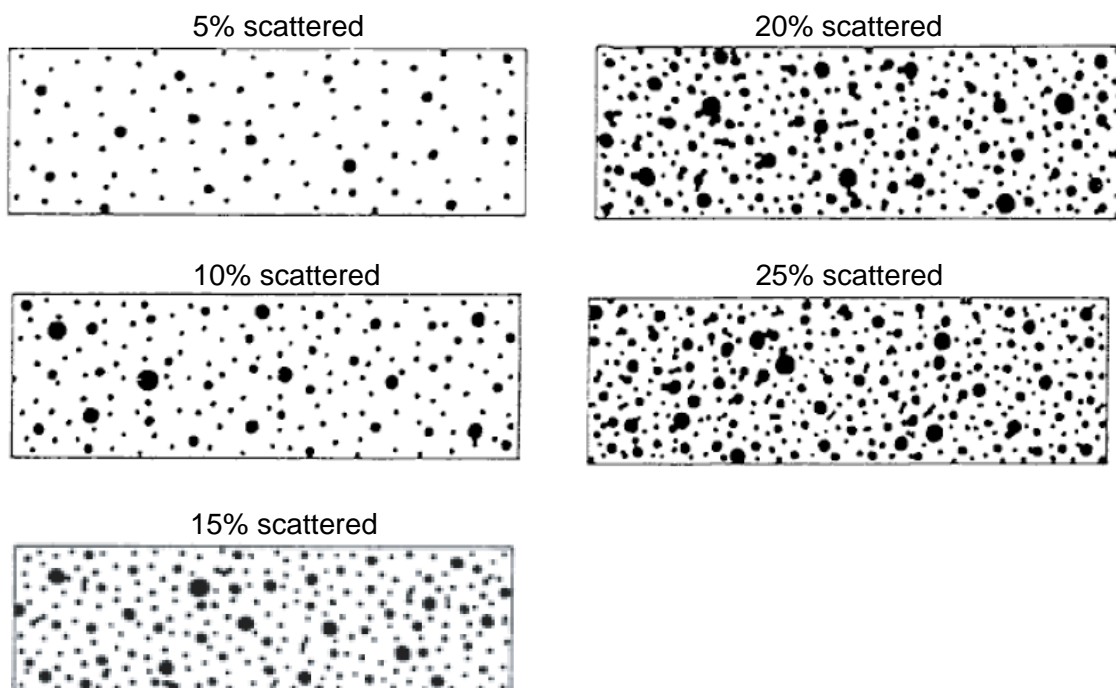


Figure 2 – Pitting intensity diagrams (from 5 to 25% intensity)

3.5 If pitting intensity is higher than 15% in an area (see figure 2), then thickness measurements shall be taken to determine the extent of the pitting corrosion. The 15% is based upon pitting or grooving on only one side of the plate.

3.6 In cases where pitting is evident as defined above (exceeding 15%) then an area of 300 mm diameter or more (or, where this is impracticable on the frame flange or the side shell, hopper tank plating or topside tank plating attached to the side frame, an equivalent rectangular area), at the most pitted part, shall 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 shall be taken as the thickness to be recorded.

3.7 The minimum acceptable remaining thickness in any pit or groove shall be equal to:

- .1 75% of the as built thickness, for pitting or grooving in the cargo hold side frame webs and flanges.
- .2 70% 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.

4 Thickness measurement methodology

4.1 The number of side frames to be measured shall be equivalent to those required at the renewal survey or intermediate survey corresponding to the ship's age. Representative thickness measurements shall be taken for each zone as specified below.

4.2 Special consideration to the extent of the thickness measurements may be given by the Administration, if the structural members show no thickness diminution with respect to the as built thicknesses and the coating is found in "as new" condition (i.e. without breakdown or rusting).

4.3 Where thickness measurement readings close to the criteria are found, the number of hold frames to be measured shall be increased.

4.4 If renewal or other measures according to resolution MSC.168(79) shall be applied on individual frames in a hold, then all frames in that hold shall have thickness measurements taken.

4.5 There is a variety of construction methods used for side shell frames in bulk carriers. Some have faceplates (T sections) on the side shell frames, some have flanged plates and some have bulb plates. The use of faceplates and flanged sections is considered similar for thickness measurement purposes in that both the web and faceplate or web and flange plate shall be measured. If a bulb plate has been used, then the web of the bulb plate shall be measured in the normal manner and the sectional modulus shall be specially considered if required.

Gaugings for Zones A, B and D

Web plating

4.6 The pattern for thickness measurements in Zones A, B and D shall be a five-point pattern (see figure 3). The five-point pattern shall be over the depth of the web and the same area vertically. The thickness measurement report shall reflect the average reading.

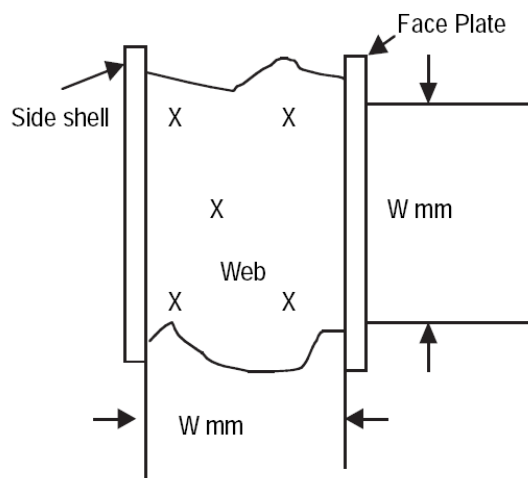


Figure 3 – Typical five-point pattern on the web plate

Thickness measurements for Zone C

Web plating

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

Thickness measurements for section a) and b) (flanges and side shell plating)

4.8 Where the lower bracket length or depth does not meet the requirements in annex 1 to resolution MSC.168(79), thickness measurements shall be taken at sections a) and b) to calculate the actual section modulus required in paragraph 3.4 of annex 2 to resolution MSC.168(79) (see figure 4). At least two readings on the flange/faceplate shall be taken in way of each section. At least one reading of the attached shell plating shall be taken on each side of the frame (i.e. fore and aft) in way of section a) and section b).

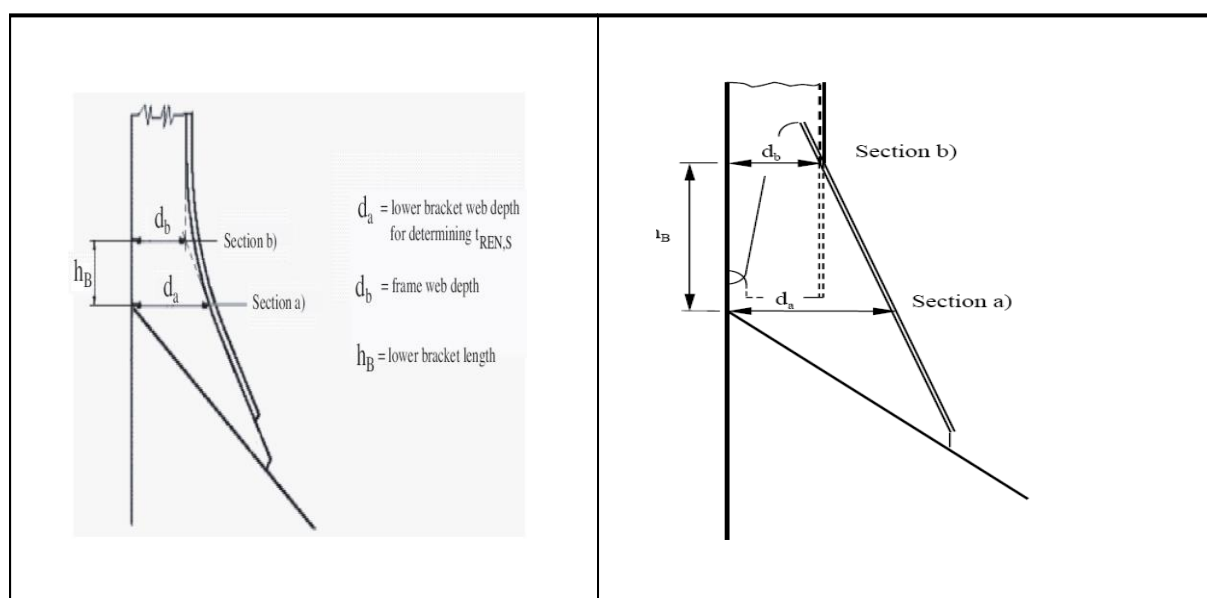


Figure 4 – Sections a) and b)

5 Report on thickness measurement of cargo hold frames

See form TM7-BC(ii) as contained in appendix 2 to annex 8A.

Reference

Resolution MSC.168(79) on Standards and criteria for side structures of bulk carriers of single-side skin construction.

ANNEX A

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING THE SURVEYS OF BULK CARRIERS

Part B

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING DOUBLE-SIDE SKIN CONSTRUCTION

1 General

1.1 Application

1.1.1 The Code shall apply to all self-propelled double-side skin bulk carriers of 500 gross tonnage and above.

1.1.2 The Code shall apply to surveys of hull structure and piping systems in way of cargo holds, cofferdams, pipe tunnels, void spaces, fuel oil tanks within the cargo length area and all ballast tanks.

1.1.3 The Code contains the minimum extent of examination, thickness measurements and tank testing. The survey shall be extended when substantial corrosion and/or structural defects are found and include additional close-up survey when necessary.

1.1.4 For bulk carriers with hybrid cargo hold arrangements, e.g. with some cargo holds of single-side skin and others of double-side skin, the requirements of part A of annex A shall apply to cargo holds of single-side skin.

1.1.5 The surveys shall be carried out during the surveys prescribed by regulation I/10 of the Convention, unless expressly provided otherwise in this Code.

1.2 Definitions

1.2.1 *Double-side skin bulk carrier* is a ship which is constructed generally with single deck, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk including ore carriers and combination carriers, in which all cargo holds are bounded by a double-side skin (regardless of the width of the wing space).

1.2.2 *Ballast tank* is a tank which is used primarily for salt water ballast or, where applicable, a space which is used for both cargo and salt water ballast will be treated as a ballast tank when substantial corrosion has been found in that space. A double-side tank shall be considered, for survey purposes, as a separate tank even if it is in connection to either the topside tank or the hopper side tank.

1.2.3 *Spaces* are separate compartments including holds, tanks, cofferdams and void spaces bounding cargo holds, decks and the outer hull.

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

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

1.2.6 *Transverse section* is the cross section of the hull perpendicular to the ship's centreline and includes all longitudinal members such as plating, longitudinals and girders at the deck sides, bottom, inner bottom, hopper sides, inner sides, top wing inner sides and longitudinal bulkheads. For transversely framed bulk carriers, a transverse section includes adjacent frames and their end connections in way of transverse sections.

1.2.7 *Representative spaces* are those which are expected to reflect the condition of other spaces of similar type and service and with similar corrosion prevention systems. When selecting representative spaces, account shall be taken of the service and repair history on board and identifiable critical structural areas and/or suspect areas.

1.2.8 *Suspect areas* are locations showing substantial corrosion and/or are considered by the surveyor to be prone to rapid wastage.

1.2.9 *Substantial corrosion* is an extent of corrosion such that assessment of corrosion pattern indicates a wastage in excess of 75% of allowable margins, but within acceptable limits. For ships built under the IACS Common Structural Rules, substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{ren} + 0.5$ mm and t_{ren} . Renewal thickness (t_{ren}) is the minimum allowable thickness, in mm, below which renewal of structural members shall be carried out.

1.2.10 A *corrosion prevention system* is normally considered a full hard protective coating. Hard protective coating should usually be epoxy coating or equivalent. Other coating systems which are neither soft nor semi-hard coatings, may be considered acceptable as alternatives provided that they are applied and maintained in compliance with the manufacturer's specifications.

1.2.11 *Coating condition* is defined 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.

1.2.12 *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 applicable, to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

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

1.2.14 *Intermediate survey* is a survey carried out either at the second or third annual survey or between these surveys.

1.2.15 A *prompt and thorough repair* is a permanent repair completed at the time of survey to the satisfaction of the surveyor, therein removing the need for the imposition of any associated condition of classification or recommendation.

1.2.16 *Convention* means the International Convention for the Safety of Life at Sea, 1974, as amended.

1.2.17 *Special consideration or specially considered* (in connection with close-up surveys and thickness measurements) means sufficient close-up inspection and thickness measurements are taken to confirm the actual average condition of the structure under the coating.

1.2.18 *Pitting corrosion* is defined as scattered corrosion spots/areas with local material reductions which are greater than the general corrosion in the surrounding area. Pitting intensity is defined in figure 1.

1.2.19 *Edge corrosion* is defined as local corrosion at the free edges of plates, stiffeners, primary support members and around openings. An example of edge corrosion is shown in figure 2.

1.2.20 *Grooving corrosion* is typically local material loss adjacent to weld joints along abutting stiffeners and at stiffener or plate butts or seams. An example of groove corrosion is shown in figure 3.

1.2.21 *Administration* means the Administration or organization recognized by the Administration.

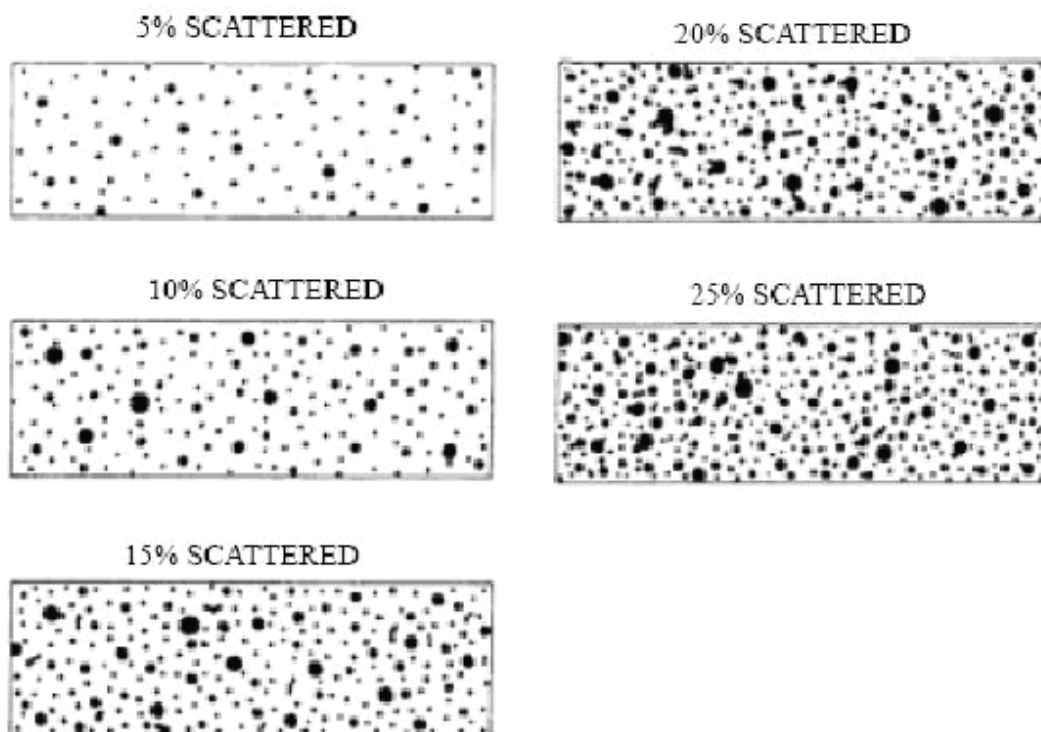


Figure 1: Pitting intensity diagrams

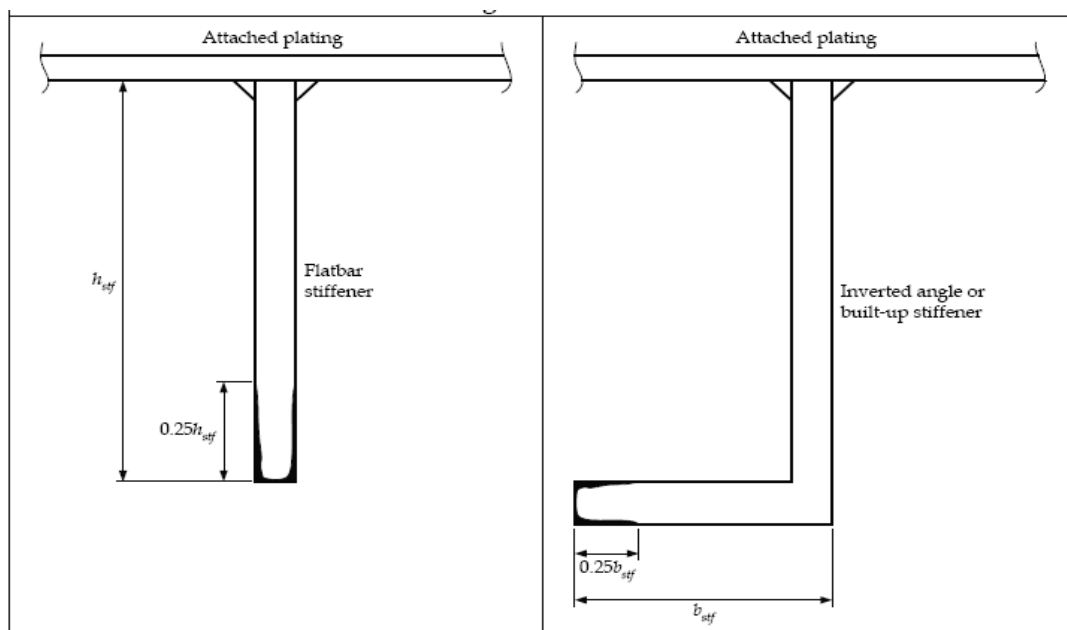


Figure 2: Edge corrosion

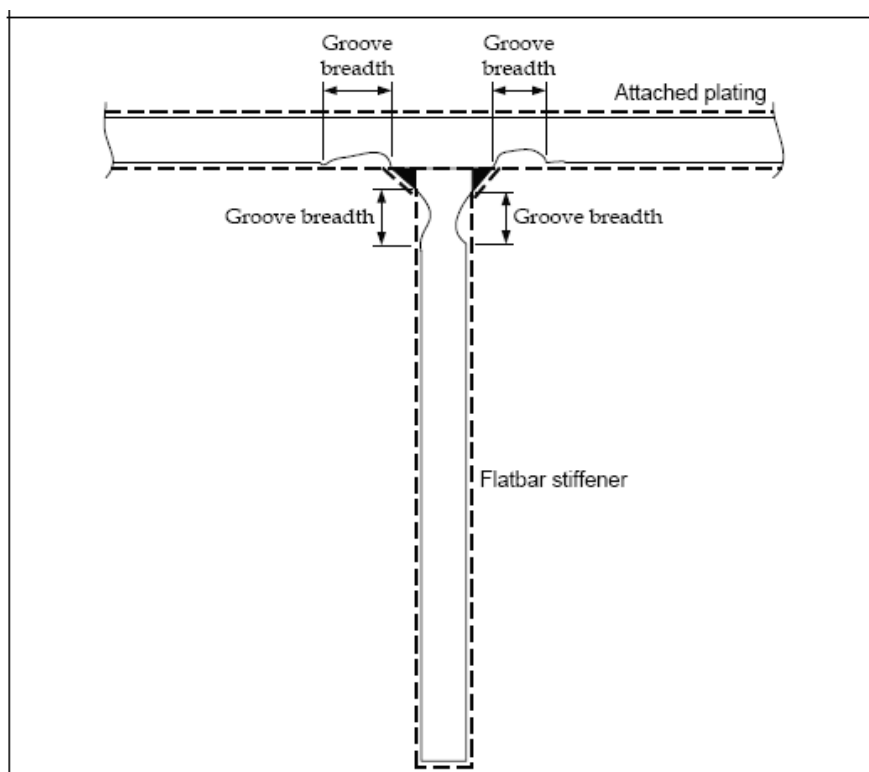


Figure 3: Grooving corrosion

1.3 Repairs

1.3.1 Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Administration, will affect the ship's structural, watertight

or weathertight integrity, shall be promptly and thoroughly (see 1.2.15) repaired. Areas to be considered include:

- .1 side structure and side plating;
- .2 deck structure and deck plating;
- .3 bottom structure and bottom plating;
- .4 inner bottom structure and inner bottom plating;
- .5 inner side structure and inner side plating;
- .6 watertight or oiltight bulkheads;
- .7 hatch covers or hatch coamings; and
- .8 items in 3.3.10.

For locations where adequate repair facilities are not available, the Administration may allow the ship to proceed directly to a repair facility. This may require discharging the cargo and/or temporary repairs for the intended voyage.

1.3.2 Additionally, when a survey results in the identification of corrosion or structural defects, either of which, in the opinion of the Administration, will impair the ship's fitness for continued service, remedial measures shall be implemented before the ship continues in service.

1.3.3 Where the damage found on the structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity after evaluation of the surrounding structure and impose an associated condition or recommendation with a specific time limit in order to complete the permanent repair and retain the validity of the relevant statutory certification.

1.4 Surveyors*

1.4.1 On bulk carriers of 20,000 tonnes deadweight (dwt) and above starting with renewal survey No.3, at renewal and intermediate hull surveys, the survey of hull structure and piping systems to which this Code applies shall be carried out by at least two surveyors of an Administration.

1.4.2 This requires that at least two surveyors attend on board at the same time to perform the required survey. Though each attending surveyor is not required to perform all aspects of the required survey, they shall consult with each other and do joint overall and close-up surveys to the extent necessary to determine the condition of the vessel areas to which this Code applies. The extent of these surveys shall be sufficient for the surveyors to agree on actions required to complete the survey with respect to renewals, repairs, and other recommendations or conditions. Each surveyor shall co-sign the survey report or indicate their concurrence in an equivalent manner.

* Refer to paragraph 4.2.4 of part 2 of the Code for Recognized Organizations (RO Code), adopted by resolution MSC.349(92).

1.4.3 The following surveys may be witnessed by a single surveyor:

- .1 thickness measurements;
- .2 tank testing; and
- .3 repairs carried out in association with intermediate and renewal hull surveys, the extent of which have been agreed upon by the required two surveyors during the course of the surveys.

1.5 *Thickness measurements and close-up surveys*

In any kind of survey, i.e. renewal, intermediate, annual or other surveys having the scope of the foregoing ones, for structures in areas where close-up surveys are required, thickness measurements, when required by annex 2, shall be carried out simultaneously with close-up surveys.

2 Renewal survey

2.1 *General*

2.1.1 The renewal survey may be commenced at the fourth annual survey and be progressed during the succeeding year with a view to completion by the fifth anniversary date. When the renewal survey is commenced prior to the fourth annual survey, the entire survey shall be completed within 15 months if such work is to be credited to the renewal survey.

2.1.2 As part of the preparation for the renewal survey, the survey programme shall be dealt with in advance of the survey. The thickness measurement shall not be held before the fourth annual survey.

2.1.3 The survey shall include, in addition to the requirements of the annual survey, examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 2.1.5, is in satisfactory condition and is fit for its intended purpose for the new period of validity of the Cargo Ship Safety Construction Certificate, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

2.1.4 All cargo holds, ballast tanks, including double-bottom and double-side tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull shall be examined, and this examination shall be supplemented by thickness measurement and testing, as required by 2.6 and 2.7, to ensure that the structural integrity remains effective. The examination shall be sufficient to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

2.1.5 All piping systems within the above spaces shall be examined and operationally tested to working pressure to the attending surveyor's satisfaction to ensure that tightness and condition remain satisfactory.

2.1.6 The survey extent of ballast tanks converted to void spaces shall be specially considered in relation to the requirements for ballast tanks.

2.1.7 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

2.2 Dry-dock survey

2.2.1 A survey in dry-dock shall be a part of the renewal survey. There shall be a minimum of two inspections of the outside of the ship's bottom during the five-year period of the certificate. In all cases, the maximum interval between bottom inspections shall not exceed 36 months.

2.2.2 For ships of 15 years of age and over, inspection of the outside of the ship's bottom shall be carried out with the ship in dry-dock. For ships of less than 15 years of age, alternate inspections of the ship's bottom not conducted in conjunction with the renewal survey may be carried out with the ship afloat. Inspection of the ship afloat shall only be carried out when the conditions are satisfactory and the proper equipment and suitably qualified staff are available.

2.2.3 If a survey in dry-dock is not completed in conjunction with the renewal survey or if the 36-month maximum interval referred to in 2.2.1 is not complied with, the Cargo Ship Safety Construction Certificate shall cease to be valid until a survey in dry-dock is completed.

2.2.4 The overall and close-up survey and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks shall be carried out in accordance with the applicable requirements for renewal survey, if not already performed.

Note: Lower portions of the cargo holds and ballast tanks are considered to be the parts below the light ballast water line.

2.3 Space protection

2.3.1 Where provided, the condition of the corrosion prevention system of ballast tanks shall be examined. For ballast tanks, excluding double-bottom tanks, where a hard protective coating is found in POOR condition as defined in 1.2.11, and it is not renewed, or where a soft or semi-hard coating has been applied, or where a hard protective coating has not been applied from the time of constructions, the tanks in question shall be examined at annual intervals. Thickness measurements shall be carried out as deemed necessary by the surveyor. When such breakdown of hard protective coating is found in water ballast double-bottom tanks and it is not renewed, or where a soft or semi-hard coating has been applied or where a hard protective coating has not been applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the surveyor, or where extensive corrosion exists, thickness measurements shall be carried out.

2.3.2 Where a hard protective coating is provided in cargo holds and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

2.3.3 For bulk carriers built under IACS Common Structural Rules (CSR), the identified substantial corrosion areas may be:

- .1 protected by a 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
- .2 required to be measured at annual intervals.

2.4 Hatch covers and coamings

The hatch covers and coamings shall be surveyed as follows:

2.4.1 A thorough inspection of the items listed in 3.3 shall be carried out, in addition to all hatch covers and coamings.

2.4.2 Checking of the satisfactory operation of all mechanically operated hatch covers shall be made, including:

- .1 stowage and securing in open condition;
- .2 proper fit and efficiency of sealing in closed condition; and
- .3 operational testing of hydraulic and power components, wires, chains and link drives.

2.4.3 The effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent shall be checked.

2.4.4 Close-up survey and thickness measurement of the hatch cover and coaming plating and stiffeners shall be carried out as given in annexes 1 and 2. For cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/thickness measurement shall be done of accessible parts of hatch covers' structures.

2.5 *Extent of overall and close-up surveys*

2.5.1 An overall survey of all tanks and spaces shall be carried out at the renewal survey. Fuel oil tanks in the cargo length area shall be surveyed as follows:

Renewal survey No.1 Age ≤ 5	Renewal survey No.2 5 < Age ≤ 10	Renewal survey No.3 10 < Age ≤ 15	Renewal survey No.4 and subsequent 15 < Age
None	One	Two	Half, minimum two
<p>Notes:</p> <ol style="list-style-type: none"> 1. These requirements apply to tanks of integral (structural) type. 2. If a selection of tanks is accepted to be examined, then different tanks shall be examined at each renewal survey, on a rotational basis. 3. Peak tanks (all uses) shall be examined internally at each renewal survey. 4. At renewal survey No.3 and subsequent renewal surveys, one deep tank for fuel oil in the cargo area shall be included, if fitted. 			

2.5.2 The minimum requirements for close-up surveys at renewal surveys are given in annex 1, appendix 1 for double-side skin bulk carriers, excluding ore carriers, and in annex 1, appendix 2 for ore carriers respectively.

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

2.5.4 For areas in spaces where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to annex 1 may be specially considered (refer also to 2.3.2).

2.6 *Extent of thickness measurements*

2.6.1 The minimum requirements for thickness measurements at the renewal survey are given in annex 2.

2.6.2 Representative thickness measurements to determine both general and local levels of corrosion in the transverse web frames in all water ballast tanks shall be carried out. Thickness measurements shall also be carried out to determine the corrosion levels on the transverse bulkhead plating. The extent of thickness measurements may be specially considered provided the surveyor is satisfied by the close-up examination that there is no structural diminution, and the hard protective coating where applied remains efficient.

2.6.3 Provisions for extended measurements for areas with substantial corrosion as defined in 1.2.9 are given in annex 10 and may be additionally specified in the survey programme as required by 5.1. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken.

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

2.6.5 For areas in tanks where hard protective coatings are found to be in GOOD condition as defined in 1.2.11, the extent of thickness measurements according to annex 2 may be specially considered by the Administration.

2.6.6 Transverse sections shall be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

2.7 *Extent of tank pressure testing*

2.7.1 All boundaries of water ballast tanks, deep tanks and cargo holds used for water ballast within the cargo length area shall be pressure tested. For fuel oil tanks, only representative tanks shall be pressure tested.

2.7.2 The surveyor may extend the tank testing as deemed necessary.

2.7.3 Boundaries of ballast tanks shall be tested with a head of liquid to the top of the air pipes.

2.7.4 Boundaries of ballast holds shall be tested with a head of liquid to near to the top of hatches.

2.7.5 Boundaries of fuel oil tanks shall be tested with a head of liquid to the highest point that liquid will rise under service conditions. Tank testing of fuel oil tanks may be specially considered based on a satisfactory external examination of the tank boundaries and a confirmation from the master stating that the pressure testing has been carried out according to the requirements with satisfactory results.

2.7.6 The testing of double-bottom tanks and other spaces not designated for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tank top is carried out.

2.8 Additional renewal survey requirements after determining compliance with regulations XII/12 and XII/13 of the Convention

2.8.1 For ships complying with the requirements of regulation XII/12 of the Convention for hold, ballast and dry space water level detectors, the renewal survey shall include an examination and a test of the water ingress detection system and of their alarms.

2.8.2 For ships complying with the requirements of regulation XII/13 of the Convention for the availability of pumping systems, the renewal survey shall include an examination and a test of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

3 Annual survey

3.1 General

Annual surveys shall be held within three months before or after the anniversary date from the date of the initial survey or of the date credited for the last renewal survey. The annual survey shall consist of an examination for the purpose of ensuring, as far as practicable, that the hull weather decks, hatch covers, coamings and piping are maintained in a satisfactory condition and shall take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

3.2 Examination of the hull

3.2.1 An examination of the hull plating and its closing appliances shall be carried out as far as can be seen.

3.2.2 An examination of watertight penetrations shall be carried out as far as practicable.

3.3 Examination of weather decks, hatch covers and coamings

3.3.1 It shall be confirmed that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

3.3.2 A thorough survey of cargo hatch covers and coamings is only possible by examination in the open as well as closed positions and shall include verification of proper opening and closing operations. As a result, the hatch cover sets within the forward 25% of the ship's length and at least one additional set, such that all sets on the ship are assessed at least once in every five-year period, shall be surveyed open, closed and in operation to the full extent in each direction at each annual survey, including:

- .1 stowage and securing in open condition;
- .2 proper fit and efficiency of sealing in closed condition; and
- .3 operational testing of hydraulic and power components, wires, chains and link drives.

The closing of the covers shall include the fastening of all peripheral, and cross joint cleats or other securing devices. Particular attention shall be paid to the condition of hatch covers in the forward 25% of the ship's length, where sea loads are normally greatest.

3.3.3 If there are indications of difficulty in operating and securing hatch covers, additional hatch cover sets above those required by 3.3.2, at the discretion of the surveyor, shall be tested in operation.

3.3.4 Where the cargo hatch securing system does not function properly, repairs shall be carried out under the supervision of the Administration. Where hatch covers or coamings undergo substantial repairs, the strength of securing devices shall be upgraded to comply with annex 11.

3.3.5 For each cargo hatch cover set, at each annual survey, the following items shall be surveyed:

- .1 cover panels, including side plates, and stiffener attachments that are accessible in the open position by close-up survey (for corrosion, cracks, deformation);
- .2 sealing arrangements of perimeter and cross joints (gaskets for condition and permanent deformation, flexible seals on combination carriers, gasket lips, compression bars, drainage channels and non-return valves);
- .3 clamping devices, retaining bars, cleating (for wastage, adjustment, and condition of rubber components);
- .4 closed cover locating devices (for distortion and attachment);
- .5 chain or rope pulleys;
- .6 guides;
- .7 guiderails and track wheels;
- .8 stoppers;
- .9 wires, chains, tensioners and gypsies;
- .10 hydraulic system, electrical safety devices and interlocks; and
- .11 end and interpanel hinges, pins and stools where fitted.

3.3.6 At each hatchway, at each annual survey, the coamings, with plating, stiffeners and brackets shall be checked for corrosion, cracks and deformation, especially of the coaming tops including close-up survey.

3.3.7 Where considered necessary, the effectiveness of sealing arrangements shall be confirmed and may be proved by hose or chalk testing supplemented by dimensional measurements of seal compressing components.

3.3.8 Where portable covers, wooden or steel pontoons are fitted, the satisfactory condition of the following shall be confirmed, where applicable:

- .1 wooden covers and portable beams, carriers or sockets for the portable beam, and their securing devices;
- .2 steel pontoons, including close-up survey of hatch cover plating;

- .3 tarpaulins;
- .4 cleats, battens and wedges;
- .5 hatch securing bars and their securing devices;
- .6 loading pads/bars and the side plate edge;
- .7 guide plates and chocks; and
- .8 compression bars, drainage channels and drain pipes (if any).

3.3.9 The flame screens on vents to all bunker tanks shall be examined.

3.3.10 Bunker and vent piping systems, including ventilators, shall be examined.

3.4 Examination of cargo holds

3.4.1 For double-side skin bulk carriers of 10 to 15 years of age, the following shall be carried out:

- .1 overall survey of two selected cargo holds;
- .2 when considered necessary by the surveyor, or where extensive corrosion exists, thickness measurements shall be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with annex 10. These extended thickness measurements shall be carried out before the survey is credited as complete. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under the IACS Common Structural Rules, 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; and
- .3 all piping and penetrations in cargo holds, including overboard piping, shall be examined.

3.4.2 For double-side skin bulk carriers over 15 years of age, the following shall be carried out:

- .1 overall survey of all cargo holds;

- .2 when considered necessary by the surveyor, or where extensive corrosion exists, thickness measurements shall be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with annex 10. These extended thickness measurements shall be carried out before the survey is credited as complete. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under the IACS Common Structural Rules, 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; and
- .3 all piping and penetrations in cargo holds, including overboard piping, shall be examined.

3.5 Examination of ballast tanks

Examination of ballast tanks shall be carried out when required as a consequence of the results of the renewal survey and intermediate survey. When considered necessary by the Administration, or where extensive corrosion exists, thickness measurements shall be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with annex 10. These extended thickness measurements shall be carried out before the survey is credited as complete. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under the IACS Common Structural Rules, 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.

3.6 Additional annual survey requirements after determining compliance with regulations XII/12 and XII/13 of the Convention

3.6.1 For ships complying with the requirements of regulation XII/12 of the Convention for hold, ballast and dry space water level detectors, the annual survey shall include an examination and a test, at random, of the water ingress detection systems and of their alarms.

3.6.2 For ships complying with the requirements of regulation XII/13 of the Convention for the availability of pumping systems, the annual survey shall include an examination and a test, of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

4 Intermediate survey

4.1 General

4.1.1 Items that are additional to the requirements of the annual survey may be surveyed either at the second or third annual survey or between these surveys.

4.1.2 The extent of survey is dependent upon the age of the ship as specified in 4.2, 4.3 and 4.4.

4.1.3 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

4.2 Double-side skin bulk carriers 5 to 10 years of age

4.2.1 Ballast tanks

4.2.1.1 For tanks used for water ballast, an overall survey of representative tanks selected by the surveyor shall be carried out. The selection shall include fore and aft peak tanks and a number of other tanks, taking into account the total number and type of ballast tanks. If such overall survey reveals no visible structural defects, the examination may be limited to verification that the corrosion prevention system remains efficient.

4.2.1.2 Where POOR condition, corrosion or other defects are found in water ballast tanks or where a hard protective coating was not applied from the time of construction, the examination shall be extended to other ballast tanks of the same type.

4.2.1.3 In ballast tanks other than double-bottom tanks, where a hard protective coating is found in POOR condition and it is not renewed, or where a soft or semi-hard coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question shall be examined and thickness measurements carried out as considered necessary at annual intervals. When such breakdown of a hard protective coating is found in ballast double-bottom tanks, where a soft or semi-hard coating has been applied, or where a hard protective coating has not been applied, the tanks in question may be examined at annual intervals. When considered necessary by the surveyor, or where extensive corrosion exists, thickness measurements shall be carried out.

4.2.1.4 In addition to the above requirements, suspect areas identified at previous surveys shall be subject to overall and close-up survey.

4.2.2 Cargo holds

4.2.2.1 An overall survey of all cargo holds shall be carried out.

4.2.2.2 Where considered necessary by the surveyor as a result of the overall survey as described in 4.2.2.1, the survey shall be extended to include a close-up survey of those areas of the structure in the cargo holds selected by the surveyor.

4.2.3 Extent of thickness measurements

4.2.3.1 Thickness measurements shall be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey where required as per 4.2.2.2 and as provided in 4.2.1.4.

4.2.3.2 The extent of thickness measurements may be specially considered provided the surveyor is satisfied by the close-up survey that there is no structural diminution and the hard protective coatings are found to be in a GOOD condition.

4.2.3.3 Where substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with the requirements of annex 10. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For bulk carriers built under IACS Common Structural Rules, the identified substantial corrosion areas shall be:

- .1 protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition; or alternatively
- .2 required to be measured at annual intervals.

Explanatory note:

For existing bulk carriers, where owners elect to coat or recoat cargo holds as noted above, consideration may be given to the extent of the close-up surveys and thickness measurement. Prior to the coating of cargo holds of existing ships, scantlings shall be ascertained in the presence of a surveyor.

4.2.3.4 Where hard protective coating is fitted in cargo holds and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

4.3 *Double-side skin bulk carriers 10 to 15 years of age*

4.3.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey as required in 2 and 5.1. However, internal examination of fuel oil tanks and pressure testing of all tanks shall not be required unless deemed necessary by the attending surveyor.

4.3.2 In application of 4.3.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

4.3.3 In application of 4.3.1, an underwater survey may be considered in lieu of the requirements of 2.2.

4.4 *Double-side skin bulk carriers exceeding 15 years of age*

4.4.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey required in 2 and 5.1. However, internal examination of fuel oil tanks and pressure testing of all tanks shall not be required unless deemed necessary by the attending surveyor.

4.4.2 In application of 4.4.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

4.4.3 In application of 4.4.1, a survey in dry-dock shall be part of the intermediate survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and water ballast tanks shall be carried out in accordance with the applicable requirements for intermediate surveys, if not already performed.

Note: Lower portions of the cargo holds and ballast tanks are considered to be the parts below the light ballast water line.

5 Preparations for survey

5.1 Survey programme

5.1.1 The owner in cooperation with the Administration shall work out a specific survey programme prior to the commencement of any part of the renewal survey and, for double-side skin bulk carriers over 10 years of age, the intermediate survey. The survey programme shall be in a written format based on the information in annex 4A. The survey shall not commence until the survey programme has been agreed.

5.1.1.1 Prior to the development of the survey programme, the survey planning questionnaire shall be completed by the owner based on the information set out in annex 4B, and forwarded to the Administration.

5.1.1.2 The survey programme at intermediate survey may consist of the survey programme at the previous renewal survey supplemented by the condition evaluation report (executive hull summary report) of that renewal survey and later relevant survey reports.

5.1.1.3 The survey programme shall be worked out taking into account any amendments to the survey requirements after the last renewal survey was carried out.

5.1.2 In developing the survey programme, the following documentation shall be collected and consulted upon with a view to selecting tanks, holds, areas and structural elements to be examined:

- .1 survey status and basic ship information;
- .2 documentation on board, as described in 6.2 and 6.3;
- .3 main structural plans (scantlings drawings), including information regarding use of high-tensile steels (HTS);
- .4 relevant previous survey and inspection reports from both the Administration and the owner;
- .5 information regarding the use of ship's holds and tanks, typical cargoes and other relevant data;
- .6 information regarding corrosion prevention level on the new building; and
- .7 information regarding the relevant maintenance level during operation.

5.1.3 The submitted survey programme shall account for, and comply, as a minimum, with the provisions of 2.7 and annexes 1 and 2 for tank testing close-up survey, and thickness measurement, respectively, and shall include relevant information, including at least:

- .1 basic ship information and particulars;
- .2 main structural plans (scantling drawings), including information regarding use of high-tensile steels (HTS);
- .3 plan of holds and tanks;

- .4 list of holds and tanks with information on use, protection and condition of coating;
- .5 conditions for survey (e.g. information regarding hold and tank cleaning, gas-freeing, ventilation, lighting, etc.);
- .6 provisions and methods for access to structures;
- .7 equipment for surveys;
- .8 nomination of holds and tanks and areas for close-up survey (see 2.5);
- .9 nomination of sections for thickness measurement (see 2.6);
- .10 nomination of tanks for testing (see 2.7); and
- .11 damage experience related to the ship in question.

5.1.4 The Administration shall advise the owner of the maximum acceptable structural corrosion diminution levels applicable to the ship.

5.1.5 Use should also be made of the Guidelines for technical assessment in conjunction with the planning of enhanced surveys for double-side skin bulk carriers, contained in annex 9. These Guidelines are a recommended tool which may be invoked at the discretion of the Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme. These Guidelines shall not be used to reduce the requirements of annexes 1 and 2 and paragraph 2.7, which shall, in all cases, be complied with as a minimum.

5.2 Conditions for survey

5.2.1 The owner shall provide the necessary facilities for a safe execution of the survey.

5.2.2 In order to enable the attending surveyors to carry out the survey, provisions for proper and safe access shall be agreed between the owner and the Administration, based on recommendations developed by the Organization*.

5.2.3 Details of the means of access shall be provided in the survey planning questionnaire.

5.2.4 In cases where the provisions of safety and required access are judged by the attending surveyor(s) not to be adequate, the survey of the spaces involved shall not proceed.

5.2.5 Cargo holds, tanks and spaces shall be safe for access. Cargo holds, tanks and spaces shall be gas free and properly ventilated. Prior to entering a tank, void or enclosed space, it shall be verified that the atmosphere in the tank is free from hazardous gas and contains sufficient oxygen.

5.2.6 In preparation for survey and thickness measurements and to allow for a thorough examination, all spaces shall be cleaned including removal from surfaces of all loose

* Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

accumulated corrosion scale. Spaces shall 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 coating. However, those areas of structure whose renewal has already been decided by the owner need only be cleaned and descaled to the extent necessary to determine the limits of the areas to be renewed.

5.2.7 Sufficient illumination shall be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the coating.

5.2.8 Where soft or semi-hard coatings have been applied, safe access shall 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 shall be removed.

5.2.9 The surveyor(s) shall always be accompanied by, at least, one responsible person, assigned by the owner, experienced in tank and enclosed space inspection.

5.3 Access to structures*

5.3.1 For overall surveys, means shall be provided to enable the surveyor to examine the structure in a safe and practical way.

5.3.2 For close-up surveys, one or more of the following means for access, acceptable to the surveyor, shall be provided:

- .1 permanent staging and passages through structures;
- .2 temporary staging and passages through structures;
- .3 hydraulic arm vehicles such as conventional cherry pickers, lifts and moveable platforms;
- .4 portable ladders;
- .5 boats or rafts; and/or
- .6 other equivalent means.

5.4 Equipment for survey

5.4.1 Thickness measurements shall normally be carried out by means of ultrasonic test equipment. The accuracy of the equipment shall be proven to the surveyor as required.

5.4.2 One or more of the following fracture detection procedures shall be required if deemed necessary by the surveyor:

- .1 radiographic equipment;
- .2 ultrasonic equipment;
- .3 magnetic particle equipment; and/or

* Refer to the *Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers* (MSC/Circ.686).

.4 dye penetrant.

5.4.3 Explosimeter, oxygen-meter, breathing apparatus, lifelines, riding belts with rope and hook and whistles together with instructions and guidance on their use shall be made available during the survey. A safety checklist shall be provided.

5.4.4 Adequate and safe lighting shall be provided for the safe and efficient conduct of the survey.

5.4.5 Adequate protective clothing shall be made available and used (e.g. safety helmet, gloves, safety shoes, etc.) during the survey.

5.5 *Rescue and emergency response equipment*

If breathing apparatus and/or other equipment is used as "Rescue and emergency response equipment", then the equipment shall be suitable for the configuration of the space being surveyed.

5.6 *Surveys at sea or at anchorage*

5.6.1 Surveys at sea or at anchorage may be accepted provided the surveyor is given the necessary assistance from the personnel on board. Necessary precautions and procedures for carrying out the survey shall be in accordance with 5.1, 5.2, 5.3 and 5.4.

5.6.2 A communication system shall be arranged between the survey party in the spaces under examination and the responsible officer on deck. This system shall also include the personnel in charge of ballast pump handling if boats or rafts are used.

5.6.3 Surveys of tanks or applicable holds by means of boats or rafts shall only be undertaken with the agreement of the surveyor, who shall take into account the safety arrangements provided, including weather forecasting and ship response under foreseeable conditions and provided the expected rise of water within the tank does not exceed 0.25 m.

5.6.4 When rafts or boats will be used for close-up survey, the following conditions shall be observed:

- .1 only rough duty, inflatable rafts or boats, having satisfactory residual buoyancy and stability even if one chamber is ruptured, shall be used;
- .2 the boat or raft shall be tethered to the access ladder and an additional person shall be stationed down the access ladder with a clear view of the boat or raft;
- .3 appropriate lifejackets shall be available for all participants;
- .4 the surface of water in the tank or hold shall be calm (under all foreseeable conditions the expected rise of water within the tank shall not exceed 0.25 m) and the water level stationary. On no account shall the level of the water be rising while the boat or raft is in use;
- .5 the tank, hold or space shall contain clean ballast water only. Even a thin sheen of oil on the water shall not be acceptable; and

- .6 at no time shall the water level 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 or hold access. Filling to levels above the deck transverses shall only 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.

5.6.5 Rafts or boats alone may be allowed for inspection of the under deck areas for tanks or spaces, if the depth of the webs is 1.5 m or less.

5.6.6 If the depth of the webs is more than 1.5 m, rafts or boats alone shall be allowed only:

- .1 when the coating of the under deck structure is in GOOD condition and there is no evidence of wastage; or
- .2 if a permanent means of access is provided in each bay to allow safe entry and exit. This means:
 - .1 access direct from the deck via a vertical ladder and a small platform fitted approximately 2 m below the deck in each bay; or
 - .2 access to deck from a longitudinal permanent platform having ladders to deck in each end of the tank. The platform shall, for the full length of the tank, be arranged level with, or above, the maximum water level needed for rafting of under deck structure. For this purpose, the ullage corresponding to the maximum water level shall be assumed not more than 3 m from the deck plate measured at the midspan of deck transverses and in the middle length of the tank.

If neither of the above conditions are met, then staging or other equivalent means shall be provided for the survey of the under-deck areas.

5.6.7 The use of rafts or boats alone in 5.6.5 and 5.6.6 does not preclude the use of boats or rafts to move about within a tank during a survey.

5.7 Survey planning meeting

5.7.1 Proper preparation and the close cooperation between the attending surveyor(s) and the owner's representatives on board prior to and during the survey are an essential part in the safe and efficient conduct of the survey. During the survey onboard safety meetings shall be held regularly.

5.7.2 Prior to commencement of any part of the renewal or intermediate survey, a survey planning meeting shall be held between the attending surveyor(s), the owner's representative in attendance, the thickness measurement firm representative, where involved, and the master of the ship or an appropriately qualified representative appointed by the master or company; for the purpose to ascertain that all the arrangements envisaged in the survey programme are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out (see also 7.1.2).

5.7.3 The following is an indicative list of items that shall be addressed in the meeting:

- .1 schedule of the ship (i.e. the voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operations, etc.);
- .2 provisions and arrangements for thickness measurements (i.e. access, cleaning/descaling, illumination, ventilation, personal safety);
- .3 extent of the thickness measurements;
- .4 acceptance criteria (refer to the list of minimum thicknesses);
- .5 extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion;
- .6 execution of thickness measurements;
- .7 taking representative readings in general and where uneven corrosion/pitting is found;
- .8 mapping of areas of substantial corrosion; and
- .9 communication between attending surveyor(s) the thickness measurement firm operator(s) and owner's representative(s) concerning findings.

6 Documentation on board

6.1 General

6.1.1 The owner shall obtain, supply and maintain on board the ship documentation as specified in 6.2 and 6.3, which shall be readily available for the surveyor. The condition evaluation report (executive hull summary report) referred to in 6.2 shall include a translation into English.

6.1.2 The documentation shall be kept on board for the lifetime of the ship.

6.1.3 For bulk carriers subject to SOLAS regulation II-1/3-10, the owner shall arrange the updating of the Ship Construction File (SCF) throughout the ship's life whenever a modification of the documentation included in the SCF has taken place. Documented procedures for updating the SCF shall be included within the Safety Management System.

6.1.4 For bulk carriers with coatings of dedicated seawater ballast tanks and double-side skin spaces subject to PSPC standards (MSC.215(82)), the owner shall arrange the updating of the Coating Technical File (CTF) throughout the ship's life whenever a maintenance, repair, or recoating activity to these coatings has taken place. Documented procedures for updating the CTF shall be included within the Safety Management System.

6.2 Survey report file

6.2.1 A survey report file shall be a part of the documentation on board consisting of:

- .1 reports of structural surveys (annex 6);
- .2 condition evaluation report (executive hull summary report) (annex 7); and
- .3 thickness measurement reports (annex 8A/annex 8B).

6.2.2 The survey report file shall be available also in the owner's and the Administration's offices.

6.3 Supporting documents

6.3.1 The following additional documentation shall be available on board:

- .1 survey programme, as required under 5.1 until such time as the renewal survey or intermediate survey, as applicable, has been completed;
- .2 main structural plans of cargo holds and ballast tanks (for bulk carriers built under the IACS Common Structural Rules, these plans shall include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition shall also be clearly indicated on the plans. The midship section plan supplied on board the ship shall include the minimum allowable hull girder sectional properties for hold transverse section in all cargo holds);
- .3 previous repair history;
- .4 cargo and ballast history;
- .5 inspections by ship's personnel with reference to:
 - .1 structural deterioration in general;
 - .2 leakages in bulkheads and piping; and
 - .3 condition of corrosion prevention system, if any. Guidance for reporting is shown in annex 3; and
- .6 any other information that would help to identify critical structural areas and/or suspect areas requiring inspection.

6.3.2 For bulk carriers subject to SOLAS regulation II-1/3-10, the Ship Construction File (SCF), limited to the items to be retained on board, shall be available on board.

6.3.3 For bulk carriers with coatings of dedicated seawater ballast tanks and double-side skin spaces subject to PSPC standards (MSC.215(82)), the Coating Technical File (CTF) shall be available on board.

6.4 Review of documentation on board

6.4.1 Prior to survey, the surveyor shall examine the completeness of the documentation on board, and its contents as a basis for the survey.

6.4.2 For bulk carriers subject to SOLAS regulation II-1/3-10, on completion of the survey, the surveyor shall verify that the update of the Ship Construction File (SCF) has been done whenever a modification of the documentation included in the SCF has taken place.

6.4.2.1 For the SCF stored on board ship, the surveyor shall examine the information on board ship. In cases where any major event takes place, including, but not limited to, substantial repair and conversion, or any modification to the ship structures; the surveyor shall also verify that the updated information is kept on board the ship. If the updating of the SCF

on board is not completed at the time of survey, the surveyor shall record it and require confirmation at the next periodical survey.

6.4.2.2 For the SCF stored in an onshore archive, the surveyor shall examine the list of information included in the onshore archive. In cases where any major event takes place, including, but not limited to, substantial repair and conversion, or any modification to the ship structures; the surveyor shall also verify that the updated information is stored in the onshore archive by examining the list of information included in the onshore archive kept on board the ship. In addition, the surveyor shall confirm that the service contract with the archive centre is valid. If the updating of the SCF Supplement ashore is not completed at the time of survey, the surveyor shall record it and require confirmation at the next periodical survey.

6.4.3 For bulk carriers subject to SOLAS regulation II-1/3-10, on completion of the survey, the surveyor shall verify any addition and/or renewal of materials used for the construction of the hull structure are documented within the Ship Construction File's list of materials.

6.4.4 For bulk carriers with coatings of dedicated seawater ballast tanks and double-side skin spaces subject to PSPC standards (MSC.215(82)), on completion of the survey, the surveyor shall verify any maintenance, repair, or recoating activities to these coatings are documented within the Coating Technical File (CTF).

7 Procedures for thickness measurements

7.1 General

7.1.1 The required thickness measurements, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The surveyor shall be on board to the extent necessary to control the process.

7.1.2 The thickness measurement firm shall be part of the survey planning meeting to be held prior to commencing the survey.

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

7.1.4 In all cases the extent of the thickness measurements shall be sufficient as to represent the actual average condition.

7.1.5 Procedural requirements for thickness measurements are set out in annex 12.

7.2 Certification of thickness measurement firm

The thickness measurements shall be carried out by a qualified firm certified by the Administration according to the principles stated in annex 5.

7.3 Number and locations of measurements

7.3.1 Application

This section only applies to ships built under the IACS Common Structural Rules* (CSR). For ships not built under IACS CSR, the requirements for the number and locations of

* IACS Common Structural Rules mean IACS Common Structural Rules for Bulk Carriers (IACS CSR for Bulk carriers) or IACS Common Structural Rules for Bulk Carriers and Oil Tankers (IACS CSR BC& OT)

measurements shall be according to the requirements of the classification society recognized by the Administration depending on the ship's age and structural elements concerned.

7.3.2 Number of measurements

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

7.3.3 Locations of measurements

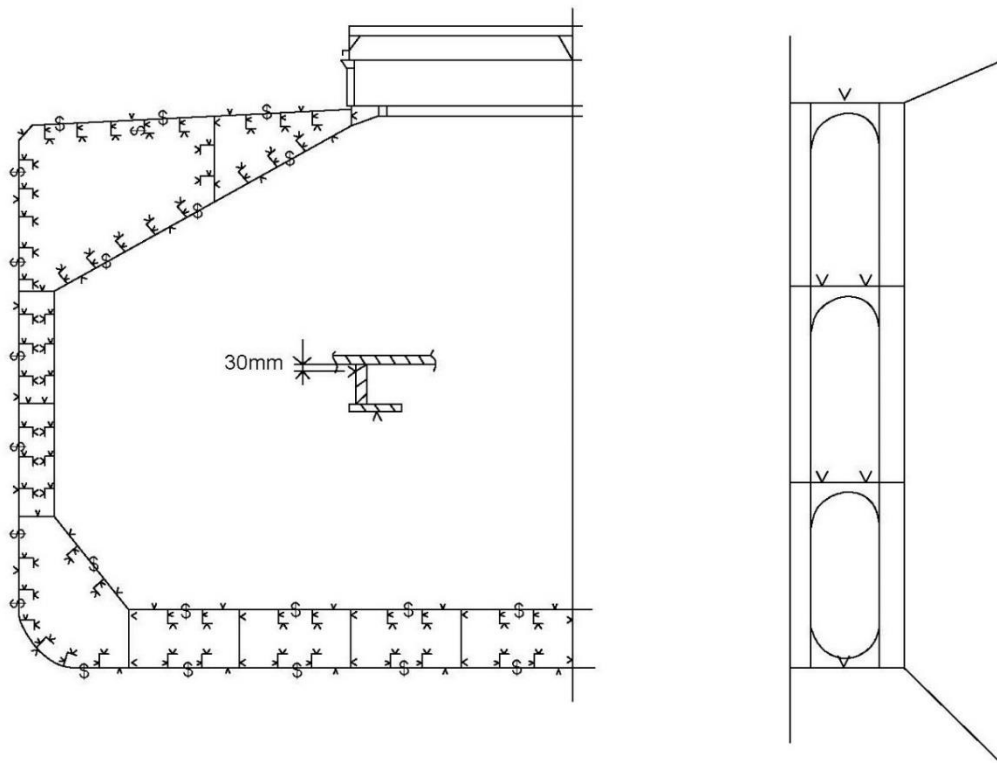
7.3.3.1 Table 1 provides explanations and/or interpretations for the application of those requirements indicated in the IACS CSR, which refer to both systematic thickness measurements related to the calculation of global hull girder strength and specific measurements connected to close-up surveys.

7.3.3.2 Figures 4 to 9 are provided to facilitate the explanations and/or interpretations given in table 1, to show typical arrangements of double-side skin bulk carriers.

Table 1 – Interpretations of requirements for the locations and number of points to be measured for CSR bulk carriers (double-side skin)

Item	Interpretation	Figure reference
Selected plates on deck, tank top, bottom, double bottom and wind-and-water area	"Selected" means at least a single point on one out of three plates, which shall be chosen on representative areas of average corrosion	
All deck, tank top and bottom plates and wind-and-water strakes	At least two points on each plate which shall be taken either at each 1/4 extremity of plate or at representative areas of average corrosion	
Transverse section	A transverse section includes all longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom, hopper sides, inner sides and top wing inner sides	Figure 4
All cargo hold hatch covers and coamings	Including plates and stiffeners	Locations of points are given in figure 5
Transverse section of deck plating outside line of cargo hatch openings	Two single points on each deck plate (which shall be taken either at each 1/4 extremity of plate or at representative areas of average corrosion) between the ship sides and hatch coamings in the transverse section concerned	
All deck plating and underdeck structure inside line of hatch	"All deck plating" means at least two points on each plate shall be taken either at each 1/4 extremity of plate or at representative areas of average corrosion	Extent of areas is shown in appendix 3 to annex 8B

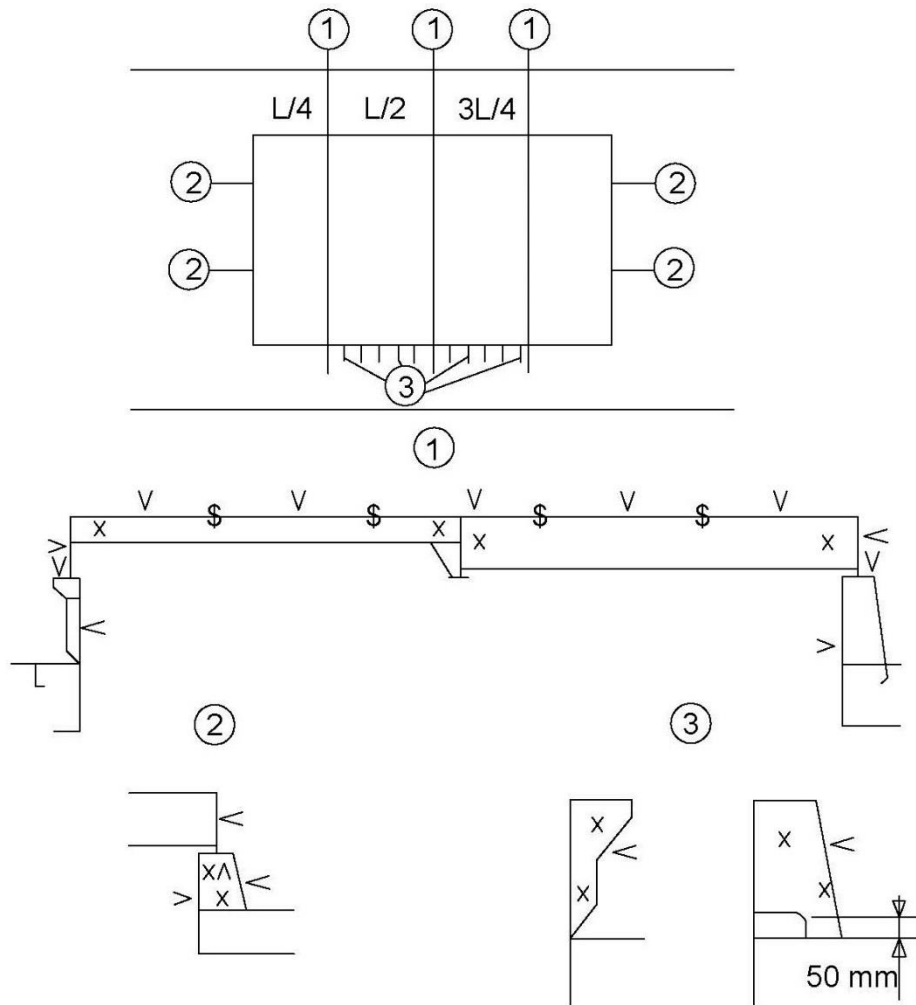
Item	Interpretation	Figure reference
openings between cargo hold hatches	"Under deck structure": at each short longitudinal girder: three points for web plating (fwd/middle/aft), single point for face plate, one point for web plating and one point for face plating of transverse beam in way. At each end of transverse beams, one point for web plating and one point for face plating	Locations of points are given in figure 9
Transverse frame in double-side tank		Figure 4
Transverse bulkheads in cargo holds	Includes bulkhead plating, stiffeners and girders, including internal structure of upper and lower stools, where fitted. Two selected bulkheads: one shall be the bulkhead between the two foremost cargo holds and the second may be chosen in other positions	Areas of measurements are shown in appendix 3 to annex 8B Locations of points are given in figure 7
One transverse bulkhead in each cargo hold	This means that the close-up survey and related thickness measurements shall be performed on one side of the bulkhead; the side shall be chosen based on the outcome of the overall survey of both sides. In the event of doubt, the surveyor may also require (possibly partial) close-up survey on the other side	Areas of measurements are shown in appendix 3 to annex 8B Locations of points are given in figure 7
Transverse bulkheads in one topside, hopper and double bottom ballast tank	Includes bulkhead and stiffening systems The ballast tank shall be chosen based on the history of ballasting among those prone to have the most severe conditions	Locations of points are given in figure 8
Transverse webs in ballast tanks	Includes web plating, face plates, stiffeners and associated plating and longitudinals One of the representative tanks of each type (i.e. topside or hopper or side tank) shall be chosen in the forward part	Areas of measurements are shown in appendix 3 to annex 8B Locations of points are given in figure 6



Double Skin Bulk Carrier

Note: Measurements shall be taken on both port and starboard sides of the selected transverse section.

Figure 4: Transverse section of a double-side skin bulk carrier



Notes:

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

Figure 5: Locations of measurements on hatch covers and coamings

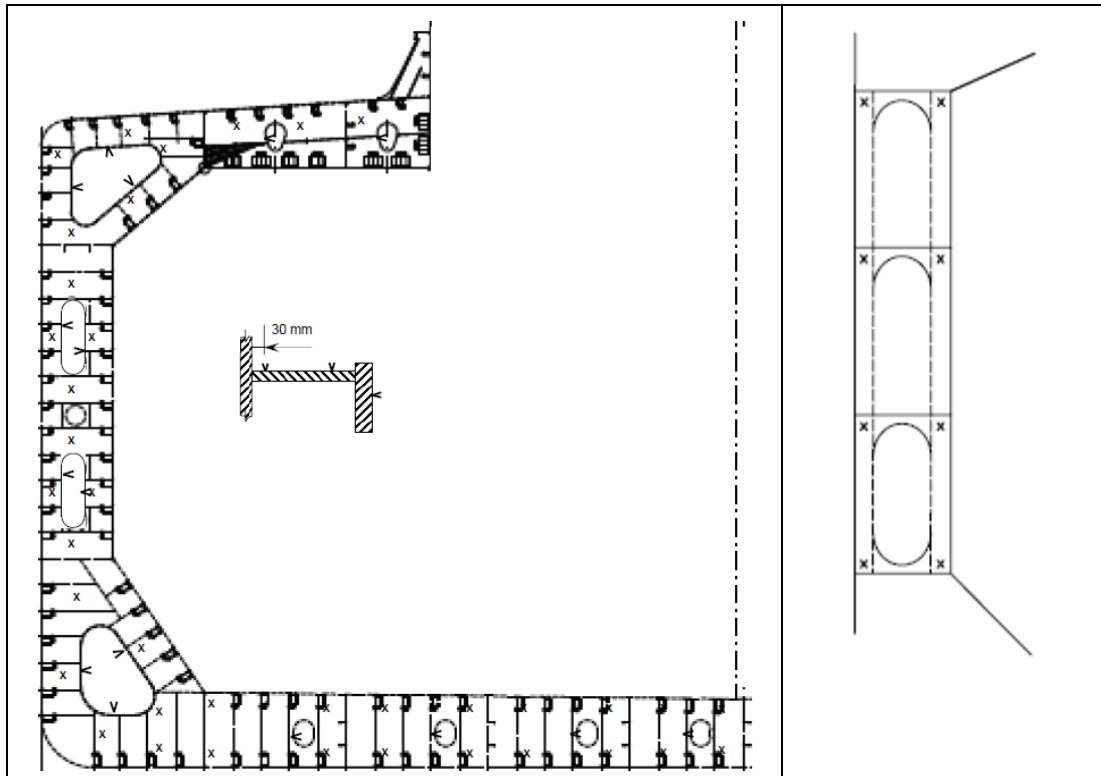
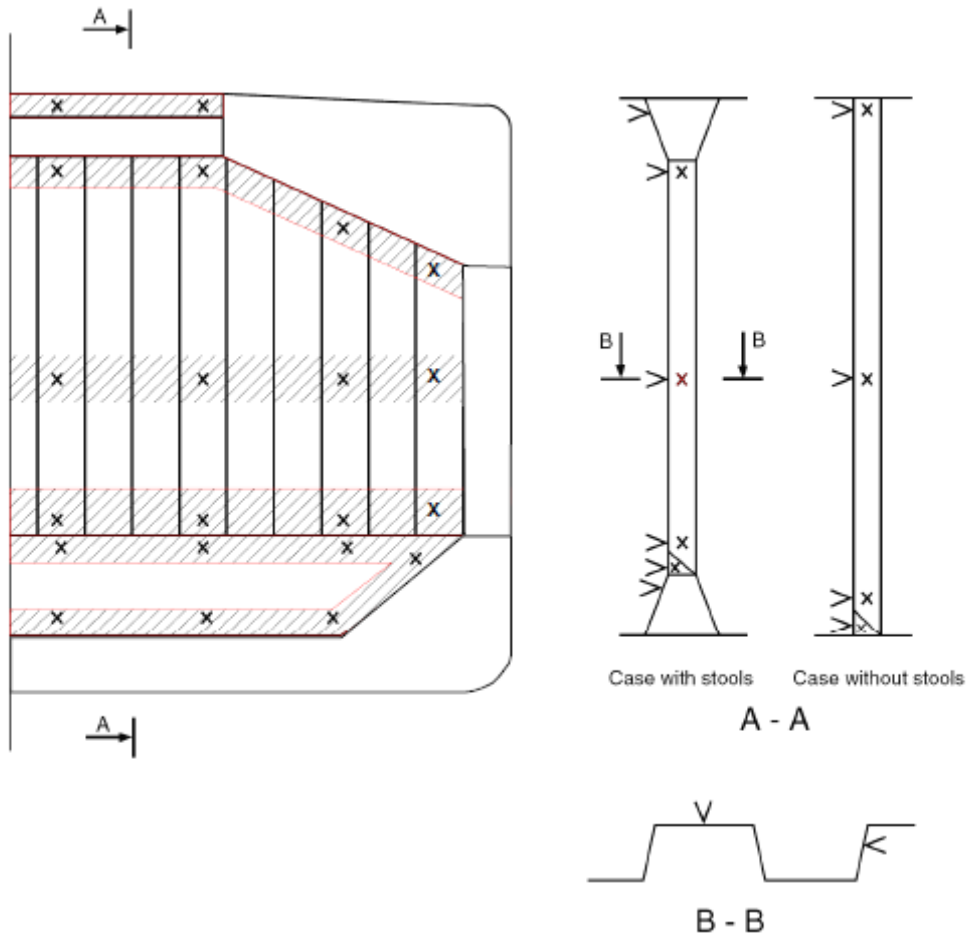
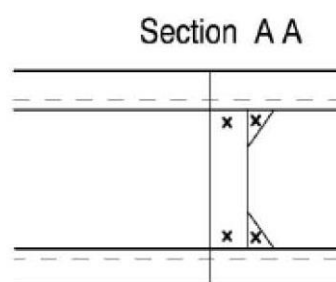
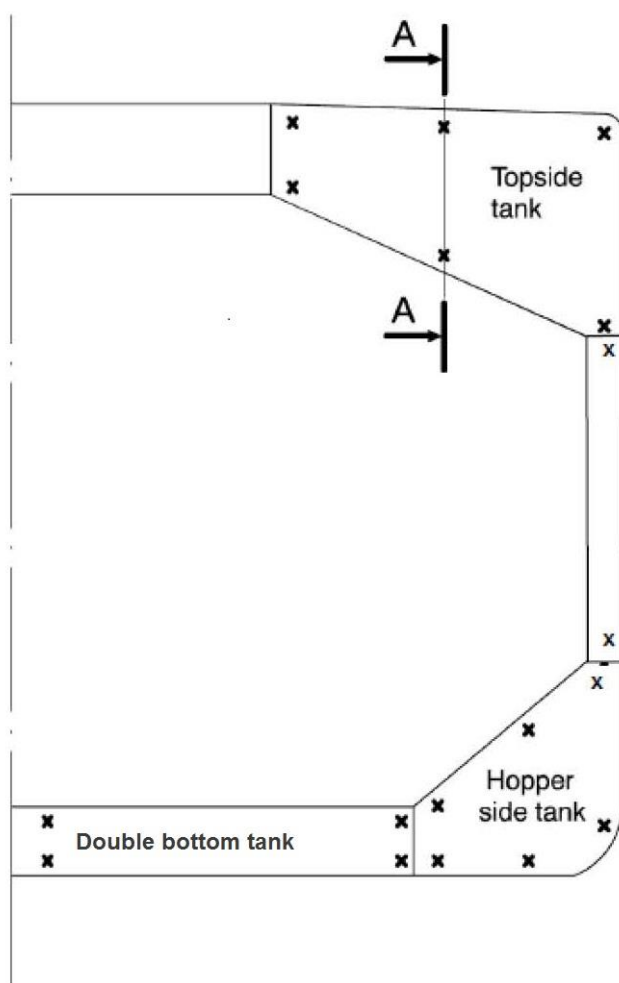


Figure 6: Locations of measurements on structural members in ballast tanks of double-side skin bulk carriers (topside or hopper or side tank)



Note: Measurements shall be taken in each shaded area as per views A–A and B–B. Additional measurements to internal structure of upper and lower stools shall be added, e.g. two points in the upper and two points in the lower stools indicated in section A-A.

Figure 7: Locations of measurements on cargo hold transverse bulkheads



Note: Measurements shall be taken in each vertical section as per view A–A.
Two additional measurements to internal structure of double bottom tank shall be added at midspan

Figure 8: Locations of measurements on transverse bulkheads of topside, hopper and double bottom tanks

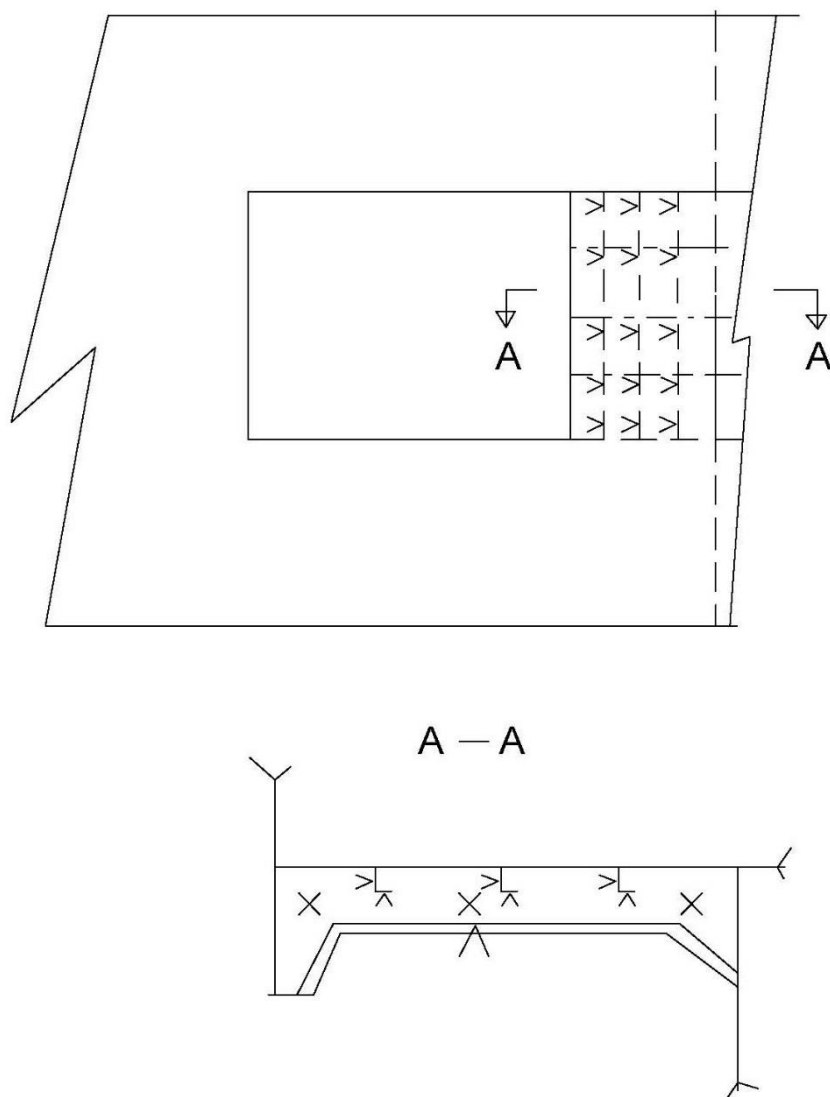


Figure 9: Locations of measurements on underdeck structure

7.4 Reporting

7.4.1 A thickness measurement report shall be prepared and submitted to the Administration. The report shall give the location of measurements, the thickness measured as well as the corresponding original thickness. Furthermore, the report shall give the date when the measurements were carried out, type of measuring equipment, names of personnel and their qualifications and be signed by the operator. The thickness measurement report should follow the principles as specified in the recommended procedures for thickness measurements set out in annex 8A/annex 8B.

7.4.2 The surveyor shall review the final thickness measurement reports and countersign the cover page.

8 Acceptance Criteria

8.1 General

8.1.1 For ships built under the IACS Common Structural Rules, the acceptance criteria shall be according to the IACS Common Structural Rules*, as applicable, and as specified in sections 8.2, 8.3 and 8.4.

8.1.2 For ships not built under the IACS Common Structural Rules, the acceptance criteria shall be according to the requirements of the classification society depending on the ship's age and structural elements concerned.

8.2 Acceptance criteria for pitting corrosion for ships built under the IACS Common Structural Rules

8.2.1 Side structures

8.2.1.1 If the pitting intensity in an area where coating is required, according to the IACS Common Structural Rules+, is higher than 15% (see figure 1), thickness measurements shall be performed to check the extent of pitting corrosion. The 15% is based on pitting or grooving on only one side of a plate.

8.2.1.2 In cases where the pitting intensity is exceeding 15%, as defined above, an area of 300 mm diameter or more, at the most pitted part of the plate, shall 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 shall be taken as the thickness to be recorded.

8.2.1.3 The minimum remaining thickness in pits, grooves or other local areas shall be greater than 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 the renewal thickness (t_{ren}).

8.2.2 Other structures

8.2.2.1 For plates with a pitting intensity less than 20%, see figure 1, the measured thickness, t_m , of any individual measurement shall meet the lesser of the following criteria:

$$t_m \geq 0.7 (t_{as-built} - t_{vol\ add}) \text{ (mm); and}$$

$$t_m \geq t_{ren} - 1 \text{ (mm),}$$

where:

$t_{as-built}$	as-built thickness of the member, in mm;
$t_{vol\ add}$	voluntary thickness addition; thickness, in mm, voluntarily added as the owner's extra margin for corrosion wastage in addition to t_c ;
t_{ren}	renewal thickness; minimum allowable thickness, in mm, below which renewal of structural members shall be carried out;

* Chapter 13 of IACS CSR for Bulk Carriers or Chapter 13 of Part 1 of IACS CSR BC & OT

+ Section 5 of Chapter 3 of IACS CSR for Bulk Carriers or Section 4 of Chapter 3 of Part 1 of IACS CSR BC&OT

t_c	total corrosion addition, in mm, defined in IACS CSR [*] ; and
t_m	measured thickness, in mm, on one item, i.e. average thickness on one item using the various measurements taken on this same item during periodical surveys of ships in service.

8.2.2.2 The average thickness across any cross section of the plating shall not be less than the renewal criteria for general corrosion given in the IACS Common Structural Rules⁺, as applicable.

8.3 **Acceptance criteria for edge corrosion for ships built under the IACS Common Structural Rules**

8.3.1 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%, see figure 2, of the stiffener flange breadth or web height, as applicable, the measured thickness, t_m , shall meet the lesser of the following criteria:

$$t_m \geq 0.7 (t_{as-built} - t_{vol add}) \text{ (mm); and}$$

$$t_m \geq t_{ren} - 1 \text{ (mm).}$$

8.3.2 The average measured thickness across the breadth or height of the stiffener shall not be less than that defined in the IACS Common Structural Rules⁺, as applicable.

8.3.3 Plate edges at openings for manholes, lightening holes, etc. may be below the minimum thickness given in the IACS Common Structural Rules⁺, as applicable, provided that:

- .1 the maximum extent of the reduced plate thickness, from the opening edge, below the minimum, shall not be more than 20% of the smallest dimension of the opening and shall not exceed 100 mm; and
- .2 rough or uneven edges may be cropped-back provided that the maximum dimension of the opening shall not be increased by more than 10% and the remaining thickness of the new edge shall not be less than $t_{ren} - 1$ mm.

8.4 **Acceptance criteria for grooving corrosion for ships built under the IACS Common Structural Rules**

8.4.1 Where the groove breadth is a maximum of 15% of the web height, but not more than 30 mm, see figure 3, the measured thickness, t_m , in the grooved area shall meet the lesser of the following criteria:

$$t_m \geq 0.75 (t_{as-built} - t_{vol add}) \text{ (mm);}$$

$$t_m \geq t_{ren} - 0.5 \text{ (mm) and}$$

$$t_m \geq 6 \text{ mm.}$$

* Section 3 of Chapter 3 of IACS CSR for Bulk Carriers or Section 3 of Chapter 3 of Part 1 of IACS CSR BC&OT.

+ Chapter 13 of IACS CSR for Bulk Carriers or Chapter 13 of Part 1 of IACS CSR BC&OT.

8.4.2 Structural members with areas of grooving greater than those in paragraph 8.4.1 above shall be assessed based on the criteria for general corrosion as defined in the IACS Common Structural Rules*, as applicable, using the average measured thickness across the plating/stiffener.

9 Reporting and evaluation of survey

9.1 Evaluation of survey report

9.1.1 The data and information on the structural condition of the ship collected during the survey shall be evaluated for acceptability and continued structural integrity of the ship.

9.1.1.1 For bulk carriers built under the IACS Common Structural Rules, the ship's longitudinal strength shall be evaluated by using the thickness of structural members measured, renewed and reinforced, as appropriate, during the renewal surveys carried out after the ship reached 15 years of age (or during the renewal survey No.3, if this is carried out before the ship reaches 15 years) in accordance with the criteria for longitudinal strength of the ship's hull girder for bulk carriers, specified in the IACS Common Structural Rules.

9.1.1.2 The final result of the evaluation of the ship's longitudinal strength required in paragraph 9.1.1.1, after renewal or reinforcement work of structural members, if carried out as a result of initial evaluation, shall be reported as a part of the condition evaluation report (executive hull summary report).

9.1.2 The analysis of data shall be carried out and endorsed by the Administration and the conclusions of the analysis shall form a part of the condition evaluation report (executive hull summary report).

9.2 Reporting

9.2.1 Principles for survey reporting are shown in annex 6.

9.2.2 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items examined and/or tested (pressure testing, thickness measurements, etc.) and an indication of whether the item has been credited, shall be made available to the next attending surveyor(s), prior to continuing or completing the survey.

9.2.3 A condition evaluation report (executive hull summary report) of the survey and results shall be issued to the owner as shown in annex 7 and placed on board the ship for reference at future surveys. The condition evaluation report (executive hull summary report) shall be endorsed by the Administration.

* Chapter 13 of IACS CSR for Bulk Carriers or Chapter 13 of Part 1 of IACS CSR BC&OT.

ANNEX 1

REQUIREMENTS FOR CLOSE-UP SURVEY AT RENEWAL SURVEYS OF DOUBLE-SIDE SKIN BULK CARRIERS

Appendix 1 – Minimum requirements for close-up survey at renewal survey of double-side skin bulk carriers excluding ore carriers

Age ≤ 5 years Renewal Survey No.1	5 < Age ≤ 10 years Renewal Survey No.2	10 < Age ≤ 15 years Renewal Survey No.3	Age > 15 years Renewal Survey No.4 and subsequent
<p>(A) One transverse web with associated plating and longitudinals in two representative water ballast tanks of each type. This shall include the foremost topside and double-side water ballast tanks on either side.</p> <p>(C) Two selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted.</p> <p>(D) All cargo hold hatch covers and coaming (plating and stiffeners).</p>	<p>(A) One transverse web with associated plating and longitudinals as applicable in each water ballast tank.</p> <p>(A) Forward and aft transverse bulkheads including stiffening system in a transverse section including topside, hopper side and double-side ballast tanks on one side of the ship (i.e. port or starboard).</p> <p>(B) 25% of ordinary transverse frames for transverse framing systems or 25% of longitudinals for longitudinal framing systems on side shell and inner side plating at forward, middle and aft parts in the foremost double-side tanks.</p> <p>(C) One transverse bulkhead in each cargo hold, including internal structure of upper and lower stools, where fitted.</p>	<p>(A) All transverse webs with associated plating and longitudinals as applicable in each water ballast tank.</p> <p>(A) All transverse bulkheads including stiffening system in each water ballast tank.</p> <p>(B) 25% of ordinary transverse frames for transverse framing systems or 25% of longitudinals for longitudinal framing systems on side shell and inner side plating at forward, middle and aft parts in all double-side tanks.</p> <p>(C) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted.</p> <p>(D) All cargo hold hatch covers and coamings (plating and stiffeners).</p> <p>(E) All deck plating and under-deck structure inside line of hatch openings between all cargo hold hatches.</p>	<p>(A) All transverse webs with associated plating and longitudinals as applicable in each water ballast tank.</p> <p>(A) All transverse bulkheads including stiffening system in each water ballast tank.</p> <p>(B) All ordinary transverse frames for transverse framing systems or all longitudinals for longitudinal framing systems on side shell and inner side plating at forward, middle and aft parts in all double-side tanks.</p> <p>Areas (C)–(E) as for renewal survey No.3</p>

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3	Renewal Survey No.4 and subsequent
	(D) All cargo hold hatch covers and coamings (plating and stiffeners). (E) All deck plating and under-deck structure inside line of hatch openings between all cargo hold hatches.		

(A), (B), (C), (D) and (E) are areas which shall be subjected to close-up surveys and thickness measurements (see sketches in appendix 3 to annex 8A/annex 8B).

- (A) Transverse web frame or watertight transverse bulkhead in topside, hopper side and double-side ballast tanks. In fore and aft peak tanks transverse web frame means a complete transverse web frame ring including adjacent structural members.
- (B) Ordinary transverse frame in double-side tanks.
- (C) Cargo hold transverse bulkhead, plating, stiffeners and girders.
- (D) Cargo hold hatch covers and coamings. For 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.
- (E) Deck plating and under-deck structure inside line of hatch openings between cargo hold hatches.

Note: Close-up survey of transverse bulkheads shall 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.

Appendix 2

Minimum requirements for close-up survey at renewal survey for ore carriers

Age < 5 years	5 < Age ≤ 10 years	age > 10
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3 and subsequent
<p>(A) One web frame ring complete including adjacent structural members in a ballast wing tank.</p> <p>(A) One transverse bulkhead lower part – including girder system and adjacent structural members – in a ballast tank.</p>	<p>(A) All web frame rings complete including adjacent structural members in a ballast wing tank.</p> <p>(A) One deck transverse including adjacent deck structural members in each remaining ballast tank.</p> <p>(A) Forward and aft transverse bulkheads complete – including girder system and adjacent structural members – in a ballast wing tank.</p> <p>(A) One transverse bulkhead lower part – including girder system and adjacent structural members – in each remaining ballast tank.</p>	<p>(A) All web frame rings complete including adjacent structural members in each ballast tank.</p> <p>(A) All transverse bulkheads complete – including girder system and adjacent structural members – in each ballast tank.</p> <p>(A) One web frame ring complete including adjacent structural members in each wing void space.</p> <p>(A) Additional web frame rings in void spaces as deemed necessary by the Administration or organization recognized by the Administration.</p>
<p>(C) Two selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted.</p>	<p>(C) One transverse bulkhead in each cargo hold, including internal structure of upper and lower stools, where fitted.</p>	<p>(C) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted.</p>
<p>(D) All cargo hold hatch covers and coamings (plating and stiffeners).</p>	<p>(D) All cargo hold hatch covers and coamings (plating and stiffeners).</p>	<p>(D) All cargo hold hatch covers and coamings (plating and stiffeners).</p>
	<p>(E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.</p>	<p>(E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches.</p>

(A), (C), (D) and (E) are areas which shall be subjected to close-up surveys and thickness measurements (see sketches in appendix 3 to annex 8A/annex 8B).

(A) Transverse web frame or watertight transverse bulkhead in ballast wing tanks and void spaces. In fore and aft peak tanks transverse web frame means a complete transverse web frame ring including adjacent structural members.

(C) Cargo hold transverse bulkhead plating, stiffeners and girders.

- (D) Cargo hold hatch covers and coamings. For 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.
- (E) Deck plating and under deck structure inside line of hatch openings between cargo hold hatches.

Note: Close-up survey of transverse bulkheads shall 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.

ANNEX 2

MINIMUM REQUIREMENTS FOR THICKNESS MEASUREMENTS AT RENEWAL SURVEYS OF DOUBLE-SIDE SKIN BULK CARRIERS

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3	Renewal Survey No.4 and subsequent
1 Suspect areas	1 Suspect areas 2 Within the cargo length area: two transverse sections of deck plating outside line of cargo hatch openings 3 Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to appendices 1 or 2 to annex 1 as applicable 4 Wind and water strakes in way of the two transverse sections considered under point 2 above 5 Selected wind and water strakes outside the cargo length area	1 Suspect areas 2 Within the cargo length area: .1 each deck plate outside line of cargo hatch openings .2 two transverse sections, one of which shall be in the amidship area, outside line of cargo hatch openings .3 All wind and water strakes within the cargo length area 3 Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to appendices 1 or 2 to annex 1 as applicable 4 Selected wind and water strakes outside the cargo length area	1 Suspect areas 2 Within the cargo length area: .1 each deck plate outside line of cargo hatch openings .2 three transverse sections, one of which shall be in the amidship area, outside line of cargo hatch openings .3 each bottom plate 3 Point 3 referred to in Renewal Survey No.3 4 All wind and water strakes, full length

ANNEX 3

OWNER'S INSPECTION REPORT

Structural condition

Ship's name:
IMO number:
Port of registry:
Owner:

TANK/HOLD	Grade of steel.	Cracks	Corrosion	Buckles	Coating condition	Pitting	Modification/repair	Other
TANK/HOLD No.....								
Deck								
Bottom								
Side								
Side framing								
Longitudinal bulkheads								
Transverse bulkheads								
Repairs carried out due to: Thickness measurements carried out (dates): Results in general: Overdue surveys: Outstanding conditions of class: Comments:								

Inspected by			
	<i>Name</i>	<i>Date of inspection</i>	<i>Signature</i>

ANNEX 4A

SURVEY PROGRAMME

Basic information and particulars

Ship's name:
IMO number:
Flag State:
Port of registry:
Gross tonnage:
Deadweight (metric tonnes):
Length between perpendiculars (m):
Shipbuilder:
Hull number:
Recognized organization (RO):
RO ship identity:
Date of build of the ship:
Owner:
Thickness measurement firm:

1 Preamble

1.1 Scope

1.1.1 The present survey programme covers the minimum extent of overall surveys, close-up surveys, thickness measurements and pressure testing within the cargo length area, cargo holds, ballast tanks, including fore and aft peak tanks, required by the Code.

1.1.2 The arrangements and safety aspects of the survey shall be acceptable to the attending surveyor(s).

1.2 Documentation

All documents used in the development of the survey programme shall be available on board during the survey as required by section 6.

2 Arrangement of cargo holds, tanks and spaces

This section of the survey programme shall provide information (either in the form of plans or text) on the arrangement of cargo holds, tanks and spaces that fall within the scope of the survey.

3 List of cargo holds, tanks and spaces with information on their use, extent of coatings and corrosion prevention system

This section of the survey programme shall indicate any changes relating to (and shall update) the information on the use of the holds and tanks of the ship, the extent of coatings and the corrosion prevention system provided in the survey planning questionnaire.

4 Conditions for survey

This section of the survey programme shall provide information on the conditions for survey, e.g. information regarding cargo hold and tank cleaning, gas freeing, ventilation, lighting, etc.

5 Provisions and method of access to structures

This section of the survey programme shall indicate any changes relating to (and shall update) the information on the provisions and methods of access to structures provided in the survey planning questionnaire.

6 List of equipment for survey

This section of the survey programme shall identify and list the equipment that will be made available for carrying out the survey and the required thickness measurements.

7 Survey requirements

7.1 Overall survey

This section of the survey programme shall identify and list the spaces that shall undergo an overall survey for this ship in accordance with 2.5.1.

7.2 Close-up survey

This section of the survey programme shall identify and list the hull structures that shall undergo a close-up survey for this ship in accordance with 2.5.2.

8 Identification of tanks for tank testing

This section of the survey programme shall identify and list the cargo holds and tanks that shall undergo tank testing for this ship in accordance with 2.7.

9 Identification of areas and sections for thickness measurements

This section of the survey programme shall identify and list the areas and sections where thickness measurements shall be taken in accordance with 2.6.1.

10 Minimum thickness of hull structures

This section of the survey programme shall specify the minimum thickness for hull structures of this ship that are subject to survey (indicate either (a) or preferably (b), if such information is available):

- (a) Determined from the attached wastage allowance table and the original thickness on the hull structure plans of the ship;
- (b) Given in the following table(s):

Area or location	Original as-built thickness (mm)	Minimum thickness (mm)	Substantial corrosion thickness (mm)
Deck			
Plating			
Longitudinals			
Longitudinal girders			
Cross deck plating			
Cross deck stiffeners			
Bottom			
Plating			
Longitudinals			
Longitudinal girders			
Inner bottom			
Plating			
Longitudinals			
Longitudinal girders			
Floors			
Ship side in way of topside tanks			
Plating			
Longitudinals			
Ship side in way of hopper side tanks			
Plating			
Longitudinals			
Ship side in way of double-hull tanks (if applicable)			
Plating			
Longitudinals or ordinary transverse frames			
Longitudinal stringers			
Longitudinal bulkhead inner side (if applicable)			
Plating			
Longitudinals (if applicable)			
Longitudinals or ordinary transverse frames			
Longitudinal girders (if applicable)			
Transverse bulkheads			
Plating			
Stiffeners (if applicable)			
Upper stool plating			
Upper stool stiffeners			
Lower stool plating			
Lower stool stiffeners			
Transverse web frames in topside tanks			
Plating			
Flanges			
Stiffeners			

Area or location	Original as-built thickness (mm)	Minimum thickness (mm)	Substantial corrosion thickness (mm)
Transverse web frames in hopper tanks			
Plating			
Flanges			
Stiffeners			
Transverse web frames in double-side tanks			
Plating			
Flanges			
Stiffeners			
Hatch covers			
Plating			
Stiffeners			
Hatch coamings			
Plating			
Stiffeners			

Note: The wastage allowance tables shall be attached to the survey programme. For ships built under the IACS Common Structural Rules, the renewal thickness of the hull structure elements shall be indicated in the appropriate drawings.

11 Thickness measurement firm

This section of the survey programme shall identify changes, if any, relating to the information on the thickness measurement firm provided in the survey planning questionnaire.

12 Damage experience related to the ship

This section of the survey programme shall provide details of the hull damages for at least the last three years in way of the cargo holds, ballast tanks and void spaces within the cargo length area, using the tables provided below. These damages shall be subject to survey.

Hull damages sorted by location for this ship

Cargo hold, tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

Hull damages for sister or similar ships (if available) in the case of design-related damage

Cargo hold, tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

13 Areas identified with substantial corrosion from previous surveys

This section of the survey programme shall identify and list the areas of substantial corrosion from previous surveys.

14 Critical structural areas and suspect areas

This section of the survey programme shall identify and list the critical structural areas and the suspect areas, when such information is available.

15 Other relevant comments and information

This section of the survey programme shall provide any other comments and information relevant to the survey.

Appendices

Appendix 1 – List of plans

The provisions of 5.1.3.2 require that the main structural plans of cargo holds and ballast tanks (scantling drawings), including information regarding the use of high-tensile steel (HTS), shall be available. This appendix of the survey programme shall identify and list the main structural plans which form part of the survey programme.

Appendix 2 – Survey planning questionnaire

The survey planning questionnaire (annex 4B), which has been submitted by the owner, shall be appended to the survey programme.

Appendix 3 – Other documentation

This part of the survey programme shall identify and list any other documentation that forms part of the plan.

Prepared by the owner in cooperation with the Administration for compliance with 5.1.3.

Date:

(name and signature of authorized owner's representative)

Date:

(name and signature of authorized representative of the Administration)

ANNEX 4B

SURVEY PLANNING QUESTIONNAIRE

The following information will enable the owner, in cooperation with the Administration, to develop a survey programme complying with the requirements of the Code. It is essential that the owner provides, when completing the present questionnaire, up-to-date information. The present questionnaire, when completed, will provide all the information and material required by the Code.

1 Particulars

Ship's name:

IMO number:

Flag State:

Port of registry:

Owner:

Recognized organization:

RO Ship identity:

Gross tonnage:

Deadweight (metric tonnes):

Date of build:

2 Information on access provision for close-up surveys and thickness measurement

The owner shall indicate, in the table below, the means of access to the structures subject to close-up survey and thickness measurement. A close-up survey is an examination where the details of structural components are within the close visual inspection range of the attending surveyor, i.e. normally within reach of hand.

Hold/Tank No.	Structure	Permanent means of access	Temporary staging	Rafts	Ladders	Direct access	Other means (please specify)
F.P.	Fore peak						
A.P.	Aft peak						
Cargo holds	Hatch side coamings						
	Topside sloping plate						
	Upper stool plating						
	Cross deck						
	Double-side tank plating						
	Transverse bulkhead						
	Hopper tank plating						
	Lower stool plating						
Topside tanks	Tank top						
	Under-deck structure						
	Side shell and structure						
	Sloping plate and structure						
Hopper tanks	Webs and bulkheads						
	Hopper sloping plate and structure						
	Side shell and structure						
	Bottom structure						
Double-side tanks	Webs and bulkheads						
	Side shell and structure						
	Inner skin and structure						
	Double-bottom structure						
	Upper stool internal structure						
	Lower stool internal structure						

Hold/Tank No.	Structure	Permanent means of access	Temporary staging	Rafts	Ladders	Direct access	Other means (please specify)
Wing tanks of ore carriers	Underdeck and structure						
	Side shell and structure						
	Side shell vertical web and structure						
	Longitudinal bulkhead and structure						
	Longitudinal bulkhead web and structure						
	Bottom plating and structure						
	Cross ties/stringers						

History of bulk cargoes of a corrosive nature (e.g. high-sulphur content)

3 Owner's inspections

Using a format similar to that of the table below (which is given as an example), the owner shall provide details of the results of their inspections, for the last three years in accordance with the Code on all CARGO holds and BALLAST tanks and VOID spaces within the cargo area.

Tank/Hold No.	Corrosion protection (1)	Coating extent (2)	Coating condition (3)	Structural deterioration (4)	Hold and tank history (5)
Cargo holds					
Topside tanks					
Hopper tanks					
Double-side tanks					
Double-bottom tanks					
Upper stools					
Lower stools					
Wing tanks (ore tankers)					
Fore peak					
Aft peak					
Miscellaneous other spaces:					

Note:

Indicate tanks which are used for oil/ballast.

- 1) HC = hard coating; SC = soft coating;
SH = semi-hard coating; NP = no protection
- 2) U = upper part; M = middle part;
L = lower part; C = complete
- 3) G = good; F = fair; P = poor;
RC = recoated (during the last three years)
- 4) N = no findings recorded; Y = findings recorded,
description of findings shall be attached to this questionnaire
- 5) DR = damage & repair; L = leakages;
CV = conversion (description shall be attached to this questionnaire)

Name of owner's representative: Signature: Date:

Reports of port State control inspections

List the reports of port State control inspections containing hull structural related deficiencies, and relevant information on rectification of the deficiencies:

Safety management system

List non-conformities related to hull maintenance, including the associated corrective actions:

Name and address of the approved thickness measurement firm

ANNEX 5

PROCEDURES FOR APPROVAL AND CERTIFICATION OF A FIRM ENGAGED IN THICKNESS MEASUREMENT OF HULL STRUCTURES

1 Application

This guidance applies for certification of the firm which intends to engage in the thickness measurement of hull structures of ships.

2 Procedures for approval and certification

Submission of documents

2.1 The following documents shall be submitted to the Administration for approval:

- .1 outline of the firm, e.g. organization and management structure;
- .2 experience of the firm on thickness measurement of hull structures of ships;
- .3 technicians' careers, i.e. experience of technicians as thickness measurement operators, technical knowledge and experience of hull structure, etc. Operators shall be qualified according to a recognized industrial non-destructive test (NDT) Standard;
- .4 equipment used for thickness measurement such as ultrasonic testing machines and their maintenance/calibration procedures;
- .5 a guide for thickness measurement operators;
- .6 training programmes for technicians for thickness measurement;
- .7 measurement record format taking into account the recommended procedures for thickness measurements (see annex 8A/annex 8B).

Auditing of the firm

2.2 Upon reviewing the documents submitted with satisfactory results, the firm shall be audited in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted, and eventually is capable of conducting thickness measurement of the hull structure of ships.

2.3 Certification shall be conditional upon an onboard demonstration of thickness measurement as well as satisfactory reporting.

3 Certification

3.1 Upon satisfactory results of both the audit of the firm referred to in 2.2 and the demonstration tests referred to in 2.3, the Administration shall issue a certificate of approval as well as a notice to the effect that the thickness measurement operation system of the firm has been certified.

3.2 Renewal/endorsement of the certificate shall be carried out at intervals not exceeding three years by verification that original conditions are maintained.

4 Information about any alteration to the certified thickness measurement operation system

In cases where any alteration to the certified thickness measurement operation system of the firm is made, such an alteration shall be immediately informed to the Administration. A re-audit shall be carried out where deemed necessary by the Administration.

5 Cancellation of approval

Approval may be cancelled and the certification withdrawn in the following cases:

- .1 where the measurements were improperly carried out or the results were improperly reported;
- .2 where the surveyor found any deficiencies in the approved thickness measurement operation systems of the firm; and
- .3 where the firm failed to inform any alteration referred to in 4 to the Administration as required.

ANNEX 6

SURVEY REPORTING PRINCIPLES

As a principle, for bulk carriers subject to this Code, the surveyor(s) shall include the following contents in the report for survey of hull structure and piping systems, as relevant for the survey. The structure of the report content may be different, depending on the reporting system of the Administration.

1 General

1.1 A survey report shall be generated in the following cases:

- .1 in connection with commencement, continuation and/or completion of periodical hull surveys, i.e. annual, intermediate and renewal surveys, as relevant;
- .2 when structural damages/defects have been found;
- .3 when repairs, renewals or modifications have been carried out; and
- .4 when a condition of class (recommendation) has been imposed or has been deleted.

1.2 The reporting shall provide:

- .1 evidence that prescribed surveys have been carried out in accordance with applicable requirements;
- .2 documentation of surveys carried out with findings, repairs carried out and condition of class (recommendation) imposed or deleted;
- .3 survey records, including actions taken, which shall form an auditable documentary trail. Survey reports shall be kept in the survey report file required to be on board;
- .4 information for planning of future surveys; and
- .5 information which may be used as input for maintenance of classification requirements and instructions.

1.3 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items surveyed, relevant findings and an indication of whether the item has been credited, shall be made available to the next attending surveyor, prior to continuing or completing the survey. Thickness measurement and tank testing carried out shall also be listed for the next surveyor.

2 Extent of the survey

2.1 Identification of compartments where an overall survey has been carried out.

2.2 Identification of locations, in each ballast tank and cargo hold including hatch covers and coamings, where a close-up survey has been carried out, together with information on the means of access used.

2.3 Identification of locations, in each ballast tank and cargo hold including hatch covers and coamings, where thickness measurement has been carried out.

Note: As a minimum, the identification of location of close-up survey and thickness measurement shall include a confirmation with description of individual structural members corresponding to the extent of requirements stipulated in part B of annex A based on type of periodical survey and the ship's age.

Where only a partial survey is required, e.g. one transverse web, two selected cargo hold transverse bulkheads, the identification shall include the location within each ballast tank and cargo hold by reference to frame numbers.

2.4 For areas in ballast tanks and cargo holds where the protective coating is found to be in GOOD condition and the extent of close-up survey and/or thickness measurement has been specially considered, structures subject to special consideration shall be identified.

2.5 Identification of tanks subject to tank testing.

2.6 Identification of piping systems on deck and within cargo holds, ballast tanks, pipe tunnels, cofferdams and void spaces where:

- .1 examination including internal examination of piping with valves and fittings and thickness measurement, as relevant, has been carried out; and
- .2 operational test to working pressure has been carried out.

3 Result of the survey

3.1 Type, extent and condition of protective coating in each tank, as relevant (rated GOOD, FAIR or POOR).

3.2 Structural condition of each compartment with information on the following, as relevant:

- .1 identification of findings, such as:
 - .1 corrosion with description of location, type and extent;
 - .2 areas with substantial corrosion;
 - .3 cracks/fractures with description of location and extent;
 - .4 buckling with description of location and extent; and
 - .5 indents with description of location and extent;
- .2 identification of compartments where no structural damages/defects are found. The report may be supplemented by sketches/photos; and
- .3 thickness measurement report shall be verified and signed by the surveyor witnessing the measurements on board.

4 Actions taken with respect to findings

4.1 Whenever the attending surveyor is of the opinion that repairs are required, each item to be repaired shall be identified in a survey report. Whenever repairs are carried out, details of the repairs effected shall be reported by making specific reference to relevant items in the survey report.

4.2 Repairs carried out shall be reported with identification of:

- .1 compartment;
- .2 structural member;
- .3 repair method (i.e. renewal or modification), including:
 - .1 steel grades and scantlings (if different from the original); and
 - .2 sketches/photos, as appropriate;
- .4 repair extent; and
- .5 non-destructive tests (NDT)/tests.

4.3 For repairs not completed at the time of survey, a condition of class/recommendation shall be imposed with a specific time limit for the repairs. In order to provide correct and proper information to the surveyor attending for survey of the repairs, the condition of class/recommendation shall be sufficiently detailed with identification of each item to be repaired. For identification of extensive repairs, reference may be given to the survey report.

ANNEX 7

CONDITION EVALUATION REPORT (EXECUTIVE HULL SUMMARY REPORT)

Issued upon completion of renewal survey

General particulars

Ship's name: Administration/recognized organization identity number:
IMO number:

Port of registry: National flag:

Deadweight (metric tonnes): Gross tonnage:
National:
ITC (1969):

Date of build: Classification notation:

Date of major conversion:

Type of conversion:

1 The survey reports and documents listed below have been reviewed by the undersigned and found to be satisfactory.

2 A summary of the survey is attached herewith on sheet 2.

3 The renewal survey has been completed in accordance with the present Code on (date)

Condition evaluation report (executive hull summary report) completed by	Name Signature	Title
Office	Date	
Condition evaluation report (executive hull summary report) verified by	Name Signature	Title
Office	Date	

Attached reports and documents:

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Contents of condition evaluation report (executive hull summary report)

- | | | |
|--------|--|---|
| Part 1 | – General particulars: | - See front page |
| Part 2 | – Report review: | - Where and how survey was done |
| Part 3 | – Close-up survey: | - Extent (which tanks/holds) |
| Part 4 | – Thickness measurements: | - Reference to thickness measurement report
- Summary of where measured
- Separate form indicating the spaces/areas with substantial corrosion, and corresponding:
- thickness diminution
- corrosion pattern |
| Part 5 | – Tank/hold corrosion prevention system: | - Separate form indicating:
- location of coating
- condition of coating (if applicable) |
| Part 6 | – Repairs: | - Identification of spaces/areas |
| Part 7 | – Condition of class (recommendations)/flag
State requirements: | |
| Part 8 | – Memoranda: | - Acceptable defects
- Any points of attention for future surveys, e.g. for suspect areas
- Extended annual/intermediate survey due to coating breakdown |
| Part 9 | – Conclusion: | - Statement on evaluation/verification of survey report |

Extract of thickness measurements for ships not built under the IACS Common Structural Rules

Reference is made to the thickness measurement report:

Position of substantially corroded tanks/areas¹ or areas with deep pitting³	Thickness diminution [%]	Corrosion pattern²	Remarks: (e.g. reference to attached sketches)

Notes:

- 1 Substantial corrosion, i.e. 75 to 100% of acceptable margins wasted.
- 2 P = Pitting
C = Corrosion in general
- 3 Any bottom plating with a pitting intensity of 20% or more, with wastage in the substantial corrosion range or having an average depth of pitting of 1/3 or more of actual plate thickness shall be noted.

Extract of thickness measurements for ships built under the IACS Common Structural Rules

Reference is made to the thickness measurements report:

Position of substantially corroded tanks/areas ¹ or areas with deep pitting	$t_m - t_{ren}$ (mm)	Corrosion pattern ²	Remarks (e.g. reference to attached sketches)

Notes:

- 1 Substantial corrosion, an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{ren} + 0.5$ mm and t_{ren} .
- 2 P = Pitting
C = Corrosion in general
Areas with deep pitting assessed according to section 8.2 shall be recorded in this column.

Tank/hold corrosion prevention system

Tank/hold Nos. ¹	Tank/hold corrosion prevention system ²	Coating condition ³	Remarks

Notes:

- 1 All ballast tanks and cargo holds shall be listed.
- 2 C = Coating
NP = No protection
- 3 Coating condition according to the following standard:

 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.

If coating condition POOR is given, extended annual surveys shall be introduced. This shall be noted in part 8 of the contents of the condition evaluation report (executive hull summary report).

ANNEX 8A

**RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS OF
DOUBLE-SIDE SKIN BULK CARRIERS NOT BUILT UNDER THE IACS COMMON
STRUCTURAL RULES***

1 These procedures should be used for recording thickness measurements as required by part B of annex A.

2 Thickness measurement sheet forms TM1-DSBC, TM2-DSBC(i), TM2-DSBC(ii), TM3-DSBC, TM4-DSBC, TM5-DSBC and TM6-DSBC (appendix 2) should be used, as appropriate, for recording thickness measurements. The maximum allowable diminution should be stated. The maximum allowable diminution could be stated in an attached document.

3 Appendix 3 contains guidance diagrams and notes relating to the reporting forms and the procedure for the thickness measurements.

4 The reporting forms should, where appropriate, be supplemented by data presented on structural sketches.

* This annex is recommendatory.

Appendix 1

GENERAL PARTICULARS

Ship's name:
IMO number:
Class/Administration identity number:
Port of registry:
Gross tonnage:
Deadweight:
Date of build:
Classification society:

Name of firm performing thickness measurement:
.....
Thickness measurement firm certified by:
Certificate number:
Certificate valid from: to
Place of measurement:
First date of measurement:
Last date of measurement:
Renewal survey/intermediate survey* due:
Details of measurement equipment:
Qualification of operator:

Report number:	consisting of pages
Name of operator:	Name of surveyor:
Signature of operator:	Signature of surveyor:
Firm official stamp:	Administration:

Official stamp

* Delete as appropriate.

Appendix 2

REPORTS ON THICKNESS MEASUREMENT

TM1-DSBC

Report on thickness measurement of all deck plating, bottom shell plating and side shell plating*

Ship's name..... IMO number..... Class identity No..... Report No.....

STRAKE POSITION																
	PLATE POSITION	No. or letter	Org. thk. mm	Forward reading				Aft reading				Mean diminution mm		Maximum allowable diminution mm		
				Gauged		Diminution P		Diminution S		Gauged		Diminution P			Diminution S	
P	S	mm	%	mm	%	P	S	mm	%	mm	%	P	S			
12th forward																
11th																
10th																
9th																
8th																
7th																
6th																
5th																
4th																
3rd																
2nd																
1st																
Amidships																
1st aft																
2nd																
3rd																
4th																
5th																
6th																
7th																
8th																
9th																
10th																
11th																
12th																

Operator's signature.....

Notes – see following page

* Delete as appropriate.

Notes to report TM1-DSBC:

- 1 This report should be used for recording the thickness measurement of:
 - .1 all strength deck plating within cargo length area;
 - .2 all keel, bottom shell plating and bilge plating within the cargo length area;
 - .3 side shell plating including selected wind and water strakes outside cargo length area; and
 - .4 all wind and water strakes within cargo length area.
- 2 The strake position should be cleared as follows:
 - .1 for strength deck indicate the number of the strake of plating inboard from the stringer plate;
 - .2 for bottom plating indicate the number of the strake of plating outboard from the keel plate; and
 - .3 for side shell plating give number of the strake of plating below sheer strake and letter as shown on shell expansion.
- 3 Only the deck plating strakes outside line of openings are to be recorded.
- 4 Measurements should be taken at the forward and aft areas of all plates and where plates cross ballast/cargo tank boundaries separate measurements for the area of plating in way of each type of tank should be recorded.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The maximum allowable diminution could be stated in an attached document.

TM2-DSBC(i)

**Report on thickness measurement of shell and deck plating at transverse sections
(one, two or three transverse sections)**

Ship's name..... IMO number..... Class identity No..... Report No.....

STRENGTH DECK AND SHEER STRAKE PLATING																											
STRAKE POSITION	FIRST TRANSVERSE SECTION AT FRAME NUMBER....									SECOND TRANSVERSE SECTION AT FRAME NUMBER....								THIRD TRANSVERSE SECTION AT FRAME NUMBER....									
	No. or letter	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%
Stringer plate																											
1st strake inboard																											
2nd																											
3rd																											
4th																											
5th																											
6th																											
7th																											
8th																											
9th																											
10th																											
11th																											
12th																											
13th																											
14th																											
centre strake																											
Sheer strake																											
TOPSIDE TOTAL																											

Operator's signature.....

Notes – see following page

Notes to report TM2-DSBC(i):

- 1 This report should be used for recording the thickness measurement of strength deck plating and sheer strake plating transverse sections:

One, two or three sections within the cargo length area, comprising of the structural items (1), (2) and (3) as shown on the diagrams of typical transverse sections (appendix 3).
- 2 Only the deck plating strakes outside line of hatch openings should be recorded.
- 3 The top side area comprises deck plating, stringer plate and sheer strake (including rounded gunwales).
- 4 The exact frame station of measurement should be stated.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The maximum allowable diminution could be stated in an attached document.

TM2-DSBC(ii)

**Report on thickness measurement of shell and deck plating at transverse sections
(one, two or three transverse sections)**

Ship's name..... IMO number..... Class identity No..... Report No.....

SHELL PLATING																											
FIRST TRANSVERSE SECTION AT FRAME NUMBER....							SECOND TRANSVERSE SECTION AT FRAME NUMBER....								THIRD TRANSVERSE SECTION AT FRAME NUMBER....												
STRAKE POSITION	No. or letter	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%
1st below sheer strake																											
2nd																											
3rd																											
4th																											
5th																											
6th																											
7th																											
8th																											
9th																											
10th																											
11th																											
12th																											
13th																											
14th																											
15th																											
16th																											
17th																											
18th																											
19th																											
20th																											
keel strake																											
BOTTOM TOTAL																											

Operator's signature.....

Notes – see following page

Notes to report TM2-DSBC(ii):

- 1 This report should be used for recording the thickness measurement of shell plating at transverse sections:

One, two or three sections within the cargo length area, comprising of the structural items (3), (4), (5) and (6) as shown on the diagrams of typical transverse sections in appendix 3.
- 2 The bottom area comprises keel, bottom and bilge plating.
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The maximum allowable diminution could be stated in an attached document.

TM3-DSBC

**Report on thickness measurement of longitudinal members at transverse sections
 (one, two or three transverse sections)**

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER	FIRST TRANSVERSE SECTION AT FRAME NUMBER....							SECOND TRANSVERSE SECTION AT FRAME NUMBER....							THIRD TRANSVERSE SECTION AT FRAME NUMBER....														
	Item No.	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S		Item No.	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S		Item No.	Orig. thk	Max allow. dimin.	Gauged		Diminution P		Diminution S			
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		

Operator's signature.....

Notes – see following page

Notes to report TM3-DSBC:

- 1 This report should be used for recording the thickness measurement of longitudinal members at transverse sections:

Two, or three sections within the cargo length area comprising of the appropriate structural items (10) to (25) as shown on diagrams of typical transverse sections in appendix 3.
- 2 The exact frame station of measurement should be stated.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM4-DSBC

**Report on thickness measurement of transverse structural members in the double-bottom,
hopper side and topside water ballast tanks**

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK DESCRIPTION:									
LOCATION OF STRUCTURE:									
STRUCTURAL MEMBER	ITEM	Original thickness	Max. allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	Port	Starboard	mm	%	mm	%

Operator's signature.....

Notes – see following page

Notes to report TM4-DSBC:

- 1 This report should be used for recording the thickness measurement of transverse structural members, comprising of the appropriate structural items (30) to (34) as shown on diagrams of typical transverse sections (appendix 3).
- 2 Guidance for areas of measurements is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

Notes to report TM5-DSBC:

- 1 This report should be used for recording the thickness measurement of watertight transverse bulkheads in cargo holds.
- 2 Guidance for areas of measurements is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM6-DSBC

Report on thickness measurement of miscellaneous structural members

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER: LOCATION OF STRUCTURE:								SKETCH	
DESCRIPTION	Orig. thk.	Max. allow. dimin.	Gauged		Diminution P		Diminution S		
	mm	mm	P	S	mm	%	mm	%	

Operator's signature.....

Notes – see following page

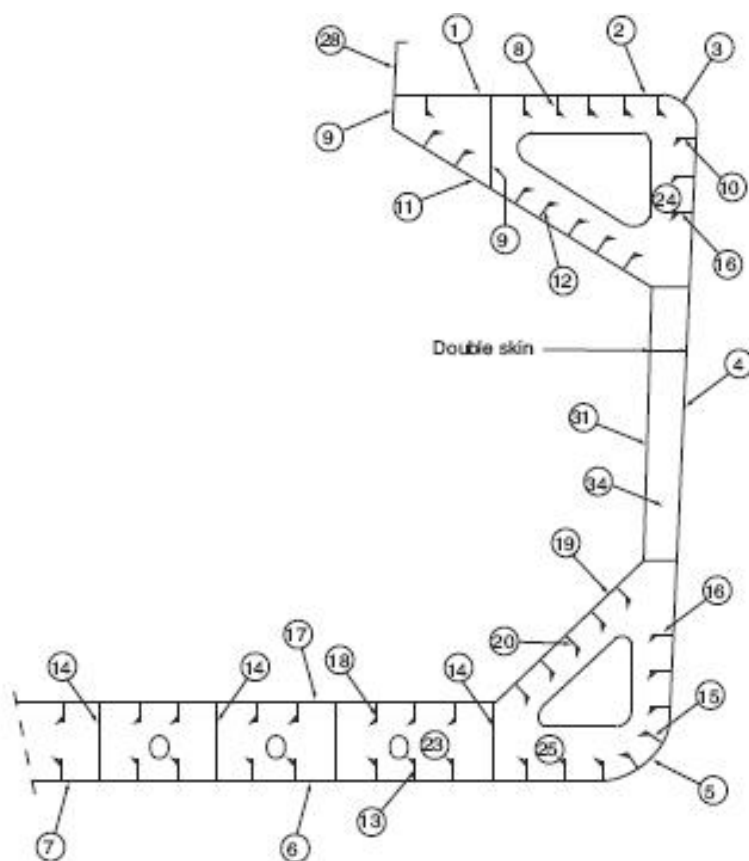
Notes to report TM6-DSBC:

- 1 This report should be used for recording the thickness measurement of miscellaneous structural members including structural items (28) and others for instance deck plating between hatches, hatch covers as shown on diagrams of typical transverse sections (appendix 3).
- 2 Guidance for areas of measurements is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

Appendix 3

GUIDANCE ON THICKNESS MEASUREMENT – DOUBLE-SIDE SKIN CONSTRUCTION SHIPS NOT BUILT UNDER IACS CSR

Typical transverse section indicating longitudinal and transverse members (Double-side skin bulk carrier)



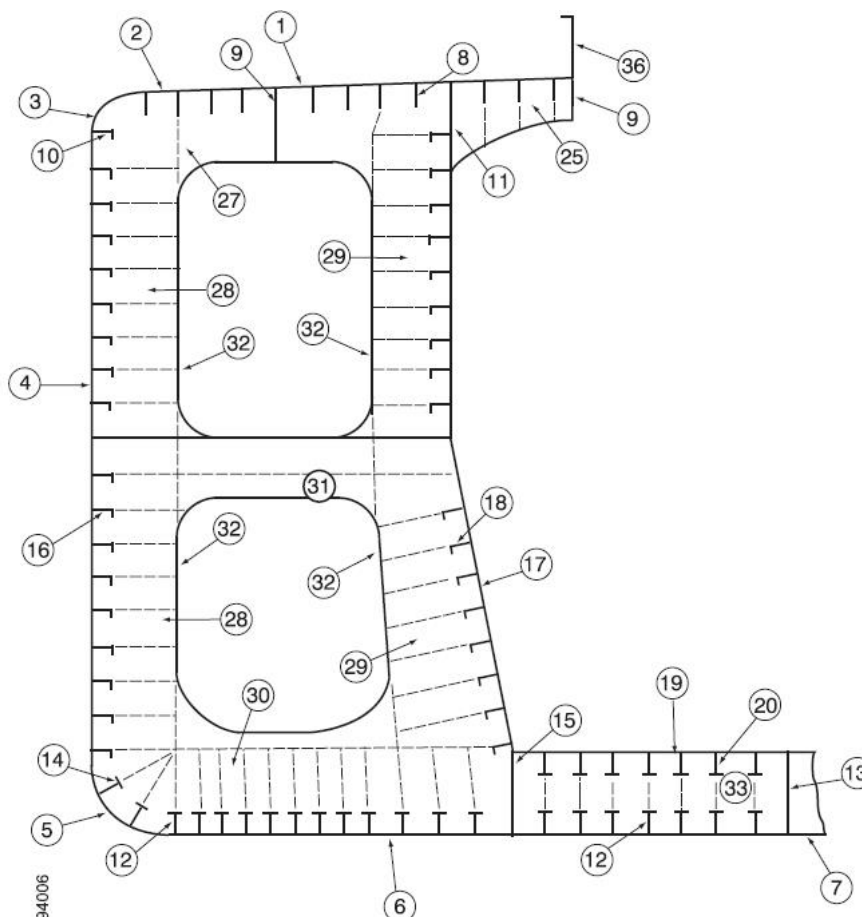
REPORT ON TM2-DSBC(i) and (ii)	
①	Strength deck plating
②	Stringer plate
③	Sheerstrake
④	Side shell plating
⑤	Bilge plating
⑥	Bottom shell plating
⑦	Keel plate

REPORT ON TM3-DSBC			
⑧	Deck longitudinal	⑩	Side shell longitudinal, if any
⑨	Deck girder	⑪	Inner bottom plating
⑩	Sheerstrake longitudinal	⑫	Inner bottom longitudinal
⑪	Topside tank sloping plating	⑬	Hopper plating
⑫	Topside tank sloping plating longitudinal	⑭	Hopper longitudinal
⑬	Bottom longitudinal	⑮	Inner side plating – Inner side longitudinal, if any – Horizontal girders in wing ballast tanks
⑭	Bottom girder		
⑮	Bilge longitudinal		

REPORT ON TM4-DSBC	
⑫	Double-bottom tank floors
⑮	Hopper side tank transverses
⑭	Transverse web frame – Topside tank transverses

REPORT ON TM6-DSBC	
⑫	Hatch coamings – Deck plating between hatches – Hatch covers

**Typical transverse section indicating longitudinal and transverse members
(Ore carriers)**



REPORT ON TM2-DSBC (i) and (ii)	
1	Strength deck plating
2	Stringer plate
3	Sheerstrake
4	Side shell plating
5	Bilge plating
6	Bottom shell plating
7	Keel plate

REPORT ON TM6-DSBC	
36	Hatch coamings
37	Deck plating between hatches
38	Hatch covers
39	
40	

REPORT ON TM3-DSBC	
8	Deck longitudinals
9	Deck girders
10	Sheerstrake longitudinals
11	Longitudinal bulkhead top strake
12	Bottom longitudinals
13	Bottom girders
14	Bilge longitudinals
15	Longitudinal bulkhead lower strake
16	Side shell longitudinals
17	Longitudinal bulkhead plating (remainder)
18	Longitudinal bulkhead longitudinals
19	Inner bottom plating
20	Inner bottom longitudinals
21	
22	
23	
24	

REPORT ON TM4-DSBC	
25	Deck transverse centre tank
26	Bottom transverse centre tank
27	Deck transverse wing tank
28	Side shell vertical web
29	Longitudinal bulkhead vertical web
30	Bottom transverse wing tank
31	Struts
32	Transverse web face plate
33	Double bottom floors
34	
35	

Transverse section outline (Double-side skin bulk carriers and ore carriers)

The diagram may be used for those ships where the typical transverse sections are not suitable.



REPORT ON TM2-DSBC(i) and (ii)	
①	Strength deck plating
②	Stringer plate
③	Sheerstrake
④	Side shell plating
⑤	Bilge plating
⑥	Bottom shell plating
⑦	Keel plate

REPORT ON TM3-DSBC	
⑧	Deck longitudinals
⑨	Deck girders
⑩	Sheerstrake longitudinals
⑪	Topside tank sloping plating
⑫	Topside tank sloping plating longitudinals
⑬	Bottom longitudinals
⑭	Bottom girders
⑮	Bilge longitudinals
⑯	Side shell longitudinals, if any
⑰	Inner bottom plating
⑱	Inner bottom longitudinals
⑲	Hopper plating
⑳	Hopper longitudinals
㉓	Inner side plating – Inner side longitudinals, if any – Horizontal girders in wing ballast tanks

REPORT ON TM4-DSBC	
㉔	Double-bottom tank floors
㉕	Hopper side tank transverses
㉖	Transverse web frame – Topside tank transverses

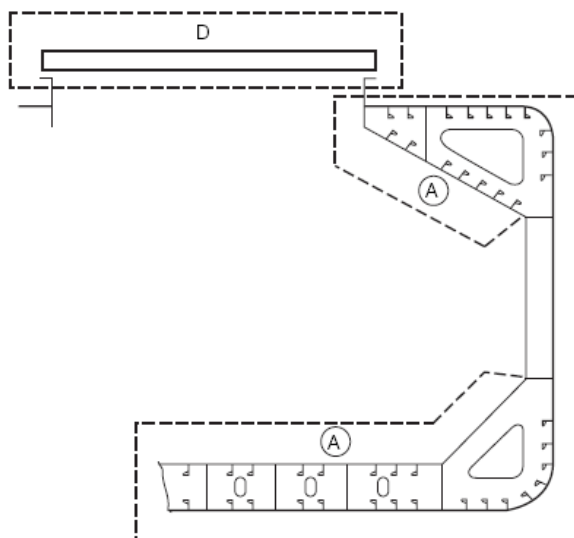
REPORT ON TM6-DSBC	
㉘	Hatch coamings – Deck plating between hatches – Hatch covers

Close-up survey and thickness measurements areas
Double-side skin bulk carriers

Areas subject to close-up survey and thickness measurements – areas (A) to (E) as defined in annex 1 of part B – The thickness measurements should be reported on TM3-DSBC, TM4-DSBC, TM5-DSBC and TM6-DSBC as appropriate.

Typical transverse section

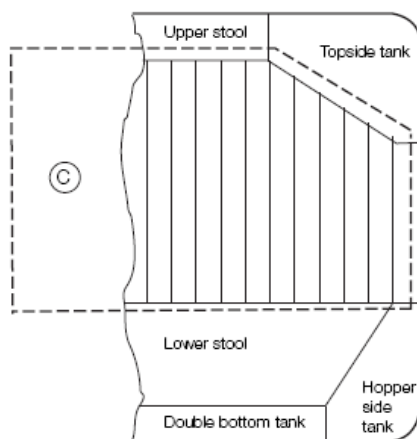
Areas (A) and (D)



Thickness should be reported on TM3-DSBC, TM4-DSBC, and TM6-DSBC, as appropriate

A cargo hold, transverse bulkhead

Area (C)

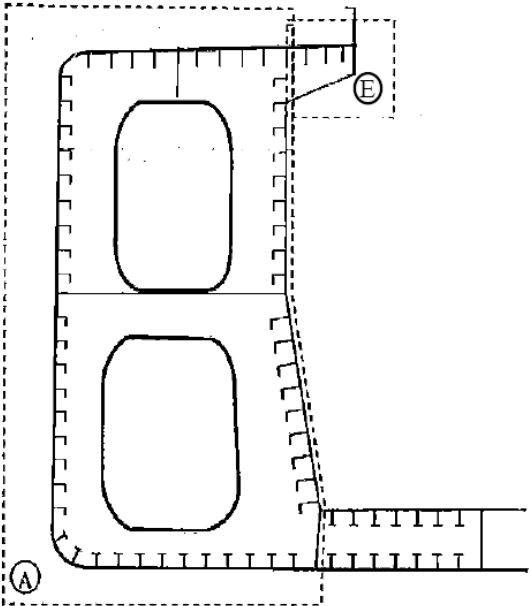


Thickness should be reported on TM5-DSBC

Ore carriers

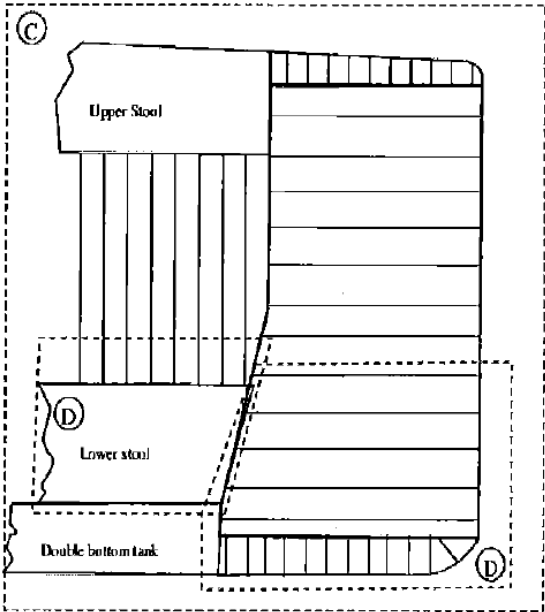
Areas subject to close-up survey and thickness measurements – areas (A), (C), (D) and (E) as defined in annex 1 of part B – The thickness measurements should be reported on TM3-DSBC, TM4-DSBC, TM5-DSBC and TM6-DSBC as appropriate

Typical transverse section close-up survey

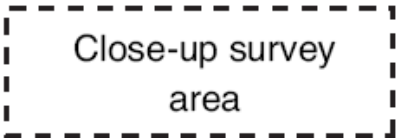


Thickness should be reported on TM3-DSBC and TM4-DSBC, as appropriate

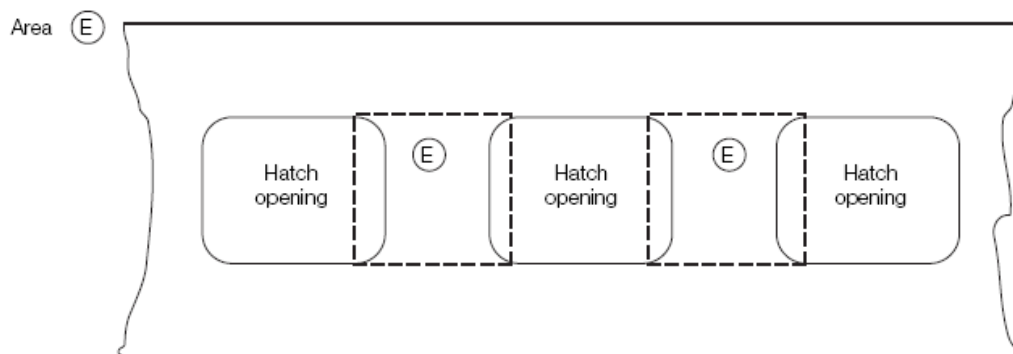
Typical transverse bulkhead



Thickness should be reported on TM5-DSBC

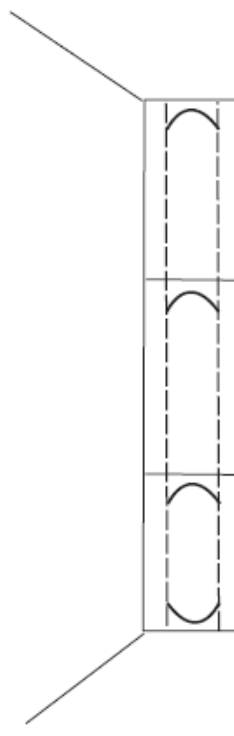


**Typical areas of deck plating and underdeck structure inside the line
of hatch openings between cargo hold hatches**



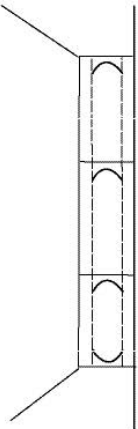
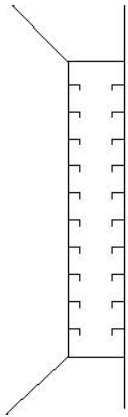
Thickness should be reported on TM1-DSBC

Area (B)



Framing in double-side tanks

Area (B)

	
Ordinary transverse frame in double-side tank	Ordinary longitudinal structure in double-side tank

Thickness should be reported on TM4-DSBC

ANNEX 8B

**RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS OF
DOUBLE-SIDE SKIN BULK CARRIERS BUILT UNDER THE IACS COMMON
STRUCTURAL RULES***

General

1 These procedures should be used for recording thickness measurements of ships built under the IACS Common Structural Rules.

2 Reporting forms TM1-DSBC(CSR), TM2-DSBC(CSR)(i), TM2-DSBC(CSR)(ii), TM3-DSBC(CSR), TM4-DSBC(CSR), TM5-DSBC(CSR) and TM6-DSBC(CSR) (see appendix 2) should be used for recording thickness measurements. The as-built thickness and the voluntary thickness addition and renewal thickness (minimum allowable thickness) should be stated in the aforementioned forms.

3 Appendix 3 contains guidance diagrams and notes clarifying the areas for thickness measurement and the respective reporting forms.

4 The reporting forms should, where appropriate, be supplemented by data presented on structural sketches.

* This annex is recommendatory.

Appendix 1

GENERAL PARTICULARS

Ship's name:
IMO number:
Class/Administration identity number:
Port of registry:
Gross tons:
Deadweight:
Date of build:
Classification Society:

Name of Firm performing thickness measurement:
Thickness measurement firm certified by:
Certificate No:
Certificate valid from.....to.....
Place of measurement:
First date of measurement:
Last date of measurement:
Renewal survey/intermediate* survey due:
Details of measurement equipment:
Qualification of operators:

Report number:	consisting of.....pages
Name of operator:	Name of surveyor:
Signature of operator:	Signature of surveyor:
Firm official stamp:	Administration:

Official Stamp

* Delete as appropriate.

Appendix 2

REPORTS ON THICKNESS MEASUREMENT

TM1-DSBC(CSR)

Report on thickness measurement of all deck plating, all bottom plating or side shell plating*

Ship's name..... IMO number..... Class identity No..... Report No.....

STRAKE POSITION															
	PLATE POSITION	No. or letter	As-built thk. mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Forward reading				Aft reading				Mean remaining corr. addition, mm	
						Gauged thk. mm (b1)		Remaining corr. addition, mm (c1)=(b1)-(a)		Gauged thk. mm (b2)		Remaining corr. addition, mm (c2)=(b2)-(a)			
						P	S	P	S	P	S	P	S	P	S
12th forward															
11th															
10th															
9th															
8th															
7th															
6th															
5th															
4th															
3rd															
2nd															
1st															
Amidships															
1st aft															
2nd															
3rd															
4th															
5th															
6th															
7th															
8th															
9th															
10th															
11th															
12th															

Operator's signature.....

Notes – see following page

* Delete as appropriate.

Notes to report TM1-DSBC(CSR)

- 1 This report should be used for recording the thickness measurement of:
 - .1 all strength deck plating within cargo length area;
 - .2 all keel, bottom shell plating and bilge plating within the cargo length area;
 - .3 side shell plating including selected wind and water strakes outside the cargo length area; and
 - .4 all wind and water strakes within the cargo length area.
- 2 The strake position should be cleared indicated as follows:
 - .1 for strength deck indicate the number of the strake of plating inboard from the stringer plate;
 - .2 for bottom plating indicate the number of the strake of plating outboard from the keel plate; and
 - .3 for side shell plating give number of the strake of plating sheer strake and letter as shown on shell expansion.
- 3 Only the deck plating strakes outside line of openings should be recorded.
- 4 Measurements should be taken at the forward and aft areas of all plates and the single measurements recorded should represent the average of multiple measurements.
- 5 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM2-DSBC(CSR)(i)

**Report on thickness measurement of shell and deck plating
(one, two or three transverse sections)**

Ship's name..... IMO number..... Class identity No..... Report No.....

STRENGTH DECK AND SHEER STRAKE PLATING																									
STRAKE POSITION	FIRST TRANSVERSE SECTION AT FRAME NUMBER						SECOND TRANSVERSE SECTION AT FRAME NUMBER						THIRD TRANSVERSE SECTION AT FRAME NUMBER												
	No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		
					P	S	P	S					P	S	P	S					P	S	P	S	
Stringer Plate																									
1st strake inboard																									
2nd																									
3rd																									
4th																									
5th																									
6th																									
7th																									
8th																									
9th																									
10th																									
11th																									
12th																									
13th																									
14th																									
centre strake																									
sheer strake																									
TOPSIDE TOTAL																									

Operator's signature.....

Notes – see following page

Notes to report *TM2-DSBC(CSR)(i)*

- 1 This report should be used for recording the thickness measurement of strength deck plating and sheer strake plating transverse sections (one, two or three sections within the cargo length area, comprising of the structural items (1), (2) and (3) as shown on the diagram of typical transverse sections (appendix 3)).
- 2 Only the deck plating strakes outside the line of openings should be recorded.
- 3 The topside area comprises deck plating, stringer plate and sheer strake (including rounded gunwales).
- 4 The exact frame station of measurement should be stated.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM2-DSBC(CSR)(ii)

Report on thickness measurement of shell plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

SHELL PLATING																								
	FIRST TRANSVERSE SECTION AT FRAME NUMBER							SECOND TRANSVERSE SECTION AT FRAME NUMBER							THIRD TRANSVERSE SECTION AT FRAME NUMBER									
STRAKE POSITION	No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)	
					P	S	P	S					P	S	P	S					P	S		
1st below sheer strake																								
2nd																								
3rd																								
4th																								
5th																								
6th																								
7th																								
8th																								
9th																								
10th																								
11th																								
12th																								
13th																								
14th																								
15th																								
16th																								
17th																								
18th																								
19th																								
20th																								
Keel strake																								
BOTTOM TOTAL																								

Operator's signature.....

Notes – see following page

Notes to report TM2-DSBC(CSR)(ii)

- 1 This report should be used for recording the thickness measurement of shell plating at transverse sections (one, two or three sections within the cargo length area, comprising of the structural items (4), (5), (6) and (7) as shown on the diagram of typical transverse sections (appendix 3)).
- 2 The bottom area comprises keel, bottom and bilge plating.
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM3-DSBC(CSR)

**Report on thickness measurement of longitudinal members
(one, two or three transverse sections)**

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER	FIRST TRANSVERSE SECTION AT FRAME NUMBER						SECOND TRANSVERSE SECTION AT FRAME NUMBER						THIRD TRANSVERSE SECTION AT FRAME NUMBER											
	Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)	
					P	S	P	S					P	S	P	S					P	S	P	S

Operator's signature.....

Notes – see following page

Notes to report TM3-DSBC(CSR)

- 1 This report should be used for recording the thickness measurement of longitudinal members at transverse sections (one, two or three sections within the cargo length area, comprising of the appropriate structural items (8) to (20) and (31) as shown on diagram of typical transverse sections (appendix 3)).
- 2 The exact frame station of measurement should be stated.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM4-DSBC(CSR)

**Report on thickness measurement of transverse structural members
in the double bottom, hopper side and topside water ballast tanks**

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK DESCRIPTION:								
LOCATION OF STRUCTURE								
STRUCTURAL MEMBER	ITEM	As-built thickness mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm		Remaining corr. addition mm	
					(b)		(b)-(a)	
					P	S	P	S

Operator's signature.....

Notes – see following page

Notes to report TM4-DSBC(CSR)

- 1 This report should be used for recording the thickness measurement of transverse structural members, comprising of the appropriate structural items (23) to (25) and (34) as shown on diagram of typical transverse section (appendix 3).
- 2 Guidance for areas of measurement is indicated on the diagrams shown in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM5-DSBC(CSR)

Report on thickness of cargo hold transverse bulkheads

Ship's name..... IMO number..... Class identity No..... Report No.....

HOLD DESCRIPTION:									
LOCATION OF STRUCTURE:					FRAME NO.:				
STRUCTURAL COMPONENT (PLATING/STIFFENER)	As-built thickness mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm		Remaining corr. addition mm			
				(b)		(b)-(a)			
				P	S	P		S	

Operator's signature.....

Notes – see following page

Notes to report TM5-DSBC(CSR)

- 1 This report form should be used for recording the thickness measurement of watertight transverse bulkheads in cargo holds.
- 2 Guidance for areas of measurement is indicated on the diagrams shown in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM6-DSBC(CSR)

Report on thickness measurement of miscellaneous structural members

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER:						SKETCH			
LOCATION OF STRUCTURE:									
Description	As-built thk. mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm		Remaining corr. addition mm			
				(b)		(b)-(a)			
				P	S	P	S	P	S

Operator's signature.....

Notes – see following page

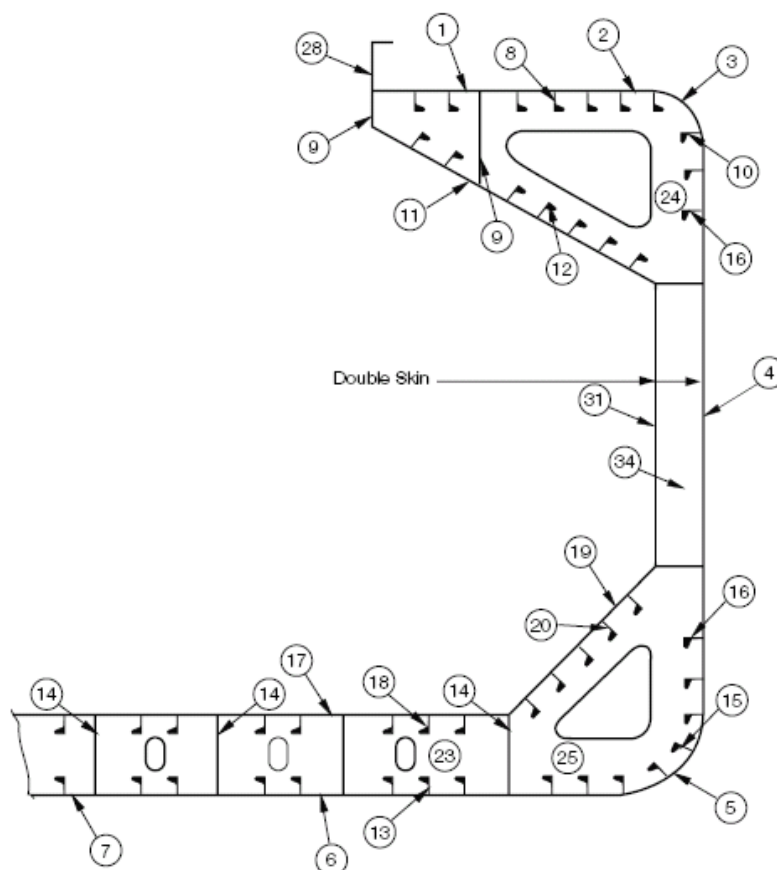
Notes to report TM6-DSBC(CSR)

- 1 This report should be used for recording the thickness measurement of miscellaneous structural members including the structural items (28), (29) and (30) as shown on diagram of typical transverse section (appendix 3).
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

Appendix 3

GUIDANCE ON THICKNESS MEASUREMENT – DOUBLE-SIDE SKIN BULK CARRIERS BUILT UNDER THE IACS COMMON STRUCTURAL RULES

Typical transverse section of a double-side skin bulk carrier with indication of longitudinal and transverse members



Reports TM2-DSBC(CSR)(i) and TM2-DSBC(CSR)(ii)	
1	Strength deck plating
2	Stringer plate
3	Sheer strake
4	Side shell plating
5	Bilge plating
6	Bottom plating
7	Keel plate

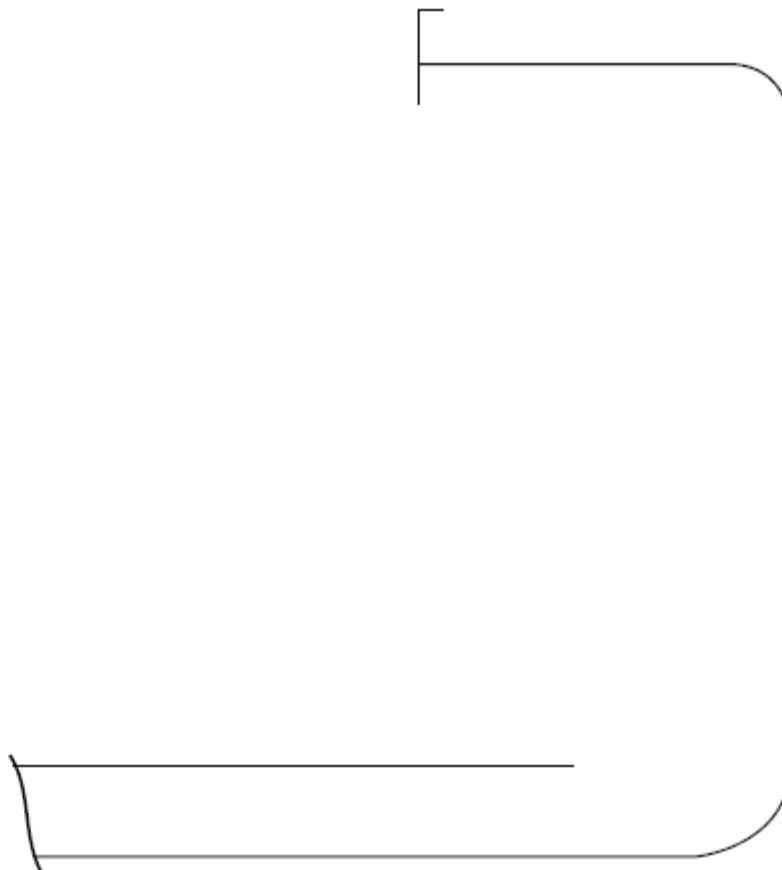
Report TM3-DSBC(CSR)			
8	Deck longitudinal	17	Inner bottom plating
9	Deck girders	18	Inner bottom longitudinals
10	Sheer strake longitudinals	19	Hopper plating
11	Topside tank sloping plating	20	Hopper longitudinals
12	Topside tank sloping plating longitudinal	31	Inner side plating
13	Bottom longitudinals	-	Inner side longitudinals, if any
14	Bottom girders	-	Horizontal girders in wing ballast tanks
15	Bilge longitudinals		
16	Side shell longitudinals, if any		

Report TM4-DSBC(CSR)	
23	Double bottom tank floors
24	Topside tank transverse
25	Hopper side tank transverse
34	Transverse web frame
-	Ordinary transverse frame in double-side tank

Report TM6-DSBC(CSR)	
28	Hatch coamings
29	Deck plating between hatches
30	Hatch covers

Transverse section outline

The diagram may be used for those ships where the typical transverse sections are not suitable.



Reports TM2-DSBC(CSR)(i) and TM2-DSBC(CSR)(ii)	
1	Strength deck plating
2	Stringer plate
3	Sheer strake
4	Side shell plating
5	Bilge plating
6	Bottom plating
7	Keel plate

Report TM3-DSBC(CSR)			
8	Deck longitudinal	17	Inner bottom plating
9	Deck girders	18	Inner bottom longitudinals
10	Sheer strake longitudinals	19	Hopper plating
11	Topside tank sloping plating	20	Hopper longitudinals
12	Topside tank sloping plating longitudinal	31	Inner side plating
13	Bottom longitudinals	-	Inner side longitudinals, if any
14	Bottom girders	-	Horizontal girders in wing ballast tanks
15	Bilge longitudinals		
16	Side shell longitudinals, if any		

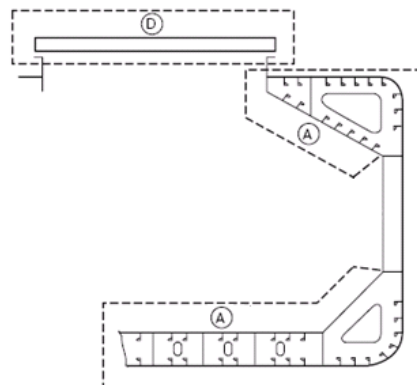
Report TM4-DSBC(CSR)	
23	Double bottom tank floors
24	Topside tank transverses
25	Hopper side tank transverses
34	Transverse web frame
-	Ordinary transverse frame in double-side tank

Report TM6-DSBC(CSR)	
28	Hatch coamings
29	Deck plating between hatches
30	Hatch covers

Close-up survey and thickness measurement areas

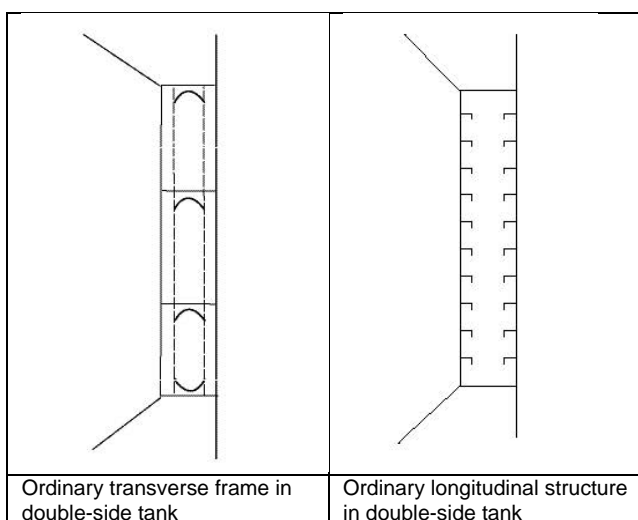
Areas subject to close-up survey and thickness measurement areas (A) to (E) as defined in annex 1. The thickness measurements should be reported in forms TM3-DSBC(CSR), TM4-DSBC(CSR), TM5-DSBC(CSR) and TM6-DSBC(CSR), as appropriate.

Typical transverse section
Areas A and D



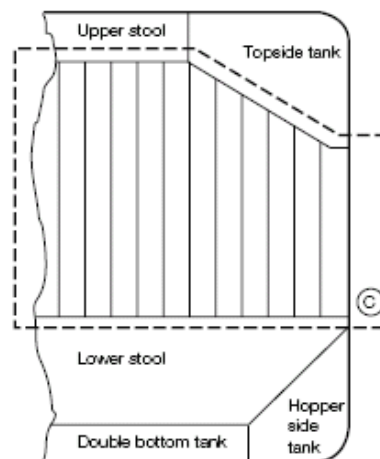
Thickness should be reported on TM3-DSBC(CSR),
TM4-DSBC(CSR), TM6-DSBC(CSR) as appropriate

Framing in double-side tanks
Area (B)



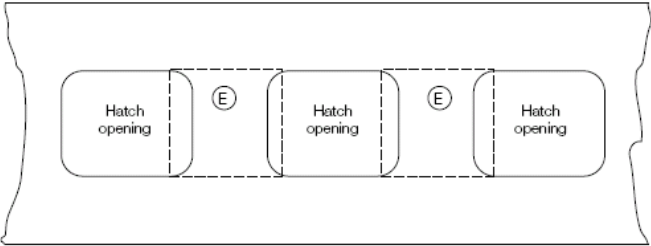
Thickness should be reported on TM4-DSBC(CSR)

A cargo hold transverse bulkhead
Area C



Thickness should be reported on TM5-DSBC(CSR)

Typical areas of deck plating inside the line of hatch openings between cargo hold hatches Area E



Thickness should be reported on TM6-DSBC(CSR)

ANNEX 9

GUIDELINES FOR TECHNICAL ASSESSMENT IN CONJUNCTION WITH PLANNING FOR ENHANCED SURVEYS OF DOUBLE-SIDE SKIN BULK CARRIERS – RENEWAL SURVEY HULL*

1 Introduction

These Guidelines contain information and suggestions concerning technical assessments, which may be of use in conjunction with the planning of enhanced renewal surveys of double-side skin bulk carriers. As indicated in 5.1.5 of the Code, the Guidelines are a recommended tool which may be invoked at the discretion of the Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme.

2 Purpose and principles

2.1 Purpose

2.1.1 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.

2.1.2 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.

2.2 Timing

As with other aspects of survey planning, the technical assessments described in these Guidelines should be carried out by the owner or operator in cooperation with the Administration 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.

2.3 Aspects to be considered

2.3.1 Technical assessments, which may include quantitative or qualitative evaluation of relative risks of possible deterioration, of the following aspects of a particular ship should 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; and

* This annex is recommendatory.

- .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.

2.3.2 Technical assessments of the relative risks of susceptibility to damage or deterioration of various structural elements and areas should be judged and decided on the basis of recognized principles and practices, such as may be found in references 2, 3 and 4.

3 Technical assessment

3.1 General

3.1.1 There are three basic types of possible failure, which should 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 plan since indents are usually noted in memoranda and assumed to be dealt with as a normal routine by surveyors.

3.1.2 Technical assessments performed in conjunction with the survey planning process should, in principle, be as shown schematically in figure 1. The approach is basically an evaluation of the risk, based on the knowledge and experience related to design and corrosion.

3.1.3 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.

3.1.4 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.

3.2 Methods

3.2.1 Design details

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

3.2.1.2 Typical damage experience which should be considered will consist of:

- .1 number, extent, location and frequency of cracks; and
- .2 location of buckles.

3.2.1.3 This information should 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.

3.2.1.4 In addition, general experience should be utilized. Also, reference should be made to reference 2, which contains a catalogue of typical damages and proposed repair methods for various structural details on single-skin bulk carriers. Reference should also be made to reference 3, which contains catalogues of typical damages and proposed repair methods for double-hull oil tanker structural details which may to some extent be similar to structural details in double-side skin bulk carriers.

3.2.1.5 Such figures should be used together with a review of the main drawings, in order to compare with the actual structure and search for similar details that may be susceptible to damage. In particular, chapter 3 of reference 3 deals with various aspects specific to double-hull tankers, such as stress concentration locations, misalignment during construction, corrosion trends, fatigue considerations and areas requiring special attention, while chapter 4 of reference 3 addresses experience gained on structural defects in double-hulls (chemical tankers, OBO carriers, ore/oil carriers, gas carriers), which should also be considered in working out the survey plan.

3.2.1.6 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. The factors contributing to damage should be carefully considered.

3.2.1.7 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, is utilized. 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.

3.2.1.8 In this respect, stress calculations of typical and important components and details, in accordance with relevant methods, may prove useful and should be considered.

3.2.1.9 The selected areas of the structure identified during this process should be recorded and marked on the structural drawings which should be included in the survey programme.

3.2.2 *Corrosion*

3.2.2.1 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.

3.2.2.2 Reference 4 gives definitive examples which may be used for judging and describing coating condition, using typical pictures of conditions.

3.2.2.3 The evaluation of corrosion risks should be based on information in both reference 2 and reference 4, as far as applicable to double-side skin construction, together with the age of the ship and relevant information on the anticipated condition of the ship as derived from the information collected in order to prepare the survey programme.

3.2.2.4 The various tanks, holds, and spaces should be listed with the corrosion risks nominated accordingly.

3.2.3 *Locations for close-up survey and thickness measurement*

3.2.3.1 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) should be nominated.

3.2.3.2 The sections subject to thickness measurement should normally be nominated in tanks, holds and spaces where corrosion risk is judged to be highest.

3.2.3.3 The nomination of tanks, holds and spaces for close-up survey should, initially, be based on where the corrosion risk is judged to be highest, and should always include ballast tanks. The principle for the selection should be that the extent is increased with age or where information is insufficient or unreliable.

References

- 1 IACS, Unified Requirement Z10.5, Hull Surveys of Double Skin Bulk Carriers
- 2 IACS, Bulk Carriers: Guidelines for Surveys, Assessment and Repair of Hull Structures, January 2007
- 3 TSCF, Guidelines for the Inspection and Maintenance of Double Hull Tanker Structures, 1995
- 4 TSCF, Guidance Manual for Tanker Structures, 1997

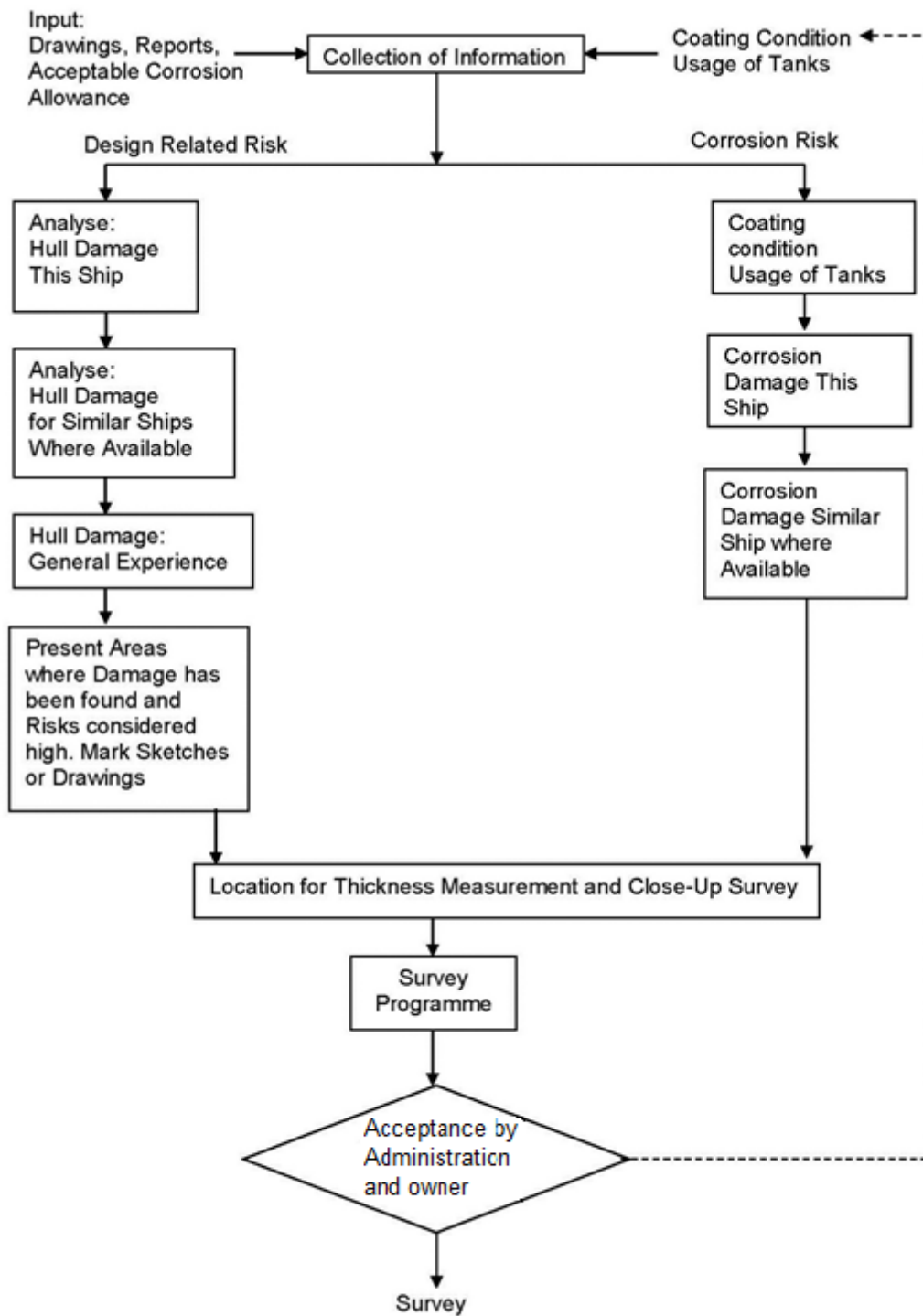


Figure 1: Technical Assessment and the Survey Planning Process

ANNEX 10

**REQUIREMENTS FOR EXTENT OF THICKNESS MEASUREMENTS AT AREAS OF
SUBSTANTIAL CORROSION OF DOUBLE-SIDE SKIN BULK CARRIERS**

Bottom, inner bottom and hopper structure

Structural member	Extent of measurement	Pattern of measurement
Bottom, inner bottom and hopper structure plating	Minimum of three bays across double-bottom tank, including aft bay Measurements around and under all suction bell mouths	Five-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of three longitudinals in each bay where bottom plating measured	Three measurements in line across flange and three measurements on the vertical web
Bottom girders, including the watertight ones	At fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with one measurement between each panel stiffener, or a minimum of three measurements
Bottom floors, including the watertight ones	Three floors in the bays where bottom plating measured, with measurements at both ends and middle	Five-point pattern over 2 m ² area
Hopper structure web frame ring	Three floors in bays where bottom plating measured	Five-point pattern over 1 m ² of plating Single measurements on flange
Hopper structure transverse watertight bulkhead or swash bulkhead	<ul style="list-style-type: none"> – lower 1/3 of bulkhead – upper 2/3 of bulkhead – stiffeners (minimum of three) 	five-point pattern over 1 m ² of plating five-point pattern over 2 m ² of plating For web, five-point pattern over span (two measurements across web at each end and one at centre of span). For flange, single measurements at each end and centre of span
Panel stiffening	Where applicable	Single measurements

**Deck structure including cross strips, main cargo hatchways,
hatch covers, coamings and topside tanks**

Structural member	Extent of measurement	Pattern of measurement
Cross deck strip plating	Suspect cross deck strip plating	Five-point pattern between under deck stiffeners over 1 m length
Under deck stiffeners	Transverse members Longitudinal member	Five-point pattern at each end and mid span Five-point pattern on both web and flange
Hatch covers	Side and end skirts, each three locations Three longitudinal bands, outboard strakes (2) and centreline strake (1)	Five-point pattern at each location Five-point measurement each band
Hatch coamings	Each side and end of coaming, one band lower 1/3, one band upper 2/3 of coaming	Five-point measurement each band, i.e. end or side coaming
Topside ballast tanks	Watertight transverse bulkheads: <ul style="list-style-type: none"> – Lower 1/3 of bulkhead – Upper 2/3 of bulkhead – Stiffeners 	Five-point pattern over 1 m ² of plating Five-point pattern over 1 m ² of plating Five-point pattern over 1 m length
Topside ballast tanks	Two representative swash transverse bulkheads: <ul style="list-style-type: none"> – Lower 1/3 of bulkhead – Upper 2/3 of bulkhead – Stiffeners 	Five-point pattern over 1 m ² of plating Five-point pattern over 1 m ² of plating Five-point pattern over 1 m length
Topside ballast tanks	Three representative bays of slope plating: <ul style="list-style-type: none"> – Lower 1/3 of tank – Upper 2/3 of tank 	Five-point pattern over 1 m ² of plating Five point pattern over 1 m ² of plating

Structural member	Extent of measurement	Pattern of measurement
Topside ballast tanks	Longitudinals, suspect and adjacent	Five-point pattern on both web and flange over 1 m length
Main deck plating	Suspect plates and adjacent (4)	Five-point pattern over 1 m ² of plating
Main deck longitudinals	Suspect plates	Five-point pattern on both web and flange over 1 m length
Web frames/transverses	Suspect plates	Five-point pattern over 1 m ² of plating

Structure in double-side spaces of double-side skin bulk carriers including wing void spaces of ore carriers

Structural member	Extent of measurement	Pattern of measurement
Side shell and inner plating: – Upper strake and strakes in way of horizontal girders – All other strakes	Plating between each pair of transverse frames/longitudinals in a minimum of three bays (along the tank) Plating between every third pair of longitudinals in same three bays	Single measurement Single measurement
Side shell and inner side transverse frames/longitudinals on: – upper strake – all other strakes	Each transverse frame/ longitudinal in same three bays Every third transverse frame/longitudinal in same three bays	Three measurements across web and one measurement on flange Three measurements across web and one measurement on flange
Transverse frames/longitudinals: – brackets	Minimum of three at top, middle and bottom of tank in same three bays	Five-point pattern over area of bracket
Vertical web and transverse bulkheads: – strakes in a way of horizontal girders – other strakes	Minimum of two webs and both transverse bulkheads Minimum of two webs and both transverse bulkheads	Five-point pattern over approximately 2 m ² area Two measurements between each pair of vertical stiffeners
Horizontal girders	Plating on each girder in a minimum of three bays	Two measurements between each pair of longitudinal girder stiffeners
Panel stiffening	Where applicable	Single measurements

Transverse bulkheads in cargo holds

Structural member	Extent of measurement	Pattern of measurement
Lower stool, where fitted	Transverse band within 25 mm of welded connection to inner bottom Transverse bands within 25 mm of welded connection to shelf plate	Five-point pattern between stiffeners over 1 m length Five-point pattern between stiffeners over 1 m length
Transverse bulkheads	Transverse band at approximately mid height Transverse band at part of bulkhead adjacent to upper deck or below upper stool shelf plate (for those ships fitted with upper stools)	Five-point pattern over 1 m ² of plating Five-point pattern over 1 m ² of plating

ANNEX 11

**STRENGTH OF CARGO HATCH COVER SECURING ARRANGEMENTS
FOR DOUBLE-SIDE SKIN BULK CARRIERS**

1 Securing devices

The strength of securing devices shall comply with the following requirements:

- .1 Panel hatch covers shall be secured by appropriate devices (bolts, wedges or similar) suitably spaced alongside the coamings and between cover elements. The arrangement and spacing shall be determined with due attention to the weathertight effectiveness, depending upon the type and the size of the hatch cover, as well as on the stiffness of the cover edges between the securing devices.

- .2 The net sectional area of each securing device shall not be less than:

$$A = 1.4 a/f \text{ (cm}^2\text{)}$$

where:

a = spacing between securing devices shall not be taken as less than 2 m

$$f = (\sigma_Y / 235)^e$$

σ_Y = specified minimum upper yield stress in N/mm² of the steel used for fabrication, shall not be taken greater than 70% of the ultimate tensile strength

$$e = 0.75 \text{ for } \sigma_Y > 235 \\ = 1.0 \text{ for } \sigma_Y \leq 235$$

Rods or bolts shall have a net diameter not less than 19 mm for hatchways exceeding 5 m² in area.

- .3 Between cover and coaming and at cross-joints, a packing line pressure sufficient to obtain weathertightness shall be maintained by the securing devices. For packing line pressures exceeding 5 N/mm, the cross section area shall be increased in direct proportion. The packing line pressure shall be specified.

- .4 The cover edge stiffness shall be sufficient to maintain adequate sealing pressure between securing devices. The moment of inertia, I , of edge elements shall not be less than:

$$I = 6 p a^4 \text{ (cm}^4\text{)}$$

where:

p = packing line pressure in N/mm, minimum 5 N/mm

a = spacing in metres of securing devices.

- .5 Securing devices shall be of reliable construction and securely attached to the hatchway coamings, decks or covers. Individual securing devices on each cover shall have approximately the same stiffness characteristics.
- .6 Where rod cleats are fitted, resilient washers or cushions shall be incorporated.
- .7 Where hydraulic cleating is adopted, a positive means shall be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.

2 Stoppers

2.1 Nos.1 and 2 hatch covers shall be effectively secured, by means of stoppers, against the transverse forces arising from a pressure of 175 kN/m².

2.2 No.2 hatch cover shall be effectively secured, by means of stoppers, against the longitudinal forces acting on the forward end arising from a pressure of 175 kN/m².

2.3 No.1 hatch cover shall be effectively secured, by means of stoppers, against the longitudinal forces acting on the forward end arising from a pressure of 230 kN/m². This pressure may be reduced to 175 kN/m² if a forecastle is fitted.

2.4 The equivalent stress in stoppers and their supporting structures and calculated in the throat of the stopper welds shall not exceed the allowable value of $0.8 \sigma_y$.

3 Materials and welding

Where stoppers or securing devices are fitted to comply with this annex, they shall be manufactured of materials, including welding electrodes, to the satisfaction of the Administration.

ANNEX 12

PROCEDURAL REQUIREMENTS FOR THICKNESS MEASUREMENTS

1 General

Thickness measurements required in the context of hull structural surveys, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The attendance of the surveyor shall be recorded. This also applies to thickness measurements taken during voyages.

2 Survey meeting

2.1 Prior to commencement of the renewal or intermediate survey, a meeting shall be held between the attending surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) in attendance and the thickness measurement firm's representative(s) so as to ensure the safe and efficient execution of the surveys and thickness measurements to be carried out on board.

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

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

2.3 When thickness measurements are taken in association with intermediate or renewal surveys, a documented record indicating where and when the meeting took place and who attended (the name of the surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) and the representative(s) of the thickness measurement firm(s)) shall be maintained.

3 Monitoring of the thickness measurement process on board

3.1 The surveyor shall decide the final extent and location of thickness measurements after overall survey of representative spaces on board.

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

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

3.4 Thickness measurements taken mainly to evaluate the extent of corrosion, which may affect the hull girder strength, shall be carried out in a systematic manner such that all longitudinal structural members are gauged, as required.

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

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

4 Review and verification

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

4.2 If, where special consideration is allowed by this Code, the extent of thickness measurements is reduced, the surveyor's special consideration shall be reported.

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

ANNEX B

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF OIL TANKERS

Part A

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF DOUBLE-HULL OIL TANKERS

1 General

1.1 *Application*

1.1.1 The Code shall apply to all self-propelled double-hull oil tankers of 500 gross tonnage and above.

1.1.2 The Code shall apply to surveys of hull structure and piping systems in way of cargo tanks, pump-rooms, cofferdams, pipe tunnels, void spaces within the cargo area and all ballast tanks.

1.1.3 The Code contains the minimum extent of examination, thickness measurements and tank testing. The survey shall be extended when substantial corrosion and/or structural defects are found and include additional close-up survey when necessary.

1.1.4 The surveys shall be carried out during the surveys prescribed by regulation I/10 of the Convention, unless expressly provided otherwise in this Code.

1.2 *Definitions*

1.2.1 *Double-hull oil tanker* is a ship which is constructed primarily for the carriage of oil in bulk, which has the cargo tanks protected by a double-hull which extends for the entire length of the cargo area, consisting of double sides and double-bottom spaces for the carriage of water ballast or void spaces.

1.2.2 *Ballast tank* is a tank which is used primarily for the carriage of salt water ballast.

1.2.3 *Combined cargo/ballast tank*, if referred to within the Code, is a tank which is used for the carriage of cargo or ballast water as a routine part of the vessel's operation and will be treated as a Ballast Tank. Cargo tanks in which water ballast might be carried only in exceptional cases per MARPOL regulation I/18.3 are to be treated as cargo tanks.

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

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

1.2.6 *Transverse section* is the cross section of the hull perpendicular to the ship's centreline and includes all longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom and longitudinal bulkheads. For transversely framed oil tankers, a transverse section includes adjacent frames and their end connections in way of transverse sections.

1.2.7 *Representative tanks* are those which are expected to reflect the condition of other tanks of similar type and service and with similar corrosion prevention systems. When selecting representative tanks, account shall be taken of the service and repair history on board and identifiable critical structural areas and/or suspect areas.

1.2.8 *Suspect areas* are locations showing substantial corrosion and/or are considered by the surveyor to be prone to rapid wastage.

1.2.9 *Substantial corrosion* is an extent of corrosion such that assessment of corrosion pattern indicates a wastage in excess of 75% of allowable margins, but within acceptable limits. For ships built under the IACS Common Structural Rules, substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{ren} + 0.5$ mm and t_{ren} . Renewal thickness (t_{ren}) is the minimum allowable thickness, in mm, below which renewal of structural members shall be carried out.

1.2.10 *Corrosion prevention system* is normally considered a full hard protective coating. Hard protective coating should usually be epoxy coating or equivalent. Other coating systems, which are neither soft nor semi-hard coatings, may be considered acceptable as alternatives provided that they are applied and maintained in compliance with the manufacturer's specification.

1.2.11 *Coating condition* is defined 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; and

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

1.2.12 *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 applicable, to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

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

1.2.14 *Intermediate survey* is a survey carried out either at the second or the third annual survey or between these surveys.

1.2.15 *Prompt and thorough repair* is a permanent repair completed at the time of survey to the satisfaction of the surveyor, therein removing the need for the imposition of any associated condition of classification or recommendation.

1.2.16 *Special consideration or specially considered* (in connection with close-up surveys and thickness measurements) means sufficient close-up inspection and thickness measurements are taken to confirm the actual average condition of the structure under coating.

1.2.17 *Pitting corrosion* is defined as scattered corrosion spots/areas with local material

reductions which are greater than the general corrosion in the surrounding area. Pitting intensity is defined in figure 1.

1.2.18 *Edge corrosion* is defined as local material loss at the free edges of plates, stiffeners, primary support members and around openings. An example of edge corrosion is shown in figure 2.

1.2.19 *Grooving corrosion* is typically local material loss adjacent to weld joints along abutting stiffeners and at stiffener or plate butts or seams. An example of groove corrosion is shown in figure 3.

1.2.20 *Administration* means the Administration or organization recognized by the Administration.

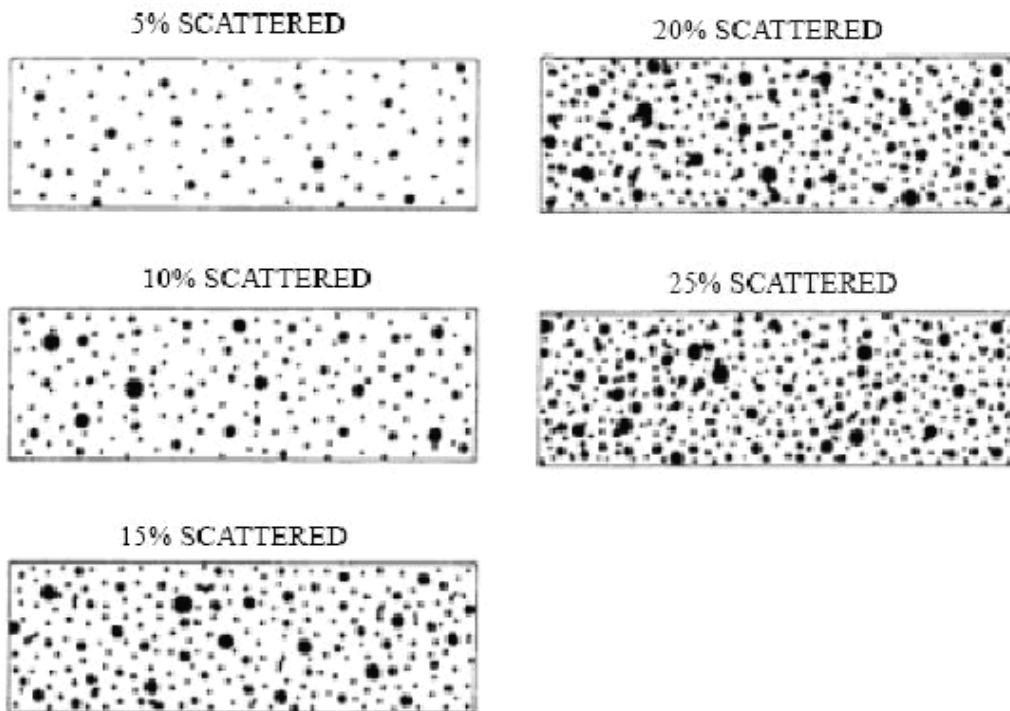


Figure 1: Pitting intensity diagrams

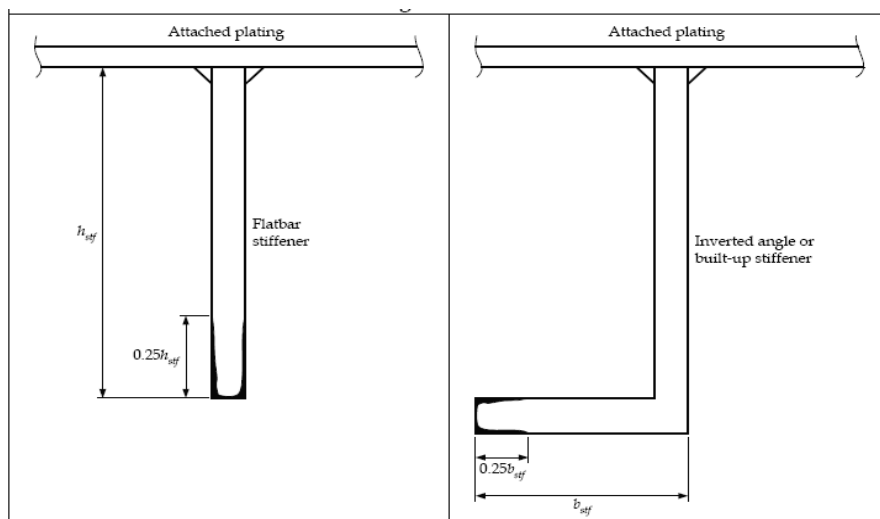


Figure 2: Edge corrosion

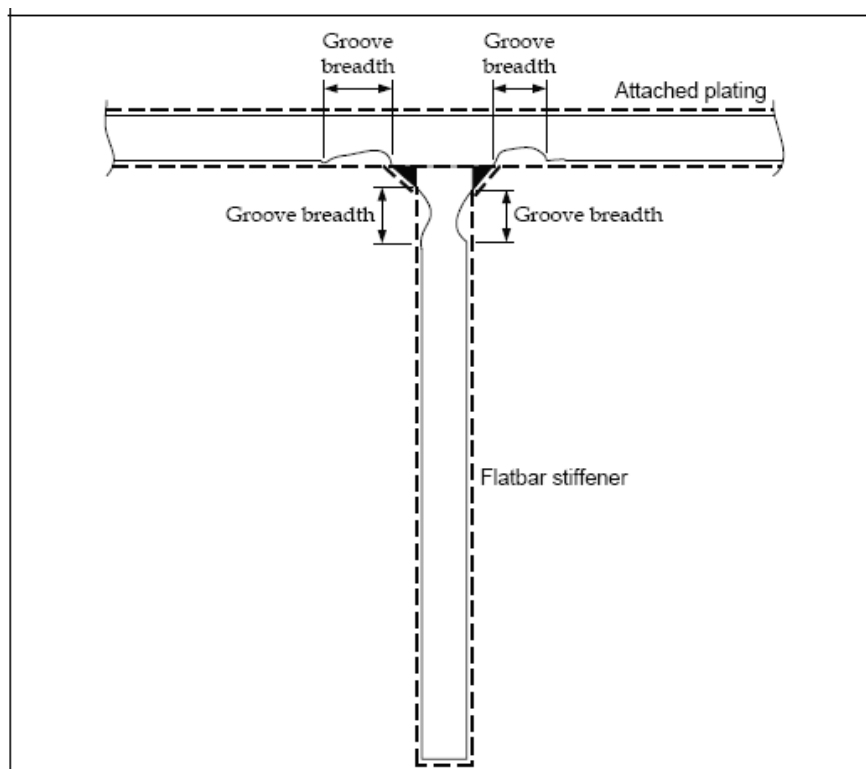


Figure 3: Grooving corrosion

1.3 Repairs

1.3.1 Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Administration, will affect the ship's structural, watertight or weathertight integrity, shall be promptly and thoroughly (see 1.2.15) repaired. Areas to be considered include:

- .1 bottom structure and bottom plating;
- .2 side structure and side plating;
- .3 deck structure and deck plating;
- .4 watertight or oiltight bulkheads; and
- .5 hatch covers and hatch coamings, where fitted (combination carriers).

For locations where adequate repair facilities are not available, the Administration may allow the ship to proceed directly to a repair facility. This may require discharging the cargo and/or temporary repairs for the intended voyage.

1.3.2 Additionally, when a survey results in the identification of corrosion or structural defects, either of which, in the opinion of the Administration, will impair the ship's fitness for

continued service, remedial measures shall be implemented before the ship continues in service.

1.3.3 Where the damage found on the structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity after evaluation of the surrounding structure and impose an associated condition or recommendation with a specific time limit in order to complete the permanent repair and retain the validity of the relevant statutory certification.

1.4 Surveyors*

1.4.1 On oil tankers 20,000 tonnes deadweight (dwt) and above starting with renewal survey No.3, at renewal and intermediate hull surveys, the survey of hull structure and piping systems to which this Code applies shall be carried out by at least two surveyors of an Administration.

1.4.2 This requires that at least two surveyors attend on board at the same time to perform the required survey. Though each attending surveyor is not required to perform all aspects of the required survey, they shall consult with each other and do joint overall and close-up surveys to the extent necessary to determine the condition of the vessel areas to which this Code applies. The extent of these surveys shall be sufficient for the surveyors to agree on actions required to complete the survey with respect to renewals, repairs, and other recommendations or conditions. Each surveyor shall co-sign the survey report or indicate their concurrence in an equivalent manner.

1.4.3 The following surveys may be witnessed by a single surveyor:

- .1 thickness measurements;
- .2 tank testing; and
- .3 repairs carried out in association with intermediate and renewal hull surveys, the extent of which have been agreed upon by the required two surveyors during the course of the surveys.

1.5 Thickness measurements and close-up surveys

In any kind of survey, i.e. renewal, intermediate, annual or other surveys having the scope of the foregoing ones, for structures in areas where close-up surveys are required, thickness measurements, when required by annex 2, shall be carried out simultaneously with close-up surveys.

2 Renewal survey

2.1 General

2.1.1 The renewal survey may be commenced at the fourth annual survey and be progressed during the succeeding year with a view to completion by the fifth anniversary date. When

* Refer to paragraph 4.2.4 of part 2 of the Code for Recognized Organizations (RO Code), adopted by resolution MSC.349(92).

the renewal survey is commenced prior to the fourth annual survey, the entire survey shall be completed within 15 months if such work is to be credited to the renewal survey.

2.1.2 As part of the preparation for the renewal survey the survey programme shall be dealt with in advance of the renewal survey. The thickness measurement shall not be held before the fourth annual survey.

2.1.3 The survey shall include, in addition to the requirements of the annual survey, examination, tests and checks of sufficient extent to ensure that the hull and related piping as required in 2.1.5 is in a satisfactory condition and is fit for its intended purpose for the new period of validity of the Cargo Ship Safety Construction Certificate, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

2.1.4 All cargo tanks, ballast tanks, including double-bottom tanks, pump-rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull shall be examined, and this examination shall be supplemented by thickness measurement and testing as required in 2.5 and 2.6, to ensure that the structural integrity remains effective. The examination shall be sufficient to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

2.1.5 Cargo piping on deck, including crude oil washing (COW) piping, and cargo and ballast piping within the above tanks and spaces shall be examined and operationally tested to working pressure to the attending surveyor's satisfaction to ensure that tightness and condition remain satisfactory. Special attention shall be given to any ballast piping in cargo tanks and any cargo piping in ballast tanks and void spaces, and surveyors shall be advised on all occasions when this piping, including valves and fittings, are open during repair periods and can be examined internally.

2.1.6 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

2.2 Dry-dock survey

2.2.1 A survey in dry dock shall be a part of the renewal survey. There shall be a minimum of two inspections of the outside of the ship's bottom during the five-year period of the Safety Construction Certificate. In all cases, the maximum interval between bottom inspections shall not exceed 36 months.

2.2.2 For ships of 15 years of age and over, inspection of the outside of the ship's bottom shall be carried out with the ship in dry dock. For ships of less than 15 years of age, alternate inspections of the ship's bottom not conducted in conjunction with the renewal survey may be carried out with the ship afloat. Inspection of the ship afloat shall only be carried out when the conditions are satisfactory and the proper equipment and suitably qualified staff are available.

2.2.3 If a survey in dry dock is not completed in conjunction with the renewal survey or if the 36-month maximum interval referred to in 2.2.1 is not complied with, the Cargo Ship Safety Construction Certificate shall cease to be valid until a survey in dry dock is completed.

2.2.4 The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and ballast tanks shall be carried out in accordance with the applicable requirements for renewal surveys, if not already performed.

Note: Lower portions of the cargo and ballast tanks are considered to be the parts below the light ballast water line.

2.3 Tank corrosion prevention system

Where provided, the condition of the corrosion prevention system of cargo tanks shall be examined. A ballast tank shall be examined at subsequent annual intervals where:

- .1 a hard protective coating has not been applied from the time of construction; or
- .2 a soft or semi-hard coating has been applied; or
- .3 substantial corrosion is found within the tank; or
- .4 the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the surveyor.

Thickness measurements shall be carried out as deemed necessary by the surveyor.

2.4 Extent of overall and close-up surveys

2.4.1 An overall survey of all tanks and spaces shall be carried out at the renewal survey. Suspect areas identified at previous surveys shall be examined.

2.4.2 The minimum requirements for close-up surveys at the renewal survey are given in annex 1.

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

- .1 in particular, tanks having structural arrangements or details which have suffered defects in similar tanks or on similar ships according to available information; and
- .2 in tanks which have structures approved with reduced scantlings in association with a corrosion prevention system approved by the Administration.

2.4.4 For areas in tanks where hard protective coatings are found to be in GOOD condition as defined in 1.2.11, the extent of close-up surveys according to annex 1 may be specially considered by the Administration.

2.5 Extent of thickness measurements

2.5.1 The minimum requirements for thickness measurements at the renewal survey are given in annex 2.

2.5.2 Provisions for extended measurements for areas with substantial corrosion are given in annex 4, and may be additionally specified in the survey programme as required in 5.1. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken.

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

2.5.4 For areas in tanks where hard protective coatings are found to be in GOOD condition as defined in 1.2.11, the extent of thickness measurements according to annex 2 may be specially considered by the Administration.

2.5.5 Transverse sections shall be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

2.5.6 In cases where two or three sections are measured, at least one shall include a ballast tank within 0.5L amidships. In case of oil tankers of 130 m in length and upwards (as defined in the International Convention on Load Lines in force) and more than 10 years of age, for the evaluation of the ship's longitudinal strength as required in 9.1.2, the sampling method of thickness measurements is given in annex 13.

2.6 *Extent of tank pressure testing*

2.6.1 The minimum requirements for ballast tank pressure testing at the renewal survey are given in 2.6.3 and in annex 3.

The minimum requirements for cargo tank testing at the renewal survey are given in 2.6.4 and annex 3.

Cargo tank testing carried out by the vessel's crew under the direction of the master may be accepted by the surveyor provided the following conditions are complied with:

- .1 tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the owner and reviewed by the Administration prior to the testing being carried out;
- .2 there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;
- .3 the tank testing has been satisfactorily carried out within the special survey window not more than 3 months prior to the date of the survey on which the overall or close-up survey is completed;
- .4 the satisfactory results of the testing is recorded in the vessel's logbook; and
- .5 the internal and external condition of the tanks and associated structure are found satisfactory by the surveyor at the time of the overall and close-up survey.

2.6.2 The surveyor may extend the tank pressure testing as deemed necessary.

2.6.3 Boundaries of ballast tanks shall be tested with a head of liquid to the top of the air pipes.

2.6.4 Boundaries of cargo tanks shall be tested to the highest point that liquid will rise to under service conditions.

2.6.5 The testing of double-bottom tanks and other spaces not designed for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tank top is carried out.

3 Annual survey

3.1 General

Annual surveys shall be held within three months before or after the anniversary date from the date of the initial survey or of the date credited for the last renewal survey. The annual survey shall consist of an examination for the purpose of ensuring, as far as practicable, that the hull and piping are maintained in a satisfactory condition and shall take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

3.2 Examination of the hull

3.2.1 An examination of the hull plating and its closing appliances shall be carried out as far as can be seen.

3.2.2 An examination of watertight penetrations shall be carried out as far as practicable.

3.3 Examination of weather decks

3.3.1 An examination of cargo tank openings including gaskets, covers, coamings and flame screens shall be carried out as far as practicable.

3.3.2 An examination of cargo tank pressure/vacuum valves and flame screens shall be carried out as far as practicable.

3.3.3 An examination of flame screens on vents to all bunker tanks shall be carried out as far as practicable.

3.3.4 An examination of cargo, crude oil washing, bunker and vent piping systems, including vent masts and headers shall be carried out as far as practicable.

3.4 Examination of cargo pump-rooms and pipe tunnels if fitted

3.4.1 An examination of all pump-room bulkheads for signs of oil leakage or fractures and, in particular, the sealing arrangements of all penetrations of pump-room bulkheads shall be carried out as far as practicable.

3.4.2 An examination of the condition of all piping systems and pipe tunnels shall be carried out as far as practicable.

3.5 Examination of ballast tanks

3.5.1 An examination of ballast tanks shall be carried out when required as a consequence of the results of the renewal survey and intermediate survey. When considered necessary by the Administration or when extensive corrosion exists, thickness measurements shall be carried out.

3.5.2 Where substantial corrosion as defined in 1.2.9 is found, the extent of thickness measurements shall be increased in accordance with the requirements in annex 4. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken.

For oil tankers built under the IACS Common Structural Rules, the identified substantial corrosion areas shall be examined and additional thickness measurements shall be carried out.

4 Intermediate survey

4.1 General

4.1.1 Items that are additional to the requirements of the annual survey may be surveyed either at the second or third annual survey or between these surveys.

4.1.2 The extent of survey of cargo and ballast tanks is dependent on the age of the ship and is specified in 4.2, 4.3 and 4.4.

4.1.3 For weather decks, an examination as far as applicable of cargo, crude oil washing, bunker, ballast, steam and vent piping systems as well as vent masts and headers shall be carried out. If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure tested, thickness measured or both.

4.1.4 For oil tankers built under the IACS Common Structural Rules, the identified substantial corrosion areas shall be examined and additional thickness measurements shall be carried out.

4.1.5 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

4.2 Oil tankers 5 to 10 years of age

4.2.1 For tanks used for water ballast, an overall survey of representative tanks selected by the surveyor shall be carried out. If such overall survey reveals no visible structural defects, the examination may be limited to verification that the corrosion prevention system remains efficient.

4.2.2 A ballast tank shall be examined at subsequent annual intervals where:

- .1 a hard protective coating has not been applied from the time of construction;
or
- .2 a soft or semi-hard coating has been applied; or
- .3 substantial corrosion is found within the tank; or
- .4 the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the surveyor.

4.3 Oil tankers 10 to 15 years of age

4.3.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey as required in 2 and 5.1. However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of hull girder as required in 9.1.2 shall not be required unless deemed necessary by the Administration.

4.3.2 In application of 4.3.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of application of 2.1.1.

4.3.3 In application of 4.3.1, an underwater survey may be considered in lieu of the requirements of 2.2.

4.4 Oil tankers exceeding 15 years of age

4.4.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey as required in 2 and 5.1. However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of hull girder as required in 9.1.2 shall not be required unless deemed necessary by the Administration.

4.4.2 In application of 4.4.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

4.4.3 In application of 4.4.1, a survey in dry-dock shall be part of the intermediate survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks shall be carried out in accordance with the applicable requirements for intermediate surveys, if not already performed.

Note: Lower portions of the cargo and ballast tanks are considered to be the parts below the light ballast water line.

5 Preparations for survey

5.1 Survey programme

5.1.1 The owner in cooperation with the Administration shall work out a specific survey programme prior to the commencement of any part of the renewal survey and, for double-hull oil tankers over 10 years of age, the intermediate survey. The survey programme shall be in a written format based on the information in annex 7A. The survey shall not commence until the survey programme has been agreed.

5.1.1.1 Prior to the development of the survey programme, the survey planning questionnaire shall be completed by the owner, based on the information set out in annex 7B, and forwarded to the Administration.

5.1.1.2 The survey programme at an intermediate survey may consist of the survey programme at the previous renewal survey supplemented by the condition evaluation report (executive hull summary report) of that renewal survey and later relevant survey reports.

5.1.1.3 The survey programme shall be worked out taking into account any amendments to the survey requirements implemented after the last renewal survey was carried out.

5.1.2 In developing the survey programme, the following documentation shall be collected and consulted upon with a view to selecting tanks, areas, and structural elements to be examined:

- .1 survey status and basic ship information;
- .2 documentation on board, as described in 6.2 and 6.3;
- .3 main structural plans of cargo and ballast tanks (scantlings drawings), including information regarding use of high-tensile steels (HTS);

- .4 condition evaluation report (executive hull summary report), according to annex 10;
- .5 relevant previous damage and repair history;
- .6 relevant previous survey and inspection reports from both the Administration and the owner;
- .7 cargo and ballast history for the last three years, including carriage of cargo under heated conditions;
- .8 details of the inert gas plant and tank cleaning procedures;
- .9 information and other relevant data regarding conversion or modification of the ship's cargo and ballast tanks since the time of construction;
- .10 description and history of the corrosion prevention system (including previous class notations), if any;
- .11 inspections of the owner's personnel during the last three years with reference to structural deterioration in general, leakages in tank boundaries and piping and condition of the corrosion prevention system if any. Guidance for reporting is shown in annex 6;
- .12 information regarding the relevant maintenance level during operation, including port State control reports of inspection containing hull related deficiencies, safety management system non-conformities relating to hull maintenance, including the associated corrective action(s); and
- .13 any other information that will help identify suspect areas and critical structural areas.

5.1.3 The submitted survey programme shall account for, and comply, as a minimum, with the provisions of 2.6 for tank testing and annexes 1, 2 and 3 for close-up survey, thickness measurement and tank testing, respectively, and shall include relevant information including at least:

- .1 basic ship information and particulars;
- .2 main structural plans of cargo and ballast tanks (scantling drawings), including information regarding use of high tensile steels (HTS);
- .3 plan of tanks;
- .4 list of tanks with information on their use, corrosion prevention system and condition of coating;
- .5 conditions for survey (e.g. information regarding tank cleaning, gas freeing, ventilation, lighting, etc.);
- .6 provisions and methods for access to structures;
- .7 equipment for surveys;

- .8 nomination of tanks and areas for close-up survey (see 2.4);
- .9 nomination of areas and sections for thickness measurement (see 2.5);
- .10 nomination of tanks for tank testing (see 2.6);
- .11 nomination of the thickness measurement firm;
- .12 damage experience related to the ship in question; and
- .13 critical structural areas and suspect areas, where relevant.

5.1.4 The Administration shall advise the owner of the maximum acceptable structural corrosion diminution levels applicable to the ship.

5.1.5 Use should also be made of the Guidelines for technical assessment in conjunction with the planning of enhanced surveys for tankers, contained in annex 12. These Guidelines are a recommended tool which may be invoked at the discretion of the Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme. These Guidelines shall not be used to reduce the requirements of annexes 1, 2 and 3, and paragraph 2.6, which shall, in all cases, be complied with as a minimum.

5.2 Conditions for survey

5.2.1 The owner shall provide the necessary facilities for a safe execution of the survey.

5.2.1.1 In order to enable the attending surveyors to carry out the survey, provisions for proper and safe access shall be agreed between the owner and the Administration, based on recommendations developed by the Organization.*

5.2.1.2 Details of the means of access shall be provided in the survey planning questionnaire.

5.2.1.3 In cases where the provisions of safety and required access are judged by the attending surveyors not to be adequate, the survey of the spaces involved shall not proceed.

5.2.2 Tanks and spaces shall be safe for access. Tanks and spaces shall be gas free and properly ventilated. Prior to entering a tank, void or enclosed space, it shall be verified that the atmosphere in that space is free from hazardous gas and contains sufficient oxygen.

5.2.3 In preparation for survey and thickness measurements and to allow for a thorough examination, all spaces shall be cleaned including removal from surfaces of all loose accumulated corrosion scale. Spaces shall 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 coating. However, those areas of structure whose renewal has already been decided by the owner need only be cleaned and descaled to the extent necessary to determine the limits of the areas to be renewed.

* Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

5.2.4 Sufficient illumination shall be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the coating.

5.2.5 Where soft or semi-hard coatings have been applied, safe access shall 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 shall be removed.

5.2.6 The surveyor(s) shall always be accompanied by at least one responsible person, assigned by the owner, experienced in tank and enclosed space inspection.

5.3 Access to structures*

5.3.1 For overall surveys, means shall be provided to enable the surveyor to examine the structure in a safe and practical way.

5.3.2 For close-up surveys, one or more of the following means for access, acceptable to the surveyor, shall be provided:

- .1 permanent staging and passages through structures;
- .2 temporary staging and passages through structures;
- .3 hydraulic arm vehicles such as conventional cherry pickers, lifts and moveable platforms;
- .4 boats or rafts;
- .5 portable ladders; and/or
- .6 other equivalent means.

5.4 Equipment for survey

5.4.1 Thickness measurements shall normally be carried out by means of ultrasonic test equipment. The accuracy of the equipment shall be proven to the surveyor as required.

5.4.2 One or more of the following fracture detection procedures shall be required if deemed necessary by the surveyor:

- .1 radiographic equipment;
- .2 ultrasonic equipment;
- .3 magnetic particle equipment;
- .4 dye penetrant; and/or
- .5 other equivalent means.

* Refer to MSC/Circ.686 on *Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers.*

5.4.3 Explosimeter, oxygen-meter, breathing apparatus, lifelines, riding belts with rope and hook and whistles together with instructions and guidance on their use shall be made available during the survey. A safety checklist shall be provided.

5.4.4 Adequate and safe lighting shall be provided for the safe and efficient conduct of the survey.

5.4.5 Adequate protective clothing shall be made available and used (e.g. safety helmet, gloves, safety shoes, etc.) during the survey.

5.5 *Rescue and emergency response equipment*

If breathing apparatus and/or other equipment is used as "Rescue and emergency response equipment", then the equipment shall be suitable for the configuration of the space being surveyed.

5.6 *Surveys at sea or at anchorage*

5.6.1 Surveys at sea or at anchorage may be accepted provided the surveyor(s) is given the necessary assistance from the personnel on board. Necessary precautions and procedures for carrying out the survey shall be in accordance with 5.1, 5.2, 5.3 and 5.4.

5.6.2 A communication system shall be arranged between the survey party in the tank and the responsible officer on deck. This system shall also include the personnel in charge of ballast pump handling if boats or rafts are used.

5.6.3 Surveys of tanks by means of boats or rafts shall only be undertaken with the agreement of the surveyor, who shall take into account the safety arrangements provided, including weather forecasting and ship response under foreseeable conditions and provided the expected rise of water within the tank does not exceed 0.25 m.

5.6.4 When rafts or boats are used for close-up surveys, the following conditions shall be observed:

- .1 only rough duty, inflatable rafts or boats, having satisfactory residual buoyancy and stability even if one chamber is ruptured, shall be used;
- .2 the boat or raft shall be tethered to the access ladder and an additional person shall be stationed down the access ladder with a clear view of the boat or raft;
- .3 appropriate lifejackets shall be available for all participants;
- .4 the surface of water in the tank shall be calm (under all foreseeable conditions the expected rise of water within the tank shall not exceed 0.25 m) and the water level stationary. On no account shall the level of the water be rising while the boat or raft is in use;
- .5 the tank or space shall contain clean ballast water only. Even a thin sheen of oil on the water shall not be acceptable;
- .6 at no time shall the water level 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

shall only 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; and

- .7 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 shall be isolated to prevent a transfer of gas from other tanks (or spaces).

5.6.5 Rafts or boats alone may be allowed for inspection of the under deck areas of tanks or spaces if the depth of the webs is 1.5 m or less.

5.6.6 If the depth of the webs is more than 1.5 m, rafts or boats alone shall be allowed only:

- .1 when the coating of the under-deck structure is in GOOD condition and there is no evidence of wastage; or
- .2 if a permanent means of access is provided in each bay to allow safe entry and exit. This means:
 - .1 access direct from the deck via a vertical ladder with a small platform fitted approximately 2 m below the deck in each bay; or
 - .2 access to deck from a longitudinal permanent platform having ladders to deck in each end of the tank. The platform shall, for the full length of the tank, be arranged level with, or above, the maximum water level needed for rafting of under deck structure. For this purpose, the ullage corresponding to the maximum water level shall be assumed not more than 3 m from the deck plate measured at the midspan of deck transverses and in the middle length of the tank (see figure 4).

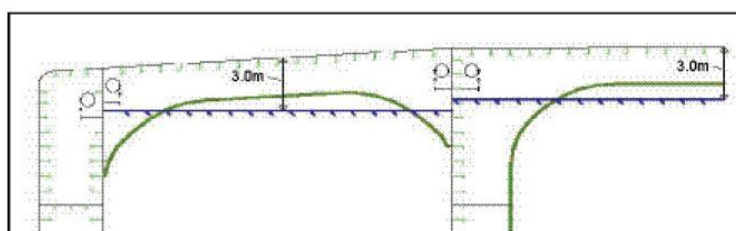


Figure 4: Maximum water level in a tank

If neither of the above conditions are met, then staging or other equivalent means shall be provided for the survey of the under-deck areas.

5.6.7 The use of rafts or boats alone in 5.6.5 and 5.6.6 does not preclude the use of boats or rafts to move about within a tank during a survey.

5.7 Survey planning meeting

5.7.1 Proper preparation and close cooperation between the attending surveyor(s) and the owner's representatives on board prior to and during the survey are an essential part in the safe and efficient conduct of the survey. During the survey on board safety meetings shall be held regularly.

5.7.2 Prior to commencement of any part of the renewal or intermediate survey, a survey planning meeting shall be held between the attending surveyor(s), the owner's representative in attendance, the thickness measurement firm representative, where involved, and the master of the ship or an appropriately qualified representative nominated by the master or company; for the purpose to ascertain that all the arrangements envisaged in the survey programme are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out (see also 7.1.2).

5.7.3 The following is an indicative list of items that shall be addressed in the meeting:

- .1 schedule of the ship (i.e. the voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operations, etc.);
- .2 provisions and arrangements for thickness measurements (i.e. access, cleaning/descaling, illumination, ventilation, personal safety);
- .3 extent of the thickness measurements;
- .4 acceptance criteria (refer to the list of minimum thicknesses);
- .5 extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion;
- .6 execution of thickness measurements;
- .7 taking representative readings in general and where uneven corrosion/pitting is found;
- .8 mapping of areas of substantial corrosion; and
- .9 communication between attending surveyor(s) the thickness measurement firm operator(s) and owner representative(s) concerning findings.

6 Documentation on board

6.1 General

6.1.1 The owner shall obtain, supply and maintain on board the ship, documentation as specified in 6.2 and 6.3 which shall be readily available for the surveyor. The condition evaluation report (executive hull summary report) referred to in 6.2 shall include a translation into English.

6.1.2 The documentation shall be kept on board for the lifetime of the ship.

6.1.3 For oil tankers subject to SOLAS regulation II-1/3-10, the owner shall arrange the updating of the Ship Construction File (SCF) throughout the ship's life whenever a modification of the documentation included in the SCF has taken place. Documented procedures for updating the SCF shall be included within the Safety Management System.

6.1.4 For oil tankers with coatings of dedicated seawater ballast tanks subject to PSC standards (MSC.215(82)), and for crude oil tankers as applicable with coatings of cargo oil tanks subject to the requirements of MSC.288(87), the owner shall arrange the updating of the Coating Technical File (CTF) throughout the ship's life whenever a maintenance, repair, or recoating activity to these coatings has taken place. Documented procedures for updating the CTF shall be included within the Safety Management System.

6.2 Survey report file

6.2.1 A survey report file shall be a part of the documentation on board consisting of:

- .1 reports of structural surveys (annex 9);
- .2 condition evaluation report (executive hull summary report) (annex 10); and
- .3 thickness measurement reports (annex 11A/annex 11B).

6.2.2 The survey report file shall be available also in the owner's and the Administration's offices.

6.3 Supporting documents

6.3.1 The following additional documentation shall be available on board:

- .1 survey programme as required by 5.1 until such time as the renewal survey, or intermediate survey, as applicable, has been completed;
- .2 main structural plans of cargo and ballast tanks (for oil tankers built under the IACS Common Structural Rules these plans shall include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition shall also to be clearly indicated on the plans. The midship section plan supplied on board the ship shall include the minimum allowable hull girder sectional properties for the tank transverse section in all cargo tanks);
- .3 previous repair history;
- .4 cargo and ballast history;
- .5 extent of use of inert gas plant and tank cleaning procedures;
- .6 inspections by ship's personnel with reference to:
 - .1 structural deterioration in general;
 - .2 leakage in bulkheads and piping; and
 - .3 condition of corrosion prevention system, if any. Guidance for reporting is shown in annex 6; and
- .7 any other information that would help to identify critical structural areas and/or suspect areas requiring inspection.

6.3.2 For oil tankers subject to SOLAS regulation II-1/3-10, the Ship Construction File (SCF), limited to the items to be retained on board, shall be available on board.

6.3.3 For oil tankers with coatings of dedicated seawater ballast tanks subject to PSPC standards (MSC.215(82)), and for crude oil tankers as applicable with coatings of cargo oil tanks subject to the requirements of MSC.288(87), the Coating Technical File (CTF) shall be available on board.

6.4 Review of documentation on board

6.4.1 Prior to survey, the surveyor shall examine the completeness of the documentation on board and its contents as a basis for the survey.

6.4.2 For oil tankers subject to SOLAS regulation II-1/3-10, on completion of the survey, the surveyor shall verify that the update of the Ship Construction File (SCF) has been done whenever a modification of the documentation included in the SCF has taken place.

6.4.2.1 For the SCF stored on board ship, the surveyor shall examine the information on board ship. In cases where any major event, including, but not limited to, substantial repair and conversion, or any modification to the ship structures; the surveyor shall also verify that the updated information is kept on board the ship. If the updating of the SCF on board is not completed at the time of survey, the surveyor shall record it and require confirmation at the next periodical survey.

6.4.2.2 For the SCF stored in an onshore archive, the surveyor shall examine the list of information included in the onshore archive. In cases where any major event, including, but not limited to, substantial repair and conversion, or any modification to the ship structures; the surveyor shall also verify that the updated information is stored in the onshore archive by examining the list of information included in the onshore archive kept on board the ship. In addition, the surveyor shall confirm that the service contract with the archive centre is valid. If the updating of the SCF Supplement ashore is not completed at the time of survey, the surveyor shall record it and require confirmation at the next periodical survey.

6.4.3 For oil tankers subject to SOLAS regulation II-1/3-10, on completion of the survey, the surveyor shall verify any addition and/or renewal of materials used for the construction of the hull structure are documented within the Ship Construction File's list of materials.

6.4.4 For oil tankers with coatings of dedicated seawater ballast tanks subject to PSPC standards (MSC.215(82)), and for crude oil tankers as applicable with coatings of cargo oil tanks subject to the requirements of MSC.288(87), on completion of the survey, the surveyor shall verify any maintenance, repair, or recoating activities to these coatings are documented within the Coating Technical File (CTF).

7 Procedures for thickness measurements

7.1 General

7.1.1 The required thickness measurements, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The surveyor shall be on board to the extent necessary to control the process.

7.1.2 The thickness measurement firm shall be part of the survey planning meeting to be held prior to commencing the survey.

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

7.1.4 In all cases the extent of the thickness measurements shall be sufficient as to represent the actual average condition.

7.1.5 Procedural requirements for thickness measurements are set out in annex 14

7.2 Certification of thickness measurement firm

The thickness measurements shall be carried out by a qualified firm certified by the Administration according to principles stated in annex 8.

7.3 Number and locations of measurements

7.3.1 Application

This section only applies to ships built under the IACS Common Structural Rules* (CSR). For ships not built under the IACS Common Structural Rules, the requirements for the number and locations of measurements shall be according to the requirements of the individual classification society recognized by the Administration depending on the ship's age and structural elements concerned.

7.3.2 Number of measurements

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

7.3.3 Locations of measurements

7.3.3.1 Table 1 provides explanations and/or interpretations for the application of those requirements indicated in the IACS CSR, which refer to both systematic thickness measurements related to the calculation of global hull girder strength and specific measurements connected to close-up surveys.

7.3.3.2 Figures 5 to 8 are provided to facilitate the explanations and/or interpretations given in table 1, to show typical arrangements of double-hull oil tankers.

Table 1 – Interpretations of requirements for the locations and number of points to be measured

Item	Interpretation	Figure reference
Selected plates	"Selected" means at least a single point on one out of three plates, which shall be chosen on representative areas of average corrosion.	
Deck, bottom plates and wind-and-water strakes	At least two points on each plate which shall be taken either at each 1/4 extremity of plate or at representative areas of average corrosion.	
Transverse section	Measurements shall be taken on all longitudinal members such as plating, longitudinals and girders at the deck, side, bottom, longitudinal bulkheads, inner bottom and hopper. One point shall be taken on each plate. Both web and flange shall be measured on longitudinals, if applicable.	Figure 5

* IACS Common Structural Rules mean IACS Common Structural Rules for Double Hull Oil Tankers (CSR of Oil Tankers) or IACS Common Structural Rules for Bulk Carriers or Oil Tankers (IACS CSR BC&OT).

Item	Interpretation	Figure reference
	For tankers older than 10 years of age, within 0.1D (where D is the ship's moulded depth) of the deck and bottom at each transverse section to be measured, every longitudinal and girder shall be measured on the web and face plate, and every plate shall be measured at one point between longitudinals.	
Transverse rings* in cargo and ballast tanks	At least two points on each plate in a staggered pattern and two points on the corresponding flange where applicable. Minimum four points on the first plate below deck. Additional points in way of curved parts. At least one point on each of two stiffeners between stringers/longitudinal girders.	Figure 6
Transverse bulkheads in cargo tanks	At least two points on each plate. Minimum 4 points on the first plate below main deck. At least one point on every third stiffener shall be taken between each stringer. At least two points on each plate of stringers and girders, and two points on the corresponding flange. Additional points in way of curved part. Two points of each diaphragm plate of stools if fitted.	Figure 7
Transverse bulkheads in ballast tanks	At least four points on plates between stringers/longitudinal girders, or per plate if stringers/girders not fitted. At least two points on each plate of stringers and girders, and two points on the corresponding flange. Additional points in way of curved part. At least one point on two stiffeners between each stringer/longitudinal girder.	Figure 8
Adjacent structural members	On adjacent structural members one point per plate and one point on every third stiffener/longitudinal.	

Note:

* Transverse rings means all transverse material appearing in a cross-section of the ship's hull, in way of a double-bottom floor, vertical web and deck transverse.

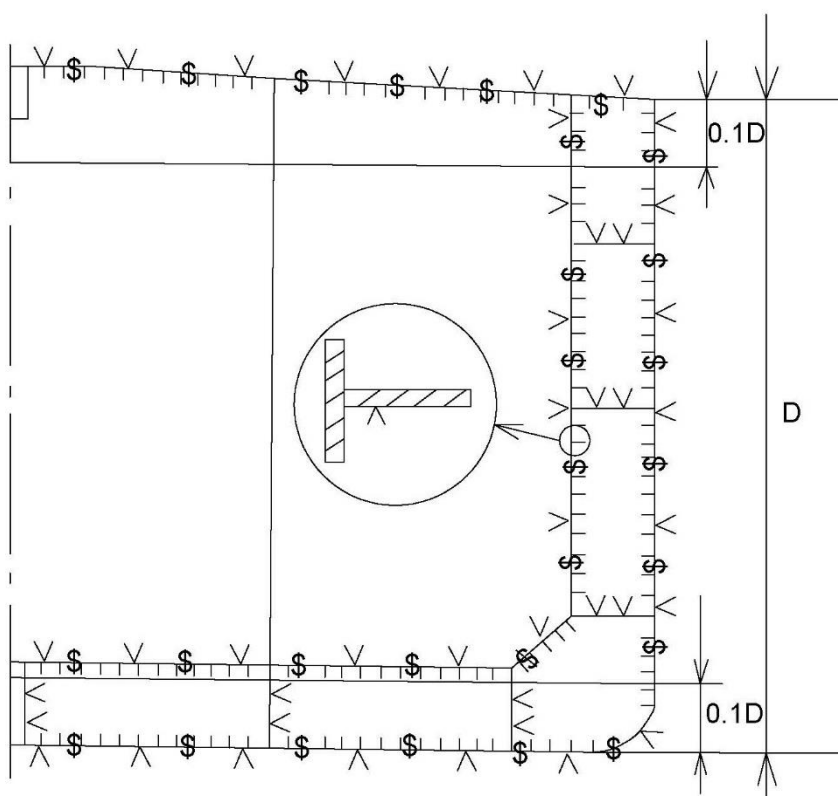


Figure 5: Transverse section

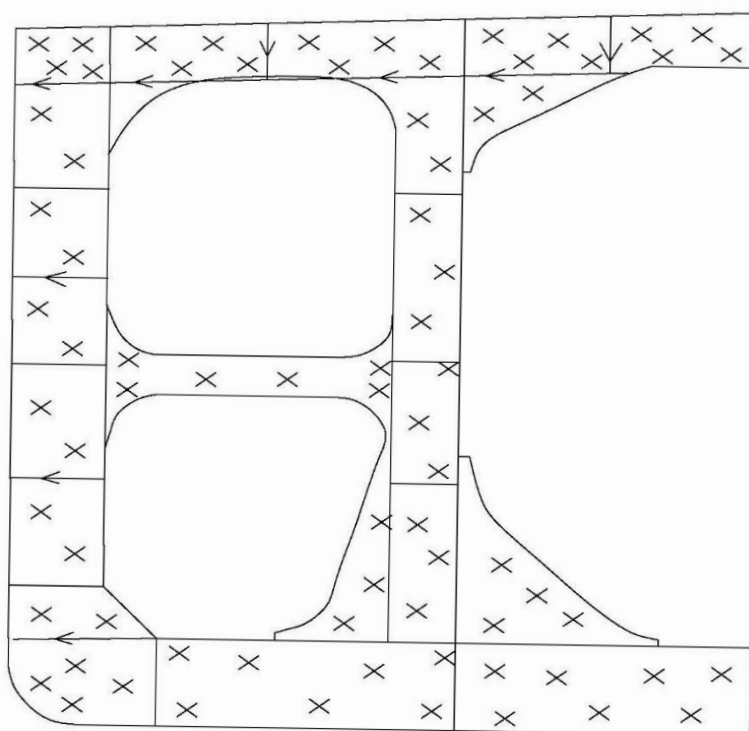


Figure 6: Transverse rings in cargo and ballast tanks

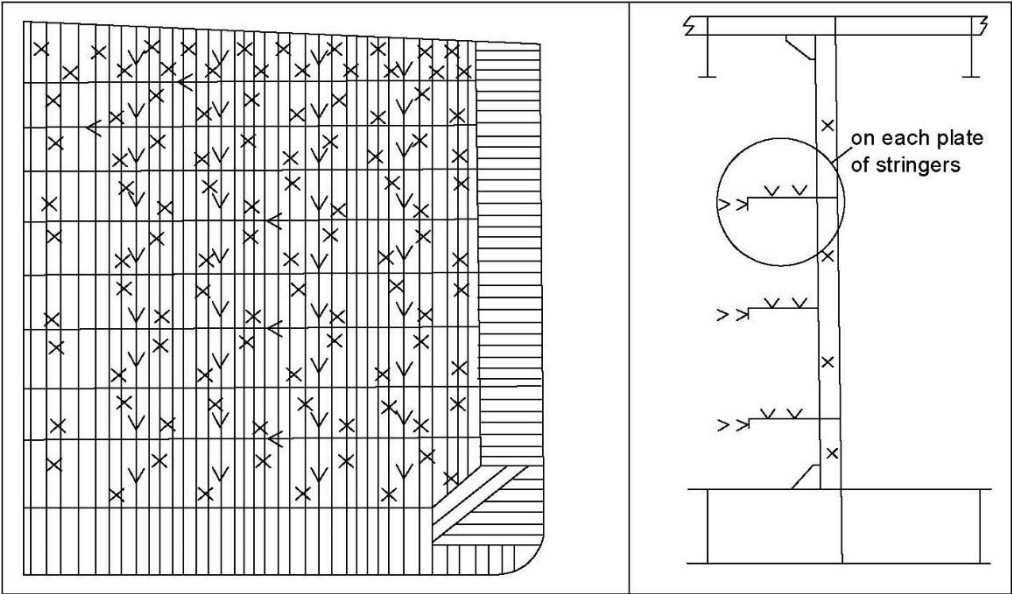


Figure 7: Transverse bulkheads in cargo tanks

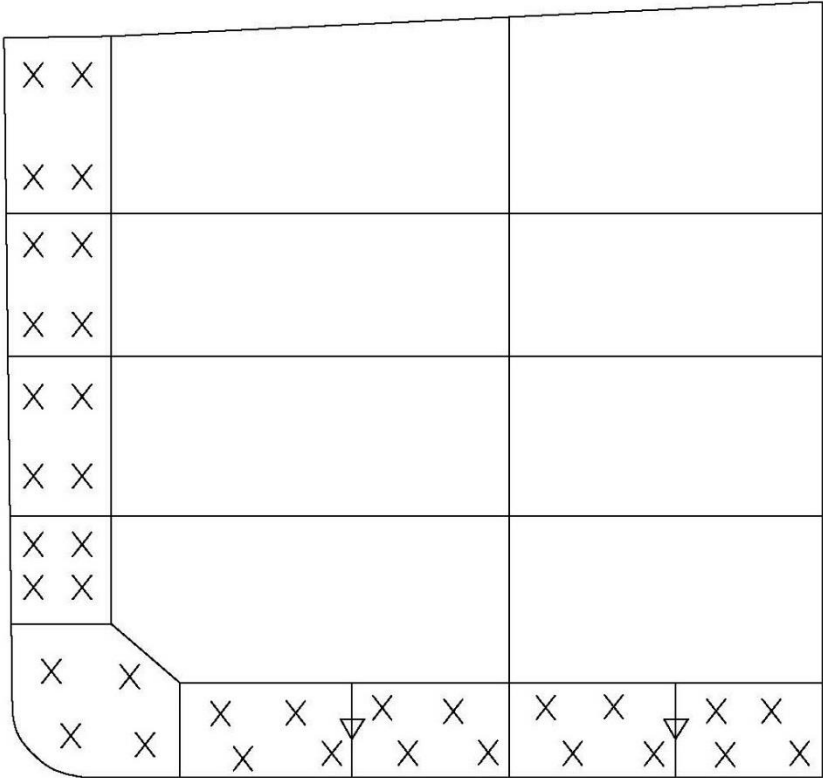


Figure 8: Transverse bulkheads in ballast tanks

7.4 Reporting

7.4.1 A thickness measurement report shall be prepared and submitted to the Administration. The report shall give the location of measurements, the thickness measured as well as the corresponding original thickness. Furthermore, the report shall give the date when the measurements were carried out, type of measuring equipment, names of personnel and their qualifications and be signed by the operator. The thickness measurement report should follow the principles as specified in the recommended procedures for thickness measurements set out in annex 11A/annex 11B.

7.4.2 The surveyor shall review the final thickness measurement report and countersign the cover page.

8 Acceptance criteria

8.1 General

8.1.1 For ships built under the IACS Common Structural Rules, the acceptance criteria shall be according to IACS Common Structural Rules*, as applicable, and as specified in sections 8.2, 8.3 and 8.4.

8.1.2 For ships not built under the IACS Common Structural Rules, the acceptance criteria shall be according to the requirements of the classification society depending on the ship's age and structural elements concerned.

8.2 Acceptance criteria for pitting corrosion for ships built under the IACS Common Structural Rules

8.2.1 For plates with a pitting intensity less than 20%, see figure 1, the measured thickness, t_m , of any individual measurement shall meet the lesser of the following criteria:

$$t_m \geq 0.7 (t_{as-built} - t_{vol\ add}) \text{ (mm); and}$$

$$t_m \geq t_{ren} - 1 \text{ (mm),}$$

where:

$t_{as-built}$ as-built thickness of the member, in mm;

$t_{vol\ add}$ voluntary thickness addition; thickness, in mm, voluntarily added as the owner's extra margin for corrosion wastage in addition to t_c ; and

t_{ren} renewal criteria for general corrosion as defined in IACS CSR,¹ as applicable.

8.2.2 The average thickness across any cross section of the plating shall not be less than the renewal criteria for general corrosion given in the IACS Common Structural Rules,⁺ as applicable.

* Section 12 of IACS CSR for Oil Tankers or Chapter 13 of Part 1 of IACS CSR BC&OT

¹ Section 12 of IACS CSR for Oil Tankers or Chapter 13 of Part 1 of IACS CSR BC&OT

⁺ Refer to paragraph 1.4.2.1 of Section 12 of IACS CSR for Oil Tankers or Section 2 of Chapter 13 of Part 1 of IACS CSR BC&OT

8.3 Acceptance criteria for edge corrosion for ships built under the IACS Common Structural Rules

8.3.1 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%, see figure 2, of the stiffener flange breadth or web height, as applicable, the measured thickness, t_m , shall meet the lesser of the following criteria:

$$t_m \geq 0.7 (t_{as-built} - t_{vol\ add}) \text{ (mm); and}$$

$$t_m \geq t_{ren} - 1 \text{ (mm),}$$

where:

$t_{as-built}$ as-built thickness of the member, in mm;

$t_{vol\ add}$ voluntary thickness addition; thickness, in mm, voluntarily added as the owner's extra margin for corrosion wastage in addition to t_c ; and

t_{ren} renewal criteria for general corrosion as defined in IACS CSR,⁺ as applicable.

8.3.2 The average measured thickness across the breadth or height of the stiffener shall not be less than that defined in the IACS Common Structural Rules,⁺ as applicable.

8.3.3 Plate edges at openings for manholes, lightening holes, etc. may be below the minimum thickness given in the IACS Common Structural Rules,⁺ as applicable, provided that:

.1 the maximum extent of the reduced plate thickness, from the opening edge, below the minimum, shall not be more than 20% of the smallest dimension of the opening and shall not exceed 100 mm; and

.2 rough or uneven edges may be cropped-back provided that the maximum dimension of the opening shall not be increased by more than 10% and the remaining thickness of the new edge shall not be less than $t_{ren} - 1$ mm.

8.4 Acceptance criteria for grooving corrosion for ships built under the IACS Common Structural Rules

8.4.1 Where the groove breadth is a maximum of 15% of the web height, but not more than 30 mm, see figure 3, the measured thickness, t_m , in the grooved area shall meet the lesser of the following criteria:

$$t_m \geq 0.75 (t_{as-built} - t_{vol\ add}) \text{ (mm);}$$

$$t_m \geq t_{ren} - 0.5 \text{ (mm); and}$$

$$t_m \geq 6 \text{ mm,}$$

⁺ Refer to paragraph 1.4.2 of Section 12 of IACS CSRs for Oil Tankers or Section 2 of Chapter 13, Part 1 of IACS CSR BC&OT.

where:

$t_{\text{as-built}}$	as-built thickness of the member, in mm;
$t_{\text{vol add}}$	voluntary thickness addition; thickness, in mm, voluntarily added as the owner's extra margin for corrosion wastage in addition to t_c ; and
t_{ren}	renewal criteria for general corrosion as defined in IACS CSR,** as applicable.

8.4.2 Structural members with areas of grooving greater than those in 8.4.1 above shall be assessed based on the criteria for general corrosion as defined in the IACS Common Structural Rules** as applicable, using the average measured thickness across the plating/stiffener.

9 Reporting and evaluation of survey

9.1 Evaluation of survey report

9.1.1 The data and information on the structural condition of the ship collected during the survey shall be evaluated for acceptability and continued structural integrity of the ship.

9.1.2 In case of oil tankers of 130 m in length and upwards (as defined in the International Convention on Load Lines in force), the ship's longitudinal strength shall be evaluated by using the thickness of structural members measured, renewed and reinforced, as appropriate, during the renewal survey of safety construction carried out after the ship reached 10 years of age, in accordance with the criteria for longitudinal strength of the ship's hull girder for oil tankers specified in annex 13.

9.1.3 The analysis of data shall be carried out and endorsed by the Administration and the conclusions of the analysis shall form a part of the condition evaluation report (executive hull summary report).

9.1.4 The final result of the evaluation of the ship's longitudinal strength required in 9.1.2, after renewal or reinforcement work of structural members, if carried out as a result of initial evaluation, shall be reported as a part of the condition evaluation report (executive hull summary report).

9.2 Reporting

9.2.1 Principles for survey reporting are shown in annex 9.

9.2.2 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items examined and/or tested (pressure testing, thickness measurements, etc.) and an indication of whether the item has been credited, shall be made available to the next attending surveyor(s), prior to continuing or completing the survey.

9.2.3 A condition evaluation report (executive hull summary report) of the survey and results shall be issued to the owner as shown in annex 10 and placed on board the ship for reference at future surveys. The condition evaluation report (executive hull summary report) shall be endorsed by the Administration.

** Refer to paragraph 1.4.2.1 of Section 12 of IACS CSR for Oil Tankers or Section 2 of Chapter 13 of Part 1 of IACS CSR BC&OT.

ANNEX 1

MINIMUM REQUIREMENTS FOR CLOSE-UP SURVEY AT RENEWAL SURVEY OF DOUBLE-HULL OIL TANKERS

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3	Renewal Survey No.4 and subsequent
<p>(A) One web frame, in a complete ballast tank (see Note 1)</p> <p>(B) One deck transverse, in a cargo oil tank</p> <p>(D) One transverse bulkhead, in a complete ballast tank (see Note 1)</p> <p>(E) One transverse bulkhead in a cargo oil centre tank</p> <p>(E) One transverse bulkhead, in a cargo oil wing tank (see Note 2)</p>	<p>(A) All web frames, in a complete ballast tank (see Note 1)</p> <p>(F) The knuckle area and the upper part (5 m approximately) of one web frame in each remaining ballast tank</p> <p>(B) One deck transverse, in two cargo oil tanks</p> <p>(D) One transverse bulkhead, in each complete ballast tank (see Note 1)</p> <p>(E) One transverse bulkhead, in two cargo oil centre tanks</p> <p>(E) One transverse bulkhead, in a cargo oil wing tank (see Note 2)</p>	<p>(A) All web frames, in all ballast tanks</p> <p>(G) All web frames, including deck transverse and cross ties, if fitted, in a cargo oil tank</p> <p>(G) One web frame, including deck transverse and cross ties, if fitted, in each remaining cargo oil tank</p> <p>(C) and (D) All transverse bulkheads, in all cargo oil and ballast tanks</p>	<p>As for renewal survey No.3</p> <p>Additional transverse areas as deemed necessary by the Administration</p>

Notes:

(A), (B), (C), (D), (E), (F) and (G) are areas which shall be subjected to close-up surveys and thickness measurements (see appendix 3 of annex 11A/annex 11B).

- (A) Web frame in a ballast tank means vertical web in side tank, hopper web in hopper tank, floor in double-bottom tank and deck transverse in double-deck tank (where fitted), including adjacent structural members. In fore and aft peak tanks web frame means a complete transverse web frame ring including adjacent structural members.
- (B) Deck transverse, including adjacent deck structural members (or external structure on deck in way of the tank, where applicable).
- (C) Transverse bulkhead complete in cargo tanks, including girder system, adjacent structural members (such as longitudinal bulkheads) and internal structure of lower and upper stools, where fitted.
- (D) Transverse bulkhead complete in ballast tanks, including girder system and adjacent structural members, such as longitudinal bulkheads, girders in double-bottom tanks, inner bottom plating, hopper side, connecting brackets.
- (E) Transverse bulkhead lower part in cargo tank, including girder system, adjacent structural members (such as longitudinal bulkheads) and internal structure of lower stool, where fitted.
- (F) The knuckle area and the upper part (5 m approximately), including adjacent structural members. Knuckle area is the area of the web frame around the connections of the slope 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.
- (G) Web frame in a cargo oil tank means deck transverse, longitudinal bulkhead structural elements and cross ties, where fitted, including adjacent structural members.

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

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

Note 2: Where no centre cargo tanks are fitted (as in the case of centre longitudinal bulkhead), transverse bulkheads in wing tanks shall be surveyed.

ANNEX 2

MINIMUM REQUIREMENTS FOR THICKNESS MEASUREMENTS AT RENEWAL SURVEYS OF DOUBLE-HULL OIL TANKERS

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3	Renewal Survey No.4 and subsequent
<p>1 One section of deck plating for the full beam of the ship within the cargo area</p> <p>2 Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1</p> <p>3 Suspect areas</p>	<p>1 Within the cargo area: .1 each deck plate .2 one transverse section</p> <p>2 Selected wind and water strakes outside the cargo area</p> <p>3 Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1</p> <p>4 Suspect areas</p>	<p>1 Within the cargo area: .1 each deck plate .2 two transverse sections (1) .3 all wind and water strakes</p> <p>2 Selected wind and water strakes outside the cargo area</p> <p>3 Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1</p> <p>4 Suspect areas</p>	<p>1 Within the cargo area: .1 each deck plate .2 three transverse sections (1) .3 each bottom plate</p> <p>2 All wind and water strakes in full length</p> <p>3 Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to annex 1</p> <p>4 Suspect areas</p>
<p>(1): at least one section shall be within 0.5L amidships.</p>			

ANNEX 3

MINIMUM REQUIREMENTS FOR TANK TESTING AT RENEWAL SURVEY OF DOUBLE-HULL OIL TANKERS

Age of ship (in years at time of renewal survey due date)	
Age ≤ 5 years	Age > 5 years
Renewal Survey No.1	Renewal Survey No.2 and subsequent
1 All ballast tank boundaries 2 Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, pump-rooms or cofferdams	1 All ballast tank boundaries 2 All cargo tank bulkheads

ANNEX 4

**REQUIREMENTS FOR EXTENT OF THICKNESS MEASUREMENTS AT AREAS OF
SUBSTANTIAL CORROSION OF DOUBLE-HULL OIL TANKERS WITHIN
THE CARGO AREA LENGTH**

Bottom, inner bottom and hopper structure

Structural member	Extent of measurement	Pattern of measurement
Bottom, inner bottom and hopper structure plating	Minimum of three bays across double-bottom tank, including aft bay Measurements around and under all suction bell mouths	Five-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of three longitudinals in each bay where bottom plating measured	Three measurements in line across flange and three measurements on vertical web
Bottom girders, including the watertight ones	At fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with one measurement between each panel stiffener, or a minimum of three measurements
Bottom floors, including the watertight ones	Three floors in bays where bottom plating measured, with measurements at both ends and middle	Five-point pattern over 2 m ² area
Hopper structure web frame ring	Three floors in bays where bottom plating measured	Five-point pattern over 1 m ² of plating. Single measurements on flange
Hopper structure transverse watertight bulkhead or swash bulkhead	- lower 1/3 of bulkhead	Five-point pattern over 1 m ² of plating
	- upper 2/3 of bulkhead	Five-point pattern over 2 m ² of plating
	- stiffeners (minimum of three)	For web, five-point pattern over span (two measurements across web at each end and one at centre of span). For flange, single measurements at each end and centre of span
Panel stiffening	Where applicable	Single measurements

Deck structure

Structural member	Extent of measurement	Pattern of measurement
Deck plating	Two transverse bands across tank	Minimum of three measurements per plate per band
Deck longitudinals	Every third longitudinal in each of two bands with a minimum of one longitudinal	Three measurements in line vertically on webs and two measurements on flange (if fitted)
Deck girders and brackets (usually in cargo tanks only)	At fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with one measurement between each panel stiffener, or a minimum of three measurements. Two measurements across flange. Five-point pattern on girder/bulkhead brackets
Deck transverse webs	Minimum of two webs, with measurements at both ends and middle of span	Five-point pattern over 1 m ² area. Single measurements on flange
Vertical web and transverse bulkhead in wing ballast tank (2 m from deck)	Minimum of two webs, and both transverse bulkheads	Five-point pattern over 1 m ² area
Panel stiffening	Where applicable	Single measurements

Structure in wing ballast tanks

Structural member	Extent of measurement	Pattern of measurement
Side shell and longitudinal bulkhead plating: - upper strake and strakes in way of horizontal girders - all other strakes	Plating between each pair of longitudinals in a minimum of three bays (along the tank) Plating between every third pair of longitudinals in same three bays	Single measurement Single measurement
Side shell and longitudinal bulkhead longitudinals on: - upper strake - all other strakes	Each longitudinal in same three bays Every third longitudinal in same three bays	Three measurements across web and one measurement on flange Three measurements across web and one measurement on flange
Longitudinals brackets	Minimum of three at top, middle and bottom of tank in same three bays	Five-point pattern over area of bracket
Vertical web and transverse bulkheads (excluding deckhead area): - strakes in way of horizontal girders - other strakes	Minimum of two webs and both transverse bulkheads Minimum of two webs and both transverse bulkheads	Five-point pattern over approximately 2 m ² area Two measurements between each pair of vertical stiffeners
Horizontal girders	Plating on each girder in a minimum of three bays	Two measurements between each pair of longitudinal girder stiffeners
Panel stiffening	Where applicable	Single measurements

Longitudinal bulkheads in cargo tanks

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

Transverse watertight and swash bulkheads in cargo tanks

Structural member	Extent of measurement	Pattern of measurement
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	Five-point pattern between stiffeners over 1 m length
Deckhead and bottom strakes, and strakes in way of horizontal stringers	Plating between pair of stiffeners at three locations: approximately $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ width of tank	Five-point pattern between stiffeners over 1 m length
All other strakes	Plating between pair of stiffeners at middle location	Single measurement
Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange of fabricated connection	Five-point pattern over approximately 1 m ² of plating
Stiffeners	Minimum of three typical stiffeners	For web, five-point pattern over span between bracket connections (two measurements across web at each bracket connection and one at centre of span) For flange, single measurements at each bracket toe and at centre of span
Brackets	Minimum of three at top, middle and bottom of tank	Five-point pattern over area of bracket
Horizontal stringers	All stringers with measurements at both ends and middle	Five-point pattern over 1 m ² area, plus single measurements near bracket toes and on flanges

ANNEX 5

**MINIMUM REQUIREMENTS FOR OVERALL AND CLOSE-UP SURVEY
AND THICKNESS MEASUREMENTS AT INTERMEDIATE SURVEY
OF DOUBLE-HULL OIL TANKERS**

Age of ship at time of intermediate survey due date		
5 < Age ≤ 10	10 < Age ≤ 15	Age > 15
Overall survey of representative ballast tanks selected by the attending surveyor (see paragraph 4.2.1)	The requirements of the previous renewal survey (see section 4.3)	The requirements of the previous renewal survey (see section 4.4)
Suspect areas identified at previous surveys shall be examined (see paragraph 4.2.2)		

ANNEX 6

OWNER'S INSPECTION REPORT

Structural condition

Ship's name:
IMO number:
Port of registry:
Owner:

TANK/HOLD	Grade of steel	Cracks	Corrosion	Buckles	Coating condition	Pitting	Modification/repair	Other
TANK/HOLD No.....								
Deck								
Bottom								
Side								
Side framing								
Longitudinal bulkheads								
Transverse bulkheads								
Repairs carried out due to:								
Thickness measurements carried out (dates):								
Results in general:								
Overdue surveys:								
Outstanding conditions of class:								
Comments:								

Inspected by			
	<i>Name</i>	<i>Date of inspection</i>	<i>Signature</i>

ANNEX 7A

SURVEY PROGRAMME

Basic information and particulars

Ship's name:
IMO number:
Flag State:
Port of registry:
Gross tonnage:
Deadweight (metric tonnes):
Length between perpendiculars (m):
Shipbuilder:
Hull number:
Recognized organization (RO):
RO ship identity:
Date of build of the ship:
Owner:
Thickness measurement firm:

1 Preamble

1.1 Scope

1.1.1 The present survey programme covers the minimum extent of overall surveys, close-up surveys, thickness measurements and pressure testing within the cargo area, cargo tanks, ballast tanks, including fore and aft peak tanks, required by the Code.

1.1.2 The arrangements and safety aspects of the survey shall be acceptable to the attending surveyor(s).

1.2 Documentation

All documents used in the development of the survey programme shall be available on board during the survey as required by section 6.

2 Arrangement of tanks and spaces

This section of the survey programme shall provide information (either in the form of plans or text) on the arrangement of tanks and spaces that fall within the scope of the survey.

3 List of tanks and spaces with information on their use, extent of coatings and corrosion prevention system

This section of the survey programme shall indicate any changes relating to (and update) the information on the use of the tanks of the ship, the extent of coatings and the corrosion protective system provided in the survey planning questionnaire.

4 Conditions for survey

This section of the survey programme shall provide information on the conditions for survey, e.g. information regarding cargo hold and tank cleaning, gas freeing, ventilation, lighting, etc.

5 Provisions and method of access to structures

This section of the survey programme shall indicate any changes relating to (and shall update) the information on the provisions and methods of access to structures provided in the survey planning questionnaire.

6 List of equipment for survey

This section of the survey programme shall identify and list the equipment that will be made available for carrying out the survey and the required thickness measurements.

7 Survey requirements

7.1 Overall survey

This section of the survey programme shall identify and list the spaces that shall undergo an overall survey for the ship in accordance with 2.4.1.

7.2 Close-up survey

This section of the survey programme shall identify and list the hull structures that shall undergo a close-up survey for the ship in accordance with 2.4.2.

8 Identification of tanks for tank testing

This section of the survey programme shall identify and list the tanks that shall undergo tank testing for the ship in accordance with 2.6.

9 Identification of areas and sections for thickness measurements

This section of the survey programme shall identify and list the areas and sections where thickness measurements shall be taken in accordance with 2.5.1.

10 Minimum thickness of hull structures

This section of the survey programme shall specify the minimum thickness for hull structures of the ship that are subject to the Code (indicate either (a) or preferably (b) if such information is available):

- (a) Determined from the attached wastage allowance table and the original thickness on the hull structure plans of the ship;
- (b) Given in the following table(s):

Area or location	Original as-built thickness (mm)	Minimum thickness (mm)	Substantial corrosion thickness (mm)
Deck			
Plating			
Longitudinals			
Longitudinal girders			
Bottom			
Plating			
Longitudinals			
Longitudinal girders			
Ship side			
Plating			
Longitudinals			
Longitudinal girders			
Longitudinal bulkhead			
Plating			
Longitudinals			
Longitudinal girders			
Inner bottom			
Plating			
Longitudinals			
Longitudinal girders			
Transverse bulkheads			
Plating			
Stiffeners			
Transverse web frames, floors and stringers			
Plating			
Flanges			
Stiffeners			
Cross ties			
Flanges			
Webs			

Note: The wastage allowance tables shall be attached to the survey programme. For ships built under the IACS Common Structural Rules, the renewal thickness of the hull structure elements is indicated in the appropriate drawings.

11 Thickness measurement firm

This section of the survey programme shall identify changes, if any, relating to the information on the thickness measurement firm provided in the survey planning questionnaire.

12 Damage experience related to the ship

This section of the survey programme shall provide details of the hull damages for at least the last three years in way of the cargo and ballast tanks and void spaces within the cargo area, using the tables provided below. These damages shall be subject to survey.

Hull damages sorted by location for this ship

Tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

**Hull damages for sister or similar ships
(if available) in the case of design-related damage**

Tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

13 Areas identified with substantial corrosion from previous surveys

This section of the survey programme shall identify and list the areas of substantial corrosion from previous surveys.

14 Critical structural areas and suspect areas

This section of the survey programme identify and list the critical structural areas and the suspect areas, if such information is available.

15 Other relevant comments and information

This section of the survey programme shall provide any other comments and information relevant to the survey.

APPENDICES

Appendix 1 – List of plans

The provisions of 5.1.3.2 require that main structural plans of cargo and ballast tanks (scantling drawings), including information regarding use of high tensile steel (HTS), shall be available. This appendix of the survey programme shall identify and list the main structural plans which form part of the survey programme.

Appendix 2 – Survey planning questionnaire

The survey planning questionnaire (annex 7B), which has been submitted by the owner, shall be appended to the survey programme.

Appendix 3 – Other documentation

This part of the survey programme shall identify and list any other documentation that forms part of the plan.

Prepared by the owner in cooperation with the Administration for compliance with 5.1.3.

Date:

(name and signature of authorized owner's representative)

Date:

(name and signature of authorized representative of the Administration)

ANNEX 7B

SURVEY PLANNING QUESTIONNAIRE

The following information will enable the owner in cooperation with the Administration to develop a survey programme complying with the requirements of the Code. It is essential that the owner provides, when completing the present questionnaire, up-to-date information. The present questionnaire, when completed, will provide all the information and material required by the resolution.

1 Particulars

Ship's name:

IMO number:

Flag State:

Port of registry:

Owner:

Recognized organization (RO):

Gross tonnage:

Deadweight (metric tonnes):

Date of build:

2 Information on access provision for close-up surveys and thickness measurement

The owner shall indicate, in the table below, the means of access to the structures subject to close-up survey and thickness measurement. A close-up survey is an examination where the details of structural components are within the close visual inspection range of the attending surveyor, i.e. normally within reach of hand.

Tank No.	Structure	C (Cargo)/ B (Ballast)	Permanent means of access	Temporary staging	Rafts	Ladders	Direct access	Other means (please specify)
F.P.	Fore peak							
A.P.	Aft peak							
Wing tanks	Underdeck							
	Side shell							
	Bottom transverse							
	Longitudinal							
	Transverse							
Centre tanks	Under deck							
	Bottom transverse							
	Transverse							

History of cargo with H₂S content or heated cargo for the last three years together with indication as to whether cargo was heated and, where available, Material Safety Data Sheets (MSDS)*

3 Owner's inspections

Using a format similar to that of the table below (which is given as an example), the owner shall provide details of the results of their inspections for the last three years on all cargo and ballast tanks and void spaces within the cargo area, including peak tanks.

Tank No.	Corrosion protection (1)	Coating extent (2)	Coating condition (3)	Structural deterioration (4)	Tank damage history (5)
Cargo centre tanks					
Cargo wing tanks					
Slop					
Ballast tanks					
Aft peak					
Fore peak					
Miscellaneous spaces					

Note:

Indicate tanks which are used for oil/ballast.

- 1) HC = hard coating; SC = soft coating;
SH = semi-hard coating;
NP = no protection
- 2) U = upper part; M = middle part;
L = lower part; C = complete
- 3) G = good; F = fair; P = poor;
RC = recoated (during the last three years)
- 4) N = no findings recorded; Y = findings recorded,
description of findings shall be attached to this questionnaire
- 5) DR = Damage & Repair; L = Leakages;
CV = Conversion (description shall be attached to this questionnaire)

Name of owner's representative:
Signature:
Date:

* Refer to resolution MSC.150(77) on Recommendation for material safety data sheets for MARPOL Annex I cargoes and marine fuel oils.

Reports of port State control inspections

List the reports of port State control inspections containing hull structural related deficiencies and relevant information on rectification of the deficiencies:

Safety management system

List non-conformities related to hull maintenance, including the associated corrective actions:

Name and address of the approved thickness measurement firm

ANNEX 8

PROCEDURES FOR APPROVAL AND CERTIFICATION OF A FIRM ENGAGED IN THICKNESS MEASUREMENT OF HULL STRUCTURES

1 Application

This guidance applies for certification of the firm which intends to engage in the thickness measurement of hull structures of ships.

2 Procedures for approval and certification

Submission of documents

2.1 The following documents shall be submitted to an organization recognized by the Administration for approval:

- .1 outline of the firm, e.g. organization and management structure;
- .2 experience of the firm in thickness measurement of hull structures of ships;
- .3 technicians' careers, i.e. experience of technicians as thickness measurement operators, technical knowledge and experience of hull structure, etc. Operators shall be qualified according to a recognized industrial non-destructive test (NDT) standard;
- .4 equipment used for thickness measurement such as ultrasonic testing machines and their maintenance/calibration procedures;
- .5 a guide for thickness measurement operators;
- .6 training programmes for technicians for thickness measurement; and
- .7 measurement record format taking into account the recommended procedures for thickness measurements (see annex 11A/annex 11B).

Auditing of the firm

2.2 Upon reviewing of the documents submitted with satisfactory results, the firm shall be audited in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted and is capable of conducting thickness measurement of the hull structure of ships.

2.3 Certification shall be conditional upon an on board demonstration of thickness measurement as well as satisfactory reporting.

3 Certification

3.1 Upon satisfactory results of both the audit of the firm referred to in 2.2 and the demonstration tests referred to in 2.3, the Administration shall issue a certificate of approval as well as a notice to the effect that the thickness measurement operation system of the firm has been certified.

3.2 Renewal/endorsement of the certificate shall be carried out at intervals not exceeding three years by verification that original conditions are maintained.

4 Information about any alteration to the certified thickness measurement operation system

In case any alteration to the certified thickness measurement operation system of the firm is made, such alteration shall be immediately informed to the Administration. A re-audit shall be carried out where deemed necessary by the Administration.

5 Cancellation of approval

Approval may be cancelled and the certification withdrawn in the following cases:

- .1 where the measurements were improperly carried out or the results were improperly reported;
- .2 where the surveyor found any deficiencies in the approved thickness measurement operation system of the firm; and
- .3 where the firm failed to inform any alteration referred to in 4 to the Administration as required.

ANNEX 9

SURVEY REPORTING PRINCIPLES

As a principle, for oil tankers subject to this Code, the surveyor(s) shall include the following contents in the report for survey of hull structure and piping systems, as relevant for the survey. The structure of the report content may be different, depending on the reporting system of the Administration.

1 General

1.1 A survey report shall be generated in the following cases:

- .1 in connection with commencement, continuation and/or completion of periodical hull surveys, i.e. annual, intermediate and renewal surveys, as relevant;
- .2 when structural damages/defects have been found;
- .3 when repairs, renewals or modifications have been carried out; and
- .4 when a condition of class (recommendation) has been imposed or has been deleted.

1.2 The reporting shall provide:

- .1 evidence that prescribed surveys have been carried out in accordance with applicable requirements;
- .2 documentation of surveys carried out with findings, repairs carried out and condition of class (recommendation) imposed or deleted;
- .3 survey records, including actions taken, which shall form an auditable documentary trail. Survey reports shall be kept in the survey report file required to be on board;
- .4 information for planning of future surveys; and
- .5 information which may be used as input for maintenance of classification requirements and instructions.

1.3 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items surveyed, relevant findings and an indication of whether the item has been credited, shall be made available to the next attending surveyor, prior to continuing or completing the survey. Thickness measurement and tank testing carried out shall also be listed for the next surveyor.

2 Extent of the survey

2.1 Identification of compartments where an overall survey has been carried out.

2.2 Identification of locations, in each tank, where a close-up survey has been carried out, together with information of the means of access used.

2.3 Identification of locations, in each tank, where thickness measurement has been carried out.

Note: As a minimum, the identification of location of close-up survey and thickness measurement shall include a confirmation with description of individual structural members corresponding to the extent of requirements stipulated in this part of annex B based on type of periodical survey and the ship's age.

Where only a partial survey is required, i.e. one web frame ring/one deck transverse, the identification shall include the location within each ballast tank and cargo tank by reference to frame numbers.

2.4 For areas in tanks where the protective coating is found to be in GOOD condition and the extent of close-up survey and/or thickness measurement has been specially considered, structures subject to special consideration shall be identified.

2.5 Identification of tanks subject to tank testing.

2.6 Identification of cargo piping systems on deck, including crude oil washing (COW) piping, and ballast piping within cargo and ballast tanks, pump-rooms, pipe tunnels, cofferdams and void spaces where:

- .1 examination including internal examination of piping with valves and fittings and thickness measurement, as relevant, has been carried out; and
- .2 operational test to working pressure has been carried out.

3 Result of survey

3.1 Type, extent and condition of protective coating in each tank, as relevant (rated GOOD, FAIR or POOR).

3.2 Structural condition of each compartment with information on the following, as relevant:

- .1 Identification of findings, such as:
 - .1 corrosion with description of location, type and extent;
 - .2 areas with substantial corrosion;
 - .3 cracks/fractures with description of location and extent;
 - .4 buckling with description of location and extent; and
 - .5 indents with description of location and extent;
- .2 Identification of compartments where no structural damage/defects are found. The report may be supplemented by sketches/photographs;
- .3 Thickness measurement report shall be verified and signed by the surveyor witnessing the measurements on board; and

- .4 Evaluation result of longitudinal strength of the hull girder of oil tankers of 130 m in length and upwards and over 10 years of age. The following data shall be included, as relevant:
 - .1 measured and as-built transverse sectional areas of deck and bottom flanges;
 - .2 diminution of transverse sectional areas of deck and bottom flanges; and
 - .3 details of renewals or reinforcements carried out, as relevant (see 4.2).

4 Actions taken with respect to findings

4.1 Whenever the attending surveyor is of the opinion that repairs are required, each item to be repaired shall be identified in a survey report. Whenever repairs are carried out, details of the repairs effected shall be reported by making specific reference to relevant items in the survey report.

4.2 Repairs carried out shall be reported with identification of:

- .1 compartment;
- .2 structural member;
- .3 repair method (i.e. renewal or modification), including:
 - .1 steel grades and scantlings (if different from the original); and
 - .2 sketches/photographs, as appropriate;
- .4 repair extent; and
- .5 non-destructive tests (NDT)/tests.

4.3 For repairs not completed at the time of survey, a condition of class/recommendation shall be imposed with a specific time limit for the repairs. In order to provide correct and proper information to the surveyor attending for survey of the repairs, the condition of class/recommendation shall be sufficiently detailed with identification of each item to be repaired. For identification of extensive repairs, reference may be given to the survey report.

ANNEX 10

CONDITION EVALUATION REPORT (EXECUTIVE HULL SUMMARY REPORT)

Issued upon completion of renewal survey

General particulars

Ship's name: Administration/recognized organization identity number:
 IMO number:
 Port of registry: National flag:
 Deadweight (metric tonnes): Gross tonnage:
 National:
 ITC (1969):
 Date of build: Classification notation:
 Date of major conversion:
 Type of conversion:

- 1 The survey reports and documents listed below have been reviewed by the undersigned and found to be satisfactory.
- 2 A summary of the survey is attached herewith on sheet 2.
- 3 The renewal survey has been completed in accordance with the present Code on (date)

Condition evaluation report (executive hull summary report) completed by	Name Signature	Title
Office	Date	
Condition evaluation report (executive hull summary report) verified by	Name Signature	Title
Office	Date	

Attached reports and documents:

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Contents of condition evaluation report (executive hull summary report)

- | | | |
|---------|--|--|
| Part 1 | – General particulars: | - See front page |
| Part 2 | – Report review: | - Where and how survey was done |
| Part 3 | – Close-up survey: | - Extent (which tanks) |
| Part 4 | – Cargo and ballast piping system: | - Examined
- Operationally tested |
| Part 5 | – Thickness measurements: | - Reference to thickness measurement report
- Summary of where measured
- Separate form indicating the spaces/areas with substantial corrosion, and corresponding: <ul style="list-style-type: none"> - thickness diminution - corrosion pattern |
| Part 6 | – Tank corrosion prevention system: | - Separate form indicating: <ul style="list-style-type: none"> - location of coating - condition of coating (if applicable) |
| Part 7 | – Repairs: | - Identification of tanks/areas |
| Part 8 | – Condition of class (recommendations)/flag State requirements: | |
| Part 9 | – Memoranda: | - Acceptable defects
- Any points of attention for future surveys, e.g. for suspect areas
- Extended annual/intermediate survey due to coating breakdown |
| Part 10 | – Evaluation results of the ship's longitudinal strength (for oil tankers of 130 m in length and upwards and over 10 years of age) | |
| Part 11 | – Conclusion: | - Statement on evaluation/verification of survey report |

Extract of thickness measurements for ships not built under the IACS Common Structural Rules

Reference is made to the thickness measurement report:

Position of substantially corroded tanks/areas ¹ or areas with deep pitting ³	Thickness diminution [%]	Corrosion pattern ²	Remarks: (e.g. reference to attached sketches)

Notes:

- 1 Substantial corrosion, i.e. 75 to 100% of acceptable margins wasted.
- 2 P = Pitting
C = Corrosion in general
- 3 Any bottom plating with a pitting intensity of 20% or more, with wastage in the substantial corrosion range or having an average depth of pitting of 1/3 or more of actual plate thickness shall be noted.

Extract of thickness measurements for ships built under the IACS Common Structural Rules

Reference is made to the thickness measurements report:

Position of substantially corroded tanks/areas ¹ or areas with deep pitting	$t_m - t_{ren}$ (mm)	Corrosion pattern ²	Remarks (e.g. reference to attached sketches)

Notes:

- 1 Substantial corrosion, an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{ren} + 0.5$ mm and t_{ren} .
- 2 P = Pitting
C = Corrosion in general
Areas with deep pitting assessed according to section 8.2 shall be recorded in this column.

Tank corrosion prevention system

Tank Nos. ¹	Tank corrosion prevention system ²	Coating condition ³	Remarks

Notes:

- 1 All segregated ballast tanks and combined cargo/ballast tanks shall be listed.
- 2 C = Coating
NP = No protection
- 3 Coating condition according to the following standard:

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.

If coating condition less than GOOD is given, extended annual surveys shall be introduced. This shall be noted in part 9 of the Contents of the condition evaluation report (executive hull summary report).

Evaluation result of longitudinal strength of the hull girder of oil tankers of 130 m in length and upwards and of over 10 years of age (of sections 1, 2 and 3 below, only one applicable section shall be completed)

1 This section applies to ships regardless of the date of construction: Transverse sectional areas of deck flange (deck plating and deck longitudinals) and bottom flange (bottom shell plating and bottom longitudinals) of the ship's hull girder have been calculated by using the thickness measured, renewed or reinforced, as appropriate, during the renewal survey of the Cargo Ship Safety Construction Certificate or the Cargo Ship Safety Certificate (SC renewal survey) most recently conducted after the ship reached 10 years of age, and found that the diminution of the transverse sectional area does not exceed 10% of the as-built area, as shown in the following table:

Table 1 – Transverse sectional area of hull girder flange

		Measured	As-built	Diminution
Transverse section 1	Deck flange	cm ²	cm ²	cm ² (%)
	Bottom flange	cm ²	cm ²	cm ² (%)
Transverse section 2	Deck flange	cm ²	cm ²	cm ² (%)
	Bottom flange	cm ²	cm ²	cm ² (%)
Transverse section 3	Deck flange	cm ²	cm ²	cm ² (%)
	Bottom flange	cm ²	cm ²	cm ² (%)

2 This section applies to ships constructed on or after 1 July 2002: Section moduli of transverse section of the ship's hull girder have been calculated by using the thickness of structural members measured, renewed or reinforced, as appropriate, during the SC renewal survey most recently conducted after the ship reached 10 years of age in accordance with the provisions of paragraph 2.2.1.1 of annex 13, and are found to be within their diminution limits determined by the Administration, taking into account the recommended diminution limit adopted by IMO resolution MSC.108(73): 90% of the required section modulus for new buildings specified in IACS' Unified Requirements S7 ($C=1.0C_n$ is to be used for the purpose of this calculation) or S11, whichever is the greater, as shown in the following table:

Table 2 – Transverse section modulus of hull girder

		Z _{act} (cm ³) ¹	Z _{req} (cm ³) ²	Remarks
Transverse section 1	Upper deck			
	Bottom			
Transverse section 2	Upper deck			
	Bottom			
Transverse section 3	Upper deck			
	Bottom			

Notes:

¹ Z_{act} means the actual section moduli of the transverse section of the ship's hull girder calculated by using the thickness of structural members measured, renewed or reinforced, as appropriate, during the SC renewal survey, in accordance with the provisions of paragraph 2.2.1.1 of annex 13.

² Z_{req} means the diminution limit of the longitudinal bending strength of ships, as calculated in accordance with the provisions of paragraph 2.2.1.1 of annex 13.

The calculation sheets for Z_{act} shall be attached to this report.

3 This section applies to ships constructed before 1 July 2002: Section moduli of transverse sections of the ship's hull girder have been calculated by using the thickness of structural members measured, renewed or reinforced, as appropriate, during the SC renewal survey most recently conducted after the ship reached 10 years of age in accordance with the provisions of paragraph 2.2.1.2 of annex 13, and found to meet the criteria required by the Administration and that Z_{act} is not less than Z_{mc} (defined in note 2 below) as specified in appendix 2 to annex 13, as shown in the following table.

Describe the criteria for acceptance of the minimum section moduli of the ship's hull girder for ships in service required by the Administration.

Table 3 – Transverse section modulus of hull girder

		$Z_{act} (cm^3)^1$	$Z_{mc} (cm^3)^2$	Remarks
Transverse section 1	Upper deck			
	Bottom			
Transverse section 2	Upper deck			
	Bottom			
Transverse section 3	Upper deck			
	Bottom			

Notes:

- 1 As defined in note 1 of table 2.
- 2 Z_{mc} means the diminution limit of minimum section modulus calculated in accordance with the provisions of paragraph 2.2.1.2 of annex 13.

ANNEX 11A

**RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS OF
DOUBLE-HULL OIL TANKERS NOT BUILT UNDER THE IACS COMMON STRUCTURAL
RULES***

General

- 1 These procedures should be used for recording thickness measurements as required by annexes 2 and 4.
- 2 Reporting forms TM1-DHT, TM2-DHT(i), TM2-DHT(ii), TM3-DHT, TM4-DHT, TM5-DHT and TM6-DHT, set out in appendix 2, should be used for recording thickness measurements and the maximum allowable diminution should be stated. The maximum allowable diminution could be stated in an attached document.
- 3 Appendix 3 contains guidance diagrams and notes relating to the reporting forms and the requirements for thickness measurement.
- 4 The reporting forms should, where appropriate, be supplemented by data presented on structural sketches.

* This annex is recommendatory.

Appendix 1

GENERAL PARTICULARS

Ship's name:
IMO number:
Class/Administration identity number:
Port of registry:
Gross tonnage:
Deadweight:
Date of build:
Classification society:

Name of firm performing thickness measurement:
Thickness measurement firm certified by:
Certificate number:
Certificate valid from: to
Place of measurement:
First date of measurement:
Last date of measurement:
Renewal survey/intermediate survey* due:
Details of measurement equipment:
Qualification of operator:

Report number: consisting of pages
Name of operator: Name of surveyor:
Signature of operator: Signature of surveyor:
Firm official stamp: Administration:

Official stamp

* Delete as appropriate.

Appendix 2

REPORTS ON THICKNESS MEASUREMENT

TM1-DHT

Report on thickness measurement of all deck plating, all bottom shell plating or side shell plating*

Ship's name..... IMO number..... Class identity No..... Report No.....

STRAKE POSITION		No. or letter	Org. thk. mm	Forward reading						Aft reading						Mean diminution mm		Maximum allowable diminution mm
PLATE POSITION	Gauged			Diminution P		Diminution S		Gauged		Diminution P		Diminution S		P	S			
	P			S	mm	%	mm	%	P	S	mm	%	mm			%		
12th forward																		
11th																		
10th																		
9th																		
8th																		
7th																		
6th																		
5th																		
4th																		
3rd																		
2nd																		
1st																		
Amidships																		
1st aft																		
2nd																		
3rd																		
4th																		
5th																		
6th																		
7th																		
8th																		
9th																		
10th																		
11th																		
12th																		

Operator's signature.....

Notes – see following page

* Delete as appropriate.

Notes to the report TM1-DHT:

- 1 This report should be used for recording the thickness measurement of:
 - .1 All strength deck plating within the cargo area.
 - .2 All keel, bottom shell plating and bilge plating within the cargo area.
 - .3 Side shell plating including selected wind and water strakes outside cargo area.
 - .4 All wind and water strakes within cargo area.
- 2 The strake position should be clearly indicated as follows:
 - .1 For strength deck indicate the number of the strake of plating inboard from the stringer plate.
 - .2 For bottom plating indicate the number of the strake of plating outboard from the keel plate.
 - .3 For side shell plating give number of the strake of plating below sheer strake and letter as shown on shell expansion.
- 3 Measurements should be taken at the forward and aft areas of all plates and where plates cross ballast/cargo tank boundaries, separate measurements for the area of plating in way of each type of tank should be recorded.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The maximum allowable diminution could be stated in an attached document.

TM2-DHT(i)

Report on thickness measurement of shell and deck plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

STRENGTH DECK AND SHEER STRAKE PLATING																											
FIRST TRANSVERSE SECTION AT FRAME NUMBER....						SECOND TRANSVERSE SECTION AT FRAME NUMBER....								THIRD TRANSVERSE SECTION AT FRAME NUMBER....													
STRAKE POSITION	No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%
Stringer plate																											
1st strake inboard																											
2nd																											
3rd																											
4th																											
5th																											
6th																											
7th																											
8th																											
9th																											
10th																											
11th																											
12th																											
13th																											
14th																											
centre strake																											
Sheer strake																											
TOPSIDE TOTAL																											

Operator's signature.....

Notes – see following page

Notes to the report TM2-DHT(i):

- 1 This report form should be used for recording the thickness measurements of strength deck plating and sheer strake plating transverse sections:

One, two or three sections within the cargo area comprising of the structural items (0), (1) and (2) as shown on the diagrams of typical transverse sections (appendix 3).
- 2 The topside area comprises deck plating, stringer plate and sheer strake (including rounded gunwales).
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The maximum allowable diminution could be stated in an attached document.

TM2-DHT(ii)

Report on thickness measurement of shell and deck plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

SHELL PLATING																											
FIRST TRANSVERSE SECTION AT FRAME NUMBER....						SECOND TRANSVERSE SECTION AT FRAME NUMBER....								THIRD TRANSVERSE SECTION AT FRAME NUMBER....													
STRAKE POSITION	No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%
1st below sheer strake																											
2nd																											
3rd																											
4th																											
5th																											
6th																											
7th																											
8th																											
9th																											
10th																											
11th																											
12th																											
13th																											
14th																											
15th																											
16th																											
17th																											
18th																											
19th																											
20th																											
keel strake																											
BOTTOM TOTAL																											

Operator's signature.....

Notes – see following page

Notes to the report TM2-DHT(ii):

- 1 This report should be used for recording the thickness measurements of shell plating transverse sections:

One, two or three sections within the cargo area comprising of the structural items (3), (4) and (5) and (6) as shown on the diagrams of typical transverse sections (appendix 3).
- 2 The bottom area comprises keel, bottom and bilge plating.
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The maximum allowable diminution could be stated in an attached document.

TM3-DHT

Report on thickness measurement of longitudinal members (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER	FIRST TRANSVERSE SECTION AT FRAME NUMBER....							SECOND TRANSVERSE SECTION AT FRAME NUMBER....							THIRD TRANSVERSE SECTION AT FRAME NUMBER....														
	Item no.	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		Item no.	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		Item no.	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S			
		mm	mm	P	S	mm	%	mm	%		mm	mm	mm	P	S	mm	%	mm		%	mm	mm	mm	P	S	mm	%	mm	%

Operator's signature.....

Notes – see following page

Notes to the report TM3-DHT:

- 1 This report should be used for recording the thickness measurements of longitudinal members at transverse sections:

One, two or three sections within the cargo area comprising of the appropriate structural items (10) to (29) as shown on the diagrams of typical transverse sections (appendix 3).
- 2 The exact frame station of measurement should be stated.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM4-DHT

**Report on thickness measurement of transverse structural members
(in the cargo oil and water ballast tanks within the cargo tank length)**

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK DESCRIPTION:									
LOCATION OF STRUCTURE:									
STRUCTURAL MEMBER	ITEM	Original thickness mm	Max. allow. dimin. mm	Gauged		Diminution P		Diminution S	
				P	S	mm	%	mm	%

Operator's signature.....

Notes – see following page

Notes to the report TM4-DHT:

- 1 This report should be used for recording the thickness measurements of transverse structural members, comprising of the appropriate structural items (30) to (36) as shown on diagrams of typical transverse sections (appendix 3).
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

**Report on thickness measurement of watertight/oiltight transverse bulkheads
 (within the cargo tank or cargo hold spaces)**

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK/HOLD description									
LOCATION OF STRUCTURE:								FRAME NO:	
STRUCTURAL COMPONENT (Plating, Stiffener)	Original thickness	Max. allow. dimin.	Gauged		Diminution P		Diminution S		
			mm	mm	P	S	mm	%	mm

Operator's signature.....

Notes – see following page

Notes to the report TM5-DHT:

- 1 This report should be used for recording the thickness measurement of W.T./O.T. transverse bulkheads.
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM6-DHT

Report on thickness measurement of miscellaneous structural members

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER: LOCATION OF STRUCTURE:							SKETCH	
Description	Org. thk.	Max. allow. dimin.	Gauged		Diminution P		Diminution S	
	mm	mm	P	S	mm	%	mm	%

Operator's signature.....

Notes – see following page

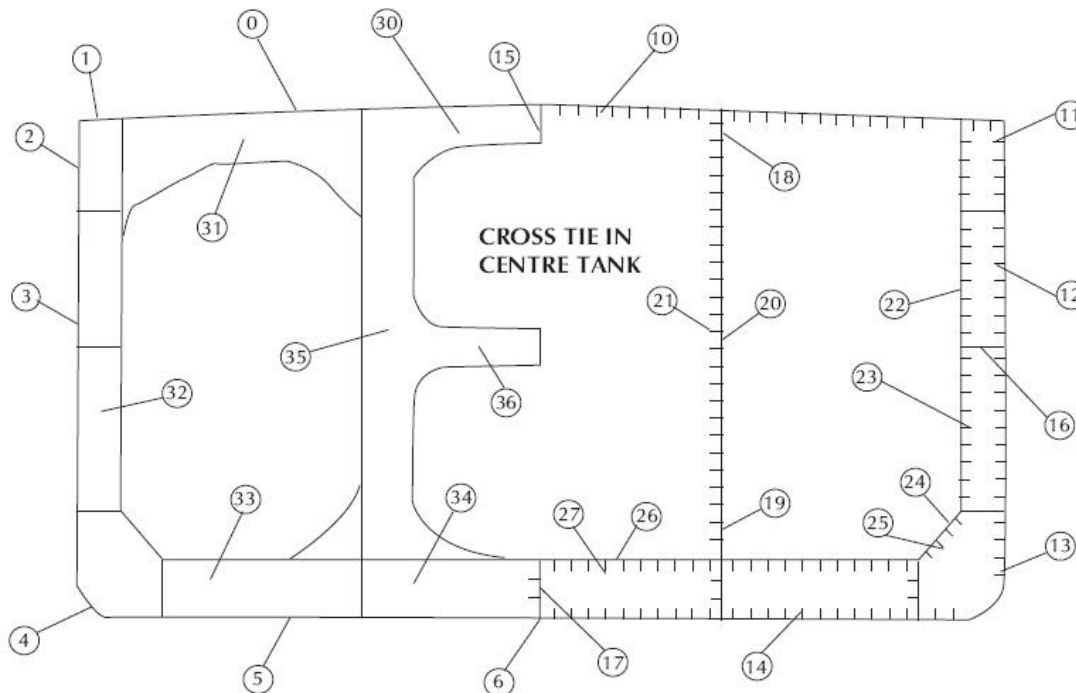
Notes to the report TM6-DHT:

- 1 This report should be used for recording the thickness measurement of miscellaneous structural members.
- 2 The single measurements recorded should represent the average of multiple measurements.
- 3 The maximum allowable diminution could be stated in an attached document.

Appendix 3

GUIDANCE ON THICKNESS MEASUREMENT – DOUBLE-HULL OIL TANKERS NOT BUILT UNDER THE IACS COMMON STRUCTURAL RULES

Typical transverse section of a double-hull oil tanker above 150,000 dwt with indication of longitudinal and transverse members.

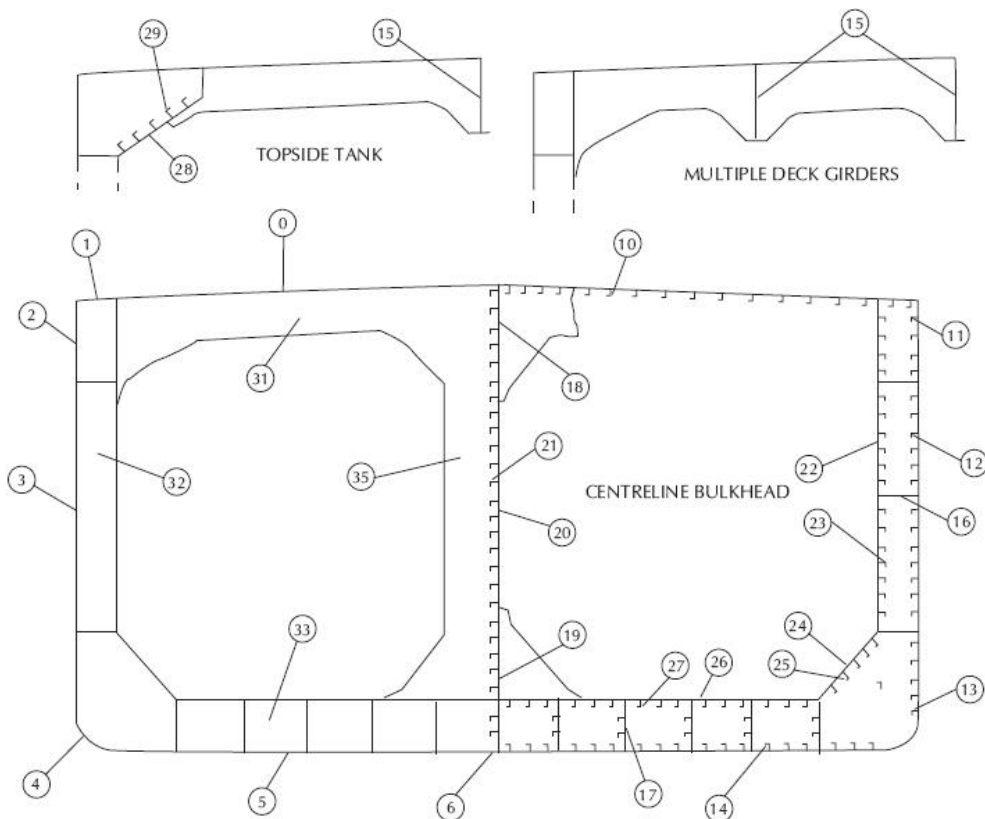


REPORT ON TM2-DHT(i) and (ii)	
0	Strength deck plating
1	Stringer plate
2	Sheerstrake
3	Side shell plating
4	Bilge plating
5	Bottom shell plating
6	Keel plate

REPORT ON TM3-DHT			
10	Deck longitudinals	20	Longitudinal bulkhead plating (remainder)
11	Sheerstrake longitudinals	21	Longitudinal bulkhead longitudinals
12	Side shell longitudinals	22	Inner side plating
13	Bilge longitudinals	23	Inner side longitudinals
14	Bottom longitudinals	24	Hopper plating
15	Deck girders	25	Hopper longitudinals
16	Horizontal girders in wing ballast tanks	26	Inner bottom plating
17	Bottom girders	27	Inner bottom longitudinals
18	Longitudinal bulkhead top strake	28	Topside tank plating
19	Longitudinal bulkhead bottom strake	29	Topside tank longitudinals

REPORT ON TM4-DHT	
30	Deck transverse – centre tank
31	Deck transverse – wing tank
32	Vertical web in wing ballast tank
33	Double bottom floor – wing tank
34	Double bottom floor – centre tank
35	Longitudinal bulkhead vertical web
36	Cross ties

Typical transverse section of a double-hull oil tanker up to 150,000 dwt with indication of longitudinal and transverse members.



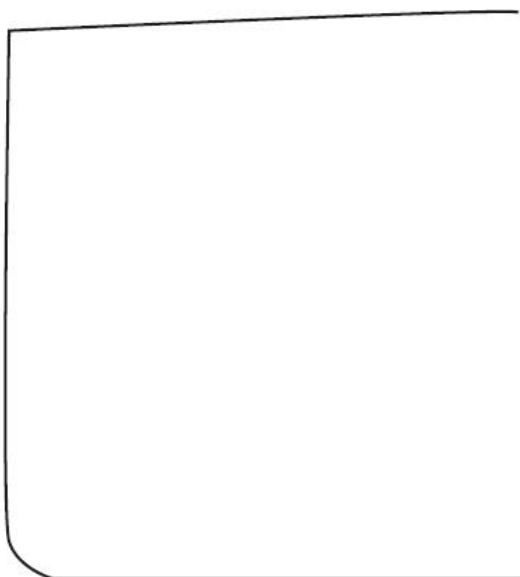
REPORT ON TM2-DHT(i) and (ii)	
0	Strength deck plating
1	Stringer plate
2	Sheerstrake
3	Side shell plating
4	Bilge plating
5	Bottom shell plating
6	Keel plate

REPORT ON TM3-DHT			
10	Deck longitudinals	20	Longitudinal bulkhead plating (remainder)
11	Sheerstrake longitudinals	21	Longitudinal bulkhead longitudinals
12	Side shell longitudinals	22	Inner side plating
13	Bilge longitudinals	23	Inner side longitudinals
14	Bottom longitudinals	24	Hopper plating
15	Deck girders	25	Hopper longitudinals
16	Horizontal girders in wing ballast tanks	26	Inner bottom plating
17	Bottom girders	27	Inner bottom longitudinals
18	Longitudinal bulkhead top strake	28	Topside tank plating
19	Longitudinal bulkhead bottom strake	29	Topside tank longitudinals

REPORT ON TM4-DHT	
30	Deck transverse – centre tank
31	Deck transverse – wing tank
32	Vertical web in wing ballast tank
33	Double bottom floor – wing tank
34	Double bottom floor – centre tank
35	Longitudinal bulkhead vertical web
36	Cross ties

Transverse section outline

The diagram may be used for those ships where typical sections are not applicable.



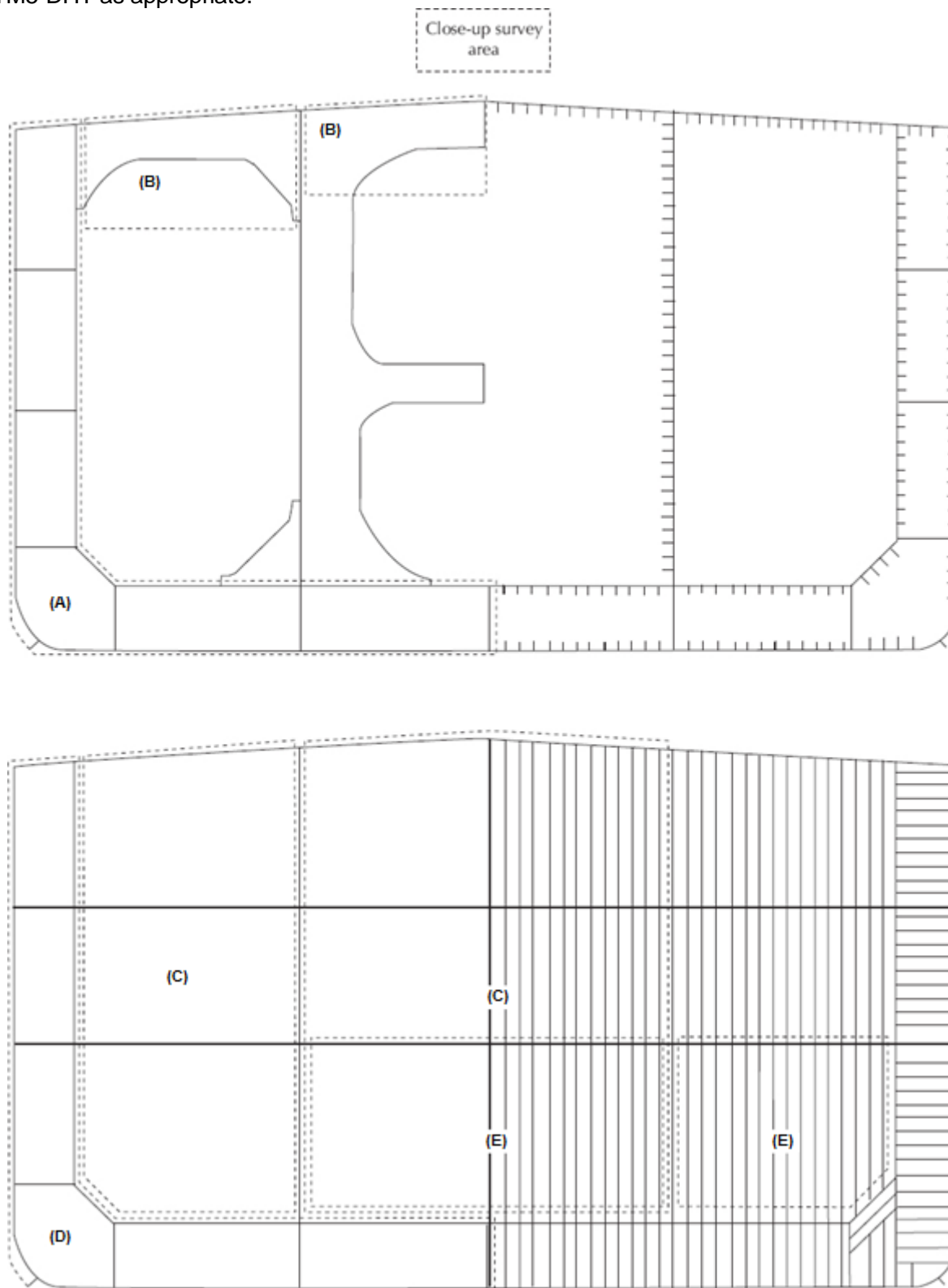
REPORT ON TM2-DHT(i) and (ii)	
①	Strength deck plating
②	Stringer plate
③	Sheerstrake
④	Side shell plating
⑤	Bilge plating
⑥	Bottom shell plating
⑦	Keel plate

REPORT ON TM3-DHT			
⑧	Deck longitudinals	⑩	Longitudinal bulkhead plating (remainder)
⑨	Sheerstrake longitudinals	⑪	Longitudinal bulkhead longitudinals
⑫	Side shell longitudinals	⑫	Inner side plating
⑬	Bilge longitudinals	⑬	Inner side longitudinals
⑭	Bottom longitudinals	⑭	Hopper plating
⑮	Deck girders	⑮	Hopper longitudinals
⑯	Horizontal girders in wing ballast tanks	⑯	Inner bottom plating
⑰	Bottom girders	⑰	Inner bottom longitudinals
⑱	Longitudinal bulkhead top strake	⑱	Topside tank plating
⑲	Longitudinal bulkhead bottom strake	⑲	Topside tank longitudinals

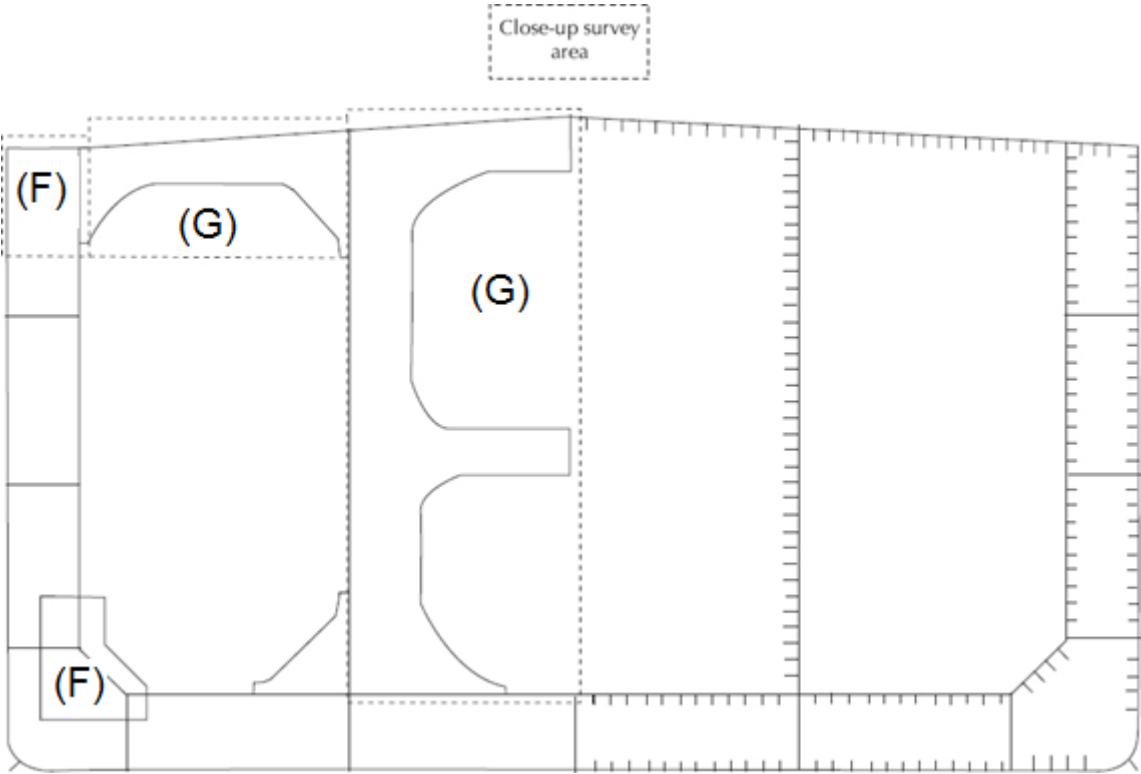
REPORT ON TM4-DHT	
⑳	Deck transverse – centre tank
㉑	Deck transverse – wing tank
㉒	Vertical web in wing ballast tank
㉓	Double bottom floor – wing tank
㉔	Double bottom floor – centre tank
㉕	Longitudinal bulkhead vertical web
㉖	Cross ties

Close-up survey and thickness measurements areas

Areas subject to close-up survey and thickness measurements – areas (A) to (E) as defined in annex 1. The thickness measurements should be reported on TM3-DHT, TM4-DHT and TM5-DHT as appropriate.



Areas subject to close-up survey and thickness measurements – areas (F) to (G) as defined in annex 1. The thickness measurements should be reported on TM3-DHT and TM4-DHT as appropriate.



ANNEX 11B

**RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS
OF DOUBLE-HULL OIL TANKERS BUILT UNDER THE IACS COMMON STRUCTURAL
RULES***

General

1 These procedures should be used for recording thickness measurements of ships built under the IACS Common Structural Rules.

2 Reporting forms TM1-DHT(CSR), TM2-DHT(CSR)(i), TM2-DHT(CSR)(ii), TM3-DHT(CSR), TM4-DHT(CSR), TM5-DHT(CSR) and TM6-DHT(CSR) (see appendix 2) should be used for recording thickness measurements. The as-built thickness and the voluntary thickness addition and renewal thickness (minimum allowable thickness) should be stated in the aforementioned forms.

3 Appendix 3 contains guidance diagrams and notes clarifying the areas for thickness measurement and the respective reporting forms.

4 The reporting forms should, where appropriate, be supplemented by data presented on structural sketches.

* This annex is recommendatory.

Appendix 1

GENERAL PARTICULARS

Ship's name:
IMO number:
Class/Administration identity number:
Port of registry:
Gross tons:
Deadweight:
Date of build:
Classification society:

Name of the firm performing thickness measurement:
Thickness measurement firm certified by:
Certificate No:
Certificate valid from.....to.....
Place of measurement:
First date of measurement:
Last date of measurement:
Renewal survey/intermediate* survey due:
Details of measurement equipment:
Qualification of operators:

Report number:	consisting of.....pages
Name of operator:	Name of surveyor:
Signature of operator:	Signature of surveyor:
Firm official stamp:	Administration:

Official Stamp

* Delete as appropriate.

Appendix 2

REPORTS ON THICKNESS MEASUREMENT

TM1-DHT(CSR)

Report on thickness measurement of all deck plating, all bottom plating or side shell plating*

Ship's name..... IMO number..... Class identity No..... Report No.....

STRAKE POSITION																			
	PLATE POSITION	No. or letter	As-built thk. mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Forward reading				Aft reading				Mean remaining corr. addition, mm					
						Gauged thk. mm (b1)		Remaining corr. addition, mm (c1)=(b1)-(a)		Gauged thk. mm (b2)		Remaining corr. addition, mm (c2)=(b2)-(a)							
						P	S	P	S	P	S	P	S	P	S				
12th forward																			
11th																			
10th																			
9th																			
8th																			
7th																			
6th																			
5th																			
4th																			
3rd																			
2nd																			
1st																			
Amidships																			
1st aft																			
2nd																			
3rd																			
4th																			
5th																			
6th																			
7th																			
8th																			
9th																			
10th																			
11th																			
12th																			

Operator's signature.....

Notes – see following page

* Delete as appropriate.

Notes to report TM1-DHT(CSR)

- 1 This report should be used for recording the thickness measurement of:
 - .1 all strength deck plating within cargo length area;
 - .2 all keel, bottom shell plating and bilge plating within the cargo length area;
 - .3 side shell plating including selected wind and water strakes outside the cargo length area; and
 - .4 all wind and water strakes within the cargo length area.
- 2 The strake position should be clearly indicated as follows:
 - .1 for strength deck indicate the number of the strake of plating inboard from the stringer plate;
 - .2 for bottom plating indicate the number of the strake of plating outboard from the keel plate; and
 - .3 for side shell plating give number of the strake of plating sheer strake and letter as shown on shell expansion.
- 3 Measurements should be taken at the forward and aft areas of all plates cross ballast/cargo tank boundaries and where plates cross ballast/cargo tank boundaries, separate measurements for the area of plating in way of each type of tank should be recorded.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The remaining corrosion addition should be recorded with result of gauged thickness minus renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM2-DHT(CSR)(i)

Report on thickness measurement of shell and deck plating
(one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

STRENGTH DECK AND SHEER STRAKE PLATING																										
	FIRST TRANSVERSE SECTION AT FRAME NUMBER							SECOND TRANSVERSE SECTION AT FRAME NUMBER							THIRD TRANSVERSE SECTION AT FRAME NUMBER											
STRAKE POSITION	No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren.t thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren.t thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren.t thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)			
					P	S	P	S					P	S	P	S					P	S	P	S		
Stringer Plate																										
1st strake inboard																										
2nd																										
3rd																										
4th																										
5th																										
6th																										
7th																										
8th																										
9th																										
10th																										
11th																										
12th																										
13th																										
14th																										
centre strake																										
sheer strake																										
TOPSIDE TOTAL																										

Operator's signature.....

Notes – see following page

Notes to report *TM2-DHT(CSR)(i)*

- 1 This report should be used for recording the thickness measurement of strength deck plating and sheer strake plating transverse sections (one, two or three sections within the cargo length area, comprising of the structural items (0), (1) and (2) as shown on the diagram of typical transverse section (appendix 3)).
- 2 The topside area comprises deck plating, stringer plate and sheer strake (including rounded gunwales).
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The remaining corrosion addition should be recorded with result of gauged thickness minus renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM2-DHT(CSR)(ii)

Report on thickness measurement of shell plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

SHELL PLATING																																									
	FIRST TRANSVERSE SECTION AT FRAME NUMBER							SECOND TRANSVERSE SECTION AT FRAME NUMBER							THIRD TRANSVERSE SECTION AT FRAME NUMBER																										
STRAKE POSITION	No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)		No. or letter	As-built thk. mm	Vol. thk. Add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)																		
					P	S	P	S					P	S	P	S					P	S																			
1 st below sheer strake																																									
2nd																																									
3rd																																									
4th																																									
5th																																									
6th																																									
7th																																									
8th																																									
9th																																									
10th																																									
11th																																									
12th																																									
13th																																									
14th																																									
15th																																									
16th																																									
17th																																									
18th																																									
19th																																									
20th																																									
Keel strake																																									
BOTTOM TOTAL																																									

Operator's signature.....

Notes – see following page

Notes to report TM2-DHT(CSR)(ii)

- 1 This report should be used for recording the thickness measurement of shell plating transverse sections (one, two or three sections within cargo length area comprising of the structural items (3), (4), (5) and (6) as shown on the diagram of typical transverse section (appendix 3)).
- 2 The bottom area comprises keel, bottom and bilge plating.
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM3-DHT(CSR)

Report on thickness measurement of longitudinal members(one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER	FIRST TRANSVERSE SECTION AT FRAME NUMBER						SECOND TRANSVERSE SECTION AT FRAME NUMBER						THIRD TRANSVERSE SECTION AT FRAME NUMBER							
	Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Item No.	As-built thk. mm	Vol. thk. add. mm	Ren. thk. mm (a)	Gauged thk. mm (b)		Remaining corr. addition, mm (b)-(a)	Remaining corr. addition, mm (b)-(a)
					P	S					P	S					P	S		

Operator's signature.....

Notes – see following page

Notes to report TM3-DHT(CSR)

- 1 This report should be used for recording the thickness measurement of longitudinal members at transverse sections (one, two, or three sections within the cargo length area, comprising of the appropriate structural items (10) to (29) as shown on diagram of typical transverse section (appendix 3)).
- 2 The exact frame station of measurement should be stated.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM4-DHT(CSR)

**Report on thickness measurement of transverse structural members
in the cargo oil and water ballast tanks within the cargo tank length**

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK DESCRIPTION:									
LOCATION OF STRUCTURE									
STRUCTURAL MEMBER	ITEM	As-built thickness mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm		Remaining corr. addition mm		
					(b)		(b)-(a)		
					P	S	P	S	

Operator's signature.....

Notes – see following page

Notes to report TM4-DHT(CSR)

- 1 This report should be used for recording the thickness measurement of transverse structural members, comprising of the appropriate structural items (30) to (36) as shown on diagram of typical transverse section (appendix 3).
- 2 Guidance for areas of measurement is indicated on the diagrams shown in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM5-DHT(CSR)

Report on thickness of watertight/oiltight transverse bulkheads within the cargo and ballast tanks

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK DESCRIPTION:									
LOCATION OF STRUCTURE:				FRAME NO.:					
STRUCTURAL COMPONENT (PLATING/STIFFENER)	As-built thickness mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm		Remaining corr. addition mm			
				(b)		(b)-(a)			
				P	S	P	S	P	S

Operator's signature.....

Notes – see following page

Notes to report TM5-DHT(CSR)

- 1 This report form should be used for recording the thickness measurement of watertight/oiltight transverse bulkheads.
- 2 Guidance for areas of measurement is indicated on the diagrams shown in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

TM6-DHT(CSR)

Report on thickness measurement of miscellaneous structural members

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER:						SKETCH							
LOCATION OF STRUCTURE:													
Description	As-built thk. mm	Voluntary thickness addition mm	Renewal thickness mm (a)	Gauged thickness mm						Remaining corr. addition mm			
				(b)						(b)-(a)			
				P	S					P	S	P	S

Operator's signature.....

Notes – see following page

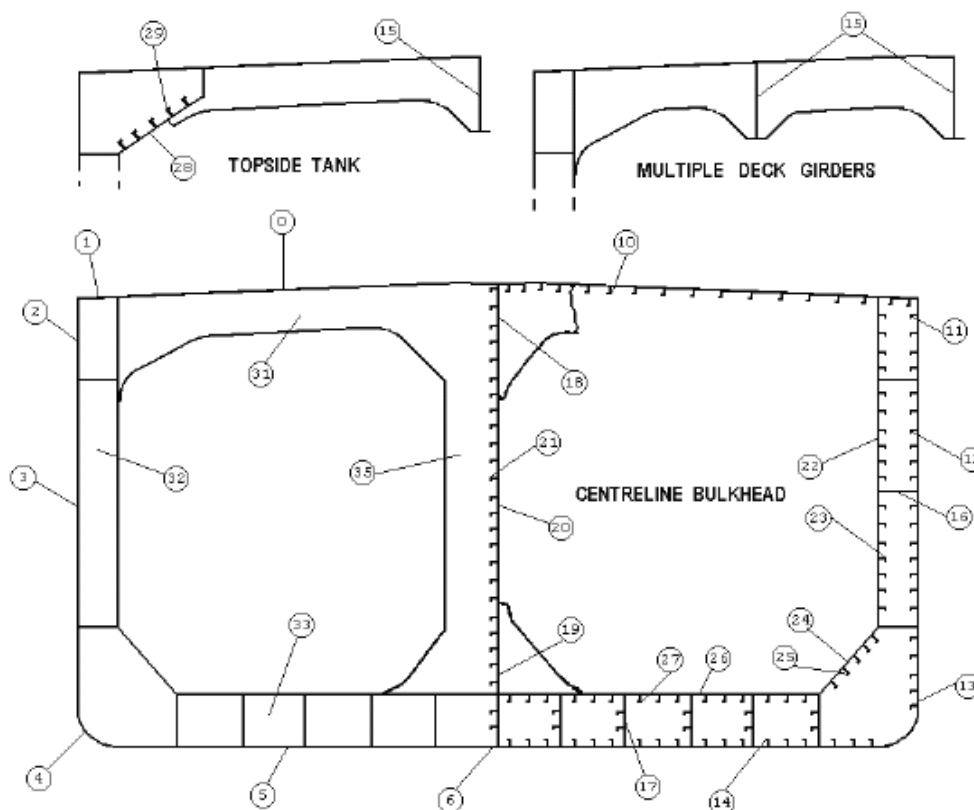
Notes to report TM6-DHT(CSR)

- 1 This report should be used for recording the thickness measurement of miscellaneous structural members.
- 2 The single measurements recorded should represent the average of multiple measurements.
- 3 The remaining corrosion addition should be recorded with the result of the gauged thickness minus the renewal thickness. If the result is negative, the structure in way should be renewed, and the mark "R" should be indicated in the right-hand column. If the result is between 0 and 0.5 mm (0 included), the structure in way should be additionally gauged, and the mark "S" should be indicated in the right-hand column.

Appendix 3

GUIDANCE ON THICKNESS MEASUREMENT – DOUBLE-HULL OIL TANKERS BUILT UNDER IACS CSR

Typical transverse section of a double-hull oil tanker up to 150,000 dwt with indication of longitudinal and transverse members

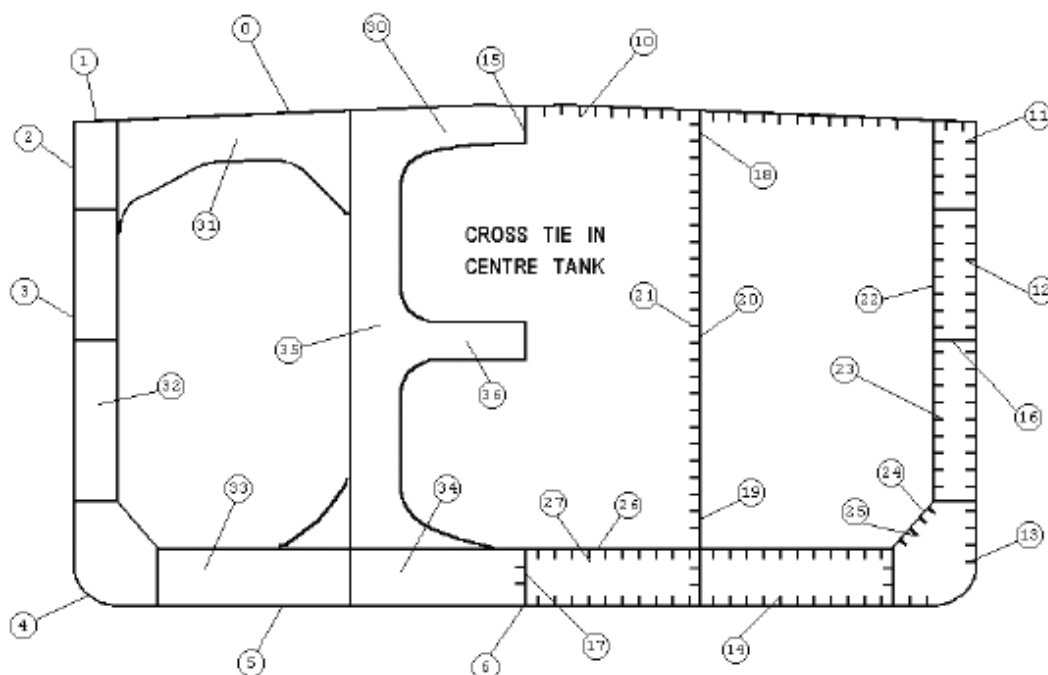


Reports TM2-DHT(CSR)(i) and TM2-DHT(CSR)(ii)	
0	Strength deck plating
1	Stringer plate
2	Sheer strake
3	Side shell plating
4	Bilge plating
5	Bottom shell plating
6	Keel plate

Report TM3-DHT(CSR)			
10	Deck longitudinals	20	Longitudinal bulkhead plating (remainder)
11	Sheer strake longitudinals	21	Longitudinal bulkhead longitudinals
12	Side shell longitudinals	22	Inner side plating
13	Bilge longitudinals	23	Inner side longitudinals
14	Bottom longitudinals	24	Hopper plating
15	Deck girders	25	Hopper longitudinals
16	Horizontal girders in wing ballast tanks	26	Inner bottom plating
17	Bottom girders	27	Inner bottom longitudinals
18	Longitudinal bulkhead top strake	28	Topside tank plating
19	Longitudinal bulkhead bottom strake	29	Topside tank longitudinals

Report TM4-DHT(CSR)	
30	Deck transverse - centre tank
31	Deck transverse - wing tank
32	Vertical web in wing ballast tank
33	Double-bottom floor - wing tank
34	Double-bottom floor - centre tank
35	Longitudinal bulkhead vertical web
36	Cross ties

Typical transverse section of a double-hull oil tanker above 150,000 dwt with indication of longitudinal and transverse members

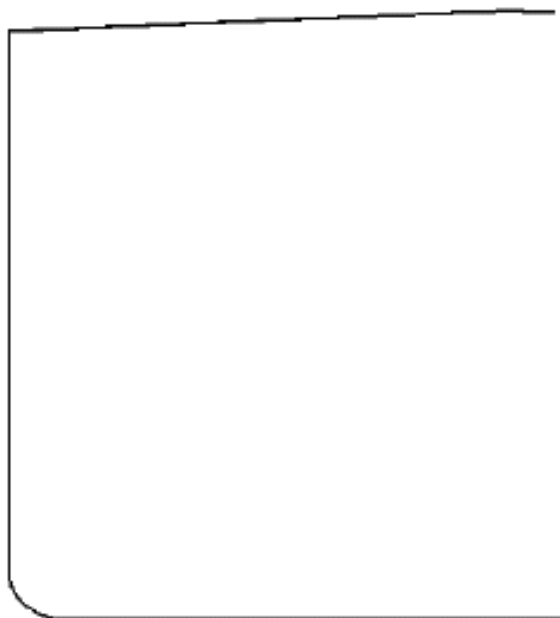


Reports TM2-DHT(CSR)(i) and TM2-DHT(CSR)(ii)		Report TM3-DHT(CSR)	
0	Strength deck plating	10	Deck longitudinals
1	Stringer plate	11	Sheer strake longitudinals
2	Sheer strake	12	Side shell longitudinals
3	Side shell plating	13	Bilge longitudinals
4	Bilge plating	14	Bottom longitudinals
5	Bottom shell plating	15	Deck girders
6	Keel plate	16	Horizontal girders in wing ballast tanks
		17	Bottom girders
		18	Longitudinal bulkhead top strake
		19	Longitudinal bulkhead bottom strake
		20	Longitudinal bulkhead plating (remainder)
		21	Longitudinal bulkhead longitudinals
		22	Inner side plating
		23	Inner side longitudinals
		24	Hopper plating
		25	Hopper longitudinals
		26	Inner bottom plating
		27	Inner bottom longitudinals
		28	Topside tank plating
		29	Topside tank longitudinals

Report TM4-DHT(CSR)	
30	Deck transverse - centre tank
31	Deck transverse - wing tank
32	Vertical web in wing ballast tank
33	Double-bottom floor - wing tank
34	Double-bottom floor - centre tank
35	Longitudinal bulkhead vertical web
36	Cross ties

Transverse section outline

This diagram may be used for those ships where the above diagrams are not suitable.

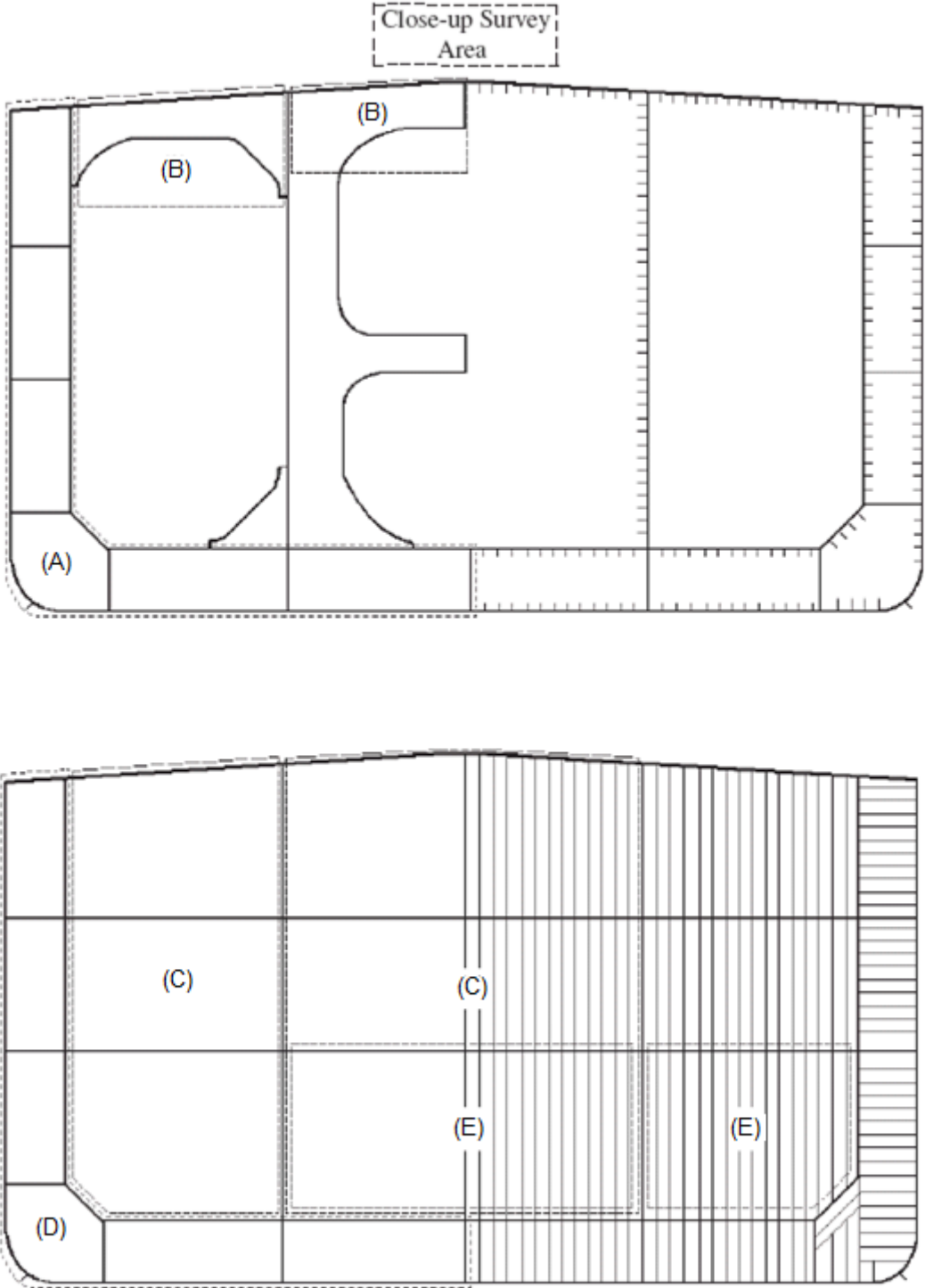


Reports TM2-DHT(CSR)(i) and TM2-DHT(CSR)(ii)		Report TM3-DHT(CSR)	
0	Strength deck plating	10	Deck longitudinals
1	Stringer plate	11	Sheer strake longitudinals
2	Sheerstrake	12	Side shell longitudinals
3	Side shell plating	13	Bilge longitudinals
4	Bilge plating	14	Bottom longitudinals
5	Bottom shell plating	15	Deck girders
6	Keel plate	16	Horizontal girders in wing ballast tanks
		17	Bottom girders
		18	Longitudinal bulkhead top strake
		19	Longitudinal bulkhead bottom strake
		20	Longitudinal bulkhead plating (remainder)
		21	Longitudinal bulkhead longitudinals
		22	Inner side plating
		23	Inner side longitudinals
		24	Hopper plating
		25	Hopper longitudinals
		26	Inner bottom plating
		27	Inner bottom longitudinals
		28	Topside tank plating
		29	Topside tank longitudinals

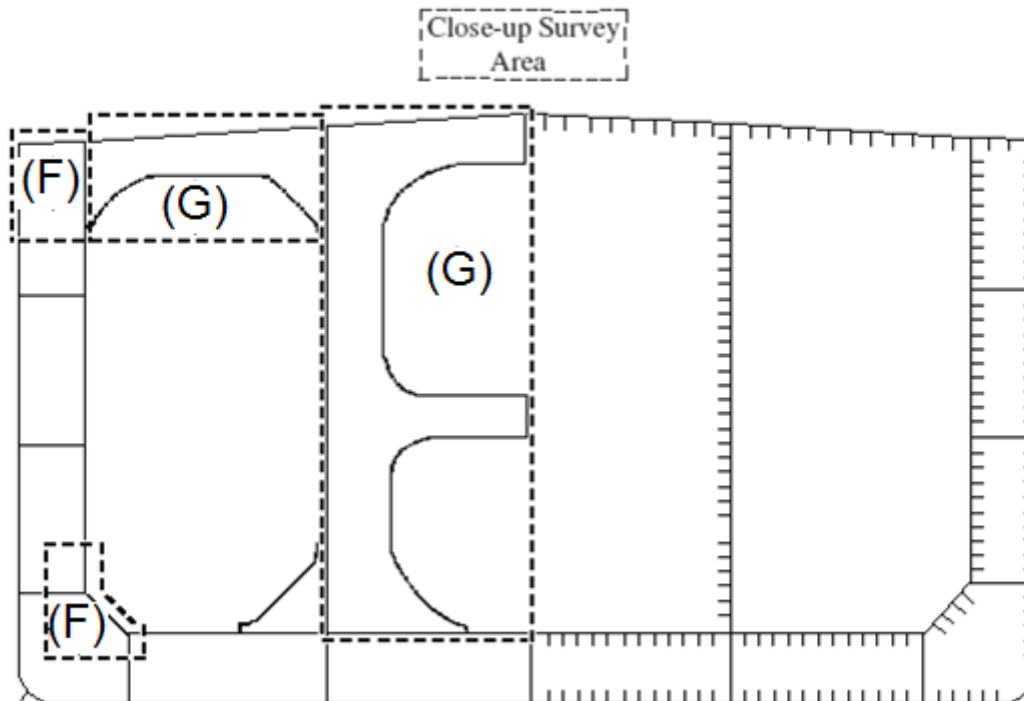
Report TM4-DHT(CSR)	
30	Deck transverse - centre tank
31	Deck transverse - wing tank
32	Vertical web in wing ballast tank
33	Double-bottom floor - wing tank
34	Double-bottom floor - centre tank
35	Longitudinal bulkhead vertical web
36	Cross ties

Close-up survey and thickness measurement areas

Areas subject to close-up survey and thickness measurements - areas (A) to (E) as defined in annex 1. The thickness measurements should be reported in forms TM3-DHT(CSR), TM4-DHT(CSR) and TM5-DHT(CSR), as appropriate.



Areas subject to close-up survey and thickness measurements - areas (F) and (G) as defined in annex 1. The thickness measurements should be reported in forms TM3-DHT(CSR) and TM4-DHT(CSR), as appropriate.



ANNEX 12

GUIDELINES FOR TECHNICAL ASSESSMENT IN CONJUNCTION WITH THE PLANNING OF ENHANCED SURVEYS FOR OIL TANKERS*

Renewal survey

1 Introduction

These Guidelines contain information and suggestions concerning technical assessments which may be of use in conjunction with the planning of enhanced renewal surveys of oil tankers. As indicated in 5.1.5 of the Code, these Guidelines are a recommended tool which may be invoked at the discretion of an Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme.

2 Purpose and principles

2.1 Purpose

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 and tanks for thickness measurement, close-up survey and tank testing.

2.2 Timing

As with other aspects of survey planning, the technical assessments described in these Guidelines should be carried out by the owner or operator in cooperation with the Administration 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.

2.3 Aspects to be considered

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

- .1 design features such as stress levels on various structural elements, design details and extent of use of high-tensile steel (HTS);
- .2 former history with respect to corrosion, cracking, buckling, indents and repairs for the particular ship as well as similar vessels, where available; and
- .3 information with respect to types of cargo carried, use of different tanks for cargo/ballast, protection of tanks and condition of coating, if any.

2.3.2 Technical assessments of the relative risks of susceptibility to damage or deterioration of various structural elements and areas should be judged and decided on the basis of recognized principles and practices, such as may be found in references 1 and 2.

* This annex is recommendatory.

3 Technical assessment

3.1 General

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

3.1.2 Technical assessments performed in conjunction with the survey planning process should, in principle, be as shown schematically in figure 1. The approach is basically an evaluation of the risk, based on the knowledge and experience related to design and corrosion.

3.1.3 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.

3.1.4 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.

3.2 Methods

3.2.1 Design details

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

3.2.1.2 Typical damage experience which should be considered will consist of:

- .1 number, extent, location and frequency of cracks; and
- .2 location of buckles.

3.2.1.3 This information should 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.

3.2.1.4 In addition, general experience should be utilized. For example, reference should be made to reference 1, which contains a catalogue of typical damages and proposed repair methods for various tanker structural details.

3.2.1.5 Such figures should be used together with a review of the main drawings, in order to compare with the actual structure and search for similar details which may be susceptible to damage. An example is shown in figure 2. In particular, chapter 3 of reference 1 deals with various aspects specific to double-hull tankers, such as stress concentration locations, misalignment during construction, corrosion trends, fatigue considerations and areas requiring special attention, which should be considered in working out the survey planning.

3.2.1.6 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. The factors contributing to damage should be carefully considered.

3.2.1.7 The use of 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, is utilized. 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.

3.2.1.8 In this respect, stress calculations of typical and important components and details, in accordance with relevant methods, may prove useful and should be considered.

3.2.1.9 The selected areas of the structure identified during this process should be recorded and marked on the structural drawings which should be included in the survey programme.

3.2.2 *Corrosion*

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

- .1 usage of tanks and spaces;
- .2 condition of coatings;
- .3 cleaning procedures;
- .4 previous corrosion damage;
- .5 ballast use and time for cargo tanks;
- .6 corrosion risk scheme (see reference 2, table 2.1); and
- .7 location of heated tanks.

3.2.2.2 Reference 2 gives definitive examples which may be used for judging and describing coating condition, using typical pictures of conditions.

3.2.2.3 The evaluation of corrosion risks should be based on information in reference 2, together with the age of the ship and relevant information on the anticipated condition of the ship as derived from the information collected in order to prepare the survey programme.

3.2.2.4 The various tanks and spaces should be listed with the corrosion risks nominated accordingly. Special attention should be given to the areas where the double-hull tanker is particularly exposed to corrosion. To this end, the specific aspects addressing corrosion in double-hull tankers indicated in 3.4 (Corrosion trends) of reference 1 should be taken into account.

3.2.3 *Locations for close-up survey and thickness measurement*

3.2.3.1 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) should be nominated.

3.2.3.2 The sections subject to thickness measurement should normally be nominated in tanks and spaces where corrosion risk is judged to be highest.

3.2.3.3 The nomination of tanks and spaces for close-up survey should, initially, be based on where the corrosion risk is judged to be highest and should always include ballast tanks. The principle for the selection should be that the extent is increased with age or where information is insufficient or unreliable.

References

- 1 TSCF, Guidelines for the Inspection and Maintenance of Double Hull Tanker Structures, 1995.
- 2 TSCF, Guidance Manual for Tanker Structures, 1997.

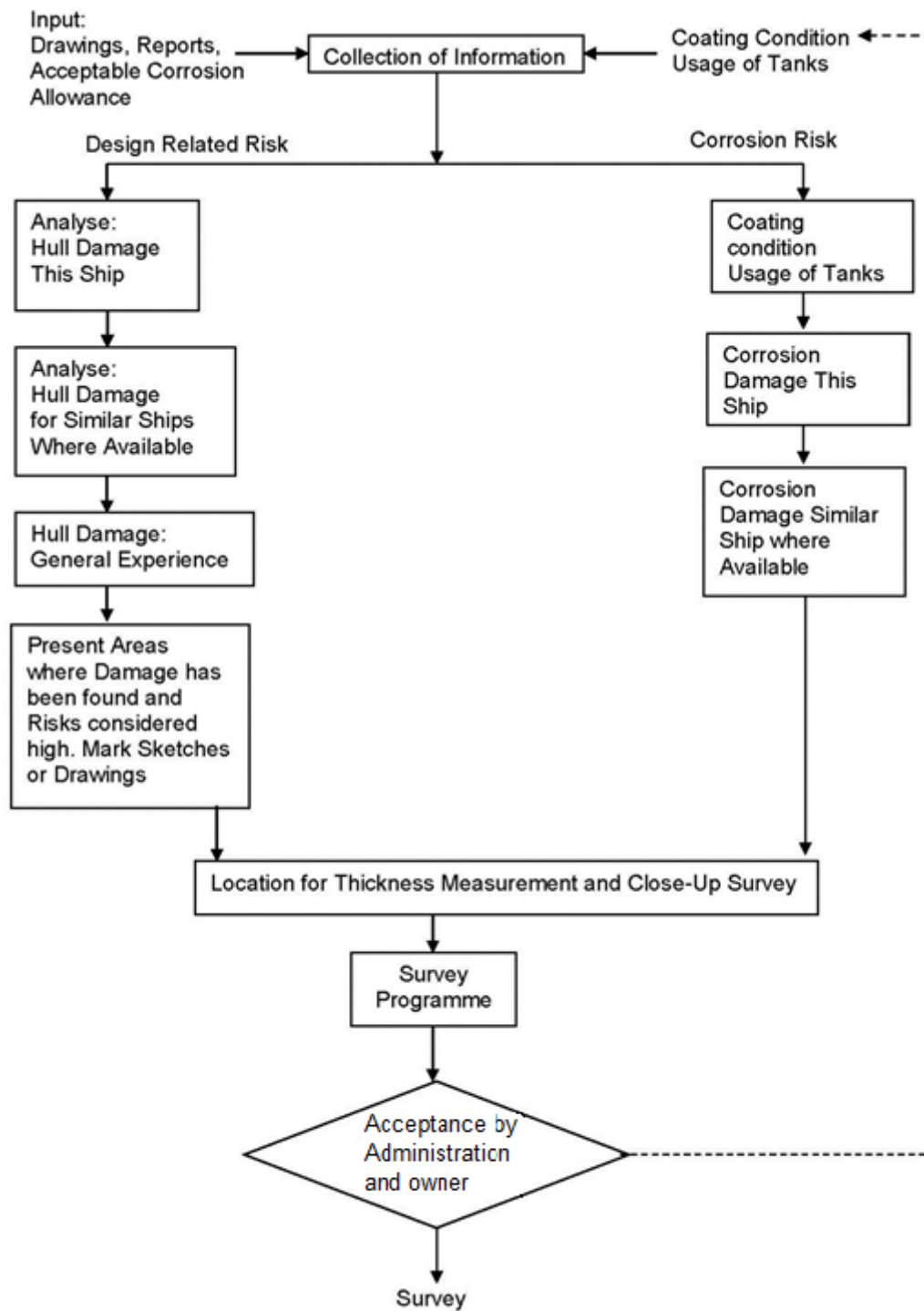


Figure 1: Technical Assessment and the Survey Planning Process

LOCATION: Connection of longitudinals to transverse webs		
EXAMPLE NO. 1 Web and flat bar fractures at cut-outs for longitudinal stiffener connections		
TYPICAL DAMAGE	PROPOSED REPAIR	
<p style="text-align: center;">view A-A</p>	<p>full collar if fractures in web plate are small and are repaired by welding</p> <p style="text-align: center;">view A-A</p>	
<p><i>Note*</i> one or more fractures may occur</p> <p><i>web and flat bar cropped and part renewed or alternatively welded</i></p>		
<p>FACTORS CONTRIBUTING TO DAMAGE</p> <ol style="list-style-type: none"> 1 Asymmetrical connection of flat bar stiffener resulting in high peak stresses at the heel of the stiffener under fatigue loading. 2 Insufficient area of connection of longitudinal to web plate. 3 Defective weld at return around the plate thickness. 4 High localized corrosion at areas of stress concentration such as flat bar stiffener connections, corners of cut-out for the longitudinal and connection of web to shell at cut-outs. 5 High shear stress in the web of the transverse. 6 Dynamic seaway loads/ship motions. 		
FIGURE 1	TANKER STRUCTURE CO-OPERATIVE FORUM SUBJECT: CATALOGUE OF STRUCTURAL DETAILS	FIGURE 1

Figure 2 – Typical damage and repair example (reproduced from reference 2)

ANNEX 13

CRITERIA FOR LONGITUDINAL STRENGTH OF HULL GIRDER FOR DOUBLE-HULL OIL TANKERS

1 General

1.1 These criteria shall be used for the evaluation of the longitudinal strength of the ship's hull girder as required by 9.1.2.

1.2 In order that the ship's longitudinal strength to be evaluated can be recognized as valid, fillet welding between longitudinal internal members and hull envelopes shall be in sound condition so as to keep the integrity of longitudinal internal members with hull envelopes.

2 Evaluation of longitudinal strength

On oil tankers of 130 m in length and upwards and over 10 years of age, the longitudinal strength of the ship's hull girder shall be evaluated in compliance with the requirements of this annex on the basis of the thickness measured, renewed or reinforced, as appropriate, during the renewal survey of the Cargo Ship Safety Construction Certificate or Cargo Ship Safety Certificate (SC renewal survey). The condition of the hull girder for longitudinal strength evaluation shall be determined in accordance with the methods specified in appendix 3.

2.1 *Calculation of transverse sectional areas of deck and bottom flanges of hull girder*

2.1.1 The transverse sectional areas of deck flange (deck plating and deck longitudinals) and bottom flange (bottom shell plating and bottom longitudinals) of the ship's hull girder shall be calculated by using the thickness measured, renewed or reinforced, as appropriate, during the SC renewal survey.

2.1.2 If the diminution of sectional areas of either deck or bottom flange exceeds 10% of their respective as-built area (i.e. original sectional area when the ship was built), either one of the following measures shall be taken:

- .1 to renew or reinforce the deck or bottom flanges so that the actual sectional area is not less than 90% of the as-built area; or
- .2 to calculate the actual section of moduli (Z_{act}) of transverse section of the ship's hull girder by applying the calculation method specified in appendix 1, by using the thickness measured, renewed or reinforced, as appropriate, during the SC renewal survey.

2.2 *Requirements for transverse section modulus of hull girder*

2.2.1 The actual section moduli of the transverse section of the ship's hull girder, calculated in accordance with 2.1.2.2, shall satisfy either of the following provisions, as applicable:

- .1 for ships constructed on or after 1 July 2002, the actual section moduli (Z_{act}) of the transverse section of the ship's hull girder calculated in accordance with the requirements of paragraph 2.1.2.2 shall be not less than the diminution limits determined by the Administration, taking into account

the recommended diminution limit adopted by IMO resolution MSC.108(73): 90% of the required section modulus for new buildings specified in IACS' Unified Requirements S7 ($C=1.0C_n$ shall be used for the purpose of this calculation) or S11, whichever is the greater; or

- .2 for ships constructed before 1 July 2002, the actual section moduli (Z_{act}) of the transverse section of the ship's hull girder calculated in accordance with the requirements of 2.1.2.2 shall meet the criteria for minimum section modulus for ships in service required by the Administration, provided that in no case Z_{act} shall be less than the diminution limit of the minimum section modulus (Z_{mc}) as specified in appendix 2.

Appendix 1

CALCULATION CRITERIA OF SECTION MODULI OF MIDSHIP SECTION OF HULL GIRDER

1 When calculating the transverse section modulus of the ship's hull girder, the sectional area of all continuous longitudinal strength members shall be taken into account.

2 Large openings, i.e. openings exceeding 2.5 m in length or 1.2 m in breadth, and scallops, where scallop welding is applied, shall always be deducted from the sectional areas used in the section modulus calculation.

3 Smaller openings (manholes, lightening holes, single scallops in way of seams, etc.) need not be deducted, provided that the sum of their breadths or shadow area breadths in one transverse section does not reduce the section modulus at deck or bottom by more than 3% and provided that the height of lightening holes, draining holes and single scallops in longitudinals or longitudinal girders does not exceed 25% of the web depth, for scallops of maximum 75 mm.

4 A deduction-free sum of smaller opening breadths in one transverse section in the bottom or deck area of $0.06(B - \Sigma b)$ (where B = breadth of ship, Σb = total breadth of large openings) may be considered equivalent to the above reduction in sectional modulus.

5 The shadow area shall be obtained by drawing two tangent lines with an opening angle of 30°.

6 The deck modulus is related to the moulded deck line at side.

7 The bottom modulus is related to the baseline.

8 Continuous trunks and longitudinal hatch coamings shall be included in the longitudinal sectional area provided they are effectively supported by longitudinal bulkheads or deep girders. The deck modulus shall then be calculated by dividing the moment of inertia by the following distance, provided this is greater than the distance to the deck line at side:

$$y_t = y \left(0.9 + 0.2 \frac{x}{B} \right)$$

where:

y = distance from neutral axis to top of continuous strength member;

x = distance from top of continuous strength member to centreline of the ship;

x and y shall be measured to the point giving the largest value of y_t .

9 Longitudinal girders between multi-hatchways shall be considered by special calculations.

Appendix 2

DIMINUTION LIMIT OF MINIMUM LONGITUDINAL STRENGTH OF SHIPS IN SERVICE

1 The diminution limit of the minimum section modulus (Z_{mc}) of oil tankers in service is given by the following formula:

$$Z_{mc} = cL^2B(C_b + 0.7)k \text{ (cm}^3\text{)}$$

where:

L = Length of ship. L is the distance, in metres, on the summer load waterline from the fore-side of stem to the after side of the rudder post, or the centre of the rudder stock if there is no rudder post. L shall not be less than 96%, and need not be greater than 97%, of the extreme length on the summer load waterline. In ships with unusual stern and bow arrangement, the length L may be specially considered.

B = Greatest moulded breadth in metres.

C_b = Moulded block coefficient at draught d corresponding to summer load waterline, based on L and B . C_b shall not be taken less than 0.6.

$$C_b = \frac{\text{moulded displacement (m}^3\text{) at draught } d}{LBd}$$

$$c = 0.9c_n$$

$$c_n = 10.75 - \left(\frac{300-L}{100}\right)^{1.5} \text{ for } 130 \text{ m} \leq L \leq 300 \text{ m}$$

$$c_n = 10.75 \text{ for } 300 \text{ m} \leq L \leq 350 \text{ m}$$

$$c_n = 10.75 - \left(\frac{L-350}{150}\right)^{1.5} \text{ for } 350 \text{ m} \leq L \leq 500 \text{ m}$$

k = material factor, e.g.

$$k = 1.0 \text{ for mild steel with yield stress of } 235 \text{ N/mm}^2 \text{ and over}$$

$$k = 0.78 \text{ for high-tensile steel with yield stress of } 315 \text{ N/mm}^2 \text{ and over}$$

$$k = 0.72 \text{ for high-tensile steel with yield stress of } 355 \text{ N/mm}^2 \text{ and over.}$$

2 Scantlings of all continuous longitudinal members of the ship's hull girder based on the section modulus requirement in 1 above shall be maintained within $0.4L$ amidships. However, in special cases, based on consideration of type of ship, hull form and loading conditions, the scantlings may be gradually reduced towards the end of $0.4L$ part, bearing in mind the desire not to inhibit the ship's loading flexibility.

3 However, the above standard may not be applicable to ships of unusual type or design, e.g. for ships of unusual main proportions and/or weight distributions.

Appendix 3

SAMPLING METHOD OF THICKNESS MEASUREMENTS FOR LONGITUDINAL STRENGTH EVALUATION AND REPAIR METHODS

1 Extent of longitudinal strength evaluation

Longitudinal strength shall be evaluated 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.

2 Sampling method of thickness measurement

2.1 Pursuant to the requirements of section 2.5, transverse sections shall be chosen such that thickness measurements can be taken for as many different tanks in corrosive environments as possible, e.g. ballast tanks sharing a common plane boundary with cargo tanks fitted with heating coils, other ballast tanks, cargo tanks permitted to be filled with seawater and other cargo tanks. Ballast tanks sharing a common plane boundary with cargo tanks fitted with heating coils and cargo tanks permitted to be filled with seawater shall be selected where present.

2.2 The minimum number of transverse sections to be sampled shall be in accordance with annex 2. The transverse sections chosen shall be located where the largest thickness reductions:

- .1 are suspected to occur; or
- .2 are revealed from deck and bottom plating measurements prescribed in 2.3.

The transverse sections chosen shall be clear of areas which have been locally renewed or reinforced.

2.3 At least two points shall be measured on each deck plate and/or bottom shell plate required to be measured within the cargo area in accordance with the requirements of annex 2.

2.4 Within $0.1D$ (where D is the ship's moulded depth) of the deck and bottom at each transverse section which shall be measured in accordance with the requirements of annex 2, every longitudinal and girder shall be measured on the web and face plate, and every plate shall be measured at one point between longitudinals.

2.5 For longitudinal members other than those specified in 2.4 to be measured at each transverse section in accordance with the requirements of annex 2, every longitudinal and girder shall be measured on the web and face plate, and every plate shall be measured at least in one point per strake.

2.6 The thickness of each component shall be determined by averaging all of the measurements taken in way of the transverse section on each component.

3 Additional measurements where the longitudinal strength is deficient

3.1 Where one or more of the transverse sections are found to be deficient in respect of the longitudinal strength requirements given in this annex, the number of transverse sections

for thickness measurement shall be increased such that each tank within the 0.5L amidships region has been sampled. Tank spaces that are partially within, but extend beyond, the 0.5L region, shall be sampled.

3.2 Additional thickness measurements shall 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 of the Code.

4 Effective repair methods

4.1 The extent of renewal or reinforcement carried out to comply with this annex shall be in accordance with 4.2.

4.2 The minimum continuous length of a renewed or reinforced structural member shall be not be 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.) shall not be within the substantial corrosion range (75% of the allowable diminution associated with each particular member). Where differences in thickness at the butt joint exceed 15% of the lower thickness, a transition taper shall be provided.

4.3 Alternative repair methods involving the fitting of straps or structural member modification shall be subject to special consideration. In considering the fitting of straps, it shall be limited to the following conditions:

- .1 to restore and/or increase longitudinal strength;
- .2 the thickness diminution of the deck or bottom plating to be reinforced shall not be within the substantial corrosion range (75% of the allowable diminution associated with the deck plating);
- .3 the alignment and arrangement, including the termination of the straps, shall be in accordance with a standard recognized by the Administration;
- .4 the straps shall be continuous over the entire 0.5L amidships length; and
- .5 continuous fillet welding and full penetration welds shall be used at butt welding and, depending on the width of the strap, slot welds. The welding procedures applied shall be acceptable to the Administration.

4.4 The existing structure adjacent to replacement areas and in conjunction with the fitted straps, etc., shall 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.

ANNEX 14

PROCEDURAL REQUIREMENTS FOR THICKNESS MEASUREMENTS

1 General

Thickness measurements required in the context of hull structural surveys, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The attendance of the surveyor shall be recorded. This also applies to thickness measurements taken during voyages.

2 Survey meeting

2.1 Prior to commencement of the renewal or intermediate survey, a meeting shall be held between the attending surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) in attendance and the thickness measurement firm's representative(s) so as to ensure the safe and efficient execution of the surveys and thickness measurements to be carried out on board.

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

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

2.3 When thickness measurements are taken in association with intermediate or renewal surveys, a documented record indicating where and when the meeting took place and who attended (the name of the surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) and the representative(s) of the thickness measurement firm(s)) shall be maintained.

3 Monitoring of the thickness measurement process on board

3.1 The surveyor shall decide the final extent and location of thickness measurements after overall survey of representative spaces on board.

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

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

3.4 Thickness measurements taken mainly to evaluate the extent of corrosion, which may affect the hull girder strength, shall be carried out in a systematic manner such that all longitudinal structural members are gauged, as required.

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

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

4 Review and verification

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

4.2 If, where special consideration is allowed by this Code, the extent of thickness measurements is reduced, the surveyor's special consideration shall be reported.

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

ANNEX B

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF OIL TANKERS

Part B

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF OIL TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS

1 General

1.1 *Application*

1.1.1 The Code shall apply to self-propelled oil tankers of 500 gross tonnage and above other than double-hull oil tankers, as defined in 1.2.1 of part A of annex B.

1.1.2 The Code shall apply to surveys of hull structure and piping systems in way of cargo tanks, pump-rooms, cofferdams, pipe tunnels, void spaces within the cargo area and all ballast tanks.

1.1.3 The Code contains the minimum extent of examination, thickness measurements and tank testing. The survey shall be extended when substantial corrosion and/or structural defects are found and include additional close-up survey when necessary.

1.1.4 The surveys shall be carried out during the surveys prescribed by regulation I/10 of the Convention, unless expressly provided otherwise in this Code.

1.2 *Definitions*

1.2.1 *Oil tanker* is a ship which is constructed primarily to carry oil in bulk and includes ship types such as combination carriers (ore/oil ships, etc.).

1.2.2 *Ballast tank* is a tank which is used primarily for the carriage of salt water ballast.

1.2.3 *Combined cargo/ballast tank*, if referred to within the Code, is a tank which is used for the carriage of cargo or ballast water as a routine part of the ship's operation and will be treated as a ballast tank. Cargo tanks in which water ballast might be carried only in exceptional cases per MARPOL regulation I/18.3 are to be treated as cargo tanks.

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

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

1.2.6 *Transverse section* is the cross section of the hull perpendicular to the ship's centreline and includes all longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom and longitudinal bulkheads. For transversely framed oil tankers, a transverse section includes adjacent frames and their end connections in way of transverse sections.

1.2.7 *Representative tanks* are those which are expected to reflect the condition of other tanks of similar type and service and with similar corrosion prevention systems. When selecting representative tanks, account shall be taken of the service and repair history on board and identifiable critical structural areas and/or suspect areas.

1.2.8 *Suspect areas* are locations showing substantial corrosion and/or are considered by the surveyor to be prone to rapid wastage.

1.2.9 *Substantial corrosion* is an extent of corrosion such that assessment of corrosion pattern indicates a wastage in excess of 75% of allowable margins, but within acceptable limits.

1.2.10 *Corrosion prevention system* is normally considered a full hard protective coating. Hard protective coating should usually be epoxy coating or equivalent. Other coating systems, which are neither soft nor semi-hard coatings, may be considered acceptable as alternatives provided that they are applied and maintained in compliance with the manufacturer's specifications.

1.2.11 *Coating condition* is defined 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.

1.2.12 *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 ship, if applicable to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

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

1.2.14 *Intermediate survey* is a survey carried out either at the second or third annual survey or between these surveys.

1.2.15 *Prompt and thorough repair* is a permanent repair completed at the time of survey to the satisfaction of the surveyor, therein removing the need for the imposition of any associated condition of classification or recommendation.

1.2.16 *Special consideration or specially considered* (in connection with close-up surveys and thickness measurements) means sufficient close-up inspection and thickness measurements are taken to confirm the actual average condition of the structure under coating.

1.2.17 *Administration* means the Administration or organization recognized by the Administration.

1.3 Repairs

1.3.1 Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Administration, will affect the ship's structural, watertight or weathertight integrity, shall be promptly and thoroughly (see 1.2.15) repaired. Areas to be considered include:

- .1 side structure and side plating;
- .2 deck structure and deck plating;
- .3 bottom structure and bottom plating;
- .4 watertight or oiltight bulkheads; and
- .5 hatch covers and hatch coamings where fitted to combination carriers.

For locations where adequate repair facilities are not available, the Administration may allow the ship to proceed directly to a repair facility. This may require discharging the cargo and/or temporary repairs for the intended voyage.

1.3.2 Additionally, when a survey results in the identification of corrosion or structural defects, either of which, in the opinion of the Administration, will impair the ship's fitness for continued service, remedial measures shall be implemented before the ship continues in service.

1.3.3 Where the damage found on the structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity after evaluation of the surrounding structure and impose an associated condition or recommendation with a specific time limit in order to complete the permanent repair and retain the validity of the relevant statutory certification.

1.4 Surveyors*

1.4.1 On oil tankers 20,000 tonnes deadweight (dwt) and above starting with renewal survey No.3, at renewal and intermediate hull surveys, the survey of hull structure and piping systems to which this Code applies shall be carried out by at least two surveyors of an Administration.

1.4.2 This requires that at least two surveyors attend on board at the same time to perform the required survey. Though each attending surveyor is not required to perform all aspects of the required survey, they shall consult with each other and do joint overall and close-up surveys to the extent necessary to determine the condition of the vessel areas to which this Code applies. The extent of these surveys shall be sufficient for the surveyors to agree on actions required to complete the survey with respect to renewals, repairs, and other recommendations or conditions. Each surveyor shall co-sign the survey report or indicate their concurrence in an equivalent manner.

* Refer to paragraph 4.2.4 of part 2 of the Code for Recognized Organizations (RO Code), adopted by resolution MSC.349(92).

1.4.3 The following surveys may be witnessed by a single surveyor:

- .1 thickness measurements;
- .2 tank testing; and
- .3 repairs carried out in association with intermediate and renewal hull surveys, the extent of which have been agreed upon by the required two surveyors during the course of the surveys.

1.5 *Thickness measurements and close-up surveys*

In any kind of survey, i.e. renewal, intermediate, annual or other surveys having the scope of the foregoing ones, for structures in areas where close-up surveys are required, thickness measurements, when required by annex 2, shall be carried out simultaneously with close-up surveys.

2 Renewal survey

2.1 *General*

2.1.1 The renewal survey may be commenced at the fourth annual survey and be progressed during the succeeding year with a view to completion by the fifth anniversary date. When the renewal survey is commenced prior to the fourth annual survey, the entire survey shall be completed within 15 months if such work is to be credited to the renewal survey.

2.1.2 As part of the preparation for the renewal survey, the survey programme shall be dealt with, in advance of the renewal survey. The thickness measurement shall not be held before the fourth annual survey.

2.1.3 The survey shall include, in addition to the requirements of the annual survey, examination, tests and checks of sufficient extent to ensure that the hull and related piping as required in 2.1.5 is in a satisfactory condition and is fit for its intended purpose for the new period of validity of the Cargo Ship Safety Construction Certificate, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

2.1.4 All cargo tanks, ballast tanks, including double-bottom tanks, pump-rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull shall be examined, and this examination shall be supplemented by thickness measurement and testing as required in 2.5 and 2.6, to ensure that the structural integrity remains effective. The examination shall be sufficient to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

2.1.5 Cargo piping on deck, including crude oil washing (COW) piping, and cargo and ballast piping within the above tanks and spaces shall be examined and operationally tested to working pressure to the attending surveyor's satisfaction to ensure that tightness and condition remain satisfactory. Special attention shall be given to any ballast piping in cargo tanks and any cargo piping in any ballast tanks and void spaces, and surveyors shall be advised on all occasions when this piping, including valves and fittings, are open during repair periods and can be examined internally.

2.1.6 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

2.2 Dry-dock survey

2.2.1 A survey in dry-dock shall be a part of the renewal survey. There shall be a minimum of two inspections of the outside of the ship's bottom during the five-year period of the Cargo Ship Safety Construction Certificate. In all cases, the maximum interval between bottom inspections shall not exceed 36 months.

2.2.2 For ships of 15 years of age and over, inspection of the outside of the ship's bottom shall be carried out with the ship in dry-dock. For ships of less than 15 years of age, alternate inspections of the ship's bottom not conducted in conjunction with the renewal survey may be carried out with the ship afloat. Inspection of the ship afloat shall only be carried out when the conditions are satisfactory and the proper equipment and suitably qualified staff are available.

2.2.3 If a survey in dry-dock is not completed in conjunction with the renewal survey or if the 36 month maximum interval referred to in 2.2.1 is not complied with, the Cargo Ship Safety Construction Certificate shall cease to be valid until a survey in dry-dock is completed.

2.2.4 The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and ballast tanks shall be carried out in accordance with the applicable requirements for renewal surveys, if not already performed.

Note: Lower portions of the cargo and ballast tanks are considered to be the parts below the light ballast water line.

2.3 Tank corrosion prevention system

Where provided, the condition of the corrosion prevention system of cargo tanks shall be examined. A ballast tank shall be examined at annual intervals where:

- .1 a hard protective coating has not been applied from the time of construction; or
- .2 a soft or semi-hard coating has been applied; or
- .3 substantial corrosion is found within the tank; or
- .4 the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the surveyor.

Thickness measurements shall be carried out as deemed necessary by the surveyor.

2.4 Extent of overall and close-up surveys

2.4.1 An overall survey of all tanks and spaces shall be carried out at the renewal survey. Suspect areas identified at previous surveys shall be examined.

2.4.2 The minimum requirements for close-up surveys at the renewal survey are given in annex 1.

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

- .1 in particular, tanks having structural arrangements or details which have suffered defects in similar tanks or on similar ships according to available information; and
- .2 in tanks which have structures approved with reduced scantlings in association with a corrosion prevention system approved by the Administration.

2.4.4 For areas in tanks where hard protective coatings are found to be in GOOD condition as defined in 1.2.11, the extent of close-up surveys according to annex 1 may be specially considered by the Administration.

2.5 *Extent of thickness measurements*

2.5.1 The minimum requirements for thickness measurements at the renewal survey are given in annex 2.

2.5.2 Provisions for extended measurements for areas with substantial corrosion are given in annex 4, and as may be additionally specified in the survey programme as required in 5.1. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken.

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

2.5.4 For areas in tanks where hard protective coatings are found to be in GOOD condition as defined in 1.2.11, the extent of thickness measurements according to annex 2 may be specially considered by the Administration.

2.5.5 Transverse sections shall be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

2.5.6 In cases where two or three sections are measured, at least one shall include a ballast tank within 0.5L amidships. In case of oil tankers of 130 m in length and upwards (as defined in the International Convention on Load Lines in force) and more than 10 years of age, for the evaluation of the ship's longitudinal strength as required in 8.1.2, the sampling method of thickness measurements is given in annex 12.

2.6 *Extent of tank pressure testing*

2.6.1 The minimum requirements for ballast tank pressure testing at the renewal survey are given in 2.6.3 and in annex 3.

The minimum requirements for cargo tank testing at the renewal survey are given in 2.6.4 and annex 3.

Cargo tank testing carried out by the vessel's crew under the direction of the master may be accepted by the surveyor provided the following conditions are complied with:

- .1 tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the owner and reviewed by the Administration prior to the testing being carried out;

- .2 there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;
- .3 the tank testing has been satisfactorily carried out within the special survey window not more than 3 months prior to the date of the survey on which the overall or close up survey is completed;
- .4 the satisfactory results of the testing is recorded in the vessel's logbook; and
- .5 the internal and external condition of the tanks and associated structure are found satisfactory by the surveyor at the time of the overall and close up survey.

2.6.2 The surveyor may extend the tank pressure testing as deemed necessary.

2.6.3 Boundaries of ballast tanks shall be tested with a head of liquid to the top of the air pipes.

2.6.4 Boundaries of cargo tanks shall be tested to the highest point that liquid will rise to under service conditions.

3 Annual survey

3.1 General

Annual surveys shall be held within three months before or after the anniversary date from the date of the initial survey or of the date credited for the last renewal survey. The annual survey shall consist of an examination for the purpose of ensuring, as far as practicable, that the hull and piping are maintained in a satisfactory condition and shall take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

3.2 Examination of the hull

3.2.1 An examination of the hull plating and its closing appliances shall be carried out as far as can be seen.

3.2.2 An examination of watertight penetrations shall be carried out as far as practicable.

3.3 Examination of weather decks

3.3.1 An examination of cargo tank openings including gaskets, covers, coamings and flame screens shall be carried out as far as practicable.

3.3.2 An examination of cargo tank pressure/vacuum valves and flame screens shall be carried out as far as practicable.

3.3.3 An examination of flame screens on vents to all bunker tanks shall be carried out as far as practicable.

3.3.4 An examination of cargo, crude oil washing, bunker and vent piping systems, including vent masts and headers shall be carried out as far as practicable.

3.4 Examination of cargo pump-rooms and pipe tunnels if fitted

3.4.1 An examination of all pump-room bulkheads for signs of oil leakage or fractures and, in particular, the sealing arrangements of all penetrations of pump-room bulkheads shall be carried out as far as practicable.

3.4.2 An examination of the condition of all piping systems and pipe tunnels shall be carried out as far as practicable.

3.5 Examination of ballast tanks

3.5.1 An examination of ballast tanks shall be carried out when required as a consequence of the results of the renewal survey and intermediate survey. When considered necessary by the Administration or when extensive corrosion exists, thickness measurements shall be carried out.

3.5.2 Where substantial corrosion as defined in 1.2.9 is found, the extent of thickness measurements shall be increased in accordance with the requirements in annex 4. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspect areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken.

4 Intermediate survey

4.1 General

4.1.1 Items that are additional to the requirements of the annual survey may be surveyed either at the second or third annual survey or between these surveys.

4.1.2 The extent of survey of cargo and ballast tanks is dependent on the age of the ship and is specified in 4.2, 4.3 and 4.4.

4.1.3 For weather decks, an examination as far as applicable of cargo, crude oil washing, bunker, ballast, steam and vent piping systems as well as vent masts and headers shall be carried out. If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure tested, thickness measured or both.

4.1.4 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces shall not be acceptable.

4.2 Oil tankers 5 to 10 years of age

4.2.1 All ballast tanks shall be examined. When considered necessary by the Administration, thickness measurement and testing shall be carried out to ensure that the structural integrity remains effective.

4.2.2 A ballast tank shall be examined at subsequent annual intervals where:

- .1 a hard protective coating has not been applied from the time of construction; or
- .2 a soft or semi-hard coating has been applied; or
- .3 substantial corrosion is found within the tanks; or

- .4 the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the surveyor.

4.2.3 In addition to the requirements above, suspect areas identified at previous surveys shall be subject to overall and close-up survey.

4.3 Oil tankers 10 to 15 years of age

4.3.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey as required in 2 and 5.1. However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of hull girder as required in 8.1.2 shall not be required unless deemed necessary by the Administration.

4.3.2 In application of 4.3.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

4.3.3 In application of 4.3.1, an underwater survey may be considered in lieu of the requirements of 2.2.

4.4 Oil tankers exceeding 15 years of age

4.4.1 The requirements of the intermediate survey shall be to the same extent as the previous renewal survey as required in 2 and 5.1. However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of hull girder as required in 8.1.2 shall not be required unless deemed necessary by the Administration.

4.4.2 In application of 4.4.1, the intermediate survey may be commenced at the second annual survey and be progressed during the succeeding year with a view to completion at the third annual survey in lieu of the application of 2.1.1.

4.4.3 In application of 4.4.1 a survey in dry-dock shall be part of the intermediate survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks shall be carried out in accordance with the applicable requirements for intermediate surveys, if not already performed.

Note: Lower portions of the cargo and ballast tanks are considered to be the parts below the light ballast water line.

5 Preparations for survey

5.1 Survey programme

5.1.1 The owner in cooperation with the Administration shall work out a specific survey programme prior to the commencement of any part of the renewal survey and, for an oil tanker other than a double-hull oil tanker over 10 years of age, the intermediate survey. The survey programme shall be in a written format based on the information in annex 6A. The survey shall not commence until the survey programme has been agreed.

5.1.1.1 Prior to the development of the survey programme, the survey planning questionnaire shall be completed by the owner based on the information set out in annex 6B, and forwarded to the Administration.

5.1.1.2 The survey programme at an intermediate survey may consist of the survey programme at the previous renewal survey supplemented by the condition evaluation report (executive hull summary report) of that renewal survey and later relevant survey reports.

5.1.1.3 The survey programme shall be worked out taking into account any amendments to the survey requirements implemented after the last renewal survey was carried out.

5.1.2 In developing the survey programme, the following documentation shall be collected and consulted upon with a view to selecting tanks, areas, and structural elements to be examined:

- .1 survey status and basic ship information;
- .2 documentation on board, as described in 6.2 and 6.3;
- .3 main structural plans of cargo and ballast tanks (scantlings drawings), including information regarding use of high-tensile steels (HTS);
- .4 condition evaluation report (executive hull summary report), according to annex 9;
- .5 relevant previous damage and repair history;
- .6 relevant previous survey and inspection reports from both the Administration and the owner;
- .7 cargo and ballast history for the last three years, including carriage of cargo under heated conditions;
- .8 details of the inert gas plant and tank cleaning procedures;
- .9 information and other relevant data regarding conversion or modification of the ship's cargo and ballast tanks since the time of construction;
- .10 description and history of the corrosion prevention system (including previous class notations), if any;
- .11 inspections of the owner's personnel during the last three years with reference to structural deterioration in general, leakages in tank boundaries and piping and condition of the corrosion prevention system if any. Guidance for reporting is shown in annex 5;
- .12 information regarding the relevant maintenance level during operation, including port State control reports of inspection containing hull related deficiencies, safety management system non-conformities relating to hull maintenance, including the associated corrective action(s); and
- .13 any other information that will help identify suspect areas and critical structural areas.

5.1.3 The submitted survey programme shall account for, and comply, as a minimum, with the provisions of 2.6 for tank testing and annexes 1, 2 and 3 for close-up survey, thickness measurement and tank testing, respectively, and shall include relevant information including at least:

- .1 basic ship information and particulars;
- .2 main structural plans of cargo and ballast tanks (scantling drawings), including information regarding use of high tensile steels (HTS);
- .3 plan of tanks;
- .4 list of tanks with information on their use, corrosion prevention system and condition of coating;
- .5 conditions for survey (e.g. information regarding tank cleaning, gas freeing, ventilation, lighting, etc.);
- .6 provisions and methods for access to structures;
- .7 equipment for surveys;
- .8 nomination of tanks and areas for close-up survey (see 2.4);
- .9 nomination of areas and sections for thickness measurement (see 2.5);
- .10 nomination of tanks for tank testing (see 2.6);
- .11 nomination of the thickness measurement firm;
- .12 damage experience related to the ship in question; and
- .13 critical structural areas and suspect areas, where relevant.

5.1.4 The Administration shall advise the owner of the maximum acceptable structural corrosion diminution levels applicable to the ship.

5.1.5 Use should also be made of the Guidelines for technical assessment in conjunction with the planning of enhanced surveys for tankers, contained in annex 11. These Guidelines are a recommended tool which may be invoked at the discretion of the Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme. These Guidelines shall not be used to reduce the requirements of annexes 1, 2 and 3, and paragraph 2.6, which shall, in all cases, be complied with as a minimum.

5.2 Conditions for survey

5.2.1 The owner shall provide the necessary facilities for a safe execution of the survey.*

5.2.1.1 In order to enable the attending surveyors to carry out the survey, provisions for proper and safe access shall be agreed between the owner and the Administration, based on recommendations developed by the Organization.+

5.2.1.2 Details of the means of access shall be provided in the survey planning questionnaire.

* Refer to the International Safety Guide for Oil Tankers and Terminals (ISGOTT), regarding Entry into and working in enclosed spaces.

+ Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

5.2.1.3 In cases where the provisions of safety and required access are judged by the attending surveyors not to be adequate, the survey of the spaces involved shall not proceed.

5.2.2 Tanks and spaces shall be safe for access. Tanks and spaces shall be gas-free and properly ventilated. Prior to entering tank, void or enclosed space, it shall be verified that the atmosphere in that space is free from hazardous gas and contains sufficient oxygen.

5.2.3 In preparation for survey and thickness measurements and to allow for a thorough examination, all spaces shall be cleaned including removal from surfaces of all loose accumulated corrosion scale. Spaces shall 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 coating. However, those areas of structure whose renewal has already been decided by the owner need only be cleaned and descaled to the extent necessary to determine the limits of the areas to be renewed.

5.2.4 Sufficient illumination shall be provided to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the coating.

5.2.5 Where soft or semi-hard coatings have been applied, safe access shall be provided for the surveyor to verify the effectiveness of the coating and to carry out an assessment of the condition of internal structures which may include spot removal of the coating. When safe access cannot be provided, the soft or semi-hard coating shall be removed.

5.2.6 The surveyor(s) shall always be accompanied by at least one responsible person, assigned by the owner, experienced in tank and enclosed space inspection.

5.3 Access to structures⁺

5.3.1 For overall surveys, means shall be provided to enable the surveyor to examine the structure in a safe and practical way.

5.3.2 For close-up surveys, one or more of the following means for access, acceptable to the surveyor, shall be provided:

- .1 permanent staging and passages through structures;
- .2 temporary staging and passages through structures;
- .3 hydraulic arm vehicles such as conventional cherry pickers, lifts and moveable platforms;
- .4 boats or rafts;
- .5 portable ladders; and/or
- .6 other equivalent means.

⁺ Refer to MSC/Circ.686, *Guidelines on the means of access to structures for inspection and maintenance of oil tankers and bulk carriers.*

5.4 *Equipment for survey*

5.4.1 Thickness measurements shall normally be carried out by means of ultrasonic test equipment. The accuracy of the equipment shall be proven to the surveyor as required.

5.4.2 One or more of the following fracture detection procedures shall be required if deemed necessary by the surveyor:

- .1 radiographic equipment;
- .2 ultrasonic equipment;
- .3 magnetic particle equipment;
- .4 dye penetrant; and/or
- .5 other equivalent means.

5.4.3 Explosimeter, oxygen-meter, breathing apparatus, lifelines, riding belts with rope and hook and whistles together with instructions and guidance on their use shall be made available during the survey. A safety checklist shall be provided.

5.4.4 Adequate and safe lighting shall be provided for the safe and efficient conduct of the survey.

5.4.5 Adequate protective clothing shall be made available and used (e.g. safety helmet, gloves, safety shoes, etc.) during the survey.

5.5 *Rescue and emergency response equipment*

If breathing apparatus and/or other equipment is used as "Rescue and emergency response equipment", then the equipment shall be suitable for the configuration of the space being surveyed.

5.6 *Surveys at sea or at anchorage*

5.6.1 Surveys at sea or at anchorage may be accepted provided the surveyor(s) is given the necessary assistance from the personnel on board. Necessary precautions and procedures for carrying out the survey shall be in accordance with 5.1, 5.2, 5.3 and 5.4.

5.6.2 A communication system shall be arranged between the survey party in the tank and the responsible officer on deck. This system shall also include the personnel in charge of ballast pump handling if boats or rafts are used.

5.6.3 Surveys of tanks by means of boats or rafts shall only be undertaken with the agreement of the surveyor, who shall take into account the safety arrangements provided, including weather forecasting and ship response under foreseeable conditions and provided the expected rise of water within the tank does not exceed 0.25 m.

5.6.4 When rafts or boats are used for close-up survey the following conditions shall be observed:

- .1 only rough duty, inflatable rafts or boats, having satisfactory residual buoyancy and stability even if one chamber is ruptured, shall be used;

- .2 the boat or raft shall be tethered to the access ladder and an additional person shall be stationed down the access ladder with a clear view of the boat or raft;
- .3 appropriate lifejackets shall be available for all participants;
- .4 the surface of water in the tank shall be calm (under all foreseeable conditions the expected rise of water within the tank shall not exceed 0.25 m) and the water level stationary. On no account shall the level of the water be rising while the boat or raft is in use;
- .5 the tank or space shall contain clean ballast water only. Even a thin sheen of oil on the water shall not be acceptable;
- .6 at no time shall the water level 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 shall only 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; and
- .7 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 shall be isolated to prevent a transfer of gas from other tanks (or spaces).

5.6.5 Rafts or boats alone may be allowed for inspection of the underdeck areas of tanks or spaces if the depth of the webs is 1.5 m or less.

5.6.6 If the depth of the webs is more than 1.5 m, rafts or boats alone shall be allowed only:

- .1 when the coating of the under-deck structure is in GOOD condition and there is no evidence of wastage; or
- .2 if a permanent means of access is provided in each bay to allow safe entry and exit. This means:
 - .1 access direct from the deck via a vertical ladder with a small platform fitted approximately 2 m below the deck in each bay; or
 - .2 access to deck from a longitudinal permanent platform having ladders to deck in each end of the tank. The platform shall, for the full length of the tank, be arranged level with, or above, the maximum water level needed for rafting of under deck structure. For this purpose, the ullage corresponding to the maximum water level shall be assumed not more than 3 m from the deck plate measured at the midspan of deck transverses and in the middle length of the tanks (see figure 1).

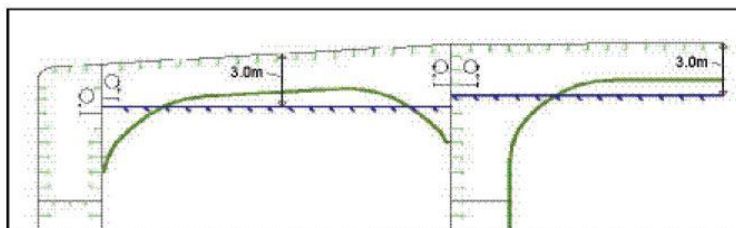


Figure 1: Maximum water level in a tank

If neither of the above conditions are met, then staging or other equivalent means shall be provided for the survey of the under-deck areas.

5.6.7 The use of rafts or boats alone in 5.6.5 and 5.6.6 does not preclude the use of boats or rafts to move about within a tank during a survey.

5.7 Survey planning meeting

5.7.1 Proper preparation and close cooperation between the attending surveyor(s) and the owner's representatives on board prior to and during the survey are an essential part in the safe and efficient conduct of the survey. During the survey onboard safety meetings shall be held regularly.

5.7.2 Prior to commencement of any part of the renewal or intermediate survey, a survey planning meeting shall be held between the attending surveyor(s), the owner's representative in attendance, the thickness measurement firm representative, where involved, and the master of the ship or an appropriately qualified representative nominated by the master or company; for the purpose to ascertain that all the arrangements envisaged in the survey programme are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out (see also 7.1.2).

5.7.3 The following is an indicative list of items that shall be addressed in the meeting:

- .1 schedule of the ship (i.e. the voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operations, etc.);
- .2 provisions and arrangements for thickness measurements (i.e. access, cleaning/de-scaling, illumination, ventilation, personal safety);
- .3 extent of the thickness measurements;
- .4 acceptance criteria (refer to the list of minimum thicknesses);
- .5 extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion;
- .6 execution of thickness measurements;
- .7 taking representative readings in general and where uneven corrosion/pitting is found;
- .8 mapping of areas of substantial corrosion; and
- .9 communication between attending surveyor(s), the thickness measurement firm operator(s), and owner representative(s) concerning findings.

6 Documentation on board

6.1 General

6.1.1 The owner shall obtain, supply and maintain on board the ship documentation as specified in 6.2 and 6.3, which shall be readily available for the surveyor. The condition evaluation report (executive hull summary report) referred to in 6.2 shall include a translation into English.

6.1.2 The documentation shall be kept on board for the lifetime of the ship.

6.1.3 For oil tankers with coatings of dedicated seawater ballast tanks subject to PSPC standards (MSC.215(82)), the owner shall arrange the updating of the Coating Technical File (CTF) throughout the ship's life whenever a maintenance, repair, or recoating activity to these coatings has taken place. Documented procedures for updating the CTF shall be included within the Safety Management System.

6.2 Survey report file

6.2.1 A survey report file shall be a part of the documentation on board consisting of:

- .1 reports of structural surveys (annex 8);
- .2 condition evaluation report (executive hull summary report) (annex 9); and
- .3 thickness measurement reports (annex 10).

6.2.2 The survey report file shall be available also in the owner's and the Administration's offices.

6.3 Supporting documents

6.3.1 The following additional documentation shall be available on board:

- .1 survey programme as required by 5.1 until such time as the renewal survey, or intermediate survey, as applicable, has been completed;
- .2 main structural plans of cargo and ballast tanks;
- .3 previous repair history;
- .4 cargo and ballast history;
- .5 extent of use of inert gas plant and tank cleaning procedures;
- .6 inspections by ship's personnel with reference to:
 - .1 structural deterioration in general;
 - .2 leakages in bulkheads and piping; and
 - .3 condition of corrosion prevention system, if any. Guidance for reporting is shown in annex 5; and

- .7 any other information that would help to identify critical structural areas and/or suspect areas requiring inspection.

6.3.2 For oil tankers with coatings of dedicated seawater ballast tanks subject to PSPC standards (MSC.215(82)), the Coating Technical File (CTF) shall be available on board.

6.4 Review of documentation on board

6.4.1 Prior to survey, the surveyor shall examine the completeness of the documentation on board and its contents as a basis for the survey.

6.4.2 For oil tankers with coatings of dedicated seawater ballast tanks subject to PSPC standards (MSC.215(82)), on completion of the survey, the surveyor shall verify any maintenance, repair, or recoating activities to these coatings are documented within the Coating Technical File (CTF).

7 Procedures for thickness measurements

7.1 General

7.1.1 The required thickness measurements, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The surveyor shall be on board to the extent necessary to control the process.

7.1.2 The thickness measurement firm shall be part of the survey planning meeting to be held prior to commencing the survey.

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

7.1.4 In all cases the extent of the thickness measurements shall be sufficient as to represent the actual average condition.

7.1.5 Procedural requirements for thickness measurements are set out in annex 13.

7.2 Certification of thickness measurement firm

The thickness measurements shall be carried out by a qualified firm certified by the Administration according to principles stated in annex 7.

7.3 Reporting

7.3.1 A thickness measurement report shall be prepared and submitted to the Administration. The report shall give the location of measurements, the thickness measured as well as the corresponding original thickness. Furthermore, the report shall give the date when the measurements were carried out, type of measuring equipment, names of personnel and their qualifications and be signed by the operator. The thickness measurement report should follow the principles as specified in the recommended procedures for thickness measurements set out in annex 10.

7.3.2 The surveyor shall review the final thickness measurement report and countersign the cover page.

8 Reporting and evaluation of survey

8.1 Evaluation of survey report

8.1.1 The data and information on the structural condition of the ship collected during the survey shall be evaluated for acceptability and continued structural integrity of the ship.

8.1.2 In case of oil tankers of 130 m in length and upwards (as defined in the International Convention on Load Lines in force), the ship's longitudinal strength shall be evaluated by using the thickness of structural members measured, renewed and reinforced, as appropriate, during the renewal survey of safety construction carried out after the ship reached 10 years of age, in accordance with the criteria for longitudinal strength of the ship's hull girder for oil tankers specified in annex 12.

8.1.3 The analysis of data shall be carried out and endorsed by the Administration and the conclusions of the analysis shall form a part of the condition evaluation report (executive hull summary report).

8.1.4 The final result of the evaluation of the ship's longitudinal strength required in 8.1.2, after renewal or reinforcement work of structural members, if carried out as a result of initial evaluation, shall be reported as a part of the condition evaluation report (executive hull summary report).

8.2 Reporting

8.2.1 Principles for survey reporting are shown in annex 8.

8.2.2 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items examined and/or tested (pressure testing, thickness measurements, etc.) and an indication of whether the item has been credited, shall be made available to the next attending surveyor(s), prior to continuing or completing the survey.

8.2.3 A condition evaluation report (executive hull summary report) of the survey and results shall be issued to the owner as shown in annex 9 and placed on board the ship for reference at future surveys. The condition evaluation report (executive hull summary report) shall be endorsed by the Administration.

ANNEX 1

**MINIMUM REQUIREMENTS FOR CLOSE-UP SURVEY AT RENEWAL SURVEY OF OIL TANKERS
OTHER THAN DOUBLE-HULL OIL TANKERS**

Age ≤ 5 years Renewal Survey No.1	5 < Age ≤ 10 years Renewal Survey No.2	10 < Age ≤ 15 years Renewal Survey No.3	Age > 15 years Renewal Survey No.4 and subsequent
<p>(A) ONE WEB FRAME RING – in a ballast wing tank, if any, or a cargo wing tank used primarily for water ballast</p> <p>(B) ONE DECK TRANSVERSE – in a cargo oil tank</p> <p>(D) ONE TRANSVERSE BULKHEAD – in a ballast tank</p> <p>(D) ONE TRANSVERSE BULKHEAD – in a cargo oil wing tank</p> <p>(D) ONE TRANSVERSE BULKHEAD – in a cargo oil centre tank</p>	<p>(A) ALL WEB FRAME RINGS – in a ballast wing tank, if any, or a cargo wing tank used primarily for water ballast</p> <p>(B) ONE DECK TRANSVERSE – in each of the remaining ballast tanks, if any</p> <p>(B) ONE DECK TRANSVERSE – in a cargo wing tank</p> <p>(B) ONE DECK TRANSVERSE – in two cargo centre tanks</p> <p>(C) BOTH TRANSVERSE BULKHEADS in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast</p> <p>(D) ONE TRANSVERSE BULKHEAD – in each remaining ballast tank</p> <p>(D) ONE TRANSVERSE BULKHEAD – in a cargo oil wing tank</p> <p>(D) ONE TRANSVERSE BULKHEAD – in two cargo oil centre tanks</p>	<p>(A) ALL WEB FRAME RINGS – in all ballast tanks</p> <p>(A) ALL WEB FRAME RINGS – in a cargo wing tank</p> <p>(A) A minimum of 30% of all web frame rings in each remaining cargo wing tank (see note 1)</p> <p>(C) ALL TRANSVERSE BULKHEADS – in all cargo and ballast tanks</p> <p>(E) A minimum of 30% of deck and bottom transverses including adjacent structural members in each cargo centre tank (see note 1)</p> <p>(F) As considered necessary by the Administration</p>	<p>As for renewal survey No.3 Additional transverses included as deemed necessary by the Administration</p>

Note 1:

The 30% shall be rounded up to the next whole integer.

(A), (B), (C), (D), (E) and (F) are areas which shall be subjected to close-up surveys and thickness measurements (see appendix 3 to annex 10).

- (A) Complete transverse web frame ring including adjacent structural members
- (B) Deck transverse including adjacent deck structural members
- (C) Transverse bulkheads complete – including girder system and adjacent structural members
- (D) Transverse bulkhead lower part – including girder system and adjacent structural members
- (E) Deck and bottom transverse including adjacent structural members
- (F) Additional complete transverse web ring frame

ANNEX 2

**MINIMUM REQUIREMENTS FOR THICKNESS MEASUREMENTS AT RENEWAL SURVEYS OF OIL TANKERS
OTHER THAN DOUBLE-HULL OIL TANKERS**

Age ≤ 5 years	5 < Age ≤ 10 years	10 < Age ≤ 15 years	Age > 15 years
Renewal Survey No.1	Renewal Survey No.2	Renewal Survey No.3	Renewal Survey No.4 and subsequent
<p>1 One section of deck plating for the full beam of the ship within the cargo area (in way of a ballast tank, if any, or a cargo tank used primarily for water ballast)</p> <p>2 Measurements of those structural members subject to close-up survey according to annex 1, for general assessment and recording of corrosion pattern</p> <p>3 Suspect areas</p>	<p>1 Within the cargo area: .1 each deck plate .2 one transverse section</p> <p>2 Measurements of those structural members subject to close-up survey according to annex 1, for general assessment and recording of corrosion pattern</p> <p>3 Suspect areas</p> <p>4 Selected wind and water strakes outside the cargo area</p>	<p>1 Within the cargo area: .1 each deck plate .2 two transverse sections (1) .3 all wind and water strakes</p> <p>2 Measurements of those structural members subject to close-up survey according to annex 1, for general assessment and recording of corrosion pattern</p> <p>3 Suspect areas</p> <p>4 Selected wind and water strakes outside the cargo area</p>	<p>1 Within the cargo area: .1 each deck plate .2 three transverse sections (1) .3 each bottom plate</p> <p>2 Measurements of those structural members subject to close-up survey according to annex 1, for general assessment and recording of corrosion pattern</p> <p>3 Suspect areas</p> <p>4 All wind and water strakes in full length</p>

(1): At least one section shall include a ballast tank within 0.5L amidships.

ANNEX 3

MINIMUM REQUIREMENTS FOR TANK TESTING AT RENEWAL SURVEY OF OIL TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS

Age of ship (in years at time of renewal survey due date)	
Age ≤ 5 years	Age > 5 years
Renewal Survey No.1	Renewal Survey No.2 and subsequent
1 All ballast tank boundaries. 2 Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, pump-rooms or cofferdams	1 All ballast tank boundaries 2 All cargo tank bulkheads

ANNEX 4

**REQUIREMENTS FOR EXTENT OF THICKNESS MEASUREMENTS AT
AREAS OF SUBSTANTIAL CORROSION OF OIL TANKERS
OTHER THAN DOUBLE-HULL OIL TANKERS**

Renewal survey within the cargo area length

Bottom structure

Structural member	Extent of measurement	Pattern of measurement
Bottom plating	Minimum of three bays across tank, including aft bay. Measurements around and under all bell mouths	Five-point pattern for each panel between longitudinals and webs
Bottom longitudinals	Minimum of three longitudinals in each bay where bottom plating measured	Three measurements in line across flange and three measurements on vertical web
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 one measurement between each panel stiffener, or a minimum of three measurements. Two measurements across face flat. Five-point pattern on girder/bulkhead brackets
Bottom transverse webs	Three webs in bays where bottom plating measured, with measurements at both ends and middle	Five-point pattern over 2 m ² area. Single measurements on face flat.
Panel stiffening	Where fitted	Single measurements

Deck structure

Structural member	Extent of measurement	Pattern of measurement
Deck plating	Two bands across tank	Minimum of three measurements per plate per band
Deck longitudinals	Minimum of three longitudinals in each of two bays	Three measurements in line vertically on webs, and two measurements on flange (if fitted)
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 one measurement between each panel stiffener, or a minimum of three measurements. Two measurements across face flat. Five-point pattern on girder/bulkhead brackets
Deck transverse webs	Minimum of two webs with measurements at middle and both ends of span	Five-point pattern over about 2 m ² area. Single measurements on face flat
Panel stiffening	Where available	Single measurements

Side shell and longitudinal bulkheads

Structural member	Extent of measurement	Pattern of measurement
Deckhead and bottom strakes, and strakes in way of stringer platforms	Plating between each pair of longitudinals in a minimum of three bays	Single measurement
All other strakes	Plating between every third pair of longitudinals in same three bays	Single measurement
Longitudinals – deckhead and bottom strakes	Each longitudinal in same three bays	Three measurements across web and one measurement on flange
Longitudinals – all others	Every third longitudinal in same three bays	Three measurements across web and one measurement on flange
Longitudinals – bracket	Minimum of three at top, middle and bottom of tank in same three bays	Five-point pattern over area of bracket
Web frames and cross ties	Three webs with minimum of three locations on each web, including in way of cross tie connections	Five-point pattern over about 2 m ² area, plus single measurements on web frame and cross tie face flats

Transverse bulkheads and swash bulkheads

Structural member	Extent of measurement	Pattern of measurement
Deckhead and bottom strakes, and strakes in way of stringer platforms	Plating between pair of stiffeners at three locations – approximately quarter, half and three-quarters width of tank	Five-point pattern between stiffeners over 1 m length
All other strakes	Plating between pair of stiffeners at middle location	Single measurement
Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange or fabricated connection	Five-point pattern over about 1 m ² of plating
Stiffeners	Minimum of three typical stiffeners	For web, five-point pattern over span between bracket connections (two measurements across web at each bracket connection, and one at centre of span). For flange, single measurements at each bracket toe and at centre of span
Brackets	Minimum of three at top, middle and bottom of tank	Five-point pattern over area of bracket
Deep webs and girders	Measurements at toe of bracket and at centre of span	For web, five-point pattern over about 1 m ² area. Three measurements across face flat
Stringer platforms	All stringers with measurements at both ends and middle	Five-point pattern over 1 m ² area plus single measurements near bracket toes and on face flats

ANNEX 5

OWNER'S INSPECTION REPORT

Structural condition

Ship's name:
IMO number:
Port of registry:
Owner:

TANK/HOLD	Grade of steel	Cracks	Corrosion	Buckles	Coating condition	Pitting	Modification/repair	Other
TANK/HOLD No.....								
Deck								
Bottom								
Side								
Side framing								
Longitudinal bulkheads								
Transverse bulkheads								
Repairs carried out due to:								
Thickness measurements carried out (dates):								
Results in general:								
Overdue surveys:								
Outstanding conditions of class:								
Comments:								

Inspected by			
	<i>Name</i>	<i>Date of inspection</i>	<i>Signature</i>

ANNEX 6A

SURVEY PROGRAMME

Basic information and particulars

Ship's name:
IMO number:
Flag State:
Port of registry:
Gross tonnage:
Deadweight (metric tonnes):
Length between perpendiculars (m):
Shipbuilder:
Hull number:
Recognized organization (RO):
RO ship identity:
Date of build of the ship:
Owner:
Thickness measurement firm:

1 Preamble

1.1 Scope

1.1.1 The present survey programme covers the minimum extent of overall surveys, close-up surveys, thickness measurements and pressure testing within the cargo area, ballast tanks, including fore and aft peak tanks, required by the Code.

1.1.2 The arrangements and safety aspects of the survey shall be acceptable to the attending surveyor(s).

1.2 Documentation

All documents used in the development of the survey programme shall be available on board during the survey as required by section 6.

2 Arrangement of tanks and spaces

This section of the survey programme shall provide information (either in the form of plans or text) on the arrangement of tanks and spaces that fall within the scope of the survey.

3 List of tanks and spaces with information on their use, extent of coatings and corrosion prevention system

This section of the survey programme shall indicate any changes relating to (and shall update) the information on the use of the tanks of the ship, the extent of coatings and the corrosion protective system provided in the survey planning questionnaire.

4 Conditions for survey

This section of the survey programme shall provide information on the conditions for survey, e.g. information regarding cargo hold and tank cleaning, gas freeing, ventilation, lighting, etc.

5 Provisions and method of access to structures

This section of the survey programme shall indicate any changes relating to (and update) the information on the provisions and methods of access to structures provided in the survey planning questionnaire.

6 List of equipment for survey

This section of the survey programme shall identify and list the equipment that will be made available for carrying out the survey and the required thickness measurements.

7 Survey requirements

7.1 Overall survey

This section of the survey programme shall identify and list the spaces that shall undergo an overall survey for the ship in accordance with 2.4.1.

7.2 Close-up survey

This section of the survey programme shall identify and list the hull structures that shall undergo a close-up survey for the ship in accordance with 2.4.2.

8 Identification of tanks for tank testing

This section of the survey programme shall identify and list the tanks that shall undergo tank testing for the ship in accordance with 2.6.

9 Identification of areas and sections for thickness measurements

This section of the survey programme shall identify and list the areas and sections where thickness measurements shall be taken in accordance with 2.5.1.

10 Minimum thickness of hull structures

This section of the survey programme shall specify the minimum thickness for hull structures of the ship that are subject to the Code (indicate either (a) or preferably (b), if such information is available):

- (a) Determined from the attached wastage allowance table and the original thickness on the hull structure plans of the ship;
- (b) Given in the following table(s):

Area or location	Original as-built thickness (mm)	Minimum thickness (mm)	Substantial corrosion thickness (mm)
Deck			
Plating			
Longitudinals			
Longitudinal girders			
Bottom			
Plating			
Longitudinals			
Longitudinal girders			
Ship side			
Plating			
Longitudinals			
Longitudinal girders			
Longitudinal bulkhead			
Plating			
Longitudinals			
Longitudinal girders			
Inner bottom			
Plating			
Longitudinals			
Longitudinal girders			
Transverse bulkheads			
Plating			
Stiffeners			
Transverse web frames, floors and stringers			
Plating			
Flanges			
Stiffeners			
Cross ties			
Flanges			
Webs			

Note: The wastage allowance tables shall be attached to the survey programme.

11 Thickness measurement firm

This section of the survey programme shall identify changes, if any, relating to the information on the thickness measurement firm provided in the survey planning questionnaire.

12 Damage experience related to the ship

This section of the survey programme shall provide details of the hull damages for at least the last three years in way of the cargo and ballast tanks and void spaces within the cargo area, using the tables provided below. These damages shall be subject to survey.

Hull damages sorted by location for the ship

Tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

**Hull damages for sister or similar ships
(if available) in the case of design related damage**

Tank or space number or area	Possible cause, if known	Description of the damages	Location	Repair	Date of repair

13 Areas identified with substantial corrosion from previous surveys

This section of the survey programme shall identify and list the areas of substantial corrosion from previous surveys.

14 Critical structural areas and suspect areas

This section of the survey programme shall identify and list the critical structural areas and the suspect areas, if such information is available.

15 Other relevant comments and information

This section of the survey programme shall provide any other comments and information relevant to the survey.

APPENDICES

Appendix 1 – List of plans

The provisions of 5.1.3.2 require that main structural plans of cargo and ballast tanks (scantling drawings), including information regarding use of high tensile steel (HTS), shall be available. This appendix of the survey programme shall identify and list the main structural plans which form part of the survey programme.

Appendix 2 – Survey planning questionnaire

The survey planning questionnaire (annex 6B), which has been submitted by the owner, shall be appended to the survey programme.

Appendix 3 – Other documentation

This part of the survey programme shall identify and list any other documentation that forms part of the plan.

Prepared by the owner in cooperation with the Administration for compliance with 5.1.3.

Date:

(name and signature of authorized owner's representative)

Date:

(name and signature of authorized representative of the Administration)

ANNEX 6B

SURVEY PLANNING QUESTIONNAIRE

The following information will enable the owner in cooperation with the Administration to develop a survey programme complying with the requirements of the Code. It is essential that the owner provides, when completing the present questionnaire, up-to-date information. The present questionnaire, when completed, will provide all the information and material required by the resolution.

1 Particulars

Ship's name:

IMO number:

Flag State:

Port of registry:

Owner:

Recognized organization (RO):

Gross tonnage:

Deadweight (metric tonnes):

Date of build:

2 Information on access provision for close-up surveys and thickness measurement

The owner shall indicate, in the table below, the means of access to the structures subject to close-up survey and thickness measurement. A close-up survey is an examination where the details of structural components are within the close visual inspection range of the attending surveyor, i.e. normally within reach of hand.

Tank No.	Structure	C (Cargo)/B (Ballast)	Temporary staging	Rafts	Ladders	Direct access	Other means (please specify)
F.P.	Fore peak						
A.P.	Aft peak						
Wing tanks	Underdeck						
	Side shell						
	Bottom transverse						
	Longitudinal						
	Transverse						
Centre tanks	Under deck						
	Bottom transverse						
	Transverse						

History of cargo with H ₂ S content or heated cargo for the last three years together with indication as to whether cargo was heated and, where available, Material Safety Data Sheets (MSDS) [§]

3 Owner's inspections

Using a format similar to that of the table below (which is given as an example), the owner shall provide details of the results of their inspections for the last three years on all cargo and ballast tanks and void spaces within the cargo area, including peak tanks.

Tank No.	Corrosion protection (1)	Coating extent (2)	Coating condition (3)	Structural deterioration (4)	Tank damage history (5)
Cargo centre tanks					
Cargo wing tanks					
Slop					
Ballast tanks					
Aft peak					
Fore peak					
Miscellaneous spaces					

Note:

Indicate tanks which are used for oil/ballast.

- 1) HC = hard coating; SC = soft coating;
SH = semi-hard coating;
NP = no protection
- 2) U = upper part; M = middle part;
L = lower part; C = complete
- 3) G = good; F = fair; P = poor;
RC = recoated (during the last three years)
- 4) N = no findings recorded; Y = findings recorded,
description of findings shall be attached to this questionnaire
- 5) DR = Damage & Repair; L = Leakages;
CV = Conversion (description shall be attached to this questionnaire)

Name of owner's representative: Signature: Date:

[§] Refer to resolution MSC.150(77) on Recommendation for material safety data sheets for MARPOL Annex I cargoes and marine fuel oils.

Reports of port State control inspections

List the reports of port State control inspections containing hull structural related deficiencies, relevant information on rectification of the deficiencies:

Safety management system

List non-conformities related to hull maintenance, including the associated corrective actions:

Name and address of the approved thickness measurement firm

ANNEX 7

PROCEDURES FOR APPROVAL AND CERTIFICATION OF A FIRM ENGAGED IN THICKNESS MEASUREMENT OF HULL STRUCTURES

1 Application

This guidance applies for certification of the firm which intends to engage in the thickness measurement of hull structures of ships.

2 Procedures for approval and certification

Submission of documents

2.1 The following documents shall be submitted to an organization recognized by the Administration for approval:

- .1 outline of the firm, e.g. organization and management structure;
- .2 experience of the firm on thickness measurement of hull structures of ships;
- .3 technicians' careers, i.e. experience of technicians as thickness measurement operators, technical knowledge and experience of hull structure, etc. Operators shall be qualified according to a recognized industrial non-destructive test (NDT) Standard;
- .4 equipment used for thickness measurement such as ultrasonic testing machines and their maintenance/calibration procedures;
- .5 a guide for thickness measurement operators;
- .6 training programmes for technicians for thickness measurement; and
- .7 measurement record format taking into account the recommended procedures for thickness measurements (see annex 10).

Auditing of the firm

2.2 Upon reviewing the documents submitted with satisfactory results, the firm shall be audited in order to ascertain that the firm is duly organized and managed in accordance with the documents submitted, and eventually is capable of conducting thickness measurement of the hull structure of ships.

2.3 Certification shall be conditional upon an on board demonstration of thickness measurement as well as satisfactory reporting.

3 Certification

3.1 Upon satisfactory results of both the audit of the firm referred to in 2.2 and the demonstration tests referred to in 2.3, the Administration shall issue a certificate of approval as well as a notice to the effect that the thickness measurement operation system of the firm has been certified.

3.2 Renewal/endorsement of the certificate shall be carried out at intervals not exceeding three years by verification that original conditions are maintained.

4 Information about any alteration to the certified thickness measurement operation system

In cases where any alteration to the certified thickness measurement operation system of the firm is made, such an alteration shall be immediately informed to the Administration. A re-audit shall be carried out where deemed necessary by the Administration.

5 Cancellation of approval

Approval may be cancelled and the certification withdrawn in the following cases:

- .1 where the measurements were improperly carried out or the results were improperly reported;
- .2 where the surveyor found any deficiencies in the approved thickness measurement operation system of the firm; and
- .3 where the firm failed to inform any alteration referred to in 4 to the Administration as required.

ANNEX 8

SURVEY REPORTING PRINCIPLES

As a principle, for oil tankers subject to this Code, the surveyor(s) shall include the following contents in the report for survey of hull structure and piping systems, as relevant for the survey. The structure of the report content may be different, depending on the reporting system of the Administration.

1 General

1.1 A survey report shall be generated in the following cases:

- .1 in connection with commencement, continuation and/or completion of periodical hull surveys, i.e. annual, intermediate and renewal surveys, as relevant;
- .2 when structural damages/defects have been found;
- .3 when repairs, renewals or modifications have been carried out; and
- .4 when a condition of class (recommendation) has been imposed or has been deleted.

1.2 The reporting shall provide:

- .1 evidence that prescribed surveys have been carried out in accordance with applicable requirements;
- .2 documentation of surveys carried out with findings, repairs carried out and condition of class (recommendation) imposed or deleted;
- .3 survey records, including actions taken, which shall form an auditable documentary trail. Survey reports shall be kept in the survey report file required to be on board;
- .4 information for planning of future surveys; and
- .5 information which may be used as input for maintenance of classification requirements and instructions.

1.3 When a survey is split between different survey stations, a report shall be made for each portion of the survey. A list of items surveyed, relevant findings and an indication of whether the item has been credited, shall be made available to the next attending surveyor, prior to continuing or completing the survey. Thickness measurement and tank testing carried out shall also be listed for the next surveyor.

2 Extent of the survey

2.1 Identification of compartments where an overall survey has been carried out.

2.2 Identification of locations, in each tank, where a close-up survey has been carried out, together with information of the means of access used.

2.3 Identification of locations, in each tank, where thickness measurement has been carried out.

Note: As a minimum, the identification of location of close-up survey and thickness measurement shall include a confirmation with description of individual structural members corresponding to the extent of requirements stipulated in this part of annex B based on type of periodical survey and the ship's age.

Where only a partial survey is required, i.e. one web frame ring/one deck transverse, the identification shall include the location within each ballast tank and cargo tank by reference to frame numbers.

2.4 For areas in tanks where the protective coating is found to be in GOOD condition and the extent of close-up survey and/or thickness measurement has been specially considered, structures subject to special consideration shall be identified.

2.5 Identification of tanks subject to tank testing.

2.6 Identification of cargo piping systems on deck, including crude oil washing (COW) piping, and ballast piping within cargo and ballast tanks, pump-rooms, pipe tunnels, cofferdams and void spaces where:

- .1 examination, including internal examination of piping with valves and fittings and thickness measurement, as relevant, has been carried out; and
- .2 operational test to working pressure has been carried out.

3 Result of survey

3.1 Type, extent and condition of protective coating in each tank, as relevant (rated GOOD, FAIR or POOR).

3.2 Structural condition of each compartment with information on the following, as relevant:

- .1 Identification of findings, such as:
 - .1 corrosion with description of location, type and extent;
 - .2 areas with substantial corrosion;
 - .3 cracks/fractures with description of location and extent;
 - .4 buckling with description of location and extent; and
 - .5 indents with description of location and extent;
- .2 Identification of compartments where no structural damages/defects are found. The report may be supplemented by sketches/photographs;
- .3 Thickness measurement report shall be verified and signed by the surveyor witnessing the measurements on board; and

- .4 Evaluation result of longitudinal strength of the hull girder of oil tankers of 130 m in length and upwards and over 10 years of age. The following data shall be included, as relevant:
 - .1 measured and as-built transverse sectional areas of deck and bottom flanges;
 - .2 diminution of transverse sectional areas of deck and bottom flanges; and
 - .3 details of renewals or reinforcements carried out, as relevant (see 4.2).

4 Actions taken with respect to findings

4.1 Whenever the attending surveyor is of the opinion that repairs are required, each item to be repaired shall be identified in a survey report. Whenever repairs are carried out, details of the repairs effected shall be reported by making specific reference to relevant items in the survey report.

4.2 Repairs carried out shall be reported with identification of:

- .1 compartment;
- .2 structural member;
- .3 repair method (i.e. renewal or modification), including:
 - .1 steel grades and scantlings (if different from the original); and
 - .2 sketches/photographs, as appropriate;
- .4 repair extent; and
- .5 non-destructive tests (NDT)/tests.

4.3 For repairs not completed at the time of survey, a condition of class/recommendation shall be imposed with a specific time limit for the repairs. In order to provide correct and proper information to the surveyor attending for survey of the repairs, the condition of class/recommendation shall be sufficiently detailed with identification of each item to be repaired. For identification of extensive repairs, reference may be given to the survey report.

ANNEX 9

CONDITION EVALUATION REPORT (EXECUTIVE HULL SUMMARY REPORT)

Issued upon completion of renewal survey

General particulars

Ship's name: Administration/recognized organization identity number:
IMO number:

Port of registry: National flag:

Deadweight (metric tonnes): Gross tonnage:
National:
ITC (1969):

Date of build: Classification notation:

Date of major conversion:
Type of conversion:

- 1 The survey reports and documents listed below have been reviewed by the undersigned and found to be satisfactory.
- 2 A summary of the survey is attached herewith on sheet 2.
- 3 The renewal survey has been completed in accordance with the present Code on (date)

Condition evaluation report (executive hull summary report) completed by	Name Signature	Title
Office	Date	
Condition evaluation report (executive hull summary report) verified by	Name Signature	Title
Office	Date	

Attached reports and documents:

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)

Contents of condition evaluation report (executive hull summary report)

- Part 1 – General particulars: - See front page
- Part 2 – Report review: - Where and how survey was done
- Part 3 – Close-up survey: - Extent (which tanks)
- Part 4 – Cargo and ballast piping system: - Examined
- Part 5 – Thickness measurements: - Operationally tested
- Part 5 – Thickness measurements: - Reference to thickness measurement report
- Part 5 – Thickness measurements: - Summary of where measured
- Part 5 – Thickness measurements: - Separate form indicating the spaces/areas with substantial corrosion, and corresponding:
 - thickness diminution
 - corrosion pattern
- Part 6 – Tank corrosion prevention system: - Separate form indicating:
 - location of coating
 - condition of coating (if applicable)
- Part 7 – Repairs: - Identification of spaces/areas
- Part 8 – Condition of class (recommendations)/flag State requirements:
- Part 9 – Memoranda: - Acceptable defects
- Part 9 – Memoranda: - Any points of attention for future surveys, e.g. for suspect areas
- Part 9 – Memoranda: - Extended annual/intermediate survey due to coating breakdown
- Part 10 – Evaluation results of the ship's longitudinal strength (for oil tankers of 130 m in length and upwards and over 10 years of age)
- Part 11 – Conclusion: - Statement on evaluation/verification of survey report

Extract of thickness measurements

Reference is made to the thickness measurement report:

Position of substantially corroded tanks/areas ¹ or areas with deep pitting ³	Thickness diminution [%]	Corrosion pattern ²	Remarks: (e.g. reference to attached sketches)

Notes:

- 1 Substantial corrosion, i.e. 75 to 100% of acceptable margins wasted.
- 2 P = Pitting
C = Corrosion in general

- 3 Any bottom plating with a pitting intensity of 20% or more, with wastage in the substantial corrosion range or having an average depth of pitting of $\frac{1}{3}$ or more of actual plate thickness shall be noted.

Tank corrosion prevention system

Tank Nos. ¹	Tank corrosion prevention system ²	Coating condition ³	Remarks

Notes:

- 1 All segregated ballast tanks and combined cargo/ballast tanks shall be listed.
- 2 C = Coating
NP = No protection
- 3 Coating condition according to the following standard:
- 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.

If coating condition less than GOOD is given, extended annual surveys shall be introduced. This shall be noted in part 9 of the Contents of the condition evaluation report (executive hull summary report).

Evaluation result of longitudinal strength of the hull girder of oil tankers of 130 m in length and upwards and of over 10 years of age (of sections 1, 2 and 3 below, only one applicable section shall be completed)

1 This section applies to ships regardless of the date of construction: Transverse sectional areas of deck flange (deck plating and deck longitudinals) and bottom flange (bottom shell plating and bottom longitudinals) of the ship's hull girder have been calculated by using the thickness measured, renewed or reinforced, as appropriate, during the renewal survey of the Cargo Ship Safety Construction Certificate or the Cargo Ship Safety Certificate (SC renewal survey) most recently conducted after the ship reached 10 years of age, and found that the diminution of the transverse sectional area does not exceed 10% of the as-built area, as shown in the following table:

Table 1 – Transverse sectional area of hull girder flange

		Measured	As-built	Diminution
Transverse section 1	Deck flange	cm ²	cm ²	cm ² (%)
	Bottom flange	cm ²	cm ²	cm ² (%)
Transverse section 2	Deck flange	cm ²	cm ²	cm ² (%)
	Bottom flange	cm ²	cm ²	cm ² (%)
Transverse section 3	Deck flange	cm ²	cm ²	cm ² (%)
	Bottom flange	cm ²	cm ²	cm ² (%)

2 This section applies to ships constructed on or after 1 July 2002: Section moduli of transverse section of the ship's hull girder have been calculated by using the thickness of structural members measured, renewed or reinforced, as appropriate, during the SC renewal survey most recently conducted after the ship reached 10 years of age in accordance with the provisions of paragraph 2.2.1.1 of annex 12, and are found to be within their diminution limits determined by the Administration, taking into account the recommended diminution limit adopted by IMO resolution MSC.108(73): 90% of the required section modulus for new buildings specified in IACS' Unified Requirements S7 (C=1.0C_n shall be used for the purpose of this calculation) or S11, whichever is the greater, as shown in the following table:

Table 2 – Transverse section modulus of hull girder

		Z _{act} (cm ³) ¹	Z _{req} (cm ³) ²	Remarks
Transverse section 1	Upper deck			
	Bottom			
Transverse section 2	Upper deck			
	Bottom			
Transverse section 3	Upper deck			
	Bottom			

Notes:

- 1 Z_{act} means the actual section moduli of the transverse section of the ship's hull girder calculated by using the thickness of structural members measured, renewed or reinforced, as appropriate, during the SC renewal survey, in accordance with the provisions of paragraph 2.2.1.1 of annex 12.
- 2 Z_{req} means the diminution limit of the longitudinal bending strength of ships, as calculated in accordance with the provisions of paragraph 2.2.1.1 of annex 12.

The calculation sheets for Z_{act} shall be attached to this report.

3 This section applies to ships constructed before 1 July 2002: Section moduli of transverse sections of the ship's hull girder have been calculated by using the thickness of structural members measured, renewed or reinforced, as appropriate, during the SC renewal survey most recently conducted after the ship reached 10 years of age in accordance with the provisions of paragraph 2.2.1.2 of annex 12, and found to meet the criteria required by the Administration and that Z_{act} is not less than Z_{mc} (defined in note 2 below) as specified in appendix 2 to annex 12, as shown in the following table.

Describe the criteria for acceptance of the minimum section moduli of the ship's hull girder for ships in service required by the Administration.

Table 3 – Transverse section modulus of hull girder

		$Z_{act} (cm^3)^1$	$Z_{mc} (cm^3)^2$	Remarks
Transverse section 1	Upper deck			
	Bottom			
Transverse section 2	Upper deck			
	Bottom			
Transverse section 3	Upper deck			
	Bottom			

Notes:

- 1 As defined in note 1 of table 2.
- 2 Z_{mc} means the diminution limit of minimum section modulus calculated in accordance with the provisions of paragraph 2.2.1.2 of annex 12.

ANNEX 10

**RECOMMENDED PROCEDURES FOR THICKNESS MEASUREMENTS OF OIL
TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS***

General

- 1 These procedures should be used for recording thickness measurements as required by annexes 2 and 4.
- 2 Reporting forms TM1-T, TM2-T(i), TM2-T(ii), TM3-T, TM4-T, TM5-T and TM6-T, set out in appendix 2, should be used for recording thickness measurements and the maximum allowable diminution should be stated. The maximum allowable diminution could be stated in an attached document.
- 3 Appendix 3 contains guidance diagrams and notes relating to the reporting forms and the requirements for thickness measurement.
- 4 The reporting forms should, where appropriate, be supplemented by data presented on structural sketches.

* This annex is recommendatory.

Appendix 1

GENERAL PARTICULARS

Ship's name:
IMO number:
Class/Administration identity number:
Port of registry:
Gross tonnage:
Deadweight:
Date of build:
Classification society:

Name of firm performing thickness measurement:
Thickness measurement firm certified by:
Certificate number:
Certificate valid from: to
Place of measurement:
First date of measurement:
Last date of measurement:
Periodical survey/intermediate survey* due:
Details of measurement equipment:
Qualification of operator:

Report number:	consisting of pages
Name of operator:	Name of surveyor:
Signature of operator:	Signature of surveyor:
Firm official stamp:	Administration:

Official stamp

* Delete as appropriate.

Appendix 2

REPORTS ON THICKNESS MEASUREMENT

TM1-T

Report on thickness measurement of all deck plating, all bottom shell plating or side shell plating*

Ship's name..... IMO number..... Class identity No..... Report No.....

STRAKE POSITION																		
	PLATE POSITION	No. or letter	Orig. thk. (mm)	Forward reading						Aft reading						Mean diminution mm		Max. allow. dimin. (mm)
				Gauged		Diminution P		Diminution S		Gauged		Diminution P		Diminution S		P	S	
				P	S	mm	%	mm	%	P	S	mm	%	mm	%			
12th forward																		
11th																		
10th																		
9th																		
8th																		
7th																		
6th																		
5th																		
4th																		
3rd																		
2nd																		
1st																		
Amidships																		
1st aft																		
2nd																		
3rd																		
4th																		
5th																		
6th																		
7th																		
8th																		
9th																		
10th																		
11th																		
12th																		

Operator's signature.....

Notes – see following page

* Delete as appropriate.

Notes to report TM1-T:

- 1 This report should be used for recording the thickness measurement of:
 - .1 All strength deck plating within the cargo area.
 - .2 All keel, bottom shell plating and bilge plating within the cargo area.
 - .3 Side shell plating including selected wind and water strakes outside the cargo area.
 - .4 All wind and water strakes within the cargo area
- 2 The strake position should be clearly indicated as follows:
 - .1 For strength deck plating, indicate the number of the strake of plating inboard from the stringer plate.
 - .2 For bottom plating, indicate the number of the strake of plating outboard from the keel plate.
 - .3 For side shell plating, give number of the strake of plating below sheer strake and letter as shown on shell expansion.
- 3 For oil tankers, all deck plating strakes should be recorded, for ore/oil ships only the deck plating strakes outside line of openings should be recorded.
- 4 Measurements should be taken at the forward and aft areas of all plates and where plates cross ballast/cargo tank boundaries, separate measurements for the area of plating in way of each type of tank should be recorded.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The maximum allowable diminution could be stated in an attached document.

TM2-T(i)

Report on thickness measurement of shell and deck plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

STRENGTH DECK AND SHEER STRAKE PLATING																											
FIRST TRANSVERSE SECTION AT FRAME NUMBER....						SECOND TRANSVERSE SECTION AT FRAME NUMBER....										THIRD TRANSVERSE SECTION AT FRAME NUMBER....											
STRAKE POSITION	No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%
Stringer plate																											
1st stake inboard																											
2nd																											
3rd																											
4th																											
5th																											
6th																											
7th																											
8th																											
9th																											
10th																											
11th																											
12th																											
13th																											
14th																											
centre strake																											
Sheer strake																											
TOPSIDE TOTAL																											

Operator's signature.....

Notes – see following page

Notes to report TM2-T(j):

- 1 This report should be used for recording the thickness measurement of strength deck plating and sheer strake plating transverse sections:

One, two or three sections within the cargo area comprising of the structural items (1), (2) and (3) as shown on the diagrams of typical transverse section (appendix 3).
- 2 For oil tankers all deck plating strakes should be recorded, for ore/oil ships only the deck plating strakes outside line of openings should be recorded.
- 3 The topside area comprises deck plating, stringer plate and sheer strake (including rounded gunwales).
- 4 The exact frame station of measurement should be stated.
- 5 The single measurements recorded should represent the average of multiple measurements.
- 6 The maximum allowable diminution could be stated in an attached document.

TM2-T(ii)

Report on thickness measurement of shell and deck plating (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

SHELL PLATING																											
FIRST TRANSVERSE SECTION AT FRAME NUMBER....						SECOND TRANSVERSE SECTION AT FRAME NUMBER....										THIRD TRANSVERSE SECTION AT FRAME NUMBER....											
STRAKE POSITION	No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		No. or letter	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%		mm	mm	P	S	mm	%	mm	%
1st below sheer strake																											
2nd																											
3rd																											
4th																											
5th																											
6th																											
7th																											
8th																											
9th																											
10th																											
11th																											
12th																											
13th																											
14th																											
15th																											
16th																											
17th																											
18th																											
19th																											
20th																											
keel strake																											
BOTTOM TOTAL																											

Operator's signature.....

Notes – see following page

Notes to report TM2-T(ii):

- 1 This report should be used for recording the thickness measurements of shell plating transverse sections:

One, two or three sections within the cargo area comprising of the structural items (4), (5), (6), and (7) as shown on the diagrams of typical transverse section (appendix 3).
- 2 The bottom area comprises keel, bottom and bilge plating.
- 3 The exact frame station of measurement should be stated.
- 4 The single measurements recorded should represent the average of multiple measurements.
- 5 The maximum allowable diminution could be stated in an attached document.

TM3-T

Report on thickness measurement of longitudinal members (one, two or three transverse sections)

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER	FIRST TRANSVERSE SECTION AT FRAME NUMBER.....								SECOND TRANSVERSE SECTION AT FRAME NUMBER.....								THIRD TRANSVERSE SECTION AT FRAME NUMBER.....										
	Item No.	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		Item No.	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S		Item No.	Orig. thk.	Max allow. dimin.	Gauged		Diminution P		Diminution S	
				P	S	mm	%	mm	%				P	S	mm	%	mm	%				P	S	mm	%	mm	%
		mm	mm			mm	%	mm	%		mm	mm			mm	%	mm	%		mm	%	mm	mm			mm	%

Operator's signature.....

Notes – see following page

Notes to report TM3-T:

- 1 This report should be used for recording the thickness measurement of longitudinal members at transverse sections:

One, two or three sections within the cargo area comprising of the structural items (8) to (20) as shown on the diagrams of typical transverse section (appendix 3).
- 2 The exact frame station of measurement should be stated.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM4-T

Report on thickness measurement of transverse structural members (in the cargo oil and water ballast tanks within the cargo tank length)

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK DESCRIPTION:									
LOCATION OF STRUCTURE:									
STRUCTURAL MEMBER	ITEM	Original thickness mm	Max. allow. dimin. mm	Gauged		Diminution P		Diminution S	
				P	S	mm	%	mm	%

Operator's signature.....

Notes – see following page

Notes to report TM4-T:

- 1 This report should be used for recording the thickness measurement of transverse structural members, comprising of the appropriate structural items (25) to (32) as shown on the diagrams of typical transverse section (appendix 3).
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM5-T

Report on thickness of watertight/oiltight transverse bulkheads (within the cargo tank or cargo hold spaces)

Ship's name..... IMO number..... Class identity No..... Report No.....

TANK/HOLD		LOCATION OF STRUCTURE:		FRAME NO:					
STRUCTURAL Stiffener)	COMPONENT (Plating,	Original thickness	Max. allow. dimin.	Gauged		Diminution P		Diminution S	
		mm	mm	P	S	mm	%	mm	%

Operator's signature.....

Notes – see following page

Notes to report TM5-T:

- 1 This report should be used for recording the thickness measurement of W.T./O.T. transverse bulkheads.
- 2 Guidance for areas of measurement is indicated in appendix 3.
- 3 The single measurements recorded should represent the average of multiple measurements.
- 4 The maximum allowable diminution could be stated in an attached document.

TM6-T

Report on thickness measurement of miscellaneous structural members

Ship's name..... IMO number..... Class identity No..... Report No.....

STRUCTURAL MEMBER:									SKETCH
LOCATION OF STRUCTURE:									
Description	Org. thk.	Max. allow. dimin.	Gauged		Diminution P		Diminution S		
	mm	mm	P	S	mm	%	mm	%	

Operator's signature.....

Notes – see following page

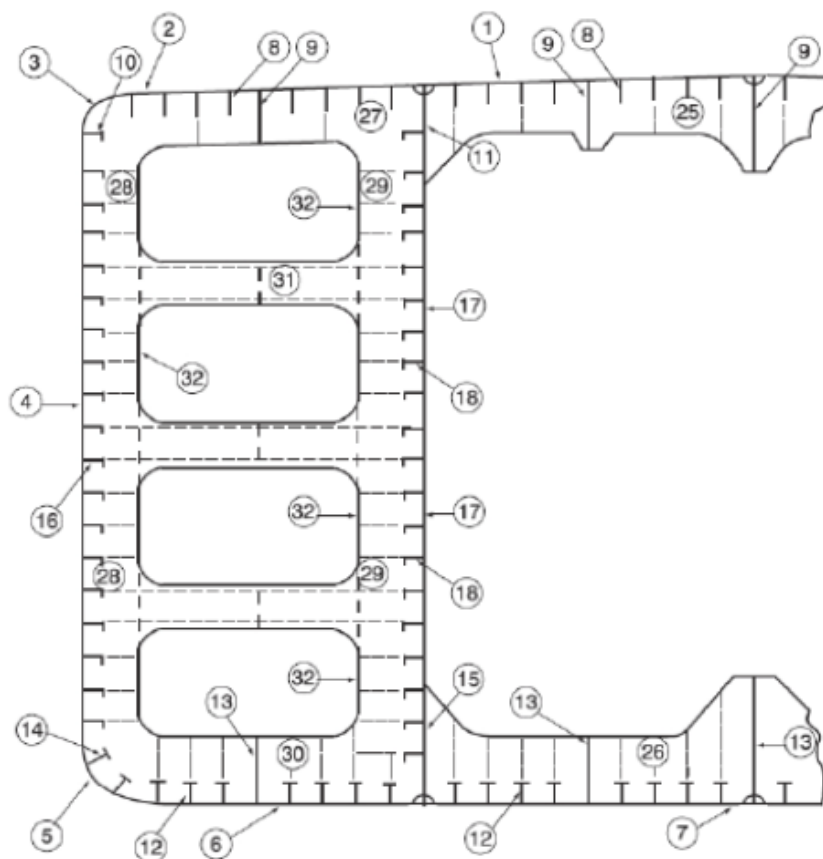
Notes to report TM6-T:

- 1 This report should be used for recording the thickness measurement of miscellaneous structural members including structural items (36), (37) and (38) (appendix 3).
- 2 The single measurements recorded should represent the average of multiple measurements.
- 3 The maximum allowable diminution could be stated in an attached document.

Appendix 3

GUIDANCE ON THICKNESS MEASUREMENT OF OIL TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS

Typical transverse section of oil tanker indicating longitudinal and transverse members

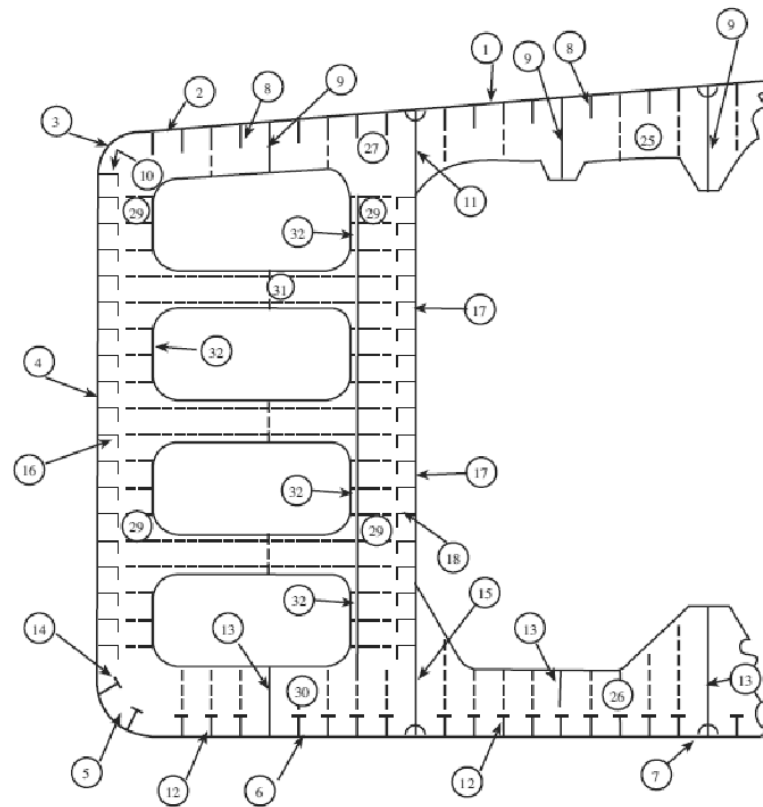


REPORT ON TM2-T(i) & (ii)
1 Strength deck plating
2 Stringer plate
3 Sheerstrake
4 Side shell plating
5 Bilge plating
6 Bottom shell plating
7 Keel plate

REPORT ON TM6-T
36 Hatch coamings
37 Deck plating between hatches
38 Hatch covers
39
40

REPORT ON TM3-T
8 Deck longitudinals
9 Deck girders
10 Sheerstrake longitudinals
11 Longitudinal bulkhead top strake
12 Bottom longitudinals
13 Bottom girders
14 Bilge longitudinals
15 Longitudinal bulkhead lower strake
16 Side shell longitudinals
17 Longitudinal bulkhead plating (remainder)
18 Longitudinal bulkhead longitudinals
19 Inner bottom plating
20 Inner bottom longitudinals
21
22
23
24

REPORT ON TM4-T
25 Deck transverse centre tank
26 Bottom transverse centre tank
27 Deck transverse wing tank
28 Side shell vertical web
29 Longitudinal bulkhead vertical web
30 Bottom transverse wing tank
31 Struts
32 Transverse web face plate
33 D.B. floors
34
35



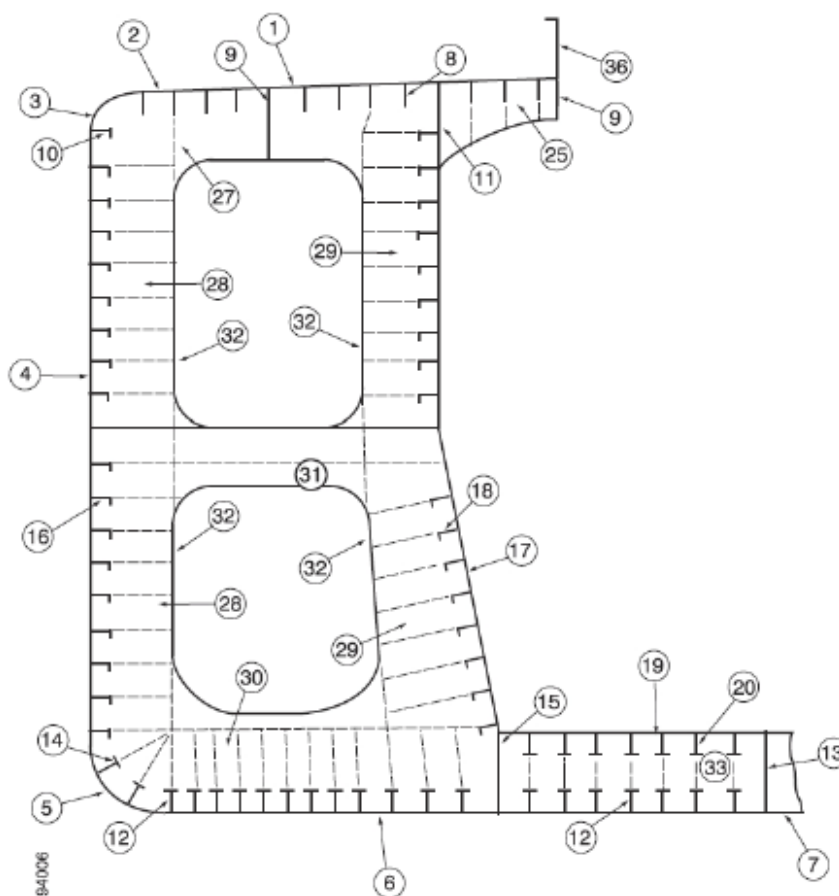
Report on TM2-T (I) & (II)	
1.	Strength deck plating
2.	Stringer plate
3.	Sheerstrake
4.	Side shell plating
5.	Bilge plating
6.	Bottom shell plating
7.	Keel plate

Report on TMS-T	
8.	Deck longitudinals
9.	Deck girders
10.	Sheerstrake longitudinals
11.	Longitudinal bulkhead top strake
12.	Bottom longitudinals
13.	Bottom girders
14.	Bilge longitudinals
15.	Longitudinal bulkhead lower strake
16.	Side shell longitudinals
17.	Longitudinal bulkhead plating (remainder)
18.	Longitudinal bulkhead longitudinals
19.	Inner bottom plating
20.	Inner bottom longitudinals
21.	
22.	
23.	
24.	

Report on TM4-T	
25.	Deck transverse centre tank
26.	Bottom transverse centre tank
27.	Deck transverse wing tank
28.	Side shell vertical web
29.	Longitudinal bulkhead vertical web
30.	Bottom transverse wing tank
31.	Struts
32.	Transverse web face plate
33.	D.B. Floors
34.	
35.	

Report on TM6-T	
36.	Hatch coamings
37.	Deck plating between hatches
38.	Hatch covers
39.	
40.	

Typical transverse section of ore/oil ship indicating longitudinal and transverse members

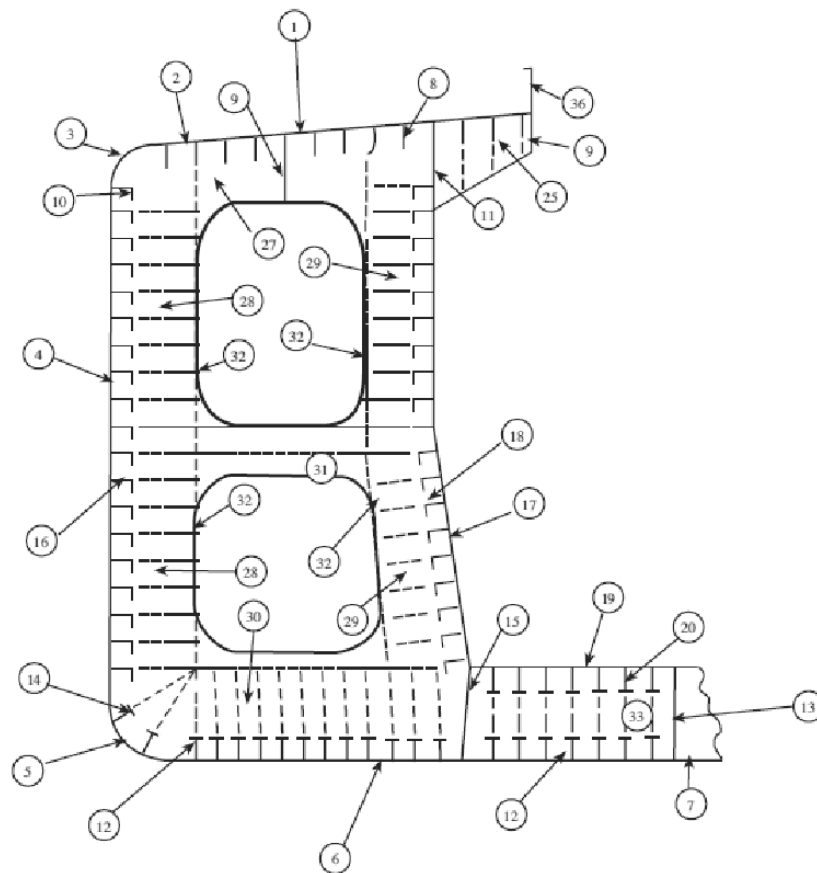


REPORT ON TM2-T(i) & (ii)	
1	Strength deck plating
2	Stringer plate
3	Sheerstrake
4	Side shell plating
5	Bilge plating
6	Bottom shell plating
7	Keel plate

REPORT ON TM6-T	
36	Hatch coamings
37	Deck plating between hatches
38	Hatch covers
39	
40	

REPORT ON TM3-T	
8	Deck longitudinals
9	Deck girders
10	Sheerstrake longitudinals
11	Longitudinal bulkhead top strake
12	Bottom longitudinals
13	Bottom girders
14	Bilge longitudinals
15	Longitudinal bulkhead lower strake
16	Side shell longitudinals
17	Longitudinal bulkhead plating (remainder)
18	Longitudinal bulkhead longitudinals
19	Inner bottom plating
20	Inner bottom longitudinals
21	
22	
23	
24	

REPORT ON TM4-T	
25	Deck transverse centre tank
26	Bottom transverse centre tank
27	Deck transverse wing tank
28	Side shell vertical web
29	Longitudinal bulkhead vertical web
30	Bottom transverse wing tank
31	Struts
32	Transverse web face plate
33	D.B. floors
34	
35	



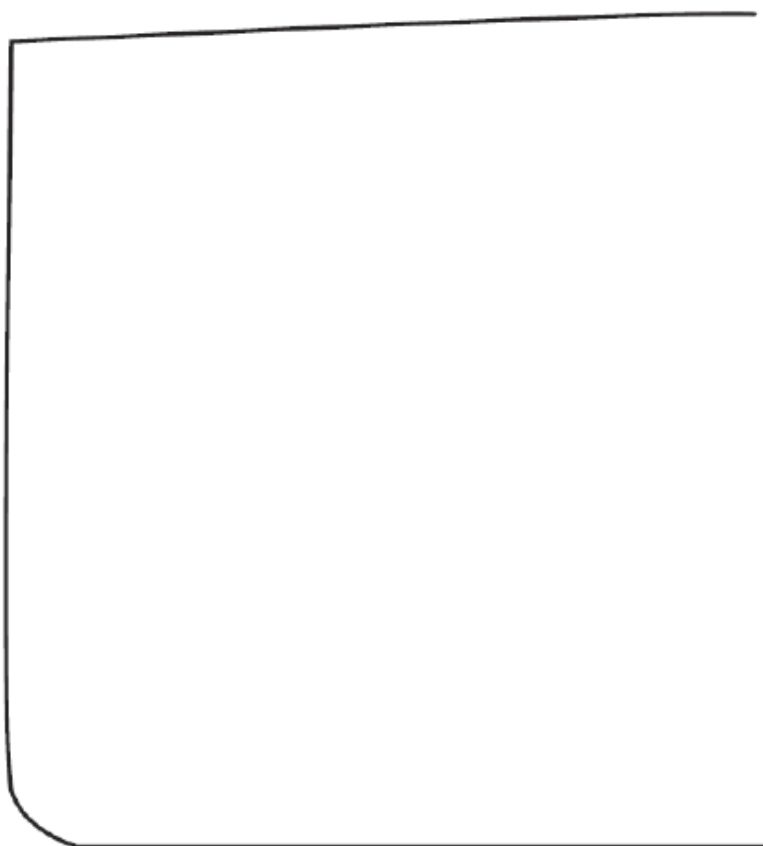
Report on TM2-T (I) & (II)	
1.	Strength deck plating
2.	Stringer plate
3.	Sheerstrake
4.	Side shell plating
5.	Bilge plating
6.	Bottom shell plating
7.	Keel plate

Report on TMS-T	
8.	Deck longitudinals
9.	Deck girders
10.	Sheerstrake longitudinals
11.	Longitudinal bulkhead top strake
12.	Bottom longitudinals
13.	Bottom girders
14.	Bilge longitudinals
15.	Longitudinal bulkhead lower strake
16.	Side shell longitudinals
17.	Longitudinal bulkhead plating (remainder)
18.	Longitudinal bulkhead longitudinals
19.	Inner bottom plating
20.	Inner bottom longitudinals
21.	
22.	
23.	
24.	

Report on TM4-T	
25.	Deck transverse centre tank
26.	Bottom transverse centre tank
27.	Deck transverse wing tank
28.	Side shell vertical web
29.	Longitudinal bulkhead vertical web
30.	Bottom transverse wing tank
31.	Struts
32.	Transverse web face plate
33.	D.B. Floors
34.	
35.	

Report on TM6-T	
36.	Hatch coamings
37.	Deck plating between hatches
38.	Hatch covers
39.	
40.	

Transverse section outline (to be used for longitudinal and transverse members where typical oil tanker or oil/ore ship sections are not applicable)

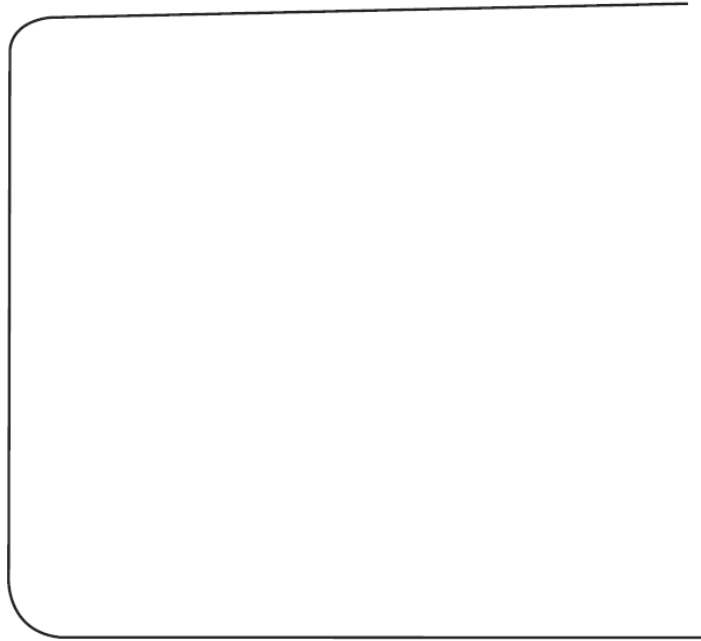


REPORT ON TM2-T  & 	
①	Strength deck plating
②	Stringer plate
③	Sheerstrake
④	Side shell plating
⑤	Bilge plating
⑥	Bottom shell plating
⑦	Keel plate

REPORT ON TM6-T	
③⑥	Hatch coamings
③⑦	Deck plating between hatches
③⑧	Hatch covers
③⑨	
④①	

REPORT ON TM3-T	
⑧	Deck longitudinals
⑨	Deck girders
⑩	Sheerstrake longitudinals
⑪	Longitudinal bulkhead top strake
⑫	Bottom longitudinals
⑬	Bottom girders
⑭	Bilge longitudinals
⑮	Longitudinal bulkhead lower strake
⑯	Side shell longitudinals
⑰	Longitudinal bulkhead plating (remainder)
⑱	Longitudinal bulkhead longitudinals
⑲	Inner bottom plating
⑳	Inner bottom longitudinals
㉑	
㉒	
㉓	
㉔	

REPORT ON TM4-T	
⑳⑤	Deck transverse centre tank
⑳⑥	Bottom transverse centre tank
⑳⑦	Deck transverse wing tank
⑳⑧	Side shell vertical web
⑳⑨	Longitudinal bulkhead vertical web
㉑①	Bottom transverse wing tank
㉑②	Struts
㉑③	Transverse web face plate
㉑④	D.B. floors
㉑⑤	



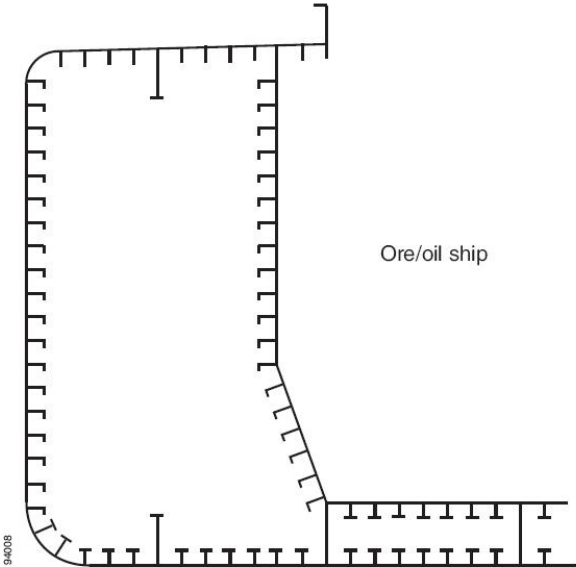
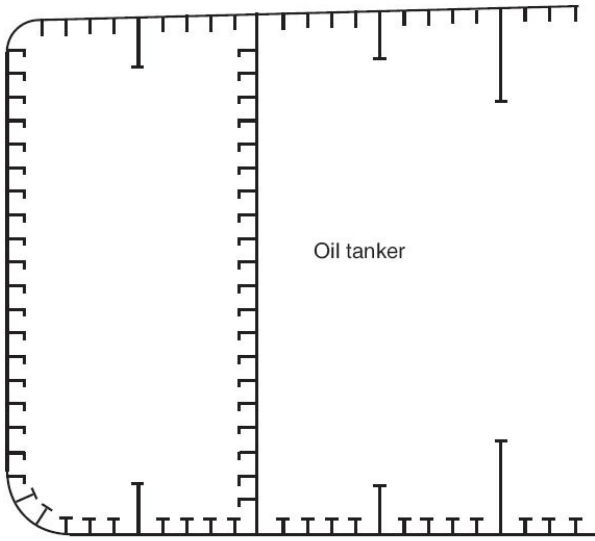
Report on TM2-T (I) & (II)	
1.	Strength deck plating
2.	Stringer plate
3.	Sheerstrake
4.	Side shell plating
5.	Bilge plating
6.	Bottom shell plating
7.	Keel plate

Report on TM3-T	
8.	Deck longitudinals
9.	Deck girders
10.	Sheerstrake longitudinals
11.	Longitudinal bulkhead top strake
12.	Bottom longitudinals
13.	Bottom girders
14.	Bilge longitudinals
15.	Longitudinal bulkhead lower strake
16.	Side shell longitudinals
17.	Longitudinal bulkhead plating (remainder)
18.	Longitudinal bulkhead longitudinals
19.	Inner bottom plating
20.	Inner bottom longitudinals
21.	
22.	
23.	
24.	

Report on TM4-T	
25.	Deck transverse centre tank
26.	Bottom transverse centre tank
27.	Deck transverse wing tank
28.	Side shell vertical web
29.	Longitudinal bulkhead vertical web
30.	Bottom transverse wing tank
31.	Struts
32.	Transverse web face plate
33.	D.B. Floors
34.	
35.	

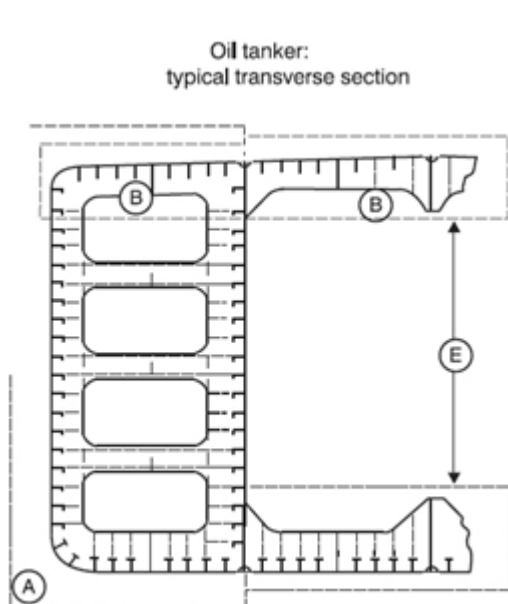
Report on TM6-T	
36.	Hatch coamings
37.	Deck plating between hatches
38.	Hatch covers
39.	
40.	

**Typical transverse sections showing all longitudinal members
to be reported on TM2-T(i) & (ii) and TM3-T**

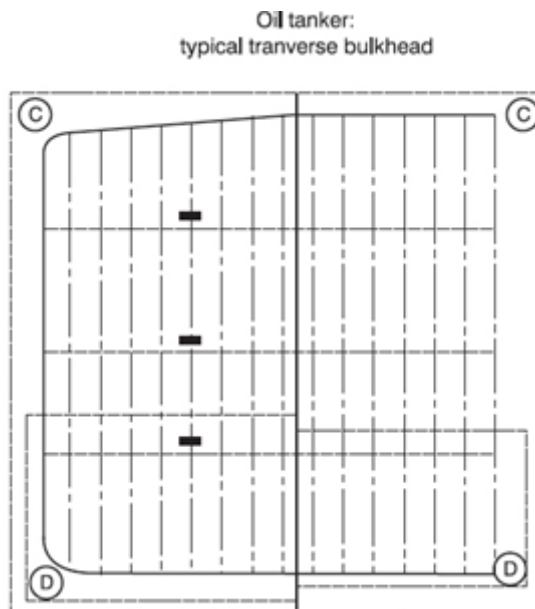


Close-up survey requirements

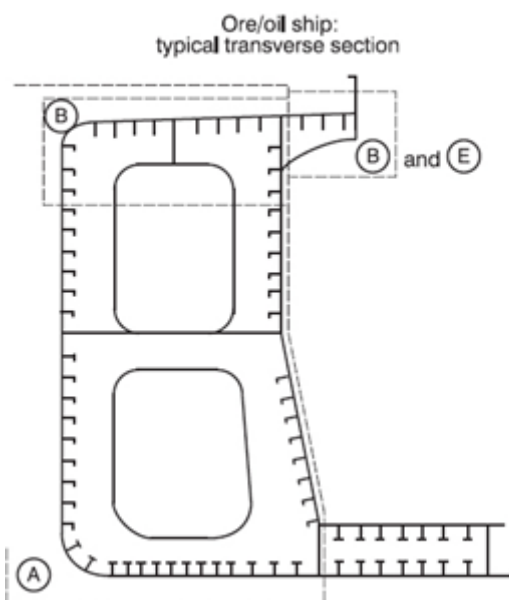
Areas subject to close-up survey and thickness measurements - areas (A) to (E) as defined in annex 1. The thickness measurement should be reported in forms TM3-T, TM4-T and TM5-T, as appropriate.



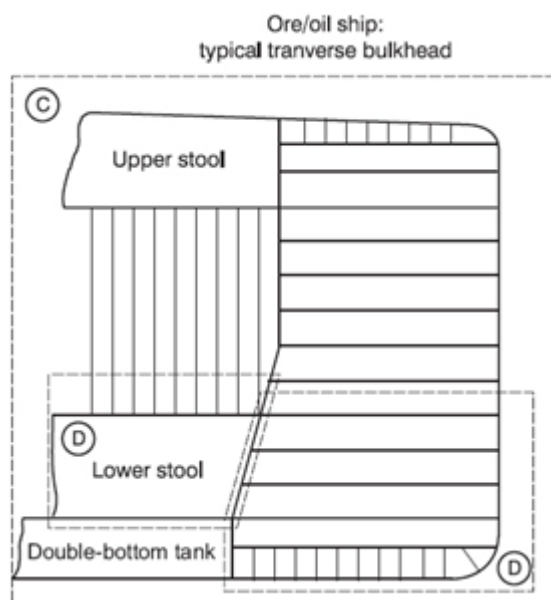
Thickness should be reported on TM3-T and TM4-T as appropriate



Thickness should be reported on TM5-T



Thickness should be reported on TM3-T and TM4-T as appropriate



Thickness should be reported on TM5-T

Close-up
survey area

Recommendations for the extent and pattern of thickness measurements are indicated in annex 4.

ANNEX 11

GUIDELINES FOR TECHNICAL ASSESSMENT IN CONJUNCTION WITH THE PLANNING OF ENHANCED SURVEYS FOR OIL TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS*

Renewal survey

1 Introduction

These Guidelines contain information and suggestions concerning technical assessments which may be of use in conjunction with the planning of enhanced renewal surveys of oil tankers. As indicated in 5.1.5 of the Code, these Guidelines are a recommended tool which may be invoked at the discretion of an Administration, when considered necessary and appropriate, in conjunction with the preparation of the required survey programme.

2 Purpose and principles

2.1 Purpose

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 and tanks for thickness measurement, close-up survey and tank testing.

2.2 Timing

As with other aspects of survey planning, the technical assessments described in these Guidelines should be carried out by the owner or operator in cooperation with the Administration 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.

2.3 Aspects to be considered

2.3.1 Technical assessments, which may include quantitative or qualitative evaluation of relative risks of possible deterioration, of the following aspects of a particular ship should be used as a basis for the nomination of 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 (HTS);
- .2 former history with respect to corrosion, cracking, buckling, indents and repairs for the particular ship as well as similar vessels, where available; and
- .3 information with respect to types of cargo carried, use of different tanks for cargo/ballast, protection of tanks and condition of coating, if any.

2.3.2 Technical assessments of the relative risks of susceptibility to damage or deterioration of various structural elements and areas should be judged and decided on the basis of recognized principles and practices, such as may be found in references 1 and 2.

* This annex is recommendatory.

3 Technical assessment

3.1 General

3.1.1 There are three basic types of possible failure which should 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 plan since indents are usually noted in memoranda and assumed to be dealt with as a normal routine by surveyors.

3.1.2 Technical assessments performed in conjunction with the survey planning process should, in principle, be as shown schematically in figure 1. The approach is basically an evaluation of the risk, based on the knowledge and experience related to design and corrosion.

3.1.3 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.

3.1.4 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.

3.2 Methods

3.2.1 Design details

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

3.2.1.2 Typical damage experience which should be considered will consist of:

- .1 number, extent, location and frequency of cracks; and
- .2 location of buckles.

3.2.1.3 This information should 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.

3.2.1.4 In addition, general experience should be utilized. For example, reference should be made to reference 1, which contains a catalogue of typical damages and proposed repair methods for various tanker structural details.

3.2.1.5 Such figures should be used together with a review of the main drawings, in order to compare with the actual structure and search for similar details which may be susceptible to damage. An example is shown in figure 2.

3.2.1.6 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. The factors contributing to damage should be carefully considered.

3.2.1.7 The use of 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, is utilized. 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.

3.2.1.8 In this respect, stress calculations of typical and important components and details, in accordance with relevant methods, may prove useful and should be considered.

3.2.1.9 The selected areas of the structure identified during this process should be recorded and marked on the structural drawings which should be included in the survey programme.

3.2.2 *Corrosion*

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

- .1 usage of tanks and spaces;
- .2 condition of coatings;
- .3 cleaning procedures;
- .4 previous corrosion damage;
- .5 ballast use and time for cargo tanks;
- .6 corrosion risk scheme (see reference 2, table 3.1); and
- .7 location of heated tanks.

3.2.2.2 Reference 2 gives definitive examples which may be used for judging and describing coating condition, using typical pictures of conditions.

3.2.2.3 The evaluation of corrosion risks should be based on information in reference 2, together with the age of the ship and relevant information on the anticipated condition of the ship as derived from the information collected in order to prepare the survey programme.

3.2.2.4 The various tanks and spaces should be listed with the corrosion risks nominated accordingly.

3.2.3 *Locations for close-up survey and thickness measurement*

3.2.3.1 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) should be nominated.

3.2.3.2 The sections subject to thickness measurement should normally be nominated in tanks and spaces where corrosion risk is judged to be highest.

3.2.3.3 The nomination of tanks and spaces for close-up survey should, initially, be based on where the corrosion risk is judged to be highest, and should always include ballast tanks. The principle for the selection should be that the extent is increased with age or where information is insufficient or unreliable.

References

- 1 TSCF, Guidance Manual for the Inspection and Condition Assessment of Tanker Structures, 1986.
- 2 TSCF, Condition Evaluation and Maintenance of Tanker Structures, 1992.

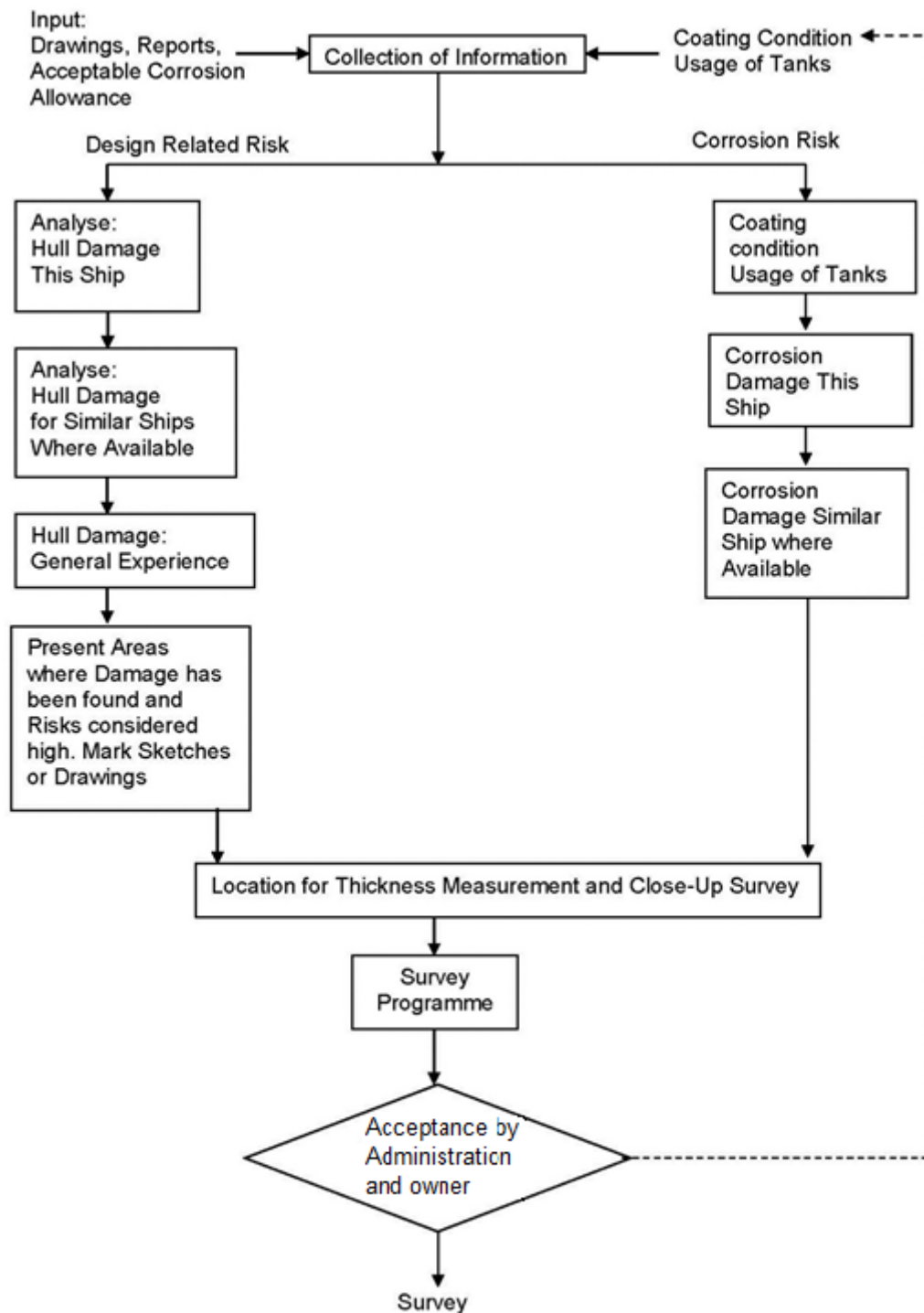


Figure 1: Technical Assessment and the Survey Planning Process

LOCATION: Connection of longitudinals to transverse webs		
EXAMPLE NO. 1 Web and flat bar fractures at cut-outs for longitudinal stiffener connections		
TYPICAL DAMAGE	PROPOSED REPAIR	
<p>shell plating or longitudinal bulkhead</p> <p>*fracture</p> <p>flat bar stiffener</p> <p>fractured weld/web</p> <p>*fracture</p> <p>view A-A</p> <p>side shell or bulkhead longitudinal web plating</p> <p>*fracture</p> <p>web flat bar stiffener</p> <p>view A-A</p> <p>Note* one or more fractures may occur</p>	<p>full collar if fractures in web plate are small and are repaired by welding</p> <p>lug</p> <p>backing bracket</p> <p>lug $\geq X$</p> <p>X</p> <p>view A-A</p> <p>web and flat bar cropped and part renewed or alternatively welded</p>	
<p>FACTORS CONTRIBUTING TO DAMAGE</p> <ol style="list-style-type: none"> 1 Asymmetrical connection of flat bar stiffener resulting in high peak stresses at the heel of the stiffener under fatigue loading. 2 Insufficient area of connection of longitudinal to web plate. 3 Defective weld at return around the plate thickness. 4 High localized corrosion at areas of stress concentration such as flat bar stiffener connections, corners of cut-out for the longitudinal and connection of web to shell at cut-outs. 5 High shear stress in the web of the transverse. 6 Dynamic seaway loads/ship motions. 		
FIGURE 1	TANKER STRUCTURE CO-OPERATIVE FORUM SUBJECT: CATALOGUE OF STRUCTURAL DETAILS	FIGURE 1

Figure 2 – Typical damage and repair example (reproduced from reference 1)

ANNEX 12

CRITERIA FOR LONGITUDINAL STRENGTH OF HULL GIRDER FOR OIL TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS

1 General

1.1 These criteria shall be used for the evaluation of the longitudinal strength of the ship's hull girder as required by 8.1.2.

1.2 In order that the ship's longitudinal strength to be evaluated can be recognized as valid, fillet welding between longitudinal internal members and hull envelopes shall be in sound condition so as to keep the integrity of longitudinal internal members with hull envelopes.

2 Evaluation of longitudinal strength

On oil tankers of 130 m in length and upwards and over 10 years of age, the longitudinal strength of the ship's hull girder shall be evaluated in compliance with the requirements of this annex on the basis of the thickness measured, renewed or reinforced, as appropriate, during the renewal survey of the Cargo Ship Safety Construction Certificate or Cargo Ship Safety Certificate (SC renewal survey). The condition of the hull girder for longitudinal strength evaluation shall be determined in accordance with the methods specified in appendix 3.

2.1 *Calculation of transverse sectional areas of deck and bottom flanges of hull girder*

2.1.1 The transverse sectional areas of deck flange (deck plating and deck longitudinals) and bottom flange (bottom shell plating and bottom longitudinals) of the ship's hull girder shall be calculated by using the thickness measured, renewed or reinforced, as appropriate, during the SC renewal survey.

2.1.2 If the diminution of sectional areas of either deck or bottom flange exceeds 10% of their respective as-built area (i.e. original sectional area when the ship was built), either one of the following measures shall be taken:

- .1 to renew or reinforce the deck or bottom flanges so that the actual sectional area is not less than 90% of the as-built area; or
- .2 to calculate the actual section moduli (Z_{act}) of transverse section of the ship's hull girder by applying the calculation method specified in appendix 1, by using the thickness measured, renewed or reinforced, as appropriate, during the SC renewal survey.

2.2 *Requirements for transverse section modulus of hull girder*

2.2.1 The actual section moduli of the transverse section of the ship's hull girder, calculated in accordance with paragraph 2.1.2.2, shall satisfy either of the following provisions, as applicable:

- .1 for ships constructed on or after 1 July 2002, the actual section moduli (Z_{act}) of the transverse section of the ship's hull girder calculated in accordance with the requirements of paragraph 2.1.2.2 shall be not less than

the diminution limits determined by the Administration, taking into account the recommended diminution limit adopted by IMO resolution MSC.108(73): 90% of the required section modulus for new buildings specified in IACS' Unified Requirements S7 ($C=1.0C_n$ shall be used for the purpose of this calculation) or S11, whichever is the greater; or

- .2 for ships constructed before 1 July 2002, the actual section moduli (Z_{act}) of the transverse section of the ship's hull girder calculated in accordance with the requirements of 2.1.2.2 shall meet the criteria for minimum section modulus for ships in service required by the Administration, provided that in no case Z_{act} shall be less than the diminution limit of the minimum section modulus (Z_{mc}) as specified in appendix 2.

Appendix 1

CALCULATION CRITERIA OF SECTION MODULI OF MIDSHIP SECTION OF HULL GIRDER

1 When calculating the transverse section modulus of the ship's hull girder, the sectional area of all continuous longitudinal strength members shall be taken into account.

2 Large openings, i.e. openings exceeding 2.5 m in length or 1.2 m in breadth, and scallops, where scallop welding is applied, shall always be deducted from the sectional areas used in the section modulus calculation.

3 Smaller openings (manholes, lightening holes, single scallops in way of seams, etc.) need not be deducted, provided that the sum of their breadths or shadow area breadths in one transverse section does not reduce the section modulus at deck or bottom by more than 3% and provided that the height of lightening holes, draining holes and single scallops in longitudinals or longitudinal girders does not exceed 25% of the web depth, for scallops of maximum 75 mm.

4 A deduction-free sum of smaller opening breadths in one transverse section in the bottom or deck area of $0.06 (B - \Sigma b)$ (where B = breadth of ship, Σb = total breadth of large openings) may be considered equivalent to the above reduction in sectional modulus.

5 The shadow area shall be obtained by drawing two tangent lines with an opening angle of 30° .

6 The deck modulus is related to the moulded deck line at side.

7 The bottom modulus is related to the baseline.

8 Continuous trunks and longitudinal hatch coamings shall be included in the longitudinal sectional area provided they are effectively supported by longitudinal bulkheads or deep girders. The deck modulus shall then be calculated by dividing the moment of inertia by the following distance, provided this is greater than the distance to the deck line at side:

$$y_t = y \left(0.9 + 0.2 \frac{x}{B} \right)$$

where:

y = distance from neutral axis to top of continuous strength member;

x = distance from top of continuous strength member to centreline of the ship;

x and y shall be measured to the point giving the largest value of y_t .

9 Longitudinal girders between multi-hatchways shall be considered by special calculations.

Appendix 2

DIMINUTION LIMIT OF MINIMUM LONGITUDINAL STRENGTH OF SHIPS IN SERVICE

1 The diminution limit of the minimum section modulus (Z_{mc}) of oil tankers in service is given by the following formula:

$$Z_{mc} = cL^2 B (C_b + 0.7)k \quad (\text{cm}^3)$$

where:

L = Length of ship. L is the distance, in metres, on the summer load waterline from the fore-side of stem to the after-side of the rudder post, or the centre of the rudder stock if there is no rudder post. L shall not be less than 96%, and need not be greater than 97%, of the extreme length on the summer load waterline. In ships with unusual stern and bow arrangement, the length L may be specially considered.

B = Greatest moulded breadth in metres.

C_b = Moulded block coefficient at draught d corresponding to summer load waterline, based on L and B . C_b shall not be taken less than 0.6.

$$C_b = \frac{\text{moulded displacement (m}^3\text{) at draught } d}{LBd}$$

$$c = 0.9c_n$$

$$c_n = 10.75 - \left(\frac{300-L}{100}\right)^{1.5} \quad \text{for } 130 \text{ m} \leq L \leq 300 \text{ m}$$

$$c_n = 10.75 \quad \text{for } 300 \text{ m} \leq L \leq 350 \text{ m}$$

$$c_n = 10.75 - \left(\frac{L-350}{150}\right)^{1.5} \quad \text{for } 350 \text{ m} \leq L \leq 500 \text{ m}$$

k = material factor, e.g.

$k = 1.0$ for mild steel with yield stress of 235 N/mm² and over

$k = 0.78$ for high-tensile steel with yield stress of 315 N/mm² and over

$k = 0.72$ for high-tensile steel with yield stress of 355 N/mm² and over.

2 Scantlings of all continuous longitudinal members of the ship's hull girder based on the section modulus requirement in 1 above shall be maintained within 0.4 L amidships. However, in special cases, based on consideration of type of ship, hull form and loading conditions, the scantlings may be gradually reduced towards the end of 0.4 L part, bearing in mind the desire not to inhibit the ship's loading flexibility.

3 However, the above standard may not be applicable to ships of unusual type or design, e.g. for ships of unusual main proportions and/or weight distributions.

Appendix 3

SAMPLING METHOD OF THICKNESS MEASUREMENTS FOR LONGITUDINAL STRENGTH EVALUATION AND REPAIR METHODS

1 Extent of longitudinal strength evaluation

Longitudinal strength shall be evaluated 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.

2 Sampling method of thickness measurement

2.1 Pursuant to the requirements of section 2.5, transverse sections shall be chosen such that thickness measurements can be taken for as many different tanks in corrosive environments as possible, e.g. ballast tanks sharing a common plane boundary with cargo tanks fitted with heating coils, other ballast tanks, cargo tanks permitted to be filled with sea water and other cargo tanks. Ballast tanks sharing a common plane boundary with cargo tanks fitted with heating coils and cargo tanks permitted to be filled with seawater shall be selected where present.

2.2 The minimum number of transverse sections to be sampled shall be in accordance with annex 2. The transverse sections chosen shall be located where the largest thickness reductions:

- .1 are suspected to occur; or
- .2 are revealed from deck and bottom plating measurements prescribed in 2.3.

The transverse sections chosen shall be clear of areas which have been locally renewed or reinforced.

2.3 At least two points shall be measured on each deck plate and/or bottom shell plate required to be measured within the cargo area in accordance with the requirements of annex 2.

2.4 Within $0.1D$ (where D is the ship's moulded depth) of the deck and bottom at each transverse section which shall be measured in accordance with the requirements of annex 2, every longitudinal and girder shall be measured on the web and face plate, and every plate shall be measured at one point between longitudinals.

2.5 For longitudinal members other than those specified in 2.4 to be measured at each transverse section in accordance with the requirements of annex 2, every longitudinal and girder shall be measured on the web and face plate, and every plate shall be measured at least in one point per strake.

2.6 The thickness of each component shall be determined by averaging all of the measurements taken in way of the transverse section on each component.

3 Additional measurements where the longitudinal strength is deficient

3.1 Where one or more of the transverse sections are found to be deficient in respect of the longitudinal strength requirements given in this annex, the number of transverse sections for thickness measurement shall be increased such that each tank within the $0.5L$ amidships

region has been sampled. Tank spaces that are partially within, but extend beyond, the $0.5L$ region, shall be sampled.

3.2 Additional thickness measurements shall 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 of the Code.

4 Effective repair methods

4.1 The extent of renewal or reinforcement carried out to comply with this annex shall be in accordance with 4.2.

4.2 The minimum continuous length of a renewed or reinforced structural member shall not be 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.) shall not be within the substantial corrosion range (75% of the allowable diminution associated with each particular member). Where differences in thickness at the butt joint exceed 15% of the lower thickness, a transition taper shall be provided.

4.3 Alternative repair methods involving the fitting of straps or structural member modification shall be subject to special consideration. In considering the fitting of straps, it shall be limited to the following conditions:

- .1 to restore and/or increase longitudinal strength;
- .2 the thickness diminution of the deck or bottom plating to be reinforced shall not be within the substantial corrosion range (75% of the allowable diminution associated with the deck plating);
- .3 the alignment and arrangement, including the termination of the straps, shall be in accordance with a standard recognized by the Administration;
- .4 the straps shall be continuous over the entire $0.5L$ amidships length; and
- .5 continuous fillet welding and full penetration welds shall be used at butt welding and, depending on the width of the strap, slot welds. The welding procedures applied shall be acceptable to the Administration.

4.4 The existing structure adjacent to replacement areas and in conjunction with the fitted straps, etc., shall 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.

ANNEX 13

PROCEDURAL REQUIREMENTS FOR THICKNESS MEASUREMENTS

1 General

Thickness measurements required in the context of hull structural surveys, if not carried out by the Administration, shall be witnessed by a surveyor of the Administration. The attendance of the surveyor shall be recorded. This also applies to thickness measurements taken during voyages.

2 Survey meeting

2.1 Prior to commencement of the renewal or intermediate survey, a meeting shall be held between the attending surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) in attendance and the thickness measurement firm's representative(s) so as to ensure the safe and efficient execution of the surveys and thickness measurements to be carried out on board.

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

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

2.3 When thickness measurements are taken in association with intermediate or renewal surveys, a documented record indicating where and when the meeting took place and who attended (the name of the surveyor(s), the master of the ship or an appropriately qualified representative appointed by the master or company, the owner's representative(s) and the representative(s) of the thickness measurement firm(s)) shall be maintained.

3 Monitoring of the thickness measurement process on board

3.1 The surveyor shall decide the final extent and location of thickness measurements after overall survey of representative spaces on board.

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

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

3.4 Thickness measurements taken mainly to evaluate the extent of corrosion, which may affect the hull girder strength, shall be carried out in a systematic manner such that all longitudinal structural members are gauged, as required.

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

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

4 Review and verification

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

4.2 If, where special consideration is allowed by this Code, the extent of thickness measurements is reduced, the surveyor's special consideration shall be reported.

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