QRS Class
QUALITAS REGISTER of SHIPPING

VOLUME III

Rules for Classification Surveys of Vessels in Service

The present edition of the General Rules for Classification of Vessels in Service has been approved by the General Manager and will enter in force on May 15, 2023.

The present edition of these Rules is based on the 2016 edition taking into account the amendments developed immediately before publication.

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CHAPTER 1
ASSIGNMENT, MAINTENANCE, SUSPENSION AND WITHDRAWAL OF CLASS

Section 1 Assignment of Class

1 General

1.1

1.1.1 Class is assigned to a ship upon a survey, with the associated operations, which is held to verify whether it is eligible to be classed based on the Rules of QRS. This may be achieved through:

- the completion of the new building, during which a survey has been performed.
- a survey carried out according to the agreement developed by the IACS Member Societies when ships change class between members, or
- a specific admission to class survey, in cases where a ship is classed with a non-IACS Society or is not classed at all.

2 New building procedure

2.1 Ships surveyed by QRS during construction

2.1.1 When a ship is surveyed by QRS during construction, it is to comply with those requirements of the Rules which are in force and applicable depending on the class of the ship.

2.1.2 QRS:

- approves the plans and documentation submitted as required by the Rules
- proceeds, if required, with the appraisal of the design of materials and equipment used in the construction of the ship and their inspection at works
- carries out surveys, attends tests and trials provided for in the Rules, or obtains appropriate evidence to satisfy itself that the scantlings and construction meet the rule requirements in relation to the approved drawings
- assigns the construction mark

2.1.3 QRS defines in specific Rules which materials and equipment used for the construction of ships built under survey are, as a rule, subject to appraisal of their design and to inspection at works, and according to which particulars.

2.1.4 As part of his interventions during the ship's construction, the Surveyor will:

- conduct an overall examination of the parts of the ship covered by the Rules
- examine the construction methods and procedures when required by the Rules
- check selected items covered by the rule requirements
- attend tests and trials where applicable and deemed necessary.

2.1.5 Use of materials, machinery, appliances and items

All materials, machinery, boilers, auxiliary installations, equipment, items etc. (generally referred to as "products") which are covered by the class and used or fitted on board ships surveyed by QRS during construction are to be new and, where intended for essential services, tested by QRS.

Second hand materials, machinery, appliances and items may be used subject to the specific agreement of QRS and the Owner.

The requirements for the selection of materials to be used in the construction of the various parts of a ship, the characteristics of products to be used for such parts and the checks required for their acceptance are to be as stated in these rules, as applicable, or as specified on approved plans. In particular, the testing of products manufactured according to quality assurance procedures approved by QRS and the approval of such procedures are governed by the requirements of these rules.

2.1.6 Defects or deficiencies and their repair

QRS may, at any time, reject items found to be defective or contrary to rule requirements or require supplementary inspections and tests and/or modifications, notwithstanding any previous certificates issued.

All repairs are subject to the preliminary agreement of QRS. When the limits of tolerance for defects are specified in the Rules concerned or by the Manufacturer, they are to be considered for repairs.

It is incumbent upon the Interested Party to notify QRS of any defects noted during the construction of the ship and/or of any item not complying with the applicable requirements or in any case unsatisfactory. Proposals regarding remedial actions intended to be adopted to eliminate such defects or unsatisfactory items are to be submitted to QRS and, if accepted, carried out to the Surveyor's satisfaction.

2.1.7 Equivalence of Rule testing under certain conditions

QRS may, at its discretion and subject to conditions and checks deemed appropriate, accept certain materials, appliances or machinery which have not been subjected to rule testing.

2.2 Documentation

2.2.1 Documentation relevant to the class applied for is to be submitted for the approval of QRS.

2.2.2 The documentation to be submitted is listed in the relevant chapters of the Rules.

The lists of requested plans, documents and other items related to classification are not exhaustive and are intended as guidance for specifying the set of information to be submitted, rather than lists of actual titles. QRS may require that additional information be submitted if deemed necessary for the verification of rule requirements, especially in the case of non-conventional design.

2.2.3 The documentation submitted to QRS is examined in relation to the class applied for in the request for classification.

2.2.4 A copy of the submitted plans will be returned duly stamped, with remarks related to the compliance with the rule requirements should the need arise.

2.2.5 As a rule, modifications of the approved plans regarding items covered by classification are to be submitted.

2.2.6 Design data to be submitted to QRS are to incorporate all information necessary for the assessment of the design of the ship for the purpose of assignment of class. It is the responsibility of the Interested Party to ascertain that the design data are correct, complete and compatible with the use of the ship.

2.2.7 Design calculations are to be provided, when called for, as supporting documents to the submitted plans.

2.2.8 Design data and calculations are to be adequately referenced. It is the duty of the Interested Party to ascertain that the references used are correct, complete and applicable to the design of the ship.

2.2.9 The submitted plans are to contain all necessary information for checking the compliance with the requirements of the Rules.

2.2.10 In the case of conflicting information, submitted documentation will be considered in the following order of precedence: design data, plans, design calculations.

2.2.11 It is the responsibility of the Interested Party to ascertain that drawings used for the procurement, construction and other works are in accordance with the approved plans.

2.2.12 Upon specific agreement between QRS and the Interested Parties, three-dimensional models may be submitted in place of two-dimensional plans. In this case, QRS may require that additional documentation containing information that cannot be specified in three-dimensional models be submitted.

3 Ships classed after construction

3.1 General

3.1.1 When an Owner applies to QRS for a ship already in service to be admitted to class, the application will be processed differently depending on whether the ship is:

- classed with an IACS Society, or
- not classed with an IACS Society.

3.2 Ships classed with a Classification Society, reported as compliant by the Losing Society

3.2.1 Surveys principle

Surveys to be carried out are based on the age of the ship and the updated current class status as provided by the previous IACS Member Society.

3.2.2 Hull surveys

a) For vessels of age less than 5 years, the survey is to take the form of an annual survey

b) For vessels between 5 and 10 years of age, in addition, the survey is to include the inspection of a representative number of ballast spaces

c) For vessels of 10 years of age and above but less than 20 years of age, in addition, the survey is to include the inspection of a representative number of cargo spaces, except for:

- For gas carriers, in lieu of internal inspection of cargo spaces, the following applies:
  - inspection of surrounding ballast tank(s), including external inspection of independent cargo tank(s) and supporting systems as far as possible
  - review of cargo log books and operational records to verify correct functioning of the cargo containment system.
- For chemical tankers of 10 years and above but less than 15 years of age, in lieu of an internal inspection of cargo tanks without internal stiffening and framing, inspections of surrounding ballast tank(s) and void spaces and deck structure, are to be applied.

d) For vessels with notation **ESP**, which are 15 years of age and above, but less than 20 years of age, the survey is to have the scope of a class renewal survey or an intermediate survey, whichever is due next

e) For all vessels which are 20 years of age and above, the survey is to have the scope of a class renewal survey (this requirement is also applicable to ships having their hull under continuous survey)

f) In lieu of the requirements in items a) through e) above, the following apply for site specific purpose-built Floating Production and/or Storage Vessels:

- for vessels of age less than 5 years, the survey is to have the scope of an annual survey
- for vessels of age between 5 and 10 years, in addition, the survey is to include the inspection of twenty percent of ballast spaces
- for vessels of age between 10 and 20 years, in addition, the survey is to include twenty percent of cargo spaces
- for vessels over 20 years of age, the survey is to have the scope of a class renewal survey.

g) For site specific Floating Production and/or Storage Vessels which have been converted from other vessels, the survey is to take form of an annual survey and also include inspection of twenty percent of ballast spaces and twenty percent of cargo spaces until 20 years have elapsed since conversion. After 20 years the survey is to have the scope of a class renewal survey.

h) In the context of applying items d) and e) above, if a dry-docking of the vessel is not due at time of transfer, consideration can be given to carrying out an underwater examination in lieu of dry-docking

i) In the context of applying items d) and e) above, as applicable, the anchors and anchor chain cables ranging and gauging for vessels over 15 years of age is not required to be carried out as part of the class entry survey unless the class entry survey is being credited as a periodical survey for maintenance of class. If the class entry survey is to be credited as a periodical survey of maintenance of class, consideration may be given by the gaining society to the acceptance of the anchors and anchor chain cables ranging and gauging carried out by the losing society provided they were carried out within the applicable survey window of the periodical survey in question

j) In the context of applying items a) to h) above, as applicable:

- if the class entry survey is to be credited as a periodical survey for maintenance of class, consideration may be given by the gaining society to the acceptance of thickness measurements taken by the losing society provided they were carried out within the applicable survey window of the periodical survey in question.
- if the class entry survey is not to be credited as a periodical survey for maintenance of class, consideration may be given by the gaining society to the acceptance of thickness measurements taken by the losing society provided they were carried out within 15 months prior to completion of class entry survey when it is in the scope of a class renewal survey, within 18 months prior to the completion of class entry survey when it is in the scope of an intermediate survey.

In both cases, the thickness measurements are to be reviewed by the gaining society for compliance with the applicable survey requirements, and confirmatory gauging are to be taken to the satisfaction of the gaining society.

k) In the context of applying c) to h) above, as applicable, tank testing for vessels over 15 years of age is not required to be carried out as part of class entry survey unless the class entry survey is being credited as a periodical survey for the maintenance of class. If the class entry survey is to be credited as a periodical survey for maintenance of class, consideration may be given by the gaining society provided they were carried out within the applicable survey window of the periodical survey in question.

l) In the context of applying a) to h) above, as applicable, compliance with IACS Unified Requirements that require compliance at the forthcoming due periodical survey (such as UR S26 and S27) are not required to be carried out /completed as part of the class entry survey unless the class entry survey is credited as a periodical survey for maintenance of class.

3.2.3 Machinery surveys

A general examination of all essential machinery is to be held including at least the following:

a) Examination under working condition of oil fuel burning equipment, boilers, economizers and steam/steam generators. The adjustment of safety valves of this equipment is to be verified by checking the records on board ship

b) All pressure vessels are to be examined

c) Insulation resistance, generator circuit breakers, preference tripping relays and generator prime mover governors are to be tested and paralleling and load sharing to be proved

d) In all cases, navigating lights and indicators are to be examined and their working and alternative sources of power verified

e) Bilge pumps, emergency fire pumps and remote controls for oil valves, oil fuel pumps, lubricating oil pumps and forced draught fans are to be examined under working condition

f) Recirculating and ice clearing arrangements, if any

g) The main and all auxiliary machinery necessary for operation of the ship at sea together with essential controls and steering gear is to be tested under working conditions. Alternative means of steering are to be tested

h) A short sea trial is to be held, at the Surveyor's discretion, if the ship has been laid up for a long period

i) Initial start arrangements are to be verified

j) In the case of oil tankers, the cargo oil system and electrical installations in way of hazardous spaces are to be checked for compliance with rule requirements. Where intrinsically safe equipment is installed, the Surveyors are to satisfy themselves that such equipment has been approved by a recognized authority. The safety devices, alarms and essential instruments of the inert gas system are to be verified and the plant generally examined to ensure that it does not constitute a hazard to the ship.

3.2.4 Documentation

As a rule, the documentation to be supplied is the following.

a) Main plans:
   - General arrangement
   - Capacity plan
   - Hydrostatic curves
   - Loading manual, where required
   - Damage stability calculation, where required.

b) Hull structure plans:
   - Midship section
   - Scantling plan
   - Decks
   - Shell expansion
   - Transverse bulkheads
   - Rudder and rudder stock
   - Hatch covers
   - For ship assigned with the additional service feature **CSR**, plans showing, for each structural element, both as-built and renewal thicknesses and any thickness for "voluntary addition".

c) Machinery plans:
- Machinery arrangement
- Intermediate, thrust and screw shafts
- Propeller
- Main engines, propulsion gears and clutch systems (or Manufacturer's make, model and rating information)
- For steam turbine ships, main boilers, superheaters and economisers (or Manufacturer's make, model and rating information) and steam piping
- Bilge and ballast piping diagram
- Wiring diagram
- Steering gear system piping and arrangements and steering gear Manufacturer's make and model information
- Torsion vibration calculations, for ships less than two years old
- Plans for flexible couplings and/or torque limiting shafting devices in the propulsion line shafting (or Manufacturer's make, model and rating information), for ships assigned with one of the ice class additional class notations
- Pumping arrangements at the forward and after ends, drainage of cofferdams and pump rooms and general arrangements of cargo piping in tanks and on decks, for oil tankers.

d) Plans required for ships assigned one of the additional class notations for Automated Machinery Systems:
- Instrument list
- Fire alarm system
- Plans for systematic maintenance and functioning tests.

e) Additional documents required for approval of alternative design and arrangements.

f) Document(s) of approval of alternative design and arrangements are to be submitted, if any.

g) Structural fire protection and fire control plan.

Alternative technical data may be accepted by QRS in lieu of specific items of the listed documentation not available at the time of the transfer of class.

3.2.5 For ships of less than 100 gross tonnage, special consideration will be given to the scope of surveys and documentation to be supplied.

3.3 Non-compliant ships

3.3.1 In this case, the class of the ship will be assigned upon a preliminary review of the documentation listed below and subsequent satisfactory completion of the surveys, the extent and scope of which are given below.

3.3.2 Surveys

The extent and scope of the admission to class survey are to be not less than those required at the class renewal survey of a ship of the same age and type; in addition all other periodical surveys should be performed together with those inspections which are linked to specific service notations and/or additional class notations and/or special installations the ship is provided with.

3.3.3 Documentation

Generally, the documentation to be supplied to QRS is not to be less than the following.

a) Main plans:
- General arrangement
- Capacity plan
- Loading cases, calculations of still water bending moments, and relevant documents, particulars of loading calculator and instruction booklet as per Society's requirements, according to the case
- Stability documents, if applicable

b) Hull structure plans:
- Midship section
- Profile and deck plan
- Watertight bulkheads
- Rudder and rudder stock
- Shell expansion
- Hatch covers
- Stern frame.

c) Machinery plans:
   - Engine room general arrangement
   - Diagram of fuel- (transfer, service), bilge-, ballast-, lubricating oil-, cooling-, steam- and feed-, general service and starting compressed air piping
   - Diagram of fire-fighting systems
   - Drawings of boilers and air receivers
   - Drawings of shaft line, reduction gear and propeller
   - Drawings of steering gear
   - Torsion vibration calculations. Such documents are required only for ships less than 2 years old or for older ships the propelling system of which has been modified during the two years preceding the classification.

d) Electrical installation plans:
   - Master plan of power distribution, lighting and emergency power circuits
   - Single line diagram of networks and switchboards
   - Location and arrangement of electrical equipment in hazardous areas.

e) Structural fire protection and fire control plan.

Alternative technical data may be accepted by QRS in lieu of specific items of the listed documentation not available at the time of the transfer of class.

3.3.4 Where appropriate within reasonable limits, a proven service record of satisfactory performance during a period of adequate length may be used as a criterion of equivalence. Special consideration will be given to ships of recent construction.

3.3.5 For installations or equipment covered by additional service and/or class notations, QRS will determine the documentation to be submitted.

3.3.6 In addition, QRS may base its judgement upon documentation such as certificates issued or accepted by the former Classification Society, if any, and statutory certificates issued by the flag Administration or by a recognized organization on its behalf; moreover, other documents and/or plans may be specifically required to be supplied to QRS in individual cases.

4 Date of initial classification

4.1 Definitions

4.1.1 Date of build

For a new building the date of build is the year and month at which the new construction survey process is completed. Where there is a substantial delay between the completion of the construction survey process and the ship commencing active service, the date of commissioning may be also specified.

If modifications are carried out, the date of build remains assigned to the ship. Where a complete replacement or addition of a major portion of the ship is involved, the following applies:

- the date of build associated with each major portion of the ship is to be indicated on the Classification Certificate and in the Register, where it has been agreed that the newer structure shall be on a different survey cycle
- survey requirements are to be based on the date of build associated with each major portion of the ship
- survey due dates may be aligned at the discretion of QRS.

4.1.2 Date of initial classification for new buildings

As a general rule, for new buildings the date of initial classification coincides with the date of build.

4.1.3 Date of initial classification for existing ships

In principle, for existing ships the date of initial classification is the date of completion of the admission to class survey.

5 Reassignment of class

5.1

5.1.1 At the request of the Owner, a ship which was previously classed with QRS, subsequently withdrawn from class and has not been classed since may have the class reassigned subject to an admission to class survey. If applicable and appropriate, account may be taken of any periodical surveys held in the former period of class with QRS.

Section 2 Maintenance of Class

1 General principles of surveys

1.1 Survey types

1.1.1 Classed ships are submitted to surveys for the maintenance of class. These surveys include the class renewal survey, intermediate and annual survey, bottom survey (either survey in dry condition or in-water survey), tailshaft survey, boiler survey, and surveys for the maintenance of additional class notations, where applicable. Such surveys are carried out at the intervals and under the conditions laid down in this Section. In addition to the above periodical surveys, ships are to be submitted to occasional surveys whenever the circumstances so require; also when the Owner requires a specific survey in case of sales.

1.1.2 Unless specified otherwise, any survey other than bottom survey and tailshaft survey may be effected by carrying out partial surveys at different times to be agreed upon with QRS, provided that each partial survey is adequately extensive. The splitting of a survey into partial surveys is to be such as not to impair its effectiveness.

1.2 Change of periodicity, postponement or advance of surveys

1.2.1 QRS reserves the right, after due consideration, to change the periodicity, postpone or advance surveys, taking into account particular circumstances.

1.2.2 When a survey becomes overdue during a voyage, the following applies:

a) In the case of a class renewal survey, QRS may grant an extension to allow for completion of the class renewal survey, provided there is documented agreement to such an extension prior to the expiry date of the Certificate of Classification, adequate arrangements have been made for attendance of the Surveyor at the first port of call and QRS is satisfied that there is technical justification for such an extension. Such an extension will be granted only until arrival at the first port of call after the expiry date of the Certificate of Classification.

   However, if owing to "exceptional circumstances", the class renewal survey cannot be completed at the first port of call, QRS may grant an extension, but the total period of extension shall in no case be longer than three months after the original limit date of the class renewal survey.

b) In the case of annual and intermediate surveys, no postponement is granted. Such surveys are to be completed within their prescribed windows.

c) In the case of all other periodical surveys and conditions of class, extension of class may be granted until the arrival of the ship at the port of destination.

1.3 Extension of scope of survey

1.3.1 The extent of any survey also depends upon the condition of the ship and its equipment. Should the Surveyor have any doubt as to the maintenance or condition of the ship or its equipment, or be advised of any deficiency or damage which may affect the class, then further examination and testing may be conducted as considered necessary.

1.4 General procedure of survey

1.4.1 The general procedure of survey consists in:

- an overall examination of the parts of the ship covered by the rule requirements
- checking selected items covered by the rule requirements
- attending tests and trials where applicable and deemed necessary by the Surveyor.

1.4.2 When a survey results in the identification of significant corrosion, structural defects or damage to hull, machinery and/or any piece of its equipment which, in the opinion of the Surveyor, affect the ship's class, remedial measures are to be implemented before the ship continues in service.

1.5 Appointment of another Surveyor

1.5.1 Should a disagreement arise between the Owner and the Surveyor during a survey, QRS may, at the request of the Owner, designate another Surveyor.

1.6 Alterations or additions to approved systems

1.6.1 When an alteration or addition to an approved system is proposed, documentation is to be submitted and approved by QRS before the work on the alteration or addition is commenced.

1.6.2 Where the modifications may affect compliance with the Rules, they are to be carried out under survey and the installation and testing are to be to the Surveyor's satisfaction.

2 Definitions and procedures related to surveys

2.1 General

2.1.1 Period of class

Period of class means the period starting either from the date of the initial classification, or from the credited date of the last class renewal survey, and expiring at the limit date assigned for the next class renewal survey.

2.1.2 Anniversary date

Anniversary date means the day of the month of each year in the period of class which corresponds to the expiry date of the period of class.

2.1.3 Survey time window

Survey time window, or more simply window, mean the fixed period during which annual and intermediate surveys are to be carried out.

2.1.4 Overdue surveys

Each periodical survey is assigned a limit date specified by the relevant requirements of the Rules (end of survey interval or end date of window) by which it is to be completed. A survey becomes overdue when it has not been completed by its limit date.

2.1.5 Condition of class

A defect and/or deficiency to be dealt with to maintain class, within a specific period, is indicated as a condition of class. A condition of class is pending until it is cleared, through a survey by the attending Surveyor or upon evidence that requirements have been completed, to the satisfaction of QRS. Where it is not cleared by its limit date, the condition of class is overdue.

Condition of class may be imposed in other cases, which, in QRS's opinion, require specific consideration.

2.1.6 Classification memoranda

Those defects and/or deficiencies which do not affect the maintenance of class and which may therefore be cleared at the Owner's convenience and any other information deemed noteworthy for QRS's convenience are indicated as classification memoranda.

Classification memoranda are not to be regarded as condition of class.

2.1.7 Statutory memoranda

Those defects and/or deficiencies which do not affect the statutory certification and which may therefore be cleared at the Owner's convenience and any other information noteworthy for QRS's convenience are indicated as statutory memoranda.

Statutory memoranda are not to be regarded as statutory recommendations

2.1.8 Exceptional circumstances

"Exceptional circumstances" means:

- unavailability of dry-docking facilities, or
- unavailability of repair facilities, or
- unavailability of essential materials, equipment or spare parts, or
- delays incurred by action taken to avoid severe weather conditions.

2.2 Terminology related to hull survey

2.2.1 Ballast tank

A ballast tank is a tank that is being used primarily for salt water ballast.

For single skin and double skin bulk carriers, a ballast tank is a tank which is used solely for salt water ballast, or, where applicable, a space which is used for both cargo and salt water ballast will be treated as a ballast tank when substantial corrosion has been found in that space. For double skin bulk carriers, a double side tank is to be considered as a separate tank even if it is in connection to either the topside tank or the hopper side tank.

For oil tankers and chemical tankers, a ballast tank is a tank which is used solely for the carriage of salt water ballast. A combined cargo/ballast tank is a tank which is used for the carriage of cargo or ballast water as a routine part of the vessel's operation and will be treated as a ballast tank. Cargo tanks in which water ballast might be carried only in exceptional cases per MARPOL I/18(3) are to be treated as cargo tanks.

2.2.2 Spaces

Spaces are separate compartments including holds and tanks.

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

2.2.3 Overall survey

An 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.

2.2.4 Close-up survey

A close-up survey is a survey where the details of structural components are within the close visual inspection range of the Surveyor.

2.2.5 Transverse section

A transverse section includes all longitudinal members contributing to longitudinal hull girder strength, such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom, longitudinal bulkheads and, as applicable for the different ship types, relevant longitudinals, hopper sides, bottom in top wing tanks, inner sides. For a transversely framed ship, a transverse section includes adjacent frames and their end connections in way of transverse sections.

2.2.6 Representative tanks or spaces

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

2.2.7 Substantial corrosion

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

For the following ships:

- ships assigned the service notation **liquefied gas carrier** contracted for construction on or after 1st July 2022,
- oil tankers built under Common Structural Rules for Double Hull Oil Tankers,
- bulk carriers built under Common Structural Rules for Bulk Carriers,
- bulk carriers or oil tankers built under Common Structural Rules for Bulk Carriers and Oil Tankers,
- cargo ships, other than container ships, with a length greater than 65m and contracted for construction on or after 1st July 2022,
- container ships with a length greater than 65 m and contracted for construction on or after 1st July 2016,
- ships having alternate light or heavy cargo loading conditions, irrespective of their length and contracted for construction on or after 1st July 2022,
- non-cargo ships with a length greater than 90 m and contracted for construction on or after 1st July 2022,

substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between ($t_{renewal}$ + 0,5 mm) and $t_{renewal}$.

2.2.8 Pitting corrosion

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

2.2.9 Edge corrosion

Edge corrosion is defined as local corrosion at the free edges of plates, stiffeners, primary support members and around openings.

2.2.10 Grooving corrosion

Grooving corrosion is typically local material loss adjacent to weld joints along abutting stiffeners and at stiffeners or plate butts or seams.

2.2.11 Suspect areas

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

2.2.12 Critical structural areas

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

2.2.13 Corrosion prevention system

A corrosion prevention system is normally considered a full hard protective coating.

Hard protective coating is usually to 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.

2.2.14 Coating condition

Coating condition is defined as follows:

- good: condition with only minor spot rusting
- fair: condition with local breakdown at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for poor condition
- poor: condition with general breakdown of coating over 20% or more or hard scale at 10% or more, of areas under consideration.

2.2.15 Cargo area (ships carrying liquid cargo in bulk)

The cargo area is that part of the ship which contains cargo tanks, slop tanks and cargo/ballast pump rooms, compressor rooms, cofferdams, ballast tanks and void spaces adjacent to cargo tanks and deck areas throughout the entire length and breadth of the part of the ship over the above-mentioned spaces.

2.2.16 Cargo length area (dry cargo ships)

The 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.

2.2.17 Prompt and thorough repair

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 class.

2.2.18 Special consideration

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

2.2.19 Air pipe head

Air pipe heads installed on the exposed decks are those extending above the freeboard deck or superstructure decks.

2.2.20 Remote inspection techniques (RIT)

Remote inspection techniques is a means of survey that enables examination of any part of the structure without the need for direct physical access of the Surveyor (refer to IACS Recommendation 42, “Guidelines for use of remote inspection techniques for surveys”).

2.2.21 Remote Survey

A “Remote Survey” is a process of verifying that a ship and its equipment are in compliance with the Rules where the verification is undertaken, or partially undertaken, without attendance on board by a Surveyor.

2.3 Procedures for thickness measurements

2.3.1 When required as per the scope of surveys defined below, thickness measurements are normally to be carried out under the responsibility of the Owner, and in the presence of the Surveyor, by a service supplier independent from the Owner.

2.3.2 For all ships, the following applies:

- thickness measurements required in the context of surveys of hull structure is to be witnessed by a Surveyor. This requires the Surveyor to be on board while the gaugings are taken, enabling him at any time to intervene and to control the process.
- prior to commencement of the intermediate or class renewal survey, a meeting is to 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 onboard.

2.3.3 In any kind of survey, such as class renewal, intermediate, annual or other surveys having the same scope, thickness measurements of structures in areas where close-up surveys are required, are to be carried out simultaneously with close-up surveys.

2.3.4 Consideration may be given by the attending Surveyor to allow the use of Remote Inspection Techniques (RIT) as an alternative to close-up survey. Surveys conducted using a RIT are to be completed to the satisfaction of the attending Surveyor. When RIT is used for a close-up survey, temporary means of access for the corresponding thickness measurements is to be provided unless such RIT is also able to carry out the required thickness measurements.

2.3.5 For structure built with a material other than steel, alternative thickness measurement requirements may be developed and applied as deemed necessary by QRS.

2.3.6 Thickness measurement is normally to be carried out by means of ultrasonic test equipment. The accuracy of the equipment is to be proven to the Surveyor as required. The thickness measurements are to be carried out by a company authorized by QRS.

QRS reserves the right to limit the scope of authorization of the Company.

2.3.7 A thickness measurement report is to be prepared. The report is to give the location of measurements, the thickness measured and the corresponding original thickness. Furthermore, the report is to include the date when the measurements were carried out, the type of measuring equipment, the names and the qualification of the operators and their signatures.

The Surveyor is to review the final thickness measurement report and countersign the cover page.

2.4 Agreement of firms for in-water survey

2.4.1 The in-water surveys referred to in the Rules are to be carried out by a certified company accepted by QRS.

2.5 Preparations and conditions for surveys

2.5.1 The Owner is to provide the necessary facilities for the safe execution of the surveys.

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

In preparation for survey and thickness measurements and to allow for a thorough examination, all spaces are to be cleaned including removal from surfaces of all loose accumulated corrosion scale. Spaces are to be sufficiently clean and free from water, scale, dirt, oil residues, etc. to reveal corrosion, deformation, fractures, damages or other structural deterioration as well as the condition of the 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.

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

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

Casings, ceilings or linings, and loose insulation, where fitted, are to be removed, as required by the Surveyor, for examination of plating and framing. Compositions on plating are to be examined and sounded, but need not be disturbed if found adhering satisfactorily to the plating.

In refrigerated cargo spaces the condition of the coating behind the insulation is to be examined at representative locations. The examination may be limited to verification that the protective coating remains effective and that there are no visible structural defects. Where POOR coating condition is found, the examination is to be extended as deemed necessary by the Surveyor. The condition of the coating is to be reported. If indents, scratches, etc., are detected during surveys of shell plating from the outside, insulations in way are to be removed as required by the Surveyor, for further examination of the plating and adjacent frames.

2.5.3 A communication system is to be arranged between the survey party in the cargo hold, tank or space being examined, the responsible officer on deck and, as the case may be, the navigation bridge. The communication arrangements are to be maintained throughout the survey. This system is also to include the personnel in charge of ballast pump handling if boats or rafts are used.

2.5.4 Explosimeter, oxygen-meter, breathing apparatus, lifelines, riding belts with rope and hook and whistles together with instructions and guidance on their use are to be made available during the survey. A safety check-list is to be provided.

2.5.5 Adequate and safe lighting is to be provided for the safe and efficient conduct of the survey.

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

2.5.7 Surveys of tanks or applicable holds by means of boats or rafts may only be undertaken with the agreement of the Surveyor, who is to 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 0,25m.

2.5.8 When rafts or boats will be used for close-up survey the following conditions are to be observed:

a) only rough duty, inflatable rafts or boats, having satisfactory residual buoyancy and stability even if one chamber is ruptured, are to be used

b) the boat or raft is to be tethered to the access ladder and an additional person is to be stationed down the access ladder with a clear view of the boat or raft

c) appropriate lifejackets are to be available for all participants

d) the surface of water in the tank or hold is to be calm (under all foreseeable conditions the expected rise of water within the tank is not to exceed 0,25 m) and the water level stationary. On no account is the level of the water to be rising while the boat or raft is in use

e) the tank, hold or space must contain clean ballast water only. Even a thin sheen of oil on the water is not acceptable, and

f) at no time is the water level to be allowed to be within 1 m of the deepest under deck web face flat so that the survey team is not isolated from a direct escape route to the tank hatch. Filling to levels above the deck transverses is only to be contemplated if a deck access manhole is fitted and open in the bay being examined, so that an escape route for the survey party is available at all times. Other effective means of escape to the deck may be considered.

g) if the tanks (or spaces) are connected by a common venting system, or Inert Gas system, the tank in which the boat or raft is to be used is to be isolated to prevent a transfer of gas from other tanks (or spaces).

2.5.9 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.

If the depth of the webs is more than 1,5 m, rafts or boats alone may be allowed only:

- when the coating of the under deck structure is in GOOD condition and there is no evidence of wastage; or
- if a permanent means of access is provided in each bay to allow safe entry and exit. This means:
  - access direct from the deck via a vertical ladder and a small platform fitted approximately 2 m below the deck in each bay; or
  - 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 in 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 is to 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 an other equivalent means is to be provided for the survey of the under deck areas.

The use of rafts or boats as mentioned above does not preclude the use of boats or rafts to move about within a tank during a survey.

2.5.10 When examination of associated structure is required, the following applies:

- ceilings in holds and floors in the engine room are to be lifted to the necessary extent for examination of the structure
- cement or other protective sheathing is to be removed when there is any doubt as to the condition of the plating underneath or when adherence to plating is not tight
- in the case of solid ballast spaces, the solid ballast is to be partially removed for examination of the condition of the structure in way. Should doubts arise, the Surveyor may require more extensive removal of the solid ballast
- insulation of compartments intended for refrigerated cargoes is to be removed over the necessary extent for examination by the Surveyor of the condition of the structure, unless constructional arrangements make such inspections possible without removing the insulation.

2.6 Access to structures

2.6.1 For overall survey, means are to be provided to enable the Surveyor to examine the hull structure in a safe and practical way.

2.6.2 For survey in cargo holds and ballast tanks, one or more of the following means for access, acceptable to the Surveyor, is to be provided:

- permanent staging and passages through structures
- temporary staging and passages through structures
- hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
- boats or rafts
- other equivalent means.

2.6.3 For surveys conducted by use of a remote inspection technique, one or more of the following means of access, acceptable to the Surveyor, is to be provided:

- unmanned robot arm
- remotely operated vehicles (ROV)
- unmanned aerial vehicles/drones
- other means acceptable to QRS

2.7 Equipment for surveys

2.7.1 One or more of the following fracture detection procedures may be required if deemed necessary by the Surveyor:

- radiographic equipment
- ultrasonic equipment
- magnetic particle equipment
- dye penetrant.

2.8 Rescue and emergency response equipment

2.8.1 If breathing apparatus and/or other equipment is used as ‘Rescue and emergency response equipment’ then it is recommended that the equipment should be suitable for the configuration of the space being surveyed.

2.9 Surveys at sea and anchorage

2.9.1 Surveys at sea or at anchorage may be accepted provided the Surveyor is given the necessary assistance by the personnel on board. Precautions and procedures for carrying out the survey are to be taken.

2.10 Repairs and maintenance during voyage

2.10.1 Where repairs to hull, machinery or other equipment, which affect or may affect the class, are to be carried out by a riding crew during a voyage, they are to be planned in advance. A complete repair procedure including the extent of proposed repair and the need for the Surveyor's attendance during the voyage is to be submitted to QRS for approval sufficiently in advance. Failure to notify QRS in advance of the repairs may result in the suspension of class of the ship.

Where in any emergency circumstance, emergency repairs are to be effected immediately, the repairs should be documented in the ship’s log and submitted thereafter to QRS for use in determining further survey requirements.

2.10.2 The above is not intended to include maintenance to and overhaul of the hull, machinery and equipment in accordance with the Manufacturer's recommended procedures and established marine practice, which does not require QRS's agreement. However, any repair resulting from such maintenance and overhauls which affects or may affect the class is to be noted in the ship's log and submitted to the attending Surveyor for use in determining further survey requirements.

2.11 Repairs

2.11.1 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 Surveyor, will affect the ship's structural, watertight or weathertight integrity, is to be promptly and thoroughly repaired.

Areas to be considered include, as applicable for the different ship types:

- side structure and side plating; side shell frames, their end attachments and adjacent shell plating; inner side structure and inner side plating
- deck structure and deck plating
- bottom structure and bottom plating; inner bottom structure and inner bottom plating
- longitudinal bulkheads structure and longitudinal bulkheads plating, where fitted
- watertight or oiltight bulkheads structure and plating
- hatch covers or hatch coamings, where fitted
- weld connection between air pipes and deck plating
- air pipe heads installed on the exposed decks
- ventilators, including closing devices, if any; bunker and vent piping systems.

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

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

2.11.4 Where the damage found on structure is isolated and of a localized nature which does not affect the ship's structural integrity, consideration may be given by the Surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity and impose a condition of class in accordance with the Rules, with a specific time limit.

2.12 Remote Inspection Techniques (RIT)

2.12.1 The RIT is to provide the information normally obtained from a close-up survey (except on ESP ships). RIT surveys are to be carried out in accordance with the requirements given here-in and the requirements of IACS Recommendation 42, "Guidelines for use of remote inspection techniques for surveys". These considerations are to be included in the proposals for use of a RIT which are to be submitted in advance of the survey so that satisfactory arrangements can be agreed with QRS.

2.12.2 The equipment and procedure for observing and reporting the survey using a RIT are to be discussed and agreed with the parties involved prior to the RIT survey, and suitable time is to be allowed to set-up, calibrate and test all equipment beforehand.

2.12.3 When using a RIT as an alternative to close-up survey, if not carried out by QRS itself, it is to be conducted by a firm approved as a service supplier and is to be witnessed by an attending Surveyor of QRS.

2.12.4 The structure to be examined using a RIT is to be sufficiently clean to permit meaningful examination. Visibility is to be sufficient to allow for a meaningful examination. QRS is to be satisfied with the methods of orientation on the structure.

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

2.12.6 If the RIT reveals damage or deterioration that requires attention, the Surveyor may require traditional survey to be undertaken without the use of a RIT.

2.13 Remote survey

2.13.1 For the planning and execution of remote surveys, the requirements given in Chapter 1 are to be applied.

3 Certificate of Classification: issue, validity, endorsement and renewal

3.1 Issue of Certificate of Classification

3.1.1 A Certificate of Classification, bearing the class notations assigned to the ship and an expiry date, is issued to any classed ship.

3.1.2 A Provisional Certificate of Classification may serve as a Certificate of Classification in some cases, such as after an admission to class survey, after a class renewal survey, or when QRS deems it necessary.

The period of validity for the Provisional Certificate of Classification is not to exceed 6 months from the date of issuance.

3.1.3 The Certificate of Classification is to be made available to QRS's Surveyors upon request.

3.2 Validity of Certificate of Classification, maintenance of class

3.2.1 QRS alone is qualified to confirm the class of the ship and the validity of its Certificate of Classification.

3.2.2 During the class period, a Certificate of Classification is valid when it is not expired.

The class is maintained during a certain period or at a given date, when during the said period or at such date the conditions for suspension or withdrawal of class are not met.

3.2.3 At the request of the Owner, a statement confirming the maintenance of class may be issued by QRS based on the information in its records for that ship at the time.

This statement is issued on the assumption that the Owner has complied with the Rules.

Should any information which would have prevented QRS from issuing the statement and which was not available at the time subsequently come to light, the statement may be cancelled.

QRS, upon becoming aware of a breach of the Rules, is empowered to suspend class from the date of the breach, which may be prior to the date of the statement.

3.2.4 A statement declaring that the class is maintained "clean and free from condition of class" may be issued by QRS when there is no pending condition of class at that date.

3.2.5 Classification-related documents and information are liable to be invalidated by QRS whenever their object is found to differ from that on which they were based or to be contrary to the applicable requirements. The Owner is liable for any damage which may be caused to any third party from improper use of such documents and information.

3.3 Endorsement of Certificate of Classification

3.3.1 Text of endorsement

When surveys are satisfactorily carried out, the Certificate of Classification is generally endorsed accordingly, with the relevant entries.

3.3.2 Possible modifications to endorsements

QRS reserves the right to modify the endorsements made by Surveyors.

3.4 Status of surveys and conditions of class

3.4.1 Information given in the Certificate of Classification, ship survey status, Rules and other ship specific documents made available to the Owner, enables the Owner to identify the status of surveys and conditions of class.

3.4.2 The omission of such information does not absolve the Owner from ensuring that surveys are held by the limit dates and pending conditions of class are cleared to avoid any inconvenience which is liable to result from the suspension or withdrawal of class..

4 Class renewal survey

4.1 General principles

4.1.1 Class renewal surveys are to be carried out at five-year or three-year intervals. However, consideration may be given by QRS to granting an extension for a maximum of three months after the limit date, in exceptional circumstances. In such cases the next period of class will start from the limit date for the previous class renewal survey before the extension was granted.

4.1.2 For surveys completed within three months before the limit date of the class renewal survey, the next period of class will start from this limit date. For surveys completed more than three months before the limit date, the period of class will start from the survey completion date.

In cases where the vessel has been laid up or has been out of service for a considerable period because of a major repair or modification and the Owner elects to carry out only the overdue surveys, the next period of class will start from the expiry date of the renewal survey. If the Owner elects to carry out the next due renewal survey, the period of class will start from the survey completion date.

4.1.3 A new period of class is assigned to the ship after the satisfactory completion of the class renewal survey, and a new Certificate of Classification is issued for the new period of class.

4.1.4 Concurrent crediting to both Intermediate Survey and Class Renewal Survey for surveys and thickness measurements of spaces are not acceptable.

4.2 Normal survey system (SS)

4.2.1 When the normal survey system is applied to ships with a 5 years period of class, the class renewal survey may be commenced at the fourth annual survey and continued during the following year with a view to completion by its due date. In this case the survey may be carried out by partial surveys at different times. The number of checks to be performed at each partial survey and the interval between partial surveys are to be agreed by QRS.

4.2.2 A class renewal survey may be commenced before the fourth annual survey at the request of the Owner. In this case, the survey is to be completed within fifteen months.

4.3 Continuous survey system (CS)

4.3.1 The request by the Owner for admission to the continuous survey system will be considered by QRS and agreement depends on the type and age of hull and machinery. This system may apply to the class renewal survey of hull (CSH), machinery (CSM) or other installations such as refrigerating installations (CSR) covered by an additional class notation.

4.3.2 The continuous survey system is not applicable to the class renewal survey of the hull of those ships subject to the Enhanced Survey Program (**ESP**), such as ships with the service notation **oil tanker**, **bulk carrier** or **chemical tanker**.

4.3.3 The continuous survey system is not applicable to the class renewal survey of the hull of ships over 20 years old. However, consideration may be given, at the discretion of QRS, to the applicability of the continuous survey system to the class renewal survey of the hull of ships over 20 years old.

4.3.4 When the continuous survey system is applied, appropriate notations are entered in the Register of Ships.

4.3.5 Ships subject to the continuous survey system are provided with lists of items to be surveyed under this system.

4.3.6 For items surveyed under the continuous survey system, the following requirements generally apply:

a) the interval between two consecutive surveys of each item is not to exceed five years

b) the items are to be surveyed in rotation, so far as practicable ensuring that approximately equivalent portions are examined each year

c) QRS may credit for continuous survey results of surveys carried out before the admission to the continuous survey scheme

d) each item is to be surveyed at one time, as far as practicable; QRS may, however, allow possible repair work to be carried out within a certain period.

e) main or auxiliary engine crankshaft journal and associated bearings may be surveyed within intervals specified in item a) or in accordance with engine manufacturers recommended replacement schedule subject to satisfactory verification of survey items listed in item f)

f) The Surveyor shall check within the 5 year CSM cycle:
   - at least 1 crank journal bearing for medium and high speed engines (> 300 rpm), with the selected bearing to be presented for survey chosen from 1 of the 3 aftermost bearings and alternate to the last CSM cycle
   - at least 2 crank journal bearings for slow speed engines (< 300 rpm), with the selected bearings to be presented for survey chosen from 1 of the 3 aftermost bearings (alternate to last CSM cycle) and the highest loaded bearing as determined by the engine manufacturer.

   The remainder of the bearings may be permitted for verification by C/E followed by confirmatory surveys, for example checking bearing clearances, oil analysis, photos of non-invasive bearing and bearing edge checks performed, crankcase inspection and verification of deflections.

4.3.7 For ships more than ten years of age, the ballast tanks are to be internally examined twice in each five-year class period.

4.3.8 For ships under continuous survey, items not included in the continuous survey cycle are to be inspected. Bottom surveys are to be carried out. In addition, the bottom survey which is to be carried out in conjunction with the end of class period is to be performed within 15 months before the end of this class period.

4.3.9 Upon application by the Owner, QRS may agree, subject to certain conditions, that some items of machinery which are included in the continuous survey cycle are examined by the Chief Engineer where QRS is not represented. The Chief Engineer's inspection is to be followed by a confirmatory survey carried out by a Surveyor.

4.3.10 The continuous survey system does not supersede the annual surveys and other periodical and occasional surveys.

4.3.11 A general examination of the ship for annual surveys, is to be carried out at the end of the period of class.

4.3.12 For laid-up ships, specific requirements apply.

4.3.13 The continuous survey system may be discontinued at any time at the discretion of QRS, or at the request of the Owner, and a specific arrangement devised.

4.4 Planned maintenance survey system for machinery (PMS)

4.4.1 A planned maintenance survey system may be considered as an alternative to the continuous survey system for machinery and is limited to components and systems covered by it. When such a system is implemented, a survey system other than those normally adopted and with intervals different from those of the continuous survey system may be accepted.

4.4.2 The conditions related to Chief Engineer's inspections within the scope of PMS are given in these rules.

4.4.3 The planned maintenance survey system does not supersede the annual surveys and other periodical and occasional surveys.

4.4.4 A general examination of the machinery for annual surveys, is to be carried out.

4.4.5 The planned maintenance survey system may be discontinued at any time at the discretion of QRS, or at the request of the Owner, and a specific arrangement devised.

4.4.6 Surveys of machinery may be carried out on a condition based maintenance (CBM) scheme basis on vessels operating on approved PMS survey system.

4.4.7 The conditions for approval of the condition monitoring and condition based maintenance survey schemes and the general scope of surveys are found in these rules.

5 Other periodical surveys

5.1 General

5.1.1 The different types of periodical surveys are summarized below.

5.2 Annual surveys

5.2.1 Annual surveys are to be carried out within three months before or after each anniversary date.

5.3 Intermediate surveys

5.3.1 An intermediate survey, where applicable, is to be carried out within the window from three months before the second to three months after the third anniversary date.

5.3.2 The intermediate survey is applicable at any period of class to ships with the following service notations:

- **oil tanker**, **chemical tanker**, **liquefied gas carrier**

5.3.3 The intermediate survey is applicable at any period of class to ships which are five years old and over.

5.3.4 Concurrent crediting to both Intermediate Survey and Class Renewal Survey for surveys and thickness measurements of spaces are not acceptable.

5.4 Bottom survey

5.4.1 Bottom survey means the examination of the outside of the ship's bottom and related items. This examination may be carried out with the ship either in dry dock (or on a slipway) or afloat: in the former case the survey will be referred to as dry- docking survey, while in the latter case as in-water survey.

5.4.2 The Owner is to notify QRS whenever the outside of the ship's bottom and related items can be examined in dry dock or on a slipway.

5.4.3 For ships classed with the class symbol **I**, there are to be two examinations of the outside of the ship's bottom and related items in each period of class of five years

In all cases, the interval between any two such examinations is not to exceed 36 months.

An extension of examination of the ship's bottom of three months beyond the due date can be granted in exceptional circumstances.

5.4.4 For ships under the normal survey system (SS), one of the bottom surveys to be performed in each period of class is to be carried out in conjunction with the class renewal survey and is to be a dry-docking survey.

QRS may allow the bottom survey carried out between class renewal surveys to be replaced by an in-water survey. Special consideration is to be given to ships of 15 years of age and over before being permitted to have such in-water examinations.

For ships with additional service feature **ESP** and over 15 years of age, it is however reminded that a bottom survey in dry dock is to be carried out concurrently with the intermediate survey.

5.4.5 For ships under the continuous survey system of hull (CSH), one of the bottom surveys to be performed in each period of class is to be carried out in conjunction with the end of class period.

This bottom survey may be an in-water survey provided that the previous bottom survey performed in the period of class was a dry-docking survey. Special consideration is to be given to ships of 15 years of age and over before being permitted to have such in-water examinations.

5.4.6 Ships with service notation **HSC**, **HSC-CAT A**, **HSC-CAT B** are to be submitted to a bottom survey in dry condition at each annual survey and each class renewal survey.

5.4.7 The interval between examinations of the outside of the ship's bottom and related items for ships operating in fresh water and for certain harbour or non-self-propelled craft may be greater than that given above, as approved by QRS.

5.5 Tailshaft survey

5.5.1 Definition

Tailshaft survey means survey of propeller shafts and tube shafts (hereafter referred to as tailshafts) as well as survey of other propulsion systems.

5.5.2 Tailshaft complete survey

Tailshafts are to be submitted to complete examination at the periodicity specified below, based on the type of shaft and its design.

a) Where the tailshaft is fitted with continuous liners, or approved oil sealing glands, or made of corrosion-resistant material, the periodicity of complete surveys is:
   - 3 years for single shafting arrangements
   - 4 years for multi-shafting arrangements.

b) These periodicities may be increased to 5 years in the following cases:
   - where the propeller is fitted keyless to the shaft taper, the shaft is protected from sea water, the design details are approved, and a non-destructive examination of the forward part of the aft shaft taper is performed at each survey by an approved crack-detection method
   - where the propeller is fitted to a solid flange coupling at the aft end of the shaft, the shaft and its fittings are not exposed to corrosion, the design details are approved. Non-destructive examination of the fillet radius of the aft propeller shaft flange may be required if the visual examination of the area is not satisfactory.

c) In all other cases the periodicity of complete surveys is two years and six months (2,5 years).

5.5.3 Tailshaft modified survey

A modified survey of the tailshaft is an alternate way of examination the scope. It may be accepted for tailshafts described in this section and for water lubricated tailshafts, provided that:

- For ships fitted with oil lubricated tailshaft bearings:
  - the tailshafts are fitted with approved oil sealing glands

- the shaft and its fittings are not exposed to corrosion
- the design details are approved
- the clearances of the aft bearing are found to be within acceptable limits
- the oil and the oil sealing arrangements prove effective
- lubricating oil analyses are carried out regularly at intervals not exceeding six months and oil consumption is recorded at the same intervals.

- For ships fitted with water lubricated tailshaft bearings:
  - the clearances of the aft bearing are found to be within acceptable limits
  - the results of the endoscopic examination are found satisfactory

The modified survey is to be carried out five years after the last complete survey, with a window period of plus or minus six months.

The next complete survey is to be carried out ten years after the last complete survey.

5.5.4 Survey of propeller shafts and tube shafts - Applicable requirements from 1 January 2016

Reference is to be for revised requirements applicable to all ships with conventional shafting fitted with a propeller, unless alternative means are provided to assure the condition of the propeller shaft assembly.

Such requirements are applicable:

- from 1 January 2016, for ships delivered on or after 1 January 2016
- after the first shaft survey scheduled on or after 1 January 2016, for ships delivered before 1 January 2016.

5.5.5 Other propulsion systems

Driving components serving the same purpose as the tailshaft in other propulsion systems, such as directional propellers, vertical axis propellers, water jet units, dynamic positioning systems and thruster assisted mooring systems, are to be submitted to periodical surveys at intervals not exceeding five years.

5.5.6 Pod propulsion systems

Shafting system (including tightness system and connection of the propeller to the shaft) of pod propulsion systems are to be submitted to complete or modified surveys, the periodicity of which is determined in the same principle as for tailshafts.

Propulsion motors, orientating devices and other arrangement, are to be surveyed at each class renewal survey.

5.6 Boiler survey

5.6.1 There are to be two internal examinations of boilers in each period of class of five years. In all cases, the interval between any two such examinations is not to exceed 36 months.

5.6.2 The internal examination of thermal oil heaters is to be carried out once during each 5-year period in conjunction with the renewal survey.

5.6.3 An extension of examination of the boiler up to three months beyond the due date can be granted in exceptional circumstances. The extension may be granted by QRS after the following is satisfactorily carried out:

- external examination of the boiler
- examination and operational test of boiler safety valve relieving gear (easing gear)
- operational test of boiler protective devices
- review of the following records since the last boiler survey: operation, maintenance, repair history, feedwater chemistry.

5.6.4 Boilers are also submitted to an external examination as a part of the annual survey of machinery.

6 Occasional surveys

6.1 General

6.1.1 An occasional survey is any survey which is not a periodical survey. The survey may be defined as an occasional survey of hull, machinery, boilers, refrigerating plants, etc., depending on the part of the ship concerned.

Where defects are found, the Surveyor may extend the scope of the survey as deemed necessary.

6.1.2 Occasional surveys are carried out at the time of, for example:

- updating of classification documents (e.g. change of the Owner, name of the ship, flag)
- damage or suspected damage
- repair or renewal work
- Port State Control inspections
- alterations or conversion
- quality system audits
- postponement of surveys or conditions of class.

6.2 Damage and repair surveys

6.2.1 In the event of damage which affects or may affect the class of the ship, the Owner is to apply to QRS for a survey. Such application is to be made as soon as possible to enable the Surveyor to ascertain the extent of the damage and necessary repairs, if any.

6.2.2 If, after sustaining damage, the ship calls at a port where QRS is not represented, the Owner is to notify QRS forthwith, supply all available information regarding the damage and make arrangements for the ship to be surveyed in the nearest port where QRS is represented.

6.2.3 All repairs to hull, machinery and equipment which may be required in order for a ship to retain its class are to be to the satisfaction of the Surveyor.

During repairs or maintenance work, the Owner is to arrange so that any damage, defects or non-compliance with the rule requirements are reported to the Surveyor during his survey.

6.2.4 Damages and partial or temporary repairs considered acceptable by the Surveyor for a limited period of time are the subject of an appropriate condition of class.

6.2.5 Damages or repairs required by the Surveyor to be re-examined after a certain period of time are the subject of an appropriate condition of class.

6.3 Port State Control survey

6.3.1 An occasional survey is to be requested by the Owner wherever a ship is detained because of a Port State Control inspection.

6.4 Conversions, alterations and repairs

6.4.1 Conversions, alterations or repairs of/to structures and arrangements affecting the class are to be carried out in accordance with the requirements of QRS and to its satisfaction. Where necessary, documentation is to be submitted to QRS and/or made available to the attending Surveyor.

6.4.2 Materials and equipment used for conversions, alterations or repairs are generally to meet the requirements of the Rules for new ships built under survey.

6.5 Quality System audits

6.5.1 QRS reserves the right to carry out occasional surveys in order to conduct audits either as deemed necessary in pursuance of its internal Quality System or as required by external organisations (e.g. IACS, flag Administrations).

6.5.2 These surveys may also be attended by auditors external to QRS.

6.5.3 The scope of these surveys is determined by QRS.

6.6 Unscheduled surveys

6.6.1 QRS reserves the right to carry out unscheduled surveys as deemed necessary and whose scope is determined by QRS, based on PSC (Port State Control) history of the ship.

7 Change of ownership

7.1

7.1.1 In the case of change of ownership, the ship retains its current class with QRS provided that:

- QRS is informed of the change sufficiently in advance to carry out any specific survey required by the Owner in view of the sale; and
- the new Owner signs the appropriate request, involving acceptance of QRS's general conditions and Rules. This request covers inter alia the condition of the ship when changing ownership.

8 Lay-up and re-commissioning

8.1 General principles

8.1.1 A ship put out of commission may be subject to specific requirements for maintenance of class, as specified below, provided that the Owner notifies QRS of the fact.

If the Owner does not notify QRS of the laying-up of the ship or does not implement the lay-up maintenance program, the ship's class may be suspended and/or withdrawn when the due surveys are not carried out by their limit dates.

8.1.2 The lay-up maintenance program provides for a "laying-up survey" to be performed at the beginning of lay-up and subsequent "annual lay-up condition surveys" to be performed in lieu of the normal annual surveys which are no longer required to be carried out as long as the ship remains laid-up. The other periodical surveys which become overdue during the lay-up period may be postponed until the re-commissioning of the ship.

8.1.3 Where the ship has an approved lay-up maintenance program and its period of class expires, the period of class is extended until it is re-commissioned, subject to the satisfactory completion of the annual lay-up condition surveys.

8.1.4 The periodical surveys carried out during the lay-up period may be credited, either wholly or in part, at the discretion of QRS, having regard to their extent and dates. These surveys will be considered for the determination of the extent of surveys required for the re-commissioning of the ship and/or the expiry dates of the next periodical surveys of the same type.

8.1.5 When a ship is re-commissioned, the Owner is to notify QRS and make provisions for the ship to be submitted to the following surveys:

- an occasional survey prior to re-commissioning, the scope of which depends on the duration of the lay-up period
- all periodical surveys which have been postponed.

8.1.6 Where the previous period of class expired before the re-commissioning and was extended, a complete class renewal survey is to be carried out prior to re-commissioning. Those items which have been surveyed in compliance with the class renewal survey requirements during the 15 months preceding the re- commissioning may be credited. A new period of class is assigned from the completion of this class renewal survey.

9 Safety Management System

9.1

9.1.1 For all ships to which the ISM Code applies, QRS may have to report possible safety management system shortcomings, on the occasion of the Annual Survey or Intermediate Survey or Class Renewal Survey or Occasional Surveys or Statutory Surveys, to the Organisation that has issued the Safety Management Certificate.

Section 3 Suspension and Withdrawal of Class

1 General

1.1 Discontinuance of class

1.1.1 The class may be discontinued either temporarily or permanently. In the former case it is referred to as “suspension” of class, in the latter case as “withdrawal” of class. In both these cases, the class is invalidated in all respects. In the case of withdrawal, the name of the ship is deleted from the Register of Ships. The current version of the Register can be consulted on QRS website.

1.2 Suspension of class

1.2.1 The class may be suspended either automatically or following the decision of QRS. In any event, the ship will be considered as not retaining its class from the date of suspension until the date when class is reinstated.

1.2.2 The class may be automatically suspended when one or more of the following circumstances occur:

- when a ship is not operated in compliance with the rule requirements, such as in cases of services or conditions not covered by the service notation, or trade outside the navigation restrictions for which the class was assigned
- when a ship proceeds to sea with less freeboard than that assigned, or has the freeboard marks placed on the sides in a position higher than that assigned, or, in cases of ships where freeboards are not assigned, the draught is greater than that assigned
- when the Owner fails to inform QRS in order to submit the ship to a survey after defects or damages affecting the class have been detected
- when repairs, alterations or conversions affecting the class are carried out either without requesting the attendance of QRS or not to the satisfaction of the Surveyor.

Suspension of class with respect to the above cases will remain in effect until such time as the cause giving rise to suspension has been removed. Moreover, QRS may require any additional surveys deemed necessary taking into account the condition of the ship and the cause of the suspension.

1.2.3 In addition, the class is automatically suspended:

- when the class renewal survey has not been completed by its limit date or within the time granted for the completion of the survey, unless the ship is under attendance by QRS’s Surveyors with a view to completion prior to resuming trading
- when the annual or intermediate surveys have not been completed by the end of the corresponding survey time window unless the ship is under attendance for completion of the survey.

  Continuous survey item(s) due or overdue at the time of annual surveys is (are) to be dealt with. The ship's class will be subject to a suspension procedure if the item(s) is (are) not surveyed or postponed by agreement with QRS.

Suspension of class with respect to the above cases will remain in effect until such time as the class is reinstated once the due items and/or surveys have been dealt with.

1.2.4 In addition to the circumstances for which automatic suspension may apply, the class of a ship may also be suspended following the decision of QRS:

- when a condition of class is not dealt with within the time limit specified, unless it is postponed before the limit date by agreement with QRS
- when, due to reported defects, QRS considers that a ship is not entitled to retain its class even on a temporary basis (pending necessary repairs or renewals, etc.)
- when the ship has not been maintained in proper condition.
- in other circumstances which QRS will consider on their merits

Suspension of class decided by QRS takes effect from the date when the conditions for suspension of class are met and will remain in effect until such time as the class is reinstated once the due items and/or surveys have been dealt with.

1.3 Withdrawal of class

1.3.1 QRS will withdraw the class of a ship in the following cases:

- at the request of the Owner
- as a rule, when the causes that have given rise to a suspension currently in effect have not been removed within six months after due notification of suspension to the Owner
- when the ship is reported as a constructive total loss
- when the ship is lost
- when the ship is reported scrapped.

Withdrawal of class may take effect from the date on which the circumstances causing such withdrawal occur. The

contract for the classification of the ship is terminated as of right in the above cases.

The class is also withdrawn according to the provisions of article 9 of the Marine & Offshore General Conditions in case of contract termination.

1.3.2 When the withdrawal of class of a ship comes into effect, QRS will:

- forward the Owner written notice
- delete the ship from the Register of Ships
- notify the flag Administration
- make the information available to the Underwriters, at their request.

1.4 Suspension/withdrawal of additional class notations

1.4.1 If the survey requirements related to maintenance of additional class notations are not complied with, the suspension or withdrawal may be limited to the notations concerned.

The same procedure may apply to service notations of ships which are assigned with more than one service notation.

1.4.2 The suspension or withdrawal of an additional class notation or a service notation (where a ship is assigned with more than one service notation) generally does not affect the class.

Appendix 1 Planned Maintenance Survey System

1 General

1.1

1.1.1 A Planned Maintenance Survey system (hereafter referred to as PMS) is a survey system for machinery items which may be considered as an alternative to the Continuous Survey for Machinery system (hereafter referred to as CSM).

1.1.2 This survey scheme is to be approved by QRS before being implemented. When the PMS system is applied, the scope and periodicity of the class renewal survey are tailored for each individual item of machinery and determined on the basis of recommended overhauls stipulated by the manufacturers, documented experience of the operators and, where applicable and fitted, condition monitoring. For instance, within the scope of a PMS system the following cases may occur:

- switchboard A is surveyed based on the regular expiry date of the class renewal survey
- lubricating oil pump B is surveyed based on CSM scope and periodicity
- diesel engine C is surveyed based on running hours
- turbo pump D is surveyed based on condition monitoring.

1.1.3 In general, the survey intervals for items surveyed under the PMS system should not exceed those specified for the CSM. However, for components where the maintenance is based on running hours, longer intervals may be accepted as long as the intervals are based on the manufacturer's recommendations.

1.1.4 The Chief Engineer shall be the responsible person on board in charge of the PMS.

Items surveyed by this authorised Chief Engineer will be subject to the confirmatory survey. Documentation on overhauls of items covered by the PMS are to be reported and signed by the Chief Engineer.

2 Conditions and procedures for the review of the system

2.1 General

2.1.1 The PMS documentation is to be subject to a consistency check. To this end the Owner is to make a formal request to QRS and provide the documentation and information required by QRS, combined in a manual describing the proposed scheme and including sample copies of the different documents to be used during the implementation of the scheme. The PMS is to be programmed and maintained by a computerized system. However, this may not be applied to the current already reviewed schemes.

2.1.2 When using computerised systems, access for updating of the maintenance documentation and the maintenance programmes is only granted to the person responsible for the PMS or another person authorised by him.

The computerised systems are to include a back-up procedure, which is to be activated at regular intervals.

The Owner himself is to confirm to QRS, by written declaration, that the required functionalities of the system are met. Or, alternatively, QRS may approve the software upon specific request.

2.2 Documentation

2.2.1 The documentation to be submitted is the manual mentioned above, which is to include:

a) a description of the scheme and its application on board as well as the proposed organization chart identifying the areas of responsibility and the people responsible for the PMS on board

b) the document flow and pertinent filing procedure

c) the list of items of machinery and components to be considered for classification in the PMS, distinguishing for each the principle of survey periodicity.

d) the procedure for the identification of the items listed in c), which is to be compatible with the identification system adopted by QRS.

e) the scope and time schedule of the maintenance procedures for each item listed in c), including acceptable limit conditions of the parameters to be monitored based on the manufacturers' recommendations or recognized standards and laid down in appropriate preventive maintenance sheets.

2.3 Information on board

2.3.1 The following information is to be available on board:

a) all the documentation listed in 2.2.

b) the maintenance instructions including routine tests and inspections for each item of machinery, as applicable (supplied by the manufacturer or by the shipyard)

c) reference documentation (trend investigation procedures etc.)

d) the records of maintenance performed, including conditions found, repairs carried out, spare parts fitted

e) the list of personnel on board in charge of the PMS management.

2.4 List of items

2.4.1 Ships subject to the planned maintenance survey system are provided with lists of items to be surveyed under this system.

3 Implementation of the system

3.1

3.1.1 When the documentation submitted has been checked for consistency and the PMS system has been implemented on board and used for a sufficient period (which is not to exceed one year) so that all personnel become familiar with it, a survey is to be carried out to start the system and make it officially operational.

3.1.2 Upon the successful outcome of the Implementation Survey, the PMS is considered approved.

4 Retention and withdrawal of the system

4.1

4.1.1 The PMS system is retained throughout the class period provided that:

- an annual report covering the year's service is supplied to QRS
- an annual audit in accordance is satisfactorily completed
- any change to the approved PMS is submitted to QRS for agreement.

4.1.2 The survey arrangement for machinery according to the PMS may be withdrawn by QRS if the PMS is not satisfactorily operated on account of either the maintenance records or the general condition of the machinery or the failure to observe the agreed intervals between overhauls.

4.1.3 The Owner may discontinue the PMS at any time by informing QRS in writing. In this case, the items which have been inspected under the PMS since the last annual audit will be credited for class at the discretion of the attending Surveyor.

4.1.4 In the case of sale or change of management of the ship or classification after construction, the assignment of the PMS will be reconsidered.

5 Surveys

5.1 Implementation survey

5.1.1 The implementation survey is to be carried out by a Surveyor of QRS within one year from the date of approval of the PMS.

5.1.2 The scope of this survey is to verify that:

- the PMS is implemented in accordance with the documentation which has been checked and is suitable for the type and complexity of the components and systems on board
- the documentation required for the annual audit is produced by the PMS
- the requirements of surveys and testing for retention of class are complied with
- the shipboard personnel are familiar with the PMS procedures.

Upon the successful outcome of the survey confirming the proper implementation of the PMS, the system is considered operational subject to the submission to QRS of a report describing the PMS.

5.2 Annual audit and confirmatory surveys

5.2.1 Once the PMS system is implemented, the continued compliance with the requirements for checks, overhauls and repairs, where needed, is to be verified by means of annual audits and confirmatory surveys in order to confirm the validity of the approved survey scheme system.

5.2.2 The annual audit and confirmatory surveys are to be carried out in conjunction with the annual class surveys.

5.2.3 The purpose of this audit is to verify that the scheme is being correctly operated, that all items (to be surveyed in the relevant period) have actually been surveyed in due time. A general examination of the items concerned is carried out.

5.2.4 The maintenance and performance records are examined to verify that the machinery has been functioning satisfactorily since the previous survey or audit or, if necessary, that the necessary measures have been taken in response to machinery operating parameters exceeding acceptable tolerances, and that the overhaul intervals have been observed.

5.2.5 Written reports of breakdown or malfunction are to be made available.

5.2.6 The description of the repairs, if any, carried out is to be examined. Any machinery part or component which has been replaced by a spare due to damage is to be retained on board, where possible. On this occasion such replaced parts are to be submitted to the examination of the Surveyor.

5.2.7 The Surveyor also checks that the personnel on board in charge of the PMS have the appropriate authorization.

5.2.8 An annual report covering the year's service is to be supplied to QRS. The Surveyor is to review this report and ensure it has been reviewed by QRS.

5.2.9 The Surveyor carries out a confirmatory survey of the items which have been surveyed by the Chief Engineer and decides which items can be confirmed for classification, on the PMS list of items.

5.3 Damage and repairs

5.3.1 Damage to components or items of machinery covered by the PMS which may affect the class is to be reported to QRS. Where applicable, a Surveyor will attend on board, survey the damaged items and, on the basis of the survey results, decide whether conditions of class are to be imposed.

5.3.2 All parts of machinery or components which need to undergo substantial repairs are to be surveyed before, during and after the repairs, as deemed appropriate by the Surveyor. Any repair and corrective action regarding machinery under PMS system shall be recorded in the PMS logbook and repairs verified by the Surveyor at the annual audit.

5.3.3 In the case of overdue condition of class or records of unrepaired damage which may affect the PMS, the relevant items are to be taken out of the PMS until the conditions of class have been fulfilled or the repairs carried out.

Appendix 2 CSM and PMS Systems: Surveys Carried out by the Chief Engineer

1 Conditions

1.1

1.1.1 The basic conditions for the acknowledgment of surveys carried out by Chief Engineers are specified hereafter. Consideration may be given to other conditions on a case by case basis.

1.1.2 An Owner's attestation, confirming that the Chief Engineer is duly qualified to carry out the inspection of the machinery items when the CSM system or PMS system, is implemented on-board, is to be made available to the Surveyor on-board.

2 Limits of the interventions

2.1

2.1.1 For ships where the CSM system is implemented, the following items of the class renewal survey for machinery cannot be inspected by the Chief Engineer:

- pressure vessels
- main and auxiliary turbines
- main reduction gears
- turbochargers of main propulsion internal combustion engines
- intermediate shafting and associated bearings.

2.1.2 For ships where the PMS system is implemented, all items covered by the system can be surveyed by the Chief Engineer, with the exception of pressure vessels.

2.1.3 In no case may the surveys of tailshafts and boilers, which are items not included in the scope of the class renewal survey, be carried out by the Chief Engineer.

3 Procedure for carrying out surveys

3.1 General

3.1.1 As regards the procedure for carrying out surveys, the Owner is to inform the Chief Engineer that surveys are to be conducted in accordance with the Rules of QRS and, specifically, the requirements for class renewal surveys related to machinery and systems.

It is the responsibility of the ship's Captain and Chief Engineer to decide the date and place for the survey of each component in order to avoid possible accidents (fire included) in the event of damage to the unit(s) remaining in service.

Some guidelines for the Chief Engineer relevant to the dismantling and inspections of main components of the machinery installation are given below.

The items and/or machinery which, as a result of the surveys, are replaced due to wear, damage or defects, are to be kept on board until they are inspected by a Surveyor of QRS.

3.2 Main diesel engines

3.2.1 The following items are to be surveyed as indicated:

- the top and bottom halves of the main bearings are to be removed and inspected, and the clearances are to be taken, recorded and compared with the limits recommended by the engine builder
- the top and bottom halves of bottom end connecting rod bearings are to be examined, and the clearances are to be taken, recorded and compared with the limits recommended by the engine builder
- crankpins, journals and webs are to be examined for crack detection, mainly at the fillets and in the vicinity of the lubricating oil holes
- crankshaft deflections are to be taken and recorded at regulars intervals, enabling verification of the trend when they are taken in the presence of QRS's Surveyor. This operation is to be effected bearing in mind that during the readings the journals are to be steady on their bearings

- other parts exposed to wear or operating incidents are to be carefully examined and the results recorded. In particular, the wear of liners is to be measured and recorded.

3.3 Auxiliary diesel engines

3.3.1 The survey generally consists of the complete dismantling of the engine and a careful examination of those items most liable to be exposed to wear or operating incidents. In particular:

- crankshaft deflections and wear of cylinder liners are to be measured
- the crankshaft is to be checked by means of dye penetrant in way of fillets and lubricating oil holes
- all top halves of the main bearings together with at least two bottom halves are to be dismantled
- crankcase explosion relief valves, if fitted, are to be checked.

3.4 Reciprocating compressors

3.4.1 The survey is to include:

- the dismantling of pistons and valves for inspection
- the examination and testing of the nest of cooler tubes
- the verification of safety relief valves after reassembling.

3.5 Coolers, condensers, heaters

3.5.1 The survey is to include:

- the dismantling of the covers
- the examination of the nest of tubes
- the testing of the nest of tubes, if necessary.

3.6 Electrical switchboard

3.6.1 The survey is to include:

- the cleaning of the switchboard
- the verification of the connection assemblies, locking device tightening and busbar tightening
- the examination of the condition of the circuit-breakers, switches and fuses
- the verification of the contacts and screens
- the checking of the measuring instruments, which are to be re-calibrated or replaced, if inaccurate
- the insulation resistance test.

3.7 a.c. and d.c. generators

3.7.1 The survey is to include:

- the removal of protection plates and brush carriers
- the cleaning of field coils and armature windings
- the verification of proper contact of brushes, which are to be renewed if excessively worn
- the verification of commutators and sliprings
- the measurement of air gap clearances
- the checking of journals and bearings
- the insulation resistance test.

3.8 Other items (pumps, electric motors, etc.)

3.8.1 The survey is generally to include the complete dismantling for inspection of the main parts exposed to wear or operating incidents, such as bearings, casings, impellers and rotors.

4 Records of surveys carried out

4.1

4.1.1 The surveys carried out by the Chief Engineer are to be recorded in the engine/machinery log-book and a survey report is to be prepared for each item surveyed.

The report is generally to be drawn up in English; however, for ships trading in specific restricted areas the use of the language of the country concerned will be accepted.

The report may be provided in hard copy or using a computerised recording system.

4.1.2 The report is to indicate the following information:

- identification data:
  - name of ship and register number
  - name of Chief Engineer and Owner's attestation
  - date and place (port or voyage leg) of the survey
  - reference of the item in the CSM or PMS list, and description of the item
- inspection conducted:
  - the type of inspection carried out: visual external examination, internal examination after dismantling, overhaul
  - readings performed, when applicable: clearances, measurements, working pressure, or other working parameters of the equipment
  - inspection findings: corrosion, fractures, pieces of equipment worn out, broken or missing
- maintenance and repairs carried out and parts replaced
- results of tests performed after the inspection, such as working test, pressure test.

For sake of completeness, other documentation such as sketches, photos, measurement reports may be attached to the report. The report is to be signed by the Chief Engineer.

5 Confirmatory survey

5.1

5.1.1 A confirmatory survey, to be carried out by a Surveyor of QRS, is to be requested according to the following principle:

- for ships under the CSM system, within a reasonably short time from the date of the surveys carried out by the Chief Engineer, and, in any case, in the first port which is under the jurisdiction of an Office of QRS
- for ships under the PMS system, at the next annual audit.

5.1.2 The Surveyor is to be supplied with a copy of this survey report and also shown the engine log-book.

5.1.3 The Surveyor carries out an external examination of the relevant items and parts replaced and, if applicable, attends running tests. If doubts arise, the Surveyor may request dismantling as deemed necessary.

5.1.4 For confirmatory survey of the main engine crankshaft and bearings, the Surveyor performs the following:

- check of condition monitoring records
- check of crankshaft deflection readings
- check of bearing clearances (where possible)
- checks for signs of wiped or broken white metal in the crankcase or filters
- check of the witness marks of shrink fits of crankshafts
- check of the bedplate structure (inside and outside)
- check that the condition of crankpins, journals and associated bearings is duly recorded.

5.1.5 Where the confirmatory survey is performed with an abnormal delay, the inspection is to be more extensive and, if necessary, the due surveys are to be completely repeated.

5.1.6 The date of the execution of the surveys will be assumed to be the date of the confirmatory survey.

6 Suspension of the Chief Engineer's authorization

6.1

6.1.1 Where the condition of the items surveyed by the Chief Engineer as specified in his or her reports does not correspond to the findings of the attending Surveyor, or in case of doubt on the general maintenance of the machinery installation, QRS may request the Owner to withdraw the Chief Engineer qualification attestation until further training and re-assessment of his/ her qualification.

Appendix 3 Thickness Measurements: Extent, Determination of Locations, Acceptance Criteria

1 General

1.1 Aim of the Appendix

1.1.1 Thickness measurements are a major part of surveys to be carried out for the maintenance of class, and the analysis of these measurements is a prominent factor in the determination and extent of the repairs and renewals of the ship's structure.

1.1.2 The Appendix is intended to provide Owners, companies performing thickness measurements and QRS's Surveyors with a uniform means with a view to fulfilling Rule requirements for thickness measurements. In particular, it will enable all the above-mentioned parties to carry out:

- the planning and preparation
- the determination of extent and location, and
- the analysis

of the thickness measurements in cooperation.

1.1.3 It is to be noted that this Appendix also takes into account specific requirements for thickness measurements relevant to close-up surveys of ships which are subject to the Enhanced Survey Program (ESP).

1.2 Scope of the Appendix

1.2.1 Separate Articles below provide the following information:

- references to rule requirements and some additional information on the extent of the thickness measurements to be performed during surveys according to types of ships and related surveys
- locations of the measurements for the main parts of the ship
- how to analyze the results of thickness measurements.

Tables and sketches are also given to detail the above points according to the types of ships.

2 Rule requirements for the extent of measurements

2.1 General

2.1.1 For the maintenance of class, thickness measurements may be required during annual, intermediate and class renewal surveys.

Some additional explanations are also given about the wording used in the Rules as well as the general principles of the required thickness measurements during class renewal surveys.

2.2 Class renewal survey: all ships except those submitted to ESP or equivalent

2.2.1 The thickness measurements required by the Rules consist of:

- systematic thickness measurements
- measurements of suspect areas
- additional measurements on areas determined as affected by substantial corrosion.

Table 1 : References to rule requirements related to thickness measurements

SERVICE NOTATION	TYPE OF SURVEY		
	CLASS RENEWAL	INTERMEDIATE	ANNUAL
all service notations except those in other rows	Table 3: systematic measurements and suspect areas Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Table 4 as guidance	Table 1: thickness measurements to be taken if deemed necessary by the Surveyor Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction	areas of substantial corrosion identified at previous surveys Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction.
bulk carrier ESP **bulk carrier BC-A ESP** **bulk carrier BC-B ESP** **bulk carrier BC-C ESP**	Planning and general requirements Table 4 and Table 5: measurements of elements subject to close-up survey Table 6: extent of systematic thickness measurements Table 7, Table 15, according to the different locations, where substantial corrosion is found	• Ships 10 years of age or less: Table 5 for cargo holds, Table 4 Table 6 for salt water ballast tanks Table 7, Table 15, according to the different locations, where substantial corrosion is found • Ships over 10 years of age: see references given for class renewal survey	Table 1 and Table 2 for cargo holds and when deemed necessary by the Surveyor, for salt ballast tanks and when deemed necessary by the Surveyor Table 7, Table 15, according to the different locations, where substantial corrosion is found
oil tanker ESP	Planning and general requirements Table , Table 2: measurements of elements subjected to close-up survey Table 3: extent of systematic thickness measurements Table 4, Table 5, according to the different locations, where substantial corrosion is found	• Ships 10 years of age or less: for salt ballast tanks, Table 4 and Table 5, according to the different locations, where substantial corrosion is found • Ships over 10 years of age: see references given for class renewal survey	Limited to salt ballast tanks and when deemed necessary by the Surveyor Table 4 and Table 5, according to the different locations, where substantial corrosion is found
chemical tanker ESP	Planning and general requirements Table 1: measurements of elements subjected to close-up survey Table 3: extent of systematic thickness measurements Table 4: according to the different locations, where substantial corrosion is found	• Ships 10 years of age or less: for salt ballast tanks Table 4: according to the different locations, where substantial corrosion is found • Ships over 10 years of age: see references given for class renewal survey	Limited to salt ballast tanks and when deemed necessary by the Surveyor Table 4: according to the different locations, where substantial corrosion is found
liquefied gas carrier	Planning and general requirements Table 2: measurements of elements subjected to close-up survey Table 3: extent of systematic thickness measurements Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Table 4 as guidance	Table 1: thickness measurements to be taken if deemed necessary by the Surveyor Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, Table 4 as guidance	Limited to ballast tanks and when deemed necessary by the Surveyor Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Table 4 as guidance
general cargo ship	Planning and general requirements Table 4: measurements of elements subjected to close-up survey Table 5: extent of systematic thickness measurements Where substantial corrosion is found, the extent of thickness measurements may be increased to the Surveyor's satisfaction, using Table 6 as guidance	Ships 15 years of age or less: Table 2 for cargo holds Table 3 for ballast tanks Table 6, where substantial corrosion is found Ships over 15 years of age: see references given for class renewal survey	Table 1 for cargo holds when deemed necessary by the Surveyor or where extensive corrosion exists For ballast tanks when deemed necessary by the Surveyor or where extensive corrosion exists Table 6 where substantial corrosion is found

2.3 Class renewal survey: ships submitted to ESP or equivalent

2.3.1 The thickness measurements required by the Rules consist of:

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

2.3.2 For the determination of close-up surveys and relevant thickness measurements as well as the areas considered as suspect areas, reference is to be made to the relevant Sections according to the different service notations of the ships.

3 Number and locations of measurements

3.1 General

3.1.1 Considering the extent of thickness measurements as required by the Rules, the locations of the points to be measured are given here for the most important items of the structure. Thus the number of points can be estimated.

3.2 Locations of points

3.2.1 Table 2 provides explanations and/or interpretations for the application of those requirements indicated in the Rules which refer to both systematic thickness measurements related to the calculation of global hull girder strength and specific measurements connected to close-up surveys.

Figures are also given to facilitate the explanations and/or interpretations given in the table. These figures show typical arrangements of cargo ships, bulk carriers and oil tankers. Due to the various designs of the other ship types, figures are not given to cover all the different cases. However, the figures provided here may be used as guidance for ships other than those illustrated.

Table 2 : Interpretations of rule requirements for the locations and number of points to be measured

ITEM	INTERPRETATION
Selected plates on deck, tank top, bottom, double bottom and wind-and-water (for all ship types including CSR ships)	"Selected" means at least a single point on one out of three plates, to be chosen on representative areas of average corrosion
All deck, tank top and bottom plates and wind-and-water strakes (for all ship types including CSR ships)	At least two points on each plate to be taken either at each 1/4 extremity of plate or at representative areas of average corrosion
Transverse section (for all ship types including CSR ships)	One point to be taken on each plate. Both web and flange to be measured on longitudinals, if applicable (for CSR oil tankers) 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 is to be measured on the web and face plate, and every plate is to be measured at one point between longitudinals (for CSR oil tankers)
All cargo hold hatch covers and coamings (for all ship types except CSR oil tankers)	Including plates and stiffeners (for CSR single skin and double skin bulk carriers)
Bulkheads on ships other than bulk carriers, oil tankers, chemical tankers, liquefied gas carriers and CSR ships (for these ships refer to B) and C): CLOSE-UP SURVEYS AND RELATED MEASUREMENTS)	"Selected bulkheads" means at least 50% of the bulkheads

Selected internal structure such as floors and longitudinals, transverse frames, web frames, deck beams, 'tweendecks, girders (for all ship types other than CSR ships)	The internal structural items to be measured in each space internally surveyed are to be at least 20% within the cargo area and 10% outside the cargo area
Transverse section of deck plating outside line of cargo hatch openings (for bulk carriers, and CSR single skin and double skin bulk carriers)	Two single points on each deck plate (to 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
Transverse rings in cargo and ballast tanks (for CSR oil tankers)	At least two points on each plate in a staggered pattern and two points on the corresponding flange where applicable. Minimum 4 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
One section of deck plating for the full beam of the ship within the cargo area (for oil tankers, chemical tankers and liquefied gas carriers, other than CSR ships)	Two single points on each deck plate (to be taken either at each 1/4 extremity of plate or at representative areas of average corrosion) in the transverse section concerned
All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches (for CSR single skin and double skin bulk carriers)	«All deck plating» means at least two points on each plate to be taken either at each 1/4 extremity of plate or at representative areas of average corrosion. "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 ends of transverse beams, one point for web plating and one point for face plating
Web frame ring (for oil tankers other than CSR ships)	"Adjacent structural members" means plating and stiffeners of deck, bottom, double bottom, sides and longitudinal bulkheads in the vicinity of the web frame ring
Transverse section (for chemical tankers and liquefied gas carriers)	"Adjacent structural members" means plating and stiffeners of deck, bottom, double bottom, sides and longitudinal bulkheads in the vicinity of the web frame ring
Deck transverse (for all ships other than CSR ships)	This is the upper part of the web frame ring including the adjacent structural members (see meaning given above). For chemical tankers it may be fitted on deck.
Transverse bulkheads (for all ships other than CSR ships)	"Complete" means the whole bulkhead including stringers and stiffeners and adjacent structural members as defined above "Lower part" means lower part of bulkhead up to 1/4 of ship's depth or 2 meters above the lower stringer, whichever is the greater (stringers, stiffeners and adjacent structural members included)
Transverse bulkheads in cargo tanks (for CSR oil tankers)	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 to 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.

Transverse bulkheads in one topside/side, hopper and double bottom ballast tank (for bulk carriers, and CSR single skin and double skin bulk carriers)	Includes bulkhead and stiffening systems (for CSR single skin and double skin bulk carriers) The ballast tank is to be chosen based on the history of ballasting among those prone to have the most severe conditions
Transverse webs in ballast tanks (for bulk carriers, and CSR single skin and double skin bulk carriers)	Either one of the representative tanks of each type (topside or hopper or side tank) is to be chosen in the forward part Includes web plating, face plates, stiffeners and associated plating and longitudinals (for CSR single skin and double skin bulk carriers) “Associated plating and longitudinals” means adjacent plating and longitudinals of deck, bottom, side shell, slope, hopper and longitudinal bulkhead, as applicable
Areas of deck plating inside line of hatch openings (for bulk carriers other than CSR ships)	“Selected” means at least a single point on one out of three plates, to be chosen on representative areas of average corrosion “All deck plating” means at least two points on each plate to be taken either at each 1/4 extremity of plate or at representative areas of average corrosion

4 Acceptance criteria for thickness measurements

4.1 General

4.1.1 Acceptance criteria stipulate limits of wastage which are to be taken into account for reinforcements, repairs or renewals of steel structure.

In cases where the ship has some structural elements with reduced wear margins (e.g. due to ship conversion, increase of draught), the minimum acceptable thickness for these elements is to be calculated with reference to the rule scantlings without taking account of any reduction originally agreed.

4.1.2 Decisions on steel renewals are taken by the attending Surveyor applying the criteria given in this Article and based on his judgment and the actual condition of the ship. Should advice be needed to support his decision, the Surveyor may refer to the relevant technical office of QRS.

4.2 Criteria

4.2.1 The acceptance criteria for the minimum thicknesses are divided into:

- criteria on hull supporting structure of shipboard fittings associated with towing and mooring
- criteria on ice strengthened structures for ships assigned with additional class notation for navigation in polar waters

4.2.2 Each measured structural item is to be checked as far as applicable. When the criteria are not met, reinforcements, repairs and renewals are to be carried out as appropriate.

4.3 Local and global strength criteria based on percentage of acceptable wastage

4.3.1 Local and global strength criteria are given for the following ship types:

- general cargo ships
- bulk carriers
- oil tankers.

These criteria are generally expressed for each structural item as a maximum percentage of acceptable wastage (W).

When thickness is not available, the as-built thickness can be used.

Only for criteria related to an item, QRS may establish a list of renewal thicknesses tailored to the different structural items. In such a case these thicknesses are used in lieu of the minimum thicknesses calculated from the percentage of wastage.

These criteria may also be used for other ship types taking into consideration the equivalence or similarity of structural elements and their contribution to local and/or global strength.

4.3.2 For the evaluation of the ship longitudinal strength, it is a prerequisite that fillet welding between longitudinal members and deck, side and bottom plating is maintained effective to keep continuity of hull structures.

4.3.3 Each structural item to be assessed is illustrated in a typical transverse section.

These structural items are also listed in a table (Table 4 for general cargo ships, Table 5 for bulk carriers, Table 6 for oil tankers) grouped according to their position and contribution to the local or global strength of the ship.

4.3.4 Each structural item is to be assessed according to four different criteria which vary with regard to the domain under which it is considered, namely:

a) an isolated area, which is meant as a part of a single structural item. This criterion takes into consideration very local aspects such as grooving of a plate or web, or local severe corrosion; however, it is not to be used for pitting for which separate criteria are considered

b) an item, which is meant as an individual element such as a plate, a stiffener, a web, etc. This criterion takes into consideration the average condition of the item, which is assessed by determining its average thickness using the various measurements taken on the same item

c) a group of items, which is meant as a set of elements of the same nature (plates, longitudinals, girders) contributing either to the longitudinal global strength of the ship in a given zone or to the global strength of other primary transverse elements not contributing to the ship longitudinal strength, e. g. bulkheads, hatch covers, web frames

d) a zone, which is meant as all and only longitudinal elements contributing to the longitudinal strength of the ship; in this regard, the three main zones are defined as deck zone, neutral axis zone and bottom zone. This criterion takes into consideration the

average condition of all groups of items belonging to the same zone.

4.3.5 The assessment of the thickness measurements is to be performed using the values given in the tables for each structural element with regard to the four criteria defined above, in the following order:

a) assessment of isolated areas (column 1 in the tables). If the criterion is not met, the wasted part of the item is to be dealt with as necessary.

b) assessment of items (column 2 in the tables). If the criterion is not met, the item is to be dealt with as necessary in the measured areas as far as the average condition of the item concerned is satisfactory. In cases where some items are renewed, the average thicknesses of these items to be considered in the next step are the new thicknesses.

c) assessment of groups of items (column 3 in the tables). If the criterion is not met, a sufficient number of elements are to be renewed in order to obtain an increased average thickness satisfying the considered criterion of the group (generally the elements to be renewed are those most wasted). As an example, for the assessment of the group “deck plates” all deck plates are measured and an average thickness of each of them is estimated. Then the average of all these values is to satisfy the criteria given for this group.

d) assessment of zones (column 4 in the tables). In principle, the criterion of the zone is met when all groups of items belonging to the zone meet their own criteria (see c) above). However, a greater diminution than those given in column 3 may be accepted for one group of items if, considering the other groups of items belonging to the same zone, the overall diminution of the zone does not exceed the criterion given for it in column 4.

   Example: The deck zone consists of two groups of items:

   - deck plating, which has an average diminution of 12% (criterion 10%)
   - deck longitudinals, which has an average diminution of 4% (criterion 10%).

   Even though the deck plating group exceeds its acceptance criterion, the average diminution of the zone, which can be very roughly estimated at 8%, is acceptable and thus the deck plating group can be accepted as it is.

4.3.6 These criteria take into consideration two main aspects:

- the overall strength of the hull girder
- the local strength and integrity of the hull structure, such as hatch covers, bulkheads, etc.

As a rule, they are applicable to the structure within the cargo area of ships having a length greater than 90 meters. However, they may also be used for smaller ships and for structure outside the cargo area according to the following principles:

- for ships having a length less than 90 meters, the percentages of acceptable wastage given in the tables can be increased by 5 (%) (e.g. 15% instead of 10%, etc.), except for those of deck and bottom zones
- for structure outside the cargo area, the same 5 (%) increase can be applied,

on the understanding, however, that both conditions cannot be applied at the same time.

Table 4 : Local and global acceptance criteria for general cargo ships (given in % of wastage)

Group of items	Description of items	1 Isolated area	2 Item	3 Group	4 Zone
	ITEMS CONTRIBUTING TO THE LONGITUDINAL STRENGTH (TRANSVERSE SECTION)				
	DECK ZONE	-	-	-	10
1	Hatch coaming	-	-	10	-
	underdeck girder web	25	20	-	-
	underdeck girder flange	20	15	-	-
2	Upperdeck plating, deck stringer plates and sheer strakes	30	20	10	-
3	Deck longitudinals	-	-	10	-
	web	30	20	-	-
	flange	25	15	-	-
	NEUTRAL AXIS ZONE	-	-	-	15
4	Side shell plating	25	20	15	-
5	'Tweendeck plating	30	20	15	-
6	'Tweendeck longitudinals	-	-	15	-
	web	30	20	-	-
	flange	25	15	-	-
	BOTTOM ZONE	-	-	-	10
7	Bilge and bottom strakes and keel plate	25	20	10	-
8	Bottom girders	25	20	10	-
9	Bilge and bottom longitudinals	-	-	10	-
	web	30	20	-	-
	flange	25	15	-	-
10	Inner bottom plating	30	20	10	-
11	Inner bottom longitudinals	-	-	10	-
	web	30	20	-	-
	flange	25	15	-	-
	OTHER ITEMS				
12	Hatch coaming plating	25	20	-	-
13	Hatch cover top plating	25	20	15	-
14	Hatch cover skirt plating	30	20	-	-
15	Hatch cover stiffeners	30	20	-	-
16	Transverse bulkheads				
	plating	30	20	15	-
	stringer web	30	20	-	-
	stringer flange	25	15	-	-
	stiffener web	30	20	-	-
	stiffener flange	25	15	-	-
	brackets	30	20	-	-
17	Side frames				
	web	30	20	-	-
	flange	25	15	-	-
	brackets	30	20	-	-
18	Deck/'tweendeck beams				
	web	30	20	-	-
	flange	25	15	-	-
19	Floors				
	plating	30	20	-	-
20	Forward and aft peak bulkheads				
	plating	30	20	15	-
	stiffener web	30	20	-	-
	stiffener flange	25	15	-	-

Table 5 : Local and global acceptance criteria for bulk carriers (given in % of wastage)

Group of items	Description of items	1 Isolated area	2 Item	3 Group	4 Zone
	ITEMS CONTRIBUTING TO THE LONGITUDINAL STRENGTH (TRANSVERSE SECTION)				
	DECK ZONE	-	-	-	10
1	Strength deck plating, deck stringer, sheer strake and part of side shell plating in way of top side tanks	25	20	10	-
2	Deck longitudinals web and flange	- 25	- 20	10 -	- -
3	Side shell longitudinals in way of top side tanks Web and flange	- 25	- 20	10 -	- -
4	Top side tank sloped plating, including strakes	25	20	10	-
5	Longitudinals connected to top side tank sloped plating Web and flange	- 25	- 20	10 -	- -
	NEUTRAL AXIS ZONE	-	-	-	15
6	Side shell plating	25	20	15	-
	BOTTOM ZONE	-	-	-	10
7	Bilge and bottom plating and keel plate	25	20	10	-
8	Bilge and bottom longitudinals Web and flange	- 25	- 20	10 -	- -
9	Bottom girders	25	15	10	-
10	Inner bottom plating and hopper tank sloped plating	25	20	10	-
11	Longitudinals connected to inner bottom and hopper tank plating web and flange	- 25	- 20	10 -	- -
	OTHER ITEMS				
12	Hatch coaming plating	25	20	-	-
14	Hatch cover top plating	25	20	15	-
15	Hatch cover skirt plating	25	20	-	-
16	Hatch cover stiffeners	25	20	-	-
17	Transverse bulkheads plating stiffener web stiffener flange	 25 25 20	 20 20 15	 15 - -	 - - -
18	Side shell frames web flange brackets	 25 20 20	 20 15 15	 - - -	 - - -
19	Topside and hopper tank web frames web flange	 25 20	 20 15	 - -	 - -
20	Floors plating	 25	 15	 -	 -
21	Forward and aft peak bulkheads plating stiffener web stiffener flange	 25 25 20	 20 20 15	 15 - -	 - - -

Table 6 : Local and global acceptance criteria for oil tankers (given in % of wastage)

Group of items	Description of items	1 Isolated area	2 Item	3 Group	4 Zone
ITEMS CONTRIBUTING TO THE LONGITUDINAL STRENGTH (TRANSVERSE SECTION)					
	DECK ZONE	-	-	-	10
1	Deck plating, stringer, sheer and longitudinal bulkhead upper strake	25	20	10	-
2	Deck and sheer strake longitudinals web	- 25	- 20	10 -	- -
3	Deck longitudinal girders web and flange	- 25	- 20	10 -	- -
4	Longitudinals connected to longitudinal bulkhead upper strake web and flange	- 25	- 20	10 -	- -
	NEUTRAL AXIS ZONE	-	-	-	15
5	Side shell plating	25	20	15	-
6	Side shell longitudinals and stringers web and flange	- 25	- 20	15 -	- -
7	Longitudinal bulkhead plating	25	20	15	-
8	Longitudinal bulkhead longitudinals and stringers web and flange	- 25	- 20	15 -	- -
	BOTTOM ZONE	-	-	-	10
9	Bilge and strakes, longitudinal bulkhead lower strake and keel plate	25	20	10	-
10	Bilge and bottom longitudinals web and flange	- 25	- 20	10 -	- -
11	Longitudinals connected to longitudinal bulkhead lower strake web and flange	- 25	- 20	10 -	- -
12	Bottom girders web and flange	- 25	- 20	10 -	- -
OTHER ITEMS					
13	Deck transverse web frame web flange brackets / stiffeners	 25 20 25	 20 15 20	 - - -	 - - -
14	Side shell web frame web flange brackets / stiffeners	 25 20 25	 20 15 20	 - - -	 - - -
15	Longitudinal bulkhead web frame web flange brackets / stiffeners	 25 20 25	 20 15 20	 - - -	 - - -
16	Bottom transverse web frame web flange brackets / stiffeners	 25 20 25	 20 15 20	 - - -	 - - -
17	Transverse bulkheads plating stringer web stringer flange stiffener web stiffener flange	 25 25 20 30 25	 20 20 15 20 15	 15 - - - -	 - - - - -

4.4 Buckling strength criterion

4.4.1 This criterion is applicable to ships having a length greater than 120 meters.

The structural items contributing to the longitudinal strength of the ship, such as deck and bottom plating, deck and bottom girders, etc., are to be assessed with regard to their buckling strength, as deemed necessary by the Surveyor. In such a case, the values shown in Table 7 are not to be exceeded.

Table 7 : Buckling strength criterion

Items		Ratio	Material		
			235	315	355 and 390
Bottom and deck plates		s / t	56,0	51,0	49,0
Longitudinals	flat bar web	wh / wt	20,0	18,0	17,5
Flanged longitudinals / girders	web	wh / wt	56,0	51,0	49,0
	symmetrical flange	fb / ft	34,0	30,0	29,0
	asymmetrical flange	fb / ft	17,0	15,0	14,5
ss	s=Longitudinal Spaciing t=Plate Thickness R=Yield Stress wh=web height wt= web thickness	fb=flange breadth ft=flange thickness			

4.5 Acceptance criteria based on net scantling approach

4.5.1 General

The acceptance criteria for allowable thickness diminution of ship hull structure are given here after.

4.5.2 Definitions

a) Deck zone

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

- strength deck plating
- longitudinal hatch coaming
- sheer strake
- side shell plating
- inner hull and other plane longitudinal bulkhead plating, if any
- topside tank sloped plating, including horizontal and vertical strakes, if any
- longitudinal upper stool, if any
- longitudinal stiffeners, girders and stringers connected to the above mentioned plating.

b) Bottom zone

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

- keel plate
- bottom plating
- bilge plating
- bottom girders
- inner bottom plating
- side shell plating
- plane longitudinal bulkheads lower strake
- hopper tank sloping plating, and horizontal plating, if any
- longitudinal lower stool, if any
- longitudinal stiffeners connected to the above mentioned plating.

c) Neutral axis zone

The neutral axis zone includes the following items between the deck zone and the bottom zone, as for example:

- side shell plating
- inner hull plating and longitudinal bulkhead, if any
- double hull girder.

4.5.3 Local corrosion

a) Renewal thickness of local structural elements

Local structural elements include local supporting members and primary supporting members.

Steel renewal is required if the measured thickness in mm, is less than the renewal thickness

b) Renewal area

Areas which need to be renewed based on the renewal criteria are to be repaired with inserted material which is to have the same or greater grade and yield stress as the original:

c) Alternative solutions

When there is a substantial corrosion, coating applied in accordance with the coating manufacturer’s requirements or annual gauging may be adopted as an alternative to the steel renewal. The coating is to be maintained in good condition.

4.5.4 Global corrosion

a) Application

The longitudinal strength of the ship is to be evaluated by using the thickness of structural members measured, renewed and reinforced, as appropriate, during Class Renewal Surveys, for ships over 10 years of age.

b) Renewal criteria

Hull girder strength criteria are given as detailed below:

- For deck and bottom zones:

  The current hull girder section modulus at deck and bottom determined with the thickness measurements are not to be less than the section modulus calculated with the gross offered thickness minus 0,5 t_c.

  Alternatively, the current sectional areas of the bottom zone and of the deck zone which are the sum of the measured item areas of the considered zones are not to be less than the sectional area of the corresponding zones determined with the gross offered thickness minus 0,5 t_c.

- For neutral axis zone:

  The current sectional area of the neutral axis zone, which is the sum of the measured plating areas of this zone, is not to be less than the sectional area of the neutral axis zone calculated with the gross offered thickness minus 0,5 t_c.

If the actual reduction of the gross offered thickness of all items, of a given transverse section which contribute to the hull girder strength is less than 0,5 t_c for the deck, bottom and neutral axis zones, the hull girder strength criteria of this transverse section is satisfied and there is no need to perform calculation of the zone areas with measured thicknesses.

4.6 Pitting

4.6.1 The maximum acceptable depth for isolated pits is 35% of the as-built thickness.

4.6.2 For areas with different pitting intensity, the surveyor must identify the percentage of affected areas.

For areas having a pitting intensity of 50% or more, the maximum average depth of pits is 20% of the as-built thickness. For intermediate values between isolated pits and 50% of affected area, the interpolation between 35% and 20% is made according to Table 8.

Table 8: Pitting intensity and corresponding maximum average depth of pitting

Pitting Intensity, (%)	Maximum average pitting depth, (% of the as-built thickness)
Isolated	35,0
5	33,5
10	32,0
15	30,5
20	29,0
25	27,5
30	26,0
40	23,0
50	20,0

4.7 Acceptance criteria for CSR ships

4.7.1 Pitting corrosion: side structures (CSR bulk carriers)

If pitting intensity, in an area where coating is required for Bulk Carriers and Oil Tankers, as applicable, is higher than 15%, thickness measurements are to be performed to check the extent of pitting corrosion. The 15% is based on pitting or grooving on only one side of a plate. In cases where pitting is exceeding 15%, as defined above, an area of 300 mm or more, at the most pitted part of the plate, is to be cleaned to bare metal and the thickness is to be measured in way of the five deepest pits within the cleaned area. The least thickness measured in way of any of these pits is to be taken as the thickness to be recorded. The minimum remaining thickness in pits, grooves or other local areas is to be greater than the following values:

- for CSR single and double skin bulk carriers: 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 on either side of it
- for CSR single skin bulk carriers: 75% of the as-built thickness, in the frame and end bracket webs and flanges.

4.7.2 Edge corrosion of CSR ships

The average measured thickness across the breadth or height of the stiffener is not to be less than the one defined for Bulk Carriers, or Double Hull Oil Tankers, as applicable.

Plate edges at openings for manholes, lightening holes, etc... may be below the minimum thickness for Bulk Carriers, or Double Hull Oil Tankers, as applicable, provided that:

a) The maximum extent of the reduced plate thickness, below the minimum for Bulk Carriers, or Double Hull Oil Tankersas applicable, from the opening edge is not more than 20% of the smallest dimension of the opening and does not exceed 100 mm.

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

4.7.3 Acceptance criteria for grooving corrosion of CSR ships

a) Where the groove breadth is a maximum of 15% of the web height but not more than 30 mm, the measured thickness in mm. is not to be less than: $t_m = 6$ mm

b) Structural members with areas of grooving greater than those in item a) are to be assessed, based on the criteria for general corrosion for Bulk Carriers and Double Hull Oil Tankersas applicable, using the average measured thickness across the plating/stiffener.

4.8 Hull supporting structure of shipboard fittings associated with towing and mooring

4.8.1 For ships contracted for construction on or after the 1st January 2007, the allowable wastage of the hull supporting structure of shipboard fittings associated with towing and mooring is not to exceed:

- the total corrosion addition for ships covered by the Common Structural Rules for Bulk Carriers or the Common Structural Rules for Double Hull Oil Tankers, or
- 2,0 mm for other ships.

4.9 Ice strengthened structures for ships assigned with additional class notation for navigation in polar waters

4.9.1 For ships assigned with one of the additional class notations **POLAR CLASS**, steel renewal for ice strengthened structures as is required when the gauged thickness is less than+ 0,5 mm.

Appendix 4 Condition Monitoring and Condition Based Maintenance

1 General

1.1 Application

1.1.1 These requirements apply to the approved Condition Monitoring and Condition Based Maintenance schemes where the condition monitoring results are used to influence the scope and/or frequency of Class survey.

1.1.2 This scheme may be applied to components and systems covered by continuous survey system for machinery (CSM), and other components and systems as requested by the owner. The extent of Condition Based Maintenance and associated monitoring equipment to be included in the maintenance scheme is decided by the Owner.

1.1.3 These requirements can be applied only to vessels operating on approved PMS survey scheme.

1.1.4 The scheme may be applied to any individual items and systems. Any items not covered by the scheme are to be surveyed and credited in accordance with their requirements.

1.1.5 Ships complying with the requirements of this Appendix are granted one of the notations **CBM**.

1.2 Definitions

1.2.1 The following standard terms are defined in ISO 13372:2012.

1.2.2 Condition monitoring

Acquisition and processing of information and data that indicate the state of a machine over time. The machine state deteriorates if faults or failures occur.

1.2.3 Diagnostic

Examination of symptoms and syndromes to determine the nature of faults or failures.

1.2.4 Condition based maintenance

Maintenance performed as governed by condition monitoring programmes.

1.3 Condition monitoring (CM)

1.3.1 Where an approved condition monitoring system is fitted, credit for survey may be based on acceptable condition monitoring results. The condition monitoring results are to be reviewed during the annual audit.

1.3.2 Limiting parameters are to be based on the Original Equipment Manufacturers guidelines (OEM), or a recognised international standard.

1.3.3 The condition monitoring system is to provide an equivalent or greater degree of confidence in the condition of the machinery to traditional survey techniques.

1.3.4 The condition monitoring system is to be approved in accordance with QRS's procedures.

1.3.5 A condition monitoring system may be used to provide a greater understanding of equipment condition, and a condition based maintenance scheme may be used to obtain maintenance efficiency. Class approval is required where owners wish to change the survey cycle based on CM/CBM.

1.3.6 Software systems can use complex algorithms, machine learning and knowledge of global equipment populations/defect data in order to identify acceptability for continued service or the requirement for maintenance. These systems may be independent of the OEM recommended maintenance and condition monitoring suggested limits. Approval of this type of software is to be based on OEM recommendations, industry standards and Society experience.

1.3.7 QRS retains the right to test or open-up the machinery, irrespective of the CM results, if deemed necessary by Surveyor during annual and renewal audits.

1.4 Condition based maintenance (CBM)

1.4.1 Where an owner wishes to base their equipment maintenance on a CBM approach, this is to meet the requirements of the ISM Code.

1.4.2 Where an approved planned maintenance and CBM scheme is in operation, the CSM and other survey intervals may be extended based on OEM maintenance recommendations and acceptable condition monitoring results.

1.4.3 Limiting parameters (alarms and warnings) are to be based on the OEM guidelines, or a recognised international standard.

1.4.4 The CBM scheme is to provide an equivalent or greater degree of confidence in the condition of the machinery to traditional maintenance techniques.

1.4.5 The scheme is to be approved in accordance with QRS's procedures.

1.4.6 Software systems can use complex algorithms, machine learning and knowledge of global equipment populations/defect data in order to identify acceptability for continued service or the requirement for maintenance. These systems may be independent of the OEM recommended maintenance and condition monitoring suggested limits. Approval of this type of software is to be based on OEM recommendations, industry standards and Society experience. In that case, written agreement from the OEM is to be provided to QRS.

2 Procedures and conditions for approval of CM and CBM

2.1 Onboard responsibility

2.1.1 The Chief Engineer is to be the responsible person on board in charge of the CM and CBM.

2.1.2 Documentation on the overhaul of items covered by CM and CBM schemes are to be reported by the Chief Engineer.

2.1.3 Access to computerized systems for updating of the maintenance documentation and maintenance program is only to be permitted by the Chief Engineer or other authorized person.

2.1.4 All personnel involved in CM and CBM is to be appropriately qualified.

2.2 Equipment and systems requirements

2.2.1 CM equipment and systems are to be approved in accordance with Condition Monitoring Systems.

2.2.2 The CM/CBM scheme and its extent, are to be approved by QRS.

2.2.3 The CBM scheme is to be capable of producing a condition report, and maintenance recommendations.

2.2.4 A system is to be provided to identify where limiting parameters (alarms and warnings) are modified during the operation of the scheme.

2.2.5 CBM schemes are to identify defects and unexpected failures that were not prevented by the CM system.

2.2.6 Systems are to include a method of backing up data at regular intervals.

2.3 Documentation and information

2.3.1 The following documentation is to be made available to QRS for the approval of the scheme:

a) procedure for changes to software system and CM parameters
b) listing of equipment to be included in the scheme
c) listing of acceptable condition monitoring parameters
d) description of CBM scheme
e) listing, specifications and maintenance procedures for condition monitoring equipment
f) baseline data for equipment with condition monitoring
g) qualification of authorized personnel and company responsible for analysing CM results.

2.3.2 In addition to the above documentation the following information is to be available on board:

a) maintenance instructions (manufacturer's and shipyard's)

b) condition monitoring data including all data since last opening of the machine and the original base line data

c) reference documentation (trend investigation procedures etc.)

d) records of maintenance including repairs and renewals carried out

e) records of changes to software systems and parameters

f) sensors calibration records / certification / status.

2.4 Approval validity

2.4.1 An annual audit is to be carried out to maintain the validity of the CM/CBM scheme.

2.4.2 The survey arrangement for machinery under CM/CBM can be cancelled by QRS if the scheme is not being satisfactorily carried out either from the maintenance records or the general condition of the machinery.

2.4.3 Items under CM/CBM scheme can be cancelled from CM/CBM scheme and moved to CSM scheme by QRS if the scheme is not found to be satisfactorily maintained either from maintenance records or the general condition of the machinery, during annual and renewal audits.

2.4.4 In the case of sale or change of management of the ship or transfer of class, the approval of CM/CBM is to be reconsidered.

2.4.5 The ship owner may, at any time, cancel the CM/CBM scheme by informing QRS in writing. In this case the items which have been inspected under this scheme since the last annual audit may be credited for class at the discretion of the attending surveyor.

3 Surveys

3.1 Installation survey

3.1.1 Condition monitoring equipment is to be installed and surveyed in accordance with QRS's rules, and a set of base line readings is to be taken.

3.2 Implementation survey

3.2.1 The implementation survey is to be carried out by the Surveyor no earlier than 6 months after installation survey and no later than the first class annual survey.

3.2.2 During the implementation survey the following is to be verified by the surveyor:

a) the CM/CBM scheme is implemented according to the approval documentation, including a comparison with baseline data

b) the scheme is producing the documentation required for the annual audit and the requirements of surveys and testing for the maintenance of class are complied with

c) the onboard personnel are familiar with operating the scheme

d) records of any limiting parameters (alarms and warnings) that have been modified during the operation of the scheme

e) records of any failures of monitored equipment are to be reviewed to ensure that the condition monitoring scheme is effective / sufficient.

3.2.3 When this survey is carried out and the implementation is found in order, a report describing the scheme is to be submitted to QRS and the scheme may be put into service.

3.3 Annual audit

3.3.1 An annual audit of the CM and CBM scheme is to be carried out by a Surveyor concurrently with the class annual survey.

3.3.2 The purpose of this audit is to be to verify that the scheme is being correctly operated and that the machinery has been functioning satisfactorily since the previous audit. This is to include any limiting parameters (alarms and warnings) that have been modified since the last audit. A general examination of the concerned items is to be carried out.

3.3.3 The performance, condition monitoring and maintenance records are to be examined to verify that the machinery has functioned satisfactorily since the previous survey, or action has been taken in response to machinery operating parameters exceeding acceptable tolerances.

3.3.4 Written details of breakdown or malfunction are to be made available.

3.3.5 At the discretion of the surveyor, function tests, confirmatory surveys and random check readings, where Condition Monitoring / Condition Based Maintenance equipment is in use, are to be carried out as far as practicable and reasonable.

3.3.6 The familiarisation of the Chief Engineer and other authorized personnel involved with the CM/CBM system is to be verified.

3.3.7 Calibration status of sensors and equipment is to be verified.

3.3.8 Verification that the suitability of the CM/CBM scheme has been reviewed following defects and failures is to be carried out.

3.3.9 An annual report covering the year's service is to be supplied to QRS. It is to include the following information:

- the list of items of machinery and components and the procedures for their identification
- the preventive maintenance sheets
- the condition monitoring data, including all data since the last dismantling and the original reference data of the machinery checked through condition monitoring
- full trend analysis (including spectrum analysis for vibrations) of machinery displaying operating parameters exceeding acceptable tolerances.

3.4 Damage and repairs

3.4.1 Damage to components or items of machinery is to be reported to QRS. The repairs of such damaged components or items of machinery are to be carried out to the satisfaction of the Surveyor.

3.4.2 Details of repairs and maintenance carried out are to be examined. Any machinery part, which has been replaced by a spare one, due to damage, is to be retained on board where possible until examined by the Surveyor.

3.4.3 Defect and failure data is to be reviewed in order to ensure the system output is appropriate. Where necessary, following review of the failure data, there is to be a method of amending the CM and CBM scheme.

3.4.4 For bearings surveyed under the continuous survey system, when a certified monitoring system is in place such a condition based monitoring or manufacturers approved bearing wear monitoring, then there is no need to turn out the bearings unless the monitoring systems are not working properly, suggest there may have been bearings problems or the monitoring data is not available and verifiable over a period covering the CSM cycle.

Appendix 5 Remote Classification Surveys

1 General

1.1 Scope

1.1.1 The surveys of ships may utilize different methods and concepts. This Section contains principles and minimum requirements for carrying out remote surveys.

Remote survey will only be appropriate provided the level of assurance is not compromised, and the survey is carried out with the same effectiveness as and is equivalent to a survey carried out with attendance on board by a Surveyor.

1.2 Application

1.2.1 These requirements apply to all vessels, self-propelled or not.

1.3 Definitions

1.3.1 Remote survey

A "Remote Survey" is a process of verifying that a ship and its equipment are in compliance with the Rules where the verification is undertaken, or partially undertaken, without attendance on board by a Surveyor.

1.3.2 Information and communication technology (ICT)

Information and Communication Technology (ICT) are the technologies used in the scope of remote surveys for gathering, storing, retrieving, processing, analysing, and transmitting information which includes both software and hardware.

2 Requirements for equivalency

2.1 General

2.1.1 The requirements for equivalency of a remote survey to a survey attended on board by a Surveyor include:

- eligibility of the remote survey
- qualification of Surveyors
- planning of the remote survey
- performance of the remote survey
- assessment of the remote survey
- reporting.

Equivalency is obtained when, with the use of available ICT, a Surveyor can perform a survey remotely being able to:

- obtain the supporting and technical evidence required according to the applicable rules
- verify applicable survey items and relevant tests

and the results of the remote survey provide the same level of assurance obtained with attendance on board by a Surveyor.

2.2 Eligibility of the remote survey

2.2.1 Eligibility of the remote survey is to be decided based on type and scope of the requested survey and, if applicable, flag State Administration acceptance and possible instructions, when the classification survey is also related to a statutory item, and QRS is carrying out the statutory survey on behalf of the flag State Administration.

A remote survey is deemed eligible when it provides the same level of assurance, according to the requirements for equivalency, as if it was conducted with attendance on board by a Surveyor.

Remote surveys are generally to be carried out with internet connection allowing a live streaming visual examination, although, at the discretion of the Surveyor, a combination of remote survey may be used. For simple/limited verifications, other types of ICT may be accepted by the Surveyor.

2.3 Planning of the remote survey

2.3.1 Planning of the remote survey is required to ensure that the remote survey is carried out in accordance with the applicable requirements. The content of the planning is to be based on the scope of the remote survey.

To ensure that the Surveyor can properly plan the remote survey and communicate with personnel/crew, so that the survey is carried out according to the applicable rules, adequate means are to be available enabling the Surveyor and allowing QRS to:

- properly interact with personnel/crew involved in the remote survey, before and during the survey process
- agree on ICT means to be used
- verify that personnel/crew involved in the remote survey are suitably skilled to use the electronic devices and/or software used by QRS to perform the remote survey
- acquire as deemed necessary information on identity and ranking of personnel/crew involved in the remote survey
- provide the survey item/scope to the personnel/crew involved in facilitating the remote surveys, including the tests that will be performed
- communicate, during the remote survey, additional actions depending on the evidence to be collected.

One or more of the following means is to be provided for planning the remote survey:

- live-streaming video and audio connection
- exchange of data / electronic documents
- other means acceptable to QRS.

The Owner is to provide the necessary facilities for the safe execution of the survey.

2.4 Performance of the remote survey

2.4.1 To ensure that the Surveyor can properly perform the remote survey according to the applicable rules, the available evidence must allow the attending surveyor to:

- examine and assess a survey item and/or a group of items and/or supporting documents
- verify and assess applicable tests and/or services.

The evidence provided to the Surveyor is subject to the technical evaluation and final acceptance by the Surveyor with respect to the completeness and accuracy, necessary to perform the requested survey according to the applicable requirements.

One or more of the following evidence is to be provided for performing the remote survey:

- live-streaming video and audio
- recorded videos provided by the Owner's representative
- photos provided by the Owner's representative
- other data and/or supporting documents acceptable to QRS.

2.5 Assessment of the remote survey

2.5.1 The Surveyor is to evaluate all evidence received and accept them before crediting the remote survey.

The means used for the remote survey must allow the Surveyor to collect the necessary evidence that will be examined according to the Surveyor's professional judgement in order to satisfactorily complete and credit the relevant survey items.

In case the Surveyor, according to their professional judgement, deems that the remote survey does not provide the same level of assurance as a survey with attendance on board by a Surveyor, the Surveyor may decide not to credit the relevant survey items.

3 Scope and procedures

3.1 Scope - eligible survey items

3.1.1 A remote survey may be proposed as an alternative to a survey attended on board by a Surveyor for the surveys listed in Table 1.

When the classification survey is also related to a statutory item, and QRS is carrying out the statutory survey on behalf of the flag State Administration, then the flag State Administration acceptance is required, and possible additional requirements are to be complied with.

The Surveyor may require to confirm the results of the remote survey, by a survey attended on board by a Surveyor, to credit the relevant survey items, in case the remote survey is not carried out to the Surveyor's satisfaction or it is required by QRS.

Table 1 : Eligible remote survey items

No.	Surveys and related items eligible to remote survey	Live streaming required
1	Postponement, issuance, deletion of Condition of Class	X
2	Postponement of Class surveys	X
3	Items of Continuous Survey for Machinery or Planned Maintenance Scheme	X
4	Occasional survey for change of ship's name	X
5	Occasional survey for loss of anchor	X
6	Occasional survey for minor machinery or equipment damage	X
7	Occasional survey for minor hull damage	X
8	Occasional survey for minor deficiencies/defects not subject to a Condition of Class	X
9	In-water bottom survey	X
10	Specified items of a class periodical survey (excluding additional specific items of initial or renewal surveys), including completion of remaining items of a part held class periodical survey	X
11	Non-propelled / un-manned barges/pontoon – annual surveys when no survey of hull compartments is due	X
12	Minor retrofit / installation / upgrade of equipment	X

3.2 Procedures

3.2.1 Digital information quality, completeness, and accuracy

Final appraisal of the quality of digital information is at the discretion of the Surveyor, who is to be satisfied with the content and the quality of digital information collected, and the survey carried out, allowing the Surveyor to confirm its completion.
The Owner is responsible for the completeness and accuracy of digital information provided. The digital information submitted by the Owner to the Surveyor is to reflect the real situation of the surveyed item. The date and time, when a photo or video was taken are to be made available to the Surveyor or identifiable from its metadata.
QRS is to collect and store digital information as evidence of the survey. It is not necessary to store all digital information received; the exact digital information stored is to support the survey decision and is to be decided by the Surveyor crediting the survey.
The remote survey is carried out under the supervision and upon instructions of the Surveyor, who oversees crediting the remote surveys. A surveyor attendance on board may be required to complete the survey, upon the Surveyor's request and at their discretion.

3.2.2 Requirements for a remote survey when live streaming is not used

When live streaming is not used, communication and digital information collection are to be performed through an ICT channels (such as emails, data streams and clouds), which is to be accepted by QRS prior to the survey.
The Owner's representative is to confirm the identity of the ship at the commencement of the survey.

3.2.3 Requirements for a remote survey when live streaming is used

The Owner's is to ensure that:

- the Owner's representative is attending on board and has access to the areas intended to be surveyed
- the Owner's representative has at his disposal a 2-ways visual and audible communication means
- ICT solution is available on the communication means and.

In the case these requirements cannot be fulfilled, the remote survey may be rejected. The Surveyor is to verify the identity of the ship at the commencement of the survey by live streaming.

3.3 Requirements for connectivity

3.3.1 The Owner's representative is to ensure that internet connectivity tests are carried out before the survey and that proper connectivity is available and maintained during the survey.

When remote survey by live streaming is being undertaken, a connection that enables live streaming between the Surveyor and the Owner's representative attending on board is required. The quality of the live streaming connection (audio and video) is to ensure proper communication and to allow the Surveyor to carry out the survey remotely, to the Surveyor's satisfaction. In the case where a live streaming connection with the Surveyor is not possible or is not continuous at the place of the survey (e.g., Engine Room), partly online sequences (where the Owner is able to capture pictures and videos offline of those items not covered by live streaming) may be accepted by the Surveyor.

4 Information and Communication Technology (ICT)

4.1 General

4.1.1 This Article outlines the minimum requirements for the use of ICT that can capture images, record video and/or live stream video or other data from a ship as considered acceptable to QRS.

4.2 Hardware

4.2.1 The Owner is responsible for ensuring that all hardware installations on board used for the remote survey comply with the applicable requirements relevant for use and location on board, including hazardous areas. The ICT is to typically consist of:

- A host computer device, to receive the streaming of images/data/video. This is usually a laptop or desktop computer compatible with the software application used for the remote survey.
- Onboard standalone device which may include digital cameras capable of capturing videos/photos/data.
- Onboard smart device compatible with the applicable software/technology.
- Communication accessories like headphones and microphone for the noisy environment as applicable and as deemed necessary.

The communication equipment used for the live streaming is to have the following minimum functionality:

- both ends are to simultaneously see the same image/videos in near real-time
- two-way direct voice communication
- possibility to take screenshots.

When using a portable device on board for live streaming, the movement of the handheld device may affect the stability of the video and the image, leading to lower quality outputs. When necessary, a suitable anti-shake device is to be used to provide proper stability.

4.3 Internet connectivity (coverage and speed)

4.3.1 The onboard smart devices are to have the capability of transmitting the images/video/data over a Cellular, Wi-Fi or Satellite Connection to the remote Surveyor.

When live streaming communication is applied, the internet connection is to have sufficient and stable bandwidth capacity to ensure quality (such as resolution and frame rate) of the direct colour image/video and voice communication to the remote survey location to the satisfaction of the Surveyor.

4.4 Software and data security

4.4.1 The software used for the remote survey is to be acceptable to QRS. The overall function and ability of the software used to ensure the security of data are to be evaluated prior to use as per the below requirements.

The Surveyor is to normally control the live video call, providing instructions to the on-site personnel/crew and supervising survey activities for capturing relevant information. The onboard device is to have the capability of transmitting the data over a Cellular, Wi-Fi, or Satellite Connection to the Surveyor.

The software used to perform the remote survey may also be provided with technologies that support the Surveyor in the process of making a decision, such as:

- Artificial Intelligence (AI) for the recognition and the classification of defects.
- Internet of things (IoT) for collecting parameters and evaluating acceptability/working condition of machinery and equipment.
- Data driven verification or other means considered acceptable by QRS.

The above software and technologies are to be evaluated and accepted by QRS in each case.

When considering the use of software/applications and other technologies, data protection are to be considered in accordance with applicable requirements of QRS before the remote survey is commenced. The software/application used to perform the remote survey is to be compatible with the technical requirements detailed in this paragraph; in addition, the software used is to comply with QRS's applicable requirements for:

- cybersecurity
- data protection and confidentiality for the transmitted data.

When not provided by QRS itself, the audio/video software or application used to perform the remote survey is to be accepted by QRS.

During the survey preparation, it is the Owner's responsibility to ensure that their data security policies are implemented as per the Company's Safety Management System.

5 Recording of evidence and reporting of survey

5.1 Recording of evidence

5.1.1 Required evidence

In principle, live streaming video and audio are to be applied to remote surveys as a primary means.

Additionally, and/or alternatively, one or more of the following evidence may be submitted or verified as requested by the Surveyor during remote survey so that the Surveyor is able to verify conditions of survey items:

- Recorded video and audio.
- Photos.
- Master's/chief engineer's statement.
- Ship's logbook.

- Owner's confirmation.

a) Live streaming video and audio:

b) Recorded videos/photos:

For the recorded videos/photos, the following information is to be available:

- confirmation that they were actually taken on the ship by the Owner's representative
- date and time when they were taken
- identity of the personnel/crew responsible for taking evidence.

c) Master's/chief engineer's statement:

Recorded videos/photos provided by the Owner's representative may be supplemented with a statement signed by the master and/or the chief engineer confirming the condition of the items shown in the evidence. The final evaluation of the remote survey by the Surveyor is to be based on all of the provided evidence, and it does not delegate the responsibility to the master/ chief engineer's statement only.

d) Ship's logbook:

The Master is to make entries into ship's logbook on the following occasions and submit copies of the relevant pages when requested by the Surveyor:

- when a remote survey is carried out by the Surveyor
- when videos/photos are taken and submitted to the Surveyor with the master's/chief engineer's statement and additional documents as applicable.

e) Owner's confirmation:

The Owner's representative or the master is to confirm the correctness and completeness of the provided information and evidence (if any) relevant to the condition of the items requested to be surveyed. This confirmation may be included in the survey application.

5.1.2 Retaining/filing evidence

The evidence submitted by the Owner's representative or master is to be retained/filed in accordance with QRS's procedures which are to include:

- type of evidence to be retained/filed
- duration/location to be retained/filed.

It is not required for QRS to record and save live streaming video and audio as evidence unless the Surveyor considers it necessary.

5.1.3 Other supporting documents

The Surveyor may request the Owner's representative or master to submit supplementary documents such as ship's maintenance reports and record for the operation of machinery and equipment and service reports issued by manufacturers, service suppliers or service providers.

While the Surveyor is to verify that the documents are duly prepared and issued to the ship, they may not be required to be retained/filed by QRS as evidence.

5.2 Reporting of remote survey

5.2.1 The report of a remote survey is to be issued in accordance with QRS's procedure. The survey report is also to include the following additional information:

- indication that the survey was carried out remotely
- description of the means used during the remote survey
- indication of the provided evidence
- confirmation of the Flag State Administration's authorization, when applicable.

CHAPTER 2
SCOPE OF SURVEYS (ALL SHIPS)

Section 1 Annual Survey

1 General

1.1

1.1.1 The requirements of this Section apply to annual surveys of all ships.

1.1.2 At the time of annual surveys, the ship is to be generally examined. The survey is to include a visual inspection of the hull, equipment and machinery of the ship and some tests thereof, so far as necessary and practicable in order to verify that the ship is in a acceptable general condition and is properly maintained.

1.1.3 Owners are reminded that, any modification to the ship's hull, equipment and machinery affecting its classification is to be made known to QRS.

2 Hull

2.1 Hull and hull equipment

2.1.1 The survey is to include a general external examination and testing, where appropriate, of the following items, as applicable:

- outer shell plating above the waterline, relevant shell doors and accessible parts of the rudder(s)
- plating of freeboard deck and exposed decks, superstructures, with their openings and means of closure
- means of closing and securing the weathertightness of miscellaneous openings in freeboard, superstructure and exposed decks (cargo hatchways, other hatchways and other openings)
- sidescuttles and deadlights, chutes and other openings with their means of closure
- bulwarks and, if applicable, the provision of freeing ports, special attention being paid to freeing ports with shutters
- guardrails, gangways, walkways, ladders and any other means provided for the protection of the crew and means for safe passage for crew
- inlets, scuppers and sanitary discharges, valves on discharge lines and their controls
- ventilators, air pipes, overflow pipes and gas vent pipes, with their coamings, means of closure and flame screens, where required
- flame screens on vents to all bunker tanks
- all air pipe heads installed on the exposed decks
- weld connection between air pipes and deck plating
- fittings and appliances for timber deck cargoes, where applicable
- verification of the position of the deck line (or reference line) and load lines and timber marks, if any, which, if necessary, are to be re-marked and re-painted
- deck equipment such as lifeboat davit foundations, bollards, fairleads, hawse pipes, etc., masts and associated rigging, including lightning conductors
- anchoring and mooring equipment, as far as practicable
- towing and mooring equipment properly marked with any restriction associated with its safe operation (only for ships built after 1st January 2007).
- watertight bulkheads, their watertight doors and associated local and remote controls, and their watertight penetrations
- main and auxiliary steering arrangements, including their associated equipment and control systems, and manoeuvring gear
- fire divisions and fire doors, dampers in ventilation ducts, means of closure of skylights and other openings
- confirmation, as far as practicable, that no significant changes have been made to the arrangement of the structural fire protection, including cargo spaces intended for the carriage of dangerous goods
- confirmation that emergency escape routes from accommodation and service spaces are satisfactory
- accessible cargo holds, in particular in areas likely to be damaged by cargo handling
- confirmation that the drainage from enclosed cargo spaces situated on the freeboard deck is satisfactory
- engine room

- availability of loading manual
- availability of electronic loading instrument, where required, and verification with standard test
- availability of approved stability documentation
- checking, in general, that there has been no deterioration in the strength of the hull
- verification that no alterations have been made to the hull or superstructures that would affect the position of the load lines
- superstructure end bulkheads and openings therein
- watertight integrity of the closures to any openings in the ship's side shell below the freeboard deck (particularly, cargo ports and other similar openings)
- garbage chutes, as far as practicable
- spurling pipes and cable lockers for verification that permanent devices are fitted to minimize water ingress
- if applicable, special requirements for ships permitted to sail with type “A” or type “B-minus” freeboard (machinery casing, gangway and access, hatchways and freeing arrangements)
- hull and its closing appliances, in general and as far as can be seen
- for ships fitted with independent cargo tanks, confirmation that cargo piping and tanks are electrically bonded to the hull, as applicable.

2.1.2 Suspect areas identified at previous surveys are to be examined. Thickness measurements are to be taken of the areas of substantial corrosion and the extent of thickness measurements is to be increased to determine areas of substantial corrosion. These extended thickness measurements are to be carried out before the annual survey is credited as completed.

2.1.3 Examination of ballast tanks when required because of the results of the class renewal survey and intermediate survey is to be carried out. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the extent of thickness measurements is to be increased to determine areas of substantial corrosion. These extended thickness measurements are to be carried out before the annual survey is credited as completed.

2.2 Hatch covers and coamings

2.2.1 The Owner or his representative is to declare to the attending Surveyor that no significant changes have been made to the hatch covers, hatch coamings and their securing and sealing devices without prior approval of QRS.

The survey of hatch covers and coamings is to include:

a) when fitted with portable covers, or wooden or steel pontoons, checking of the satisfactory condition, where applicable, of:
   - wooden covers and portable beams, carriers or sockets for the portable beams, and their securing devices
   - steel pontoons
   - tarpaulins
   - cleats, battens and wedges
   - hatch securing bars and their securing devices
   - loading pads/bars and the side plate edge
   - guide plates and chocks
   - compression bars, drainage channels and drain pipes (if any)

b) when fitted with mechanically operated steel covers, checking of the satisfactory condition, as applicable, of:
   - hatch covers
   - tightness devices of longitudinal, transverse and intermediate cross junctions (gaskets, gasket lips, compression bars, drainage channels and, if any, drain pipes)
   - clamping devices, retaining bars, cleating
   - chain or rope pulleys
   - guides

- guide rails and track wheels
- stoppers, etc.
- wires, chains, gypsies, tensioning devices
- hydraulic system essential to closing and securing
- safety locks and retaining devices
- the operation of hatch covers, by means of random examination: stowage and securing in open condition, proper fit, locking and efficiency of sealing in closed position, operational testing of hydraulic and power components, wires, chains and link drives

c) checking of the satisfactory condition of hatch coaming plating and its stiffeners, where applicable.

3 Machinery and systems

3.1 General machinery installations

3.1.1 The survey of general machinery installations is to cover the following items:

- confirmation that the machinery, boilers and other pressure vessels, associated piping systems and fittings are maintained so as to reduce to a minimum any danger to persons on board, due regard being given to moving parts, hot surfaces and other hazards
- confirmation that the normal operation of the propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative
- confirmation that provisions are made so as to bring the machinery into operation from the dead ship condition without external aid
- confirmation that the means of escape from accommodation, machinery and other spaces are satisfactory
- general examination of the machinery, boilers, all steam, hydraulic, pneumatic and other systems and their associated fittings, for confirmation of their proper maintenance
- examination of the means for the operation of the main and auxiliary machineries essential for the safety of the ship (including the control, monitoring, reporting, alert and safety action)
- test of the means of remotely controlling the propulsion machinery from the navigation bridge, where applicable
- examination of the arrangements to operate the main and other machineries from a machinery control room, where applicable
- confirmation that the ventilation system for the machinery spaces works correctly
- confirmation that the engine-room telegraph, the second means of communication between the navigation bridge and the machinery, and the means of communication with any other position, from where the engines can be controlled, operates satisfactorily
- confirmation that the engineer's alarm is clearly audible in the engineers' accommodation
- confirmation that the means of communication between the navigation bridge and the steering compartment are satisfactorily operating
- confirmation that the means of indicating the angular position of the rudder are satisfactorily operating
- for ships having emergency steering positions, confirmation that means of relaying heading information (telephone or other means of communication) are provided; confirmation that means to supply visual compass readings to the emergency steering position are provided if necessary
- confirmation that the various alarms required for hydraulic power-operated, electric- and electro-hydraulic steering gears work satisfactorily
- confirmation that the re-charging arrangements for hydraulically operated steering gears are maintained
- examination, as far as practicable, of the bilge pumping systems and bilge wells, including operation of the pumps, remote reach rods and level alarms, where fitted
- visual examination of the condition of any expansion joints in sea water systems
- examination of the arrangements for periodically unattended machinery spaces and, in particular, the random testing of alarms, automatic and shut-down functions
- external examination of pressure vessels other than boilers and their appurtenances, including safety devices, foundations, controls, relieving gear, high pressure piping, insulation and gauges
- examination, where applicable, of the alternative design and arrangements for machinery or electrical installations, or fire safety, in accordance with the test, inspection and maintenance requirements, if any, specified in the approved documentation
- confirmation that the ballasting arrangements are satisfactory.

3.1.2 When the ship is equipped with a refrigerating plant (whether or not covered by an additional class notation), the annual survey is to include the external examination of:

- pressure vessels of the installation to the same extent
- refrigerant piping, as far as practicable
- for refrigerating machinery spaces using ammonia as refrigerant:
  - ventilation system including functional test
  - water-spraying fire-extinguishing system;
  - bilge system including functional test
  - electrical equipment, confirming its proper maintenance
  - gas detection system
  - breathing apparatus and protective clothing.

3.1.3 When the ship is equipped with thruster installations, the annual survey is to include:

- an external examination of the machinery installation
- an operating test of the complete installation.

3.1.4 For ships fitted with an exhaust gas cleaning system (scrubber), the annual survey is to include an examination of the distance pieces on the overboard discharge system of the scrubber and a confirmation that there is no reduction of thickness of these distance pieces.

3.2 Boilers

3.2.1 For main and auxiliary steam boilers, the annual survey consists of an external examination of boilers and their appurtenances, including safety devices, foundations, controls, relieving, high pressure and steam escape piping, insulation and gauges.

The annual survey is to include test of safety and protective devices and test of safety valve using its relieving gear.

For exhaust gas heated economizers, the safety valves are to be tested by the Chief Engineer at sea within the annual survey window. This test is to be recorded in the log book for review by the attending Surveyor prior to crediting the Annual Survey of Machinery.

3.2.2 For thermal oil heaters, a functional test while in operation is to be carried out, during which the following items are checked:

- the heater for detection of leakages
- the condition of the insulation
- the operation of indication, control and safety devices
- the condition of remote controls for shut-off and discharge valves.

A satisfactory analysis of the quality of oil is to be made available to the Surveyor.

3.2.3 For exhaust gas thermal oil heaters, a visual examination and a tightness testing to the working pressure of the heater tubes are to be carried out.

3.2.4 For electrical steam generators, a functional test while in operation is to be carried out, during which the following items are checked:

- the heater system for detection of leakages
- the operation of indication, control, alarm and safety devices.

3.3 Electrical machinery and equipment

3.3.1 The survey of electrical machinery and equipment is to cover the following items:

- general examination, visually and in operation, as feasible, of the electrical installations for power and lighting, in particular main and emergency generators, electric motors, switchboards, switchgears, cables and circuit protective devices, indicators of electrical insulation and automatic starting, where provided, of emergency sources of power
- checking, as far as practicable, the operation of emergency sources of power and, where they are automatic, also including the automatic mode
- verification that the precautions provided against shock, fire and other hazards of electrical origin are maintained.

3.3.2 The survey is also to cover the bridge control of propulsion machinery, and related arrangements (alarms and safety devices), when fitted.

3.3.3 The survey is also to cover the computerized systems through the control of the Software Registry. This survey shall include:

- checking of modification of Software Registry, in particular the reporting of security checks during software modification inside the Software Registry
- checking that revision of software mentioned in Software Registry corresponds with revision effectively used for at least one computerized system chosen at the satisfaction of the Surveyor
- checking that Software Registry has been updated according to the last ship relevant modifications.

3.3.4 For ships where the electrical distribution system includes harmonic filters, the survey is to include:

- Annual measurement, as a minimum, of the harmonic distortion levels of main busbars under seagoing conditions as close to the periodical machinery survey as possible so as to give a clear representation of the condition of the entire plant to the Surveyor. Harmonic distortion readings are to be carried out when the greatest amount of distortion is indicated by the measuring equipment. An entry showing which equipment was running and/or filters in service is to be recorded in the log so this can be replicated for the next periodical survey. Harmonic distortion levels are also to be measured following any modification to the ship's electrical distribution system or associated consumers by suitably trained ship's personnel or by a qualified outside source.
- Verification that records of all above measurements are made available to the Surveyor at each periodical survey.

- For ships contracted for construction on or after 1st July 2017, verification that the facilities used for continuous monitoring of the levels of harmonic distortion experienced on the main busbars as well as alerting the crew when the level of harmonic distortion exceeds the acceptable limits are working properly and review of corresponding records.

3.3.5 For Li-Ion batteries of a capacity above 20kWh or used as emergency source or transitional source, the survey is to include:

- general examination of the battery pack(s)
- general examination of the battery monitoring system
- general examination of the battery support system
- general examination of the battery compartment, including visual check of the safety measures and functions related to battery spaces, such as battery installation, ventilation, fire safety measures and alarms
- check of the electrolyte level and pH level
- check of State of health (SOH) of battery system according to the Manufacturer's specification and verification that the battery capacity has been regularly recorded and complies with the parameters specified by the Manufacturer
- test of sensor and alarm associated to the battery at random
- undertaking of measurement of insulation of battery packs
- additional checks when some specific part of the battery is or has been replaced (e.g. battery cells, BMS) according to the Manufacturer specification and to the satisfaction of the Surveyor.

3.3.6 For batteries used for electrical supply of pods, the survey is to include:

- verification of proper working of monitoring systems
- verification of proper working of alarms and defaults and related functions and/or interfacing to the other ship systems
- disconnection of the electrical storage system (ESS) in different operating modes, and automatic start of stand-by source, as necessary
- test of the fire detection of the battery compartment
- test of the gas detection system of the battery compartment
- examination of the fire-extinguishing system of the battery compartment as applicable
- verification that accessibility for common maintenance and devices for battery overhaul, if any, are maintained.

3.4 Fire protection, detection and extinction

3.4.1 The survey of fire prevention and other general arrangements is to cover the following items:

- checking that fire control plans are properly posted
- examination and testing, as feasible, of the operation of manual and/or automatic fire doors, where fitted
- checking, as far as practicable, that, where fitted, the remote controls for stopping fans in accommodation spaces and the means of cutting off power to the galley are in working order
- examination of the fire-extinguishing and special arrangements in the machinery spaces and confirmation, as far as practicable and as appropriate, of the operation of the remote means of control provided for the opening and closing of the skylights, the release of smoke, the closure of funnel and ventilation openings, the closure of power operated and other doors, the stopping of ventilation and boiler forced and induced draft fans and the stopping of oil fuel and other pumps that discharge flammable liquids
- examination of the arrangements for remote closing of valves for oil fuel, lubricating oil and other flammable oils and confirmation, as far as practicable and as appropriate, of the operation of the remote means of closing valves on the tanks that contain oil fuel, lubricating oil and other flammable oils
- test of the means of stopping power ventilation systems from outside the spaces served
- examination and testing of the closing arrangements of ventilators, funnel annular spaces, skylights, doorways, tunnel or other closing means for various openings, where applicable
- examination, as far as practicable, and testing, as feasible and at random, of the fire and/or smoke detection systems
- examination, where applicable, of the alternative design and arrangements for fire safety or life-saving appliances and arrangements, in accordance with the test, inspection and maintenance requirements, if any, specified in the approved documentation.

3.4.2 The operational readiness and maintenance of fire-fighting systems is to be checked. Confirmation that its means of operation is clearly marked. The survey requirements for all types of fire-fighting systems that are usually found on board ships related either to machinery spaces or cargo spaces or vehicle spaces or special category spaces or ro-ro spaces or accommodation spaces, irrespective of the service notation assigned, are the following:

a) water fire system
   - examination of the fire main system and confirmation that each fire pump including the emergency fire pump can be operated separately so that the two required powerful jets of water can be produced simultaneously from different hydrants, at any part of the ship whilst the required pressure is maintained in the fire main
   - checking that fire hoses, nozzles, applicators, spanners and international shore connection (where fitted) are in satisfactory working condition and situated at their respective locations

b) fixed gas fire-extinguishing system
   - external examination of receivers of CO_2 (or other gas) fixed fire-extinguishing systems and their accessories, including the removal of insulation for insulated low pressure CO_2 containers
   - examination of fixed fire-fighting system controls, piping, instructions and marking; checking for evidence of proper maintenance and servicing, including date of last system tests
   - checking that fixed CO_2 fire-extinguishing systems for the protection of machinery spaces and cargo pump-rooms, where applicable, are provided with two separate controls, one for opening of the gas piping and one for discharging the gas from the storage container, each of them located in a release box clearly identified for the particular space
   - test of the alarm triggered before the CO_2 is released

c) sprinkler system
   - examination of the system, including piping, valves, sprinklers and header tank
   - test of the automatic starting of the pump activated by a pressure drop
   - check of the alarm system while the above test is carried out

d) water-spraying system
   - examination of the system, including piping, nozzles, distribution valves and header tank
   - test of the starting of the pump activated by a pressure drop (applicable only for machinery spaces)

e) fixed foam systems (low or high expansion)
   - examination of the foam system
   - test to confirm that the minimum number of jets of water at the required pressure in the fire main is obtained when the system is in operation
   - checking the supplies of foam concentrate and receiving confirmation that it is periodically tested (not later than three years after manufacture and annually thereafter) by the manufacturer or an agent

f) dry powder system
   - examination of the dry powder system, including the powder release control devices
   - checking the supplies of powder contained in the receivers and that it has maintained its original smoothness
   - checking that the pressure of propelling inert gas contained in the relevant bottles is satisfactory.

3.4.3 As far as other fire-fighting equipment is concerned, it is to be checked that:

- semi-portable and portable fire extinguishers and foam applicators are in their stowed positions, with evidence of proper maintenance and servicing, and detection of any discharged containers
- the fire fighter's outfits including its self-contained compressed air breathing apparatus and emergency escape breathing devices (EEBDs) are complete and in satisfactory condition and provision of two-way portable radiotelephone apparatus of an explosion-proof type or intrinsically safe; where more than one fire-fighter's outfit is carried, confirmation that they are stored in separated positions
- the cylinders, including the spare cylinders, of any self-contained breathing apparatus are suitably charged, and that onboard means of recharging breathing apparatus cylinders used during drills or a suitable number of spare cylinders to replace those used are provided.

3.4.4 The fire-extinguishing systems for spaces containing paint and/or flammable liquids and deep-fat cooking equipment in accommodation and service spaces are to be examined.

3.4.5 When appropriate, the examination of the special arrangements for carrying dangerous goods is to be carried out, including checking of the electrical equipment and wiring, the ventilation, the provision of protective clothing and portable appliances, testing any fire detection and alarm system and any sample extraction smoke detection system and testing as far as practical, the water supply, bilge pumping and any water spray system.

3.4.6 For ships designed to carry containers on or above the weather deck, as applicable, examination of the water mist lance, and as appropriate, the mobile water monitors and all necessary hoses, fittings and required fixing hardware.

3.5 General emergency alarm system

3.5.1 The general emergency alarm system is to be examined and tested.

Section 2 Intermediate Survey

1 General

1.1

1.1.1 The requirements of this Section apply to intermediate surveys of all ships.

1.1.2 A survey planning meeting is to be held prior to the commencement of the survey.

1.1.3 Concurrent crediting to both Intermediate Survey and Class Renewal Survey for surveys and thickness measurements of spaces are not acceptable.

1.1.4 The intermediate survey is to include examination and checks on a sufficiently extensive part of the structure to show that the structures of the ship are in satisfactory condition so that the ship is expected to operate until the end of the current period of class, provided that the ship is properly maintained and other surveys for maintenance of class are duly carried out during this period.

2 Hull

2.1

2.1.1 The requirements given in Table 1 for the survey and testing of ballast tanks, cargo holds (for dry cargo ships to which the additional requirements do not apply) and cargo tanks (for non-ESP tankers) are to be complied with.

Table 1 : Intermediate survey of hull (all ships)

ITEM	Age of ship (in years at time of intermediate survey)		
	5 < age 10	10 < age 15	age > 15
BALLAST TANKS	Representative ballast tanks internally examined Thickness measurements, if considered necessary by the Surveyor	All ballast tanks internally examined Thickness measurements, if considered necessary by the Surveyor	All ballast tanks internally examined Thickness measurements, if considered necessary by the Surveyor Tightness of inner bottom plating of cargo holds in way of double bottom ballast tanks checked, if considered necessary by the Surveyor
CARGO HOLDS (dry cargo ships)			Selected cargo holds internally examined
CARGO SPACES (for ships other than ships engaged in the carriage of dry cargoes only)		Selected cargo spaces internally examined	Selected cargo spaces internally examined
CARGO TANKS (non-ESP tankers)		Selected cargo tanks internally examined	Selected cargo tanks internally examined

2.1.2 For ships fitted with independent cargo tanks, external examination of cargo tanks, as far as practicable, including tank supports, chocks and keys. The internal examination may be required if deemed necessary by the Surveyor.

For ships fitted with independent cargo tanks, confirmation that cargo piping and tanks are electrically bonded to the hull, as applicable.

Section 3 Class Renewal Survey

1 General

1.1

1.1.1 The requirements of this Section apply to class renewal surveys of all ships.

1.1.2 A survey planning meeting is to be held prior to the commencement of the survey.

1.1.3 Concurrent crediting to both Intermediate Survey and Class Renewal Survey for surveys and thickness measurements of spaces are not acceptable.

1.1.4 In addition to the requirements of the annual survey, the class renewal survey is to include sufficiently extensive examination and checks to show that the structures, main and auxiliary machinery, systems, equipment and various arrangements of the ship are in satisfactory condition or restored to such condition as to allow the ship to operate for the new period of class of five years to be assigned, provided that the ship is properly maintained and operated and other surveys for maintenance of class are duly carried out during this period.

The examinations of the hull are to be supplemented by testing and thickness measurements, to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deformation that may be present.

1.1.5 The Owner is to provide the necessary facilities to enable this class renewal survey.

1.1.6 When the ship is under the continuous survey system for hull or machinery, the scope of the class renewal survey as described in this Section is carried out on a continuous basis over the period of class.

When the machinery installation is surveyed under the Planned Maintenance System, a specific program of survey replaces the scope of the class renewal survey of machinery and systems.

1.1.7 Upon completion of the class renewal survey, or at the end of the period of class (if the relevant part of the ship is surveyed under the continuous survey system), a general examination of the ship having the same scope as that of an annual survey is to be carried out for class renewal.

2 Hull and hull equipment

2.1 Bottom survey in dry condition

2.1.1 A bottom survey in dry condition is to be carried out

2.1.2 For ships of unusual characteristics or engaged on special services, means of underwater inspection equivalent to the bot- tom survey in dry condition may be considered as an alternative by QRS, particularly when a suitable high resistance paint is applied to the underwater portion of the hull or an approved system of impressed current for external cathodic protection is fitted.

2.1.3 Anchors, windlass(es) and chain cables are to be ranged and examined, and the required complement and condition are to be checked. When the ship is more than 5 years old, chain cables are to be gauged.

Any length of chain cable which is found to be damaged or excessively worn is to be renewed.

2.1.4 Sea valves and cocks are to be opened up for internal examination.

2.1.5 Thickness measurements of the outer shell plating, as and if required within the scope of the related class renewal survey, are to be carried out, if not already done within 15 months before the end of class period.

2.2 Decks, hatch covers and equipment

2.2.1 Decks are to be examined, particular attention being given to the areas where stress concentration or increased corrosion are likely to develop, such as hatch corners and other discontinuities of structure.

Deck erections such as hatch coamings, deckhouses and superstructures are to be examined.

The sheathing of wood-sheathed steel decks may be removed, at the Surveyor's discretion, in the case of doubt as to the condition of plating underneath.

Due attention is to be given to the examination in way of end and side openings and related shell and inner doors.

2.2.2 The hatch covers and coamings are to be surveyed as follows:

- Subject to cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey is to be done of the accessible parts of hatch cover structures
- checking of the satisfactory operation of all mechanically operated hatch covers is to be made, including stowage and securing in open condition, proper fit, locking and efficiency of sealing in closed position, operational testing of hydraulic and power components, wires, chains and link drives
- checking the effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent is to be carried out
- thickness measurements of coaming and attached stiffeners, hatch cover plating and stiffeners (see Table 3).

2.2.3 The survey of hull equipment is to cover the following points:

- windlass and chain stoppers, with disassembly as deemed necessary to verify the condition of the equipment and control and safety devices, holdfasts, hawse pipes
- steering arrangements, including steering gear, control and indication devices, operational tests and disassembly as deemed necessary; in the case of chain and rod gears, chains, rods, sheaves, pins and rollers are to be examined for wear
- connection of masts and standing rigging to the hull structure as well as condition of structure underneath.

2.2.4 All bilge and ballast piping systems are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory.

2.2.5 For all ships, automatic air pipe heads installed on the exposed decks are to be completely examined, both externally and internally, in accordance with the requirements given in Table 1.

Table 1 : Requirements for internal and external examination of automatic air pipe heads at class renewal survey of all ships

Age of ship (in years at time of class renewal survey)		
Class renewal survey No.1 age < 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 and subsequent age > 10
Two air pipe heads, one port and one starboard, located on the exposed decks in the forward 0,25 L, preferably air pipes serving ballast tanks.	All air pipe heads located on the exposed decks in the forward 0,25 L.	All air pipe heads located on the exposed decks.
Two air pipe heads, one port and one starboard, on the exposed decks, serving spaces aft of 0,25 L, preferably air pipes serving ballast tanks.	At least 20% of air pipe heads on the exposed decks serving spaces aft of 0,25 L, preferably air pipes serving ballast tanks.	

2.3 Holds and other dry compartments

2.3.1 Holds, 'tweendecks, cofferdams, pipe tunnels and duct keels, void spaces and other dry compartments which are integral to the hull structure are to be internally examined, ascertaining the condition of the structure, bilges and drain wells, sounding, venting, pumping and drainage arrangements.

At class renewal survey No.3 and subsequent class renewal surveys, structural down flooding ducts and structural ventilation ducts are to be internally examined.

2.3.2 Machinery and boiler spaces, pump rooms and other spaces containing machinery are to be internally examined, ascertaining the condition of the structure. Particular attention is to be given to tank tops, shell plating in way of tank tops, brackets connecting side shell frames and tank tops, and bulkheads in way of tank tops and bilge wells. Particular attention is to be given to the sea suctions, sea water cooling pipes and overboard discharge valves and their connections to the shell plating. Where wastage is evident or suspected, thickness measurements are to be carried out, and renewals or repairs effected when wastage exceeds allowable limits.

2.3.3 Chain lockers are to be internally examined, while the anchor chains are ranged as required for the bottom survey in dry condition. The pumping arrangement of the chain lockers is to be tested.

2.4 Tanks

2.4.1 The type and number of tanks to be internally examined at each class renewal survey are detailed in Table 2, according to the age of the ship.

This internal examination is to ascertain the condition of the structure, bilges and drain wells, sounding, venting, pumping and drainage arrangements, including piping systems and their fittings. Due attention is to be given to plating or double plates below the lower end of sounding and suction pipes.

Where the inner surface of the tanks is covered with cement or other compositions, the removal of coverings may be waived provided they are examined, found sound and adhering satisfactorily to the steel structures.

2.4.2 Where provided, the condition of corrosion prevention system of ballast tanks is to be examined. For ballast tanks, excluding double bottom tanks, where a hard protective coating is found in poor condition and it is not renewed, where soft or semi-hard coating has been applied or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined at annual intervals. Thickness measurements are to be carried out as deemed necessary by the surveyor.

When such breakdown of hard protective coating is found in double bottom ballast tanks and it is not renewed, where a soft or semi hard coating has been applied, or where a hard protective was not 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 are to be carried out.

2.4.3 Boundaries of double bottom, deep, ballast, peak and other tanks, both integral and independent tanks, including holds adapted for the carriage of salt water ballast, are to be tested with a head of liquid to the top of air pipes or to near the top of hatches for ballast/cargo holds.

2.4.4 Boundaries of fuel oil, lube oil and fresh water tanks are to be tested with a head of liquid to the highest point that liquid will rise under service conditions. Tank testing of fuel oil, lube oil and fresh water 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. The surveyor may extend the testing as deemed necessary.

Table 2 : Requirements for internal examination of integral (structural) tanks at class renewal survey

Tank	Age of ship (in years at time of class renewal survey)			
	Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age ❶15	Class renewal survey No.4 and subsequent age > 15
Peaks (all use)	all	all	all	all
Ballast tanks (all types)	all	all	all	all
Fresh water	none	one	all	all
Fuel oil bunkertanks: • Engine room • Cargo length area • If no tanks in cargo length area, additional fuel tank(s) outside of Engine room (if fitted)	 none none none	 none one one	 one two one	 one half, minimum 2 two
Lubricating oil tanks	none	none	none	one
Cargo tanks	all	all	all	all

2.4.5 Non-structural storage tanks for fuel for auxiliary vehicles, are to be externally examined; the relevant fittings, with regard to the remote-control shut-off valves under hydrostatic head, are to be externally examined and operationally tested to check that they are working properly and to verify the absence of cracks or leakage.

2.5 Thickness measurements

2.5.1 Thickness measurements are to be carried out

The extent of thickness measurements is detailed in Table 3, according to the age of the ship. The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to determine areas of substantial corrosion in accordance with the requirements of Table 4. These extended thickness measurements are to be carried out before the survey is credited as completed.

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

Thickness measurements of internals may be specially considered by the Surveyor if the hard protective coating is in good condition.

2.6 Independent cargo tanks

2.6.1 All independent cargo tanks are to be cleaned and examined internally, as well as their liquid-level indicators.

2.6.2 When accessible, the outer surface of uninsulated cargo tanks or the outer surface of cargo tank insulation is to be examined.

Special attention is to be given to the tank and insulation in way of chocks, supports, keys, anti-rolling/pitching systems.

Removal of insulation, in part or entirely, may be required to verify the condition of the tank or the insulation itself if deemed necessary by the Surveyor.

2.6.3 Thickness measurements may be required if deemed necessary by the Surveyor.

2.6.4 The tightness of all cargo tanks is to be verified by an appropriate procedure.

2.6.5 The pressure relief valves for the cargo tanks are to be opened for examination, adjusted, function tested and sealed. Where a proper record of continuous overhaul and re-testing of individually identifiable relief valves is maintained, consideration may be given to acceptance on the basis of opening, internal examination and testing of a representative sample of valves, including each size and type of relief valves in use, provided there is evidence in the log-book that the remaining valves have been overhauled and tested since crediting of the previous class renewal survey.

2.6.6 The cargo containment venting system is to be examined.

Table 3 : Requirements for thickness measurements at class renewal survey

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
Suspect areas throughout the vessel	Suspect areas throughout the vessel	Suspect areas throughout the vessel	Suspect areas throughout the vessel
	One transverse section of deck plating within the amidships 0,5 L (in way of a cargo space, if applicable)	Two transverse sections within the amidships 0,5L (in way of two cargo spaces, if applicable)	A minimum of three transverse sections within the amidships 0,5L (in way of cargo spaces, if applicable)
		All cargo hold hatch covers and coamings	
		Internals in fore peak and after peak ballast tanks	
			All exposed main deck plating full length.
			Representative exposed superstructure deck plating (poop, bridge, and forecastle deck).
			Lowest strake and strakes in way of 'tween decks of all transverse bulkheads in cargo spaces together with internals in way.
			All wind – and water strakes, port and starboard, full length.
			All keel plates full length. Also, additional bottom plates in way of cofferdams, machinery space, and aft end of tanks.
			Plating of sea chests. Shell plating in way of overboard discharges as considered necessary by the attending surveyor

Table 4: Guidance for additional thickness measurements in way of substantial corrosion areas

Structural member	Extent of measurements	Pattern of measurements
Plating	Suspect area and adjacent plates	5 point pattern over 1 square meter
Stiffeners	Suspect area	3 measurements each in line across web and flange

2.6.7 All piping, equipment and machinery for loading, venting, heating or otherwise handling the cargo are to be examined. Insulation is to be removed as deemed necessary to ascertain the condition of the pipes.

If the visual examination raises doubts as to the integrity of the pipelines, a pressure test at 1,25 times the MARVS for the pipeline is to be carried out. After reassembly the complete piping systems are to be tested for leaks.

2.6.8 All emergency shutdown and quick-closing valves in the cargo piping systems are to be examined and proven operable. A random selection of valves is to be opened up for examination.

2.6.9 Holds around cargo tanks are to be internally examined. In case of ships built without longitudinal bulkhead in the centre line of the ship, and fitted with long deck beams, the welded connections between the deck beams and the plating of the double hull spaces are to be thoroughly examined.

3 Machinery and systems

3.1 General

3.1.1 The survey items listed below are to be covered to the satisfaction of the Surveyor. However, other survey alternatives deemed equivalent by the Surveyor in relation to the characteristics and general condition of the ship concerned may also be accepted.

As part of the Class Renewal Survey of Machinery, a dock trial is to be carried out, to the satisfaction of the attending Surveyor, to confirm satisfactory operation of main and auxiliary machinery. If significant repairs are carried out to main or auxiliary machinery or steering gear, consideration is to be given to a sea trial, to the satisfaction of the attending Surveyor.

If the significant repairs as stated above, is considered by QRS to have any impact on response characteristics of the propulsion systems, then the scope of sea trial shall also include a test plan for astern response characteristics based on those required for such an equipment or system when fitted to the new ship.

The tests are to demonstrate the satisfactory operation of the equipment or system under realistic service conditions at least over the maneuvering range of the propulsion plant, for both ahead and astern directions.

Depending on the actual extent of the repair, QRS may accept a reduction of the test plan.

3.2 Main and auxiliary engines and turbines

3.2.1 General

Depending on the type of machinery, the following parts are to be opened up as necessary for inspection, unless surveyed, items e) and f). Parts and components are to be pressure tested as appropriate or as deemed necessary by the Surveyor. A working test is also to be carried out, including testing of alarms and safety devices.

3.2.2 Internal combustion engines

a) Columns and entablature

b) Cylinders with their liners, cylinder covers (together with valves and valve gear), pistons with their rods, crossheads, slippers and guides (or gudgeon pins), connecting rods (with their top and bottom end bearings), control gear, driven scavenge pumps, driven air compressors, driven fuel pumps, supercharging blowers, fuel injection pumps, turning gear, etc.

c) Crankshafts (together with their main bearings)

d) Reverse gear, reduction gear and clutches, if fitted.

3.2.3 Steam turbines

a) Condensers and their cooling water and condensate extraction pumps

b) Casings and rotors (including their blading), impulse wheels (including guide blading and diaphragms), nozzles and nozzle boxes, journals and bearings, dummy pistons, labyrinths, external glands, etc.

c) Shafts, including their flexible couplings.

Where the propulsion steam turbines are of a well-known type, and fitted with rotor position indicators and vibration indicators of an approved type, as well as measuring equipment of steam pressure at proper locations along the steam flow, and the arrangements for change-over in the event of emergency operation of the plant are readily operable, the first class renewal survey may be limited to the examination of rotor bearings, thrust bearings and flexible couplings, provided the Surveyor is satisfied from operation service records and power trials subsequent to the survey, that the turbine plant is in good working condition.

3.2.4 Gas turbines

a) Casings, rotors and disks, impellers and blading of all turbines and compressors, combustion chambers, burners, heat exchangers, gas piping, compressed air piping with fittings, starting and reverse arrangements

b) Shafts and their flexible couplings.

3.2.5 Electric propulsion

Where the propulsion machinery consists of an electrical system, the propulsion motors, generators, cables and all ancillary electrical gear, exciters and ventilating plant (including coolers) associated therewith are to be examined and the insulation resistance to earth tested. Due attention is to be given to windings, commutations and sliprings. The operation of protective gear and alarm devices is to be checked, as far as practicable. Interlocks intended to prevent unsafe operations or unauthorised access are to be checked to verify that they are functioning correctly.

3.2.6 Thruster installations

When the ship is equipped with thruster installations, the class renewal survey is also to include:

- an examination of the machinery and electrical installation, as applicable
- an external examination of the propulsive part of the installation to be carried out at the dry dock survey due as part of the class renewal survey. During this examination other checks such as clearance readings, tightness of hub and blade sealing for controllable pitch propellers are to be verified. Locking arrangements for bolts, if fitted, are to be checked. Results of lubricating oil analysis to detect possible deterioration of internal gears and bearings or the presence of water are to be confirmed as acceptable. The Manufacturer’s requirements may be taken into account. Dismantling of the assembly for the examination of internal parts may be required if the foregoing checks are not satisfactory
- a running test of the system under operating conditions.

3.2.7 Pod propulsion systems

When the ship is equipped with pod propulsion systems, the class renewal survey is to include the examination of:

- electric propulsion motors and associated equipment,
- pod orientation device (gears and wheels, hydraulic/ electric system, sealing arrangements)
- oil lubricating system of shaft bearings
- bilge system inside pod
- ventilation and cooling system
- rotating commutator
- alarm system.

3.3 Reduction gears, main thrust and intermediate shaft(s)

3.3.1 Reduction gears complete with all wheels, pinions, shafts, couplings, bearings and gear teeth, including incorporated clutch arrangements, are to be opened up, as deemed necessary by the Surveyor, for visual inspection. For complicated assemblies, gears and roller bearings may be surveyed without dismantling.

3.3.2 All shafts, thrust blocks and bearings are to be examined.

3.4 Pumps and other machinery items

3.4.1 General

The items listed below are to be opened up, as deemed necessary by the Surveyor, for visual inspection. Their parts and components are to be pressure tested as appropriate and considered necessary by the Surveyor. A working test is also to be carried out, including testing of alarms and safety devices if deemed necessary by the Surveyor.

3.4.2 Items to be surveyed

a) Air compressors with their intercoolers, filters and/or oil separators and safety devices

b) Heat exchangers, ventilation fans for boilers and other equipment used for essential services

c) Piston pumps and centrifugal pumps for sea water, bilge and salt water ballast

d) Screw pumps, gear pumps and centrifugal pumps other than those listed in c) above (opening up is not required).

3.5 Systems in machinery spaces

3.5.1 Valves, cocks and strainers of the bilge and ballast systems are to be opened up, as deemed necessary by the Surveyor, for visual inspection, and, together with the piping and safety devices, examined and tested under working conditions.

3.5.2 The fuel oil, lubricating oil, hydraulic oil, thermal oil, and feed and cooling water systems, together with pressure filters, heaters and coolers used for essential services, are to be opened up and examined or tested, as considered necessary by the Surveyor. Safety devices for the foregoing items are to be examined.

3.5.3 The compressed air system together with its valves, fittings and safety devices is to be examined, as considered necessary by the Surveyor.

3.5.4 Compressed air receivers and other pressure vessels for essential services are to be cleaned internally and examined internally and externally. Their fittings, valves and safety devices are to be opened up, as deemed necessary by the Surveyor, for visual inspection and pressure tested as appropriate.

3.5.5 Steel pipes for superheated steam having a temperature of the steam at the superheater outlet exceeding 450°C are to be examined and tested at each class renewal survey.

3.5.6 Steel pipes for saturated steam or superheated steam having a temperature of the steam at the superheater outlet not exceeding 450°C are to be examined and tested at each class renewal survey for ships over 5 years of age. When the ship is 5 years of age or less, the inspection may be limited to a check of the satisfactory general condition of pipes.

3.5.7 The examination and hydrostatic test of steel pipes for main steam machinery, and steel pipes for auxiliary steam machinery having internal diameter 75 mm and over, are to be carried out on a number of pipes selected by the Surveyor after the lagging in way is removed.

3.5.8 Representative pipe lengths connected with bolted flanges are to be internally and externally examined, and hydrostatically tested to 1,1 times the working pressure at ambient temperature. Bolts and butt-welded joints between flanges and pipes are to be submitted to a non-destructive test for crack detection.

3.5.9 Non-structural tanks located in machinery spaces are to be externally examined; the relevant fittings, with regard to the remote control shut-off valves under hydrostatic head, are to be externally examined and operationally tested to check that they are working properly and to verify the absence of cracks or leakage.

3.5.10 When the ship is equipped with a refrigerating plant, the class renewal survey is to include:

- examination and test at the design pressure of the parts of the plant under pressure
- for refrigerating machinery spaces using ammonia as refrigerant:
  - examination and test of the water-spraying fire-extinguishing system
  - examination of valves and pumps of the bilge system
  - examination and test of the electrical equipment
  - test of the gas detection system.

3.6 Electrical equipment and installations

3.6.1 An electrical insulation resistance test is to be performed on the electrical equipment and cables. If needed, for the purpose of this test, the installation may be subdivided or equipment which may be damaged disconnected.

3.6.2 The following minimum values, when performing the insulation test, are to be considered:

- for main and emergency switchboards, feeder circuit breakers being open, busbar circuit closed, measuring and monitoring instruments disconnected, the resistance of insulation measured across each insulated busbar and the hull, and across insulated busbars, should not be less than 1 megohm
- for generators, the equipment and circuits normally connected between the generator and the first circuit breaker being connected, the resistance of insulation (preferably at working temperature whenever possible), in ohms, is to be greater than 1 000 times the rated voltage, in volts. If appropriate, the Surveyor checks also that the insulation resistance of generators separate exciter gear is not less than 1 megohm
- the insulation resistance of the entire electrical system is to be checked with all circuit breakers and protective devices closed, except for generators; in general, the resistance should not be less than 100 000 ohms. However, the variation of the resistance with time is to be checked, comparing the current figure with previous readings. If the insulation resistance was to drop suddenly or be insufficient, the defective circuits are to be traced, disconnecting the circuits as much as necessary.

3.6.3 The prime movers of generators are to be surveyed and their governors tested. All generators are to be presented for inspection, clean and with covers opened and examined under working conditions.

3.6.4 Main and emergency switchboards, section boards and distribution boards are to be cleaned and doors or covers opened for examination of their fittings. The condition of overcurrent protective devices and fuses is to be checked. Circuit-breakers of generators are to be tested, as far as practicable, to verify that protective devices including preference tripping relays, if fitted, operate satisfactorily. It is to be verified that there are no loose connections on busbar.

3.6.5 Electrical cables and cable runs are to be examined at random, in particular in places where deterioration is likely to occur; terminal boxes of essential services are also to be subjected to a random check.

3.6.6 The motors and starters concerning essential services together with associated control and switchgear are to be examined and, if considered necessary by the Surveyor, checked, as far as practicable, under working conditions.

3.6.7 Navigation light indicators are to be tested under working conditions, and correct operation on the failure of supply or failure of navigation lights verified.

3.6.8 The emergency sources of electrical power, their automatic arrangements and associated circuits are to be tested.

3.6.9 Emergency lighting, transitional emergency lighting, supplementary emergency lighting, general emergency alarm and public address systems are to be tested as far as practicable.

3.6.10 The visible condition of electrical equipment and installations is also to be checked as regards precautions against shock, fire and other hazards of electrical origin.

3.6.11 A general examination of the electrical equipment in areas where there may be flammable gas or vapour and/or combustible dust is to be carried out to ensure that the integrity of the electrical equipment of a safety type has not been impaired owing to corrosion, missing bolts, etc., and that there is not an excessive build-up of dust on or in dust-protected electrical equipment. Cable runs are to be examined for sheath and armouring defects, where practicable, and to ensure that the means of supporting the cables are in satisfactory condition. The proper condition of bonding straps for the control of static electricity is to be checked. Alarms and interlocks associated with pressurised equipment or spaces are to be tested for correct operation.

3.6.12 The survey is also to cover the computerized systems through the control of the Software Registry. This survey shall include:

- checking of modification of Software Registry, in particular the reporting of security checks during software modification inside the Software Registry
- checking that revision of software mentioned in Software Registry corresponds with revision effectively used for each computerized system
- checking that Software Registry has been updated according to the last ship relevant modifications.

3.6.13 For ships where the electrical distribution system includes harmonic filters, the survey is to include:

- annual measurement, as a minimum, of the harmonic distortion levels of main busbars under seagoing conditions as close to the periodical machinery survey as possible so as to give a clear representation of the condition of the entire plant to the surveyor. Harmonic distortion readings are to be carried out when the greatest amount of distortion is indicated by the measuring equipment. An entry showing which equipment was running and/or filters in service is to be recorded in the log so this can be replicated for the next periodical survey. Harmonic distortion levels are also to be measured following any modification to the ship's electrical distribution system or associated consumers by suitably trained ship's personnel or by a qualified outside source.
- verification that records of all above measurements are made available to the surveyor at each periodical survey.
- for ships contracted for construction on or after 1st July 2017, verification that the facilities used for continuous monitoring of the levels of harmonic distortion experienced on the main busbars as well as alerting the crew when the level of harmonic distortion exceeds the acceptable limits are working properly and review of corresponding records.

3.6.14 For Li-Ion batteries of a capacity above 20kWh or used as emergency source or transitional source, the requirements below for annual survey are to be complied with.

- a comprehensive test of indication and alarms is to be carried out
- the traceability of cells replacement is to be checked
- the traceability of software modification is to be checked
- a battery capacity (State of Health - SOH) test is to be witnessed when:
  - release of flammable or toxic gases during battery operation was identified
  - loss of battery might jeopardize the manoeuvrability of the ship.

3.6.15 For batteries used for electrical supply of pods, the requirements below for renewal survey are to be complied with.

- verification of the quality of the power supply
- examination of the fire-extinguishing system as applicable

3.7 Controls

3.7.1 Where remote and/or automatic controls, not covered by an additional class notation related to automated installation, are fitted for essential machinery, they are to be tested to demonstrate that they are in satisfactory condition.

3.8 Fire protection, detection and extinction

3.8.1 The Owner or his representative is to declare to the attending Surveyor that no significant changes have been made to the arrangement of structural fire protection.

3.8.2 The class renewal survey of fire prevention arrangements is to cover the following items.

a) Visible parts of items forming part of structural fire protection arrangements in accommodation spaces and in machinery spaces such as bulkheads, decks, doors, stairways, crew and service lift trunks, and light and air trunks are to be examined, due attention being given to their integrity and that of the insulating material.

b) The operation of manual/automatic fire doors, where fitted, is to be checked.

c) Remote controls for stopping fans and machinery and shutting off fuel supplies in machinery spaces and, where fitted, remote controls for stopping fans in accommodation spaces and means of automatically shutting off the electrical power of the deep- fat cooking equipment upon activation of the fire-extinguishing system are to be tested.

d) Closing arrangements of ventilators, funnel annular spaces, skylights, doorways and tunnels, where applicable, are to be tested.

e) Fire and/or smoke detection and alarm systems are to be tested.

3.8.3 The survey requirements for all types of fire-fighting systems that are usually found on board ships related either to machinery spaces or to cargo areas and/or spaces or to accommodation spaces, irrespective of the service notation assigned, are the following:

a) water fire system
   - the associated pumps are to be opened up and examined at the Surveyor's discretion
   - the fire main is to be hydrostatically tested to the working pressure at the Surveyor's discretion

b) fixed gas fire-extinguishing system

   Receivers of CO_2 (or other gas) fixed fire-extinguishing systems are to be externally examined together with all stationary fittings and devices. In addition, the following applies:
   - the total loss of CO_2 is not to exceed 10% of the installed quantity (5% for Halon)
   - after being repaired or discharged, containers are to be subjected to a hydrostatic test
   - hydrostatic testing of high pressure CO_2 containers is to be carried out at intervals not exceeding 10 years; the number of the tested containers is to be not less than 10% of the total number
   - low pressure CO_2 containers are to be internally surveyed if the content has been released and the container is older than five years; depending upon the result of the internal examination, the Surveyor may require the container to be hydrostatically tested.

   It is to be checked that the distribution pipework is proved clear.

c) sprinkler system
   - the associated pumps are to be opened up and examined at the Surveyor's discretion

d) water spraying system
   - the associated pumps are to be opened up and examined at the Surveyor's discretion
   - a working test is to be carried out as far as reasonable and appropriate

e) fixed foam systems (low or high expansion)
   - the associated pumps are to be opened up and examined at the Surveyor's discretion

f) dry powder system
   - it is to be verified that the propelling inert gas bottles have been hydrostatically tested. The same applies to bottles disembarked for refilling or embarked for replacement.

3.8.4 As far as other fire-fighting equipment is concerned, the following items are to be hydrostatically tested, at intervals not exceeding 10 years:

- any CO_2 bottles of extinguishers
- shells of foam extinguishers
- shells of powder extinguishers
- air or gas bottles associated with fire extinguishers whose shells are not kept under pressure (if internally examined, the test need not be performed).

3.9 Hold, ballast and dry spaces water level detectors

3.9.1 For ships subject to compliance with these requirements, the class renewal survey is to include an examination and a test of the water ingress detection systems and of their alarms.

3.10 Availability of pumping systems

3.10.1 For ships subject to compliance with these requirements, the class renewal survey is to 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.

Section 4 Bottom Survey

1 General

1.1

1.1.1 Examinations of the outside of ship's bottom and related items of ships is normally to be carried out with the ship in dry- dock or on a slipway. However, consideration may be given to alternate examination while the ship is afloat as an in-water survey.

2 Bottom survey in dry condition

2.1 General requirements

2.1.1 When a ship is in dry-dock or on a slipway, it is to be placed on blocks of sufficient height and with the necessary staging to permit the examination of elements such as shell plating including bottom and bow plating, stern frame and rudder, sea chests and valves, propeller.

2.1.2 The shell plating is to be examined for excessive corrosion, or deterioration due to chafing or contact with the ground or for any undue unfairness or buckling. Special attention is to be paid to the connection between the bilge strakes and the bilge keels and to the plating of end structures (stem and sternframes). Important plate unfairness or other deterioration which do not necessitate immediate repairs are to be recorded.

2.1.3 Sea chests and their gratings, sea connections and overboard discharge valves and cocks and their fastenings to the hull or sea chests are to be examined. Sea valves and cocks need not be opened up more than once in a period of class unless considered necessary by the Surveyor.

For ships fitted with box coolers (chest coolers), the connection between the box cooler and the sea chest top plate are to be specifically examined from both sea side and inside (dry side) at bottom survey in drydock only.

2.1.4 Visible parts of the propeller(s), stern bush(es), propeller shaft boss, brackets and tightness system(s) are to be examined. The clearances of the propeller shaft(s) (or wear down gauge) are to be checked and recorded. For controllable pitch propellers, the Surveyor is to be satisfied with the fastenings and tightness of hub and blade sealing.

Visible parts of side thrusters are to be examined. Other propulsion systems which also have manoeuvring characteristics (such as directional propellers, vertical axis propellers, water jet units) are to be examined externally with focus on the condition of gear housing, propeller blades, bolt locking and other fastening arrangements. Sealing arrangement of propeller blades, propeller shaft and steering column shall be verified.

Dismantling is to be carried out, if considered necessary, notably where leakages are detected.

2.1.5 Visible parts of the rudder(s), rudder pintles, rudder stock and couplings as well as the sternframe are to be examined. If considered necessary by the Surveyor, the rudder(s) is (are) to be lifted or the inspection plates removed for the examination of pintles.

The clearances in the rudder bearings and the rudder lowering are to be checked and recorded. Where applicable, pressure test of the rudder may be required as deemed necessary by the Surveyor.

2.2 Bottom survey held within the scope of class renewal survey

2.2.1 The examination and checks for bottom survey are to be carried out as part of the class renewal survey.

3 Bottom in-water survey

3.1 General

3.1.1 An in-water survey may normally be carried out if authorized by the Flag Authority.

3.1.2 In principle, no outstanding conditions of class are to exist requiring repair work to be carried out to the underwater part of the shell plating, the rudder, the propeller or the propeller shaft, unless QRS is satisfied that such repairs may be carried out while the ship is afloat.

3.1.3 Proposals for in-water survey are to be submitted in advance of the survey by the Owner so that satisfactory arrangements can be agreed with QRS.

The in-water survey is to be carried out with the ship in sheltered water and preferably with weak tidal streams and currents. The in-water visibility and the cleanliness of the hull below the waterline are to be clear enough to permit a meaningful examination allowing the Surveyor and the in-water survey firm to determine the condition of the plating, the appendages and the welding.

The equipment, procedure for observing and reporting the survey are to be discussed with the parties involved prior to the in- water survey, and suitable time is to be allowed to permit the in-water survey firm to test all equipment beforehand.

3.1.4 The in-water survey is to be carried out under the surveillance of a Surveyor by an in-water survey firm approved as a service supplier by QRS.

The Surveyor is to be satisfied with the methods of orientation of the diver(s) or remotely operated vehicle (ROV) on the plating, which should make use where necessary of permanent markings on the plating at selected points and with the method of pictorial representation. An efficient two-way communication between the Surveyor and the diver(s) is to be provided.

3.1.5 The in-water survey is to provide the information normally obtained from a bottom survey in dry condition. Special consideration shall be given to ascertaining rudder bearing clearances and stern bush clearances of oil stern bearings based on a review of the operating history, on board testing and stern oil sample reports. These considerations are to be included in the proposals for in-water survey.

Upon completion of the survey, the approved diving firm is to submit to the attending Society Surveyor a detailed report including video tapes, as well as a photographic documentation of the main parts inspected.

3.1.6 If the in-water survey reveals damage or deterioration that requires immediate attention, the Surveyor may require that the ship be drydocked in order that a detailed survey can be undertaken and the necessary repairs carried out.

Section 5 Tailshaft Survey

1 Survey of tailshafts

1.1 General

1.1.1 The different types of surveys to which tailshafts may be subjected and the intervals at which they are to be carried out are below:

- complete survey
- modified survey.

1.2 Complete survey

1.2.1 The complete survey of tailshafts consists of the following, as applicable:

a) removal of propeller and key, where fitted, and their examination

b) complete withdrawal of shaft to permit the examination of sterntube bearings (outboard or inboard depending on the type of shaft)

c) examination by an appropriate crack detection method of the after end of the cylindrical part of the shaft and forward one third of shaft cone, or the fillet of the flange in the case of a flanged coupling

d) examination of shaft bearing surfaces, liners, joints, threaded end and nut

e) examination of oil sealing glands with the necessary dismantling

f) measurements of clearances and/or weardown (prior to and after the survey) and their recording

g) opening-up of controllable pitch propellers and examination of their working parts and control gear, if considered necessary.

1.3 Modified survey

1.3.1 General

For the different types of shafts, the following is required:

a) for shafts with keyed propeller coupling:
   - removal of propeller and key, and their examination in way of the connection area
   - examination by an appropriate crack detection method of the after end of the cylindrical part of shaft and forward one third of shaft cone

b) for shafts with keyless type propeller coupling:
   - check of the tightness of the propeller hub (propeller hood, fore gland)

c) for shafts with a solid flange coupling at the aft end and variable pitch propeller:
   - check of tightness in way of blade glands and distribution box
   - check of analysis of hydraulic oil
   - working test, as far as practicable, of the blade maneuvering.

1.3.2 Where the Surveyor considers that the data presented is not entirely to his satisfaction, further dismantling may be required, including withdrawal of the tailshaft.

2 Periodical survey of other propulsion systems

2.1 Rotating and azimuth thrusters

2.1.1 The periodical survey of rotating and azimuth thrusters consists of:

a) removing the propeller(s) to examine the following items, as applicable:
   - exposed parts
   - cone and keyway to be checked by an appropriate crack detection method
   - sealing glands
   - threaded end and nut

b) examining the results of a lubricating oil analysis (water content and presence of material particles) to detect possible deterioration of internal gears and bearings

c) examining the orientation device.

If the foregoing checks are not satisfactory, dismantling of the internal parts may be required.

2.2 Vertical axis propellers

2.2.1 The periodical survey of vertical axis propeller systems consists of:

- checking the tightness of the oil glands and the backlash of the gears from outside by action on the blades
- checking the condition of gears and couplings from inside the ship
- examining the results of a lubricating oil analysis (water content and presence of material particles) to detect possible deterioration of internal gears and bearings.

If the foregoing checks are not satisfactory, dismantling of the internal parts may be required.

2.3 Pump jet systems

2.3.1 The periodical survey of pump jet systems consists of examining the following parts:

- impeller, shaft and clearances of bearings
- tightness of gland
- water duct
- steering nozzle
- reversing arrangements and control gear.

If the foregoing checks are not satisfactory, further dismantling may be required.

2.4 Pod propulsion systems

2.4.1 Where the system is fitted with:

- a vibration monitoring of roll bearings
- a temperature monitoring of bearings, and
- a monitoring of automatic bilge pumping system,

the shaft need not be withdrawn at the complete survey provided that all condition monitoring data (vibrations and temperatures in way of bearings, consumption and analysis of lubricating oil, running rate of bilge system) are found to be within permissible limits and the remaining requirements for the complete survey are complied with.

Where the Surveyor considers that the data presented is not to his satisfaction, further dismantling are to be required.

3 Survey of propeller shafts and tube shafts

3.1 General

3.1.1 Application

Unless alternative means are provided to assure the condition of the propeller shaft assembly, these requirements apply to all ships with conventional shafting fitted with a propeller, as follows:

- from 1 January 2016, for ships delivered on or after 1 January 2016
- after the first shaft survey scheduled on or after 1 January 2016, for ships delivered before 1 January 2016.

3.1.2 Definitions

a) Shaft

For the purpose of this Article, shaft is a general definition that includes:

- propeller shaft
- tube shaft.

The definition does not include the intermediate shafts which are considered as part of the propulsion shafting inside the ship.

b) Propeller shaft

Propeller shaft is the part of the propulsion shaft to which the propeller is fitted. It may also be called screwshaft or tailshaft.

c) Tube shaft

Tube shaft is a shaft placed between the intermediate shaft and the propeller shaft, normally arranged within a stern tube or running in open water. It may also be called sterntube shaft.

d) Sterntube

Tube or pipe fitted in the shell of a ship at the stern (or rear part of the ship), below the waterline, through which passes the tube shaft or the aftermost section of the propeller shaft.

Sterntube is the housing of the shaft bearings, generally two (one aft and one fore), that sustain the shaft and allow its rotation with less frictional resistance. The sterntube also accommodates the shaft sealing arrangement.

e) Closed loop (system) oil lubricated bearing

Closed loop oil lubricating systems use oil to lubricate the bearings and are sealed against the environment (seawater) by adequate sealing/gland devices.

f) Water lubricated bearing

Water lubricated bearings are bearings cooled/lubricated by water (fresh or salt).

g) Closed loop (system) fresh water lubricated bearing

Closed loop water lubricating systems use fresh water to lubricate the bearings and are sealed against the environment (such as seawater) by adequate sealing/gland devices.

h) Open systems (water)

Open water lubricating systems use water to lubricate the bearings and are exposed to the environment.

i) Adequate means for protection against corrosion

An adequate means for protection against corrosion is an approved means for full protection of the core shaft against sea water intrusion and subsequent corrosion attack. Such means are used for the protection of common steel material against corrosion, particularly in combination with water lubricated bearings.

Typical means are, for example:

- continuous metallic, corrosion resistant liners
- continuous cladding
- multiple layer synthetic coating
- multiple layer of fibreglass
- combinations of above mentioned
- rubber/elastomer covering coating.

The means for protection against corrosion are installed/ applied according to class approved procedures.

j) Corrosion resistant shaft

Corrosion resistant shaft is made in approved corrosion resistant steel as core material for the shaft.

k) Sterntube sealing system

Sterntube sealing system is the equipment installed on the inboard extremity and, for closed systems, at outboard extremity of the sterntube.

Inboard seal is the device fitted on the fore part of the sterntube that achieves the sealing against the possible leakage of the lubricant media into the ship internal.

Outboard seal is the device fitted on the aft part of the sterntube that achieves the sealing against the possible sea water ingress and the leakage of the lubricant media.

l) Service records

Service records are regularly recorded data showing in-service conditions of the shaft(s) and may include, as applicable: lubricating oil temperature, bearing temperature and oil consumption records (for oil lubricated bearings) or water flow, water temperature, salinity, pH, make-up water and water pressure (for closed loop fresh water lubricated bearings, depending on the design).

m) Oil sample examination

Oil sample examination is a visual examination of the sterntube lubricating oil taken in the presence of the Surveyor, with a focus on water contamination.

n) Lubricating oil analysis

Lubricating oil analysis is to be carried out at regular intervals not exceeding 6 months. The

documentation on lubricating oil analysis is to be available on board.

Oil samples, to be submitted for the analysis, should be taken under service conditions.

o) Fresh water sample test

Fresh water sample test should be carried out at regular intervals not exceeding 6 months

Samples are to be taken under service conditions and are to be representative of the water circulating within the sterntube. Analysis results are to be retained on board and made available to the Surveyor.

At time of survey, the sample for the test is to be taken in the presence of the Surveyor. Fresh

water sample test shall include the following parameters:

- chlorides content
- pH value
- presence of bearing particles or other particles (only for laboratory analysis, not required for tests carried out in the presence of the Surveyor).

p) Keyless connection

Keyless connection is the forced coupling methodology, between the shaft and the propeller without a key, achieved through the interference fit of the propeller boss on the shaft tapered end.

q) Keyed connection

Keyed connection is the forced coupling methodology, between the shaft and the propeller with a key and a keyway, achieved through the interference fit of the propeller boss on the shaft tapered end.

r) Flanged connection

Flanged connection is the coupling methodology, between the shaft and the propeller, achieved by a flange built-in at the shaft aft end and bolted to the propeller boss.

s) Alternative means

Shafting arrangements such as, but not limited to, an approved Condition Monitoring Scheme an/or other reliable approved means for assessing and monitoring the condition of the tail shaft, bearings, sealing devices and the sterntube lubricant system capable to assure the condition of the propeller shaft assembly

3.2 Oil lubricated shafts or closed loop system fresh water lubricated shafts (closed system)

3.2.1 Shaft survey - Method 1

The survey is to consist in:

- Drawing the shaft and examining the entire shaft, seals system and bearings
- For keyed and keyless connections:
  - removing the propeller to expose the forward end of the taper
  - performing a non-destructive examination (NDE) by an approved surface crack detection method all around the shaft in way of the forward portion of the taper section, including the keyway (if fitted). For shaft provided with liners, the NDE shall be extended to the after edge of the liner
- For flanged connection:

  Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs, or when deemed necessary by the Surveyor, the coupling bolts and the flange radius are to be examined by means of an approved surface crack detection method
- Checking and recording the bearing clearances
- Verifying that the propeller is free of damages which may cause the propeller to be out of balance
- Verifying the satisfactory conditions of inboard and outboard seals during reinstallation of the shaft and the propeller
- Recording the bearing weardown measurements (after reinstallation).

3.2.2 Shaft survey - Method 2

The survey is to consist of:

- For keyed and keyless connections:
  - removing the propeller to expose the forward end of the taper
  - performing a non-destructive examination (NDE) by an approved surface crack detection method all around the shaft in way of the forward portion of the taper section, including the keyway (if fitted)
- For flanged connection:

  Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs, or when deemed necessary by the Surveyor, the coupling bolts and the flange radius are to be examined by means of an approved surface crack detection method
- Checking and recording of the bearing weardown measurements
- Visual inspection of all the accessible parts of the shafting system
- Verification that the propeller is free of damages which may cause the propeller to be out of balance
- Seal liner found to be or placed in a satisfactory condition
- Verification of the satisfactory reinstallation of the propeller, including verification of the satisfactory conditions of inboard and outboard seals.

Prerequisites, to satisfactorily verify in order to apply method 2, are the following ones:

- Review of service records
- Review of test records of:
  - lubricating oil analysis (for oil lubricated shafts), or
  - fresh water sample test (for closed system fresh water lubricated shafts)
- Oil sample examination (for oil lubricated shafts), or fresh water sample test (for closed system fresh water lubricated shafts)
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.

3.2.3 Shaft survey - Method 3

The survey is to consist of:

- Checking and recording of the bearing weardown measurements
- Visual inspection of all the accessible parts of the shafting system
- Verification that the propeller is free of damages which may cause the propeller to be out of balance
- Seal liner found to be or placed in a satisfactory condition
- Verification of the satisfactory conditions of inboard and outboard seals.

Prerequisites, to satisfactorily verify in order to apply method 3, are the following ones:

- Review of service records
- Review of test records of:
  - lubricating oil analysis (for oil lubricated shafts), or
  - fresh water sample test (for closed system fresh water lubricated shafts)
- Oil sample examination (for oil lubricated shafts), or fresh water sample test (for closed system fresh water lubricated shafts)
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.

3.2.4 Shaft extension surveys - Extension types

a) Extension up to 2,5 years

The survey is to consist of:

- Checking and recording of the bearing weardown measurements, as far as practicable
- Visual inspection of all the accessible parts of the shafting system
- Verification that the propeller is free of damages which may cause the propeller to be out of balance
- Verification of the effectiveness of the inboard seal and outboard seals.

Prerequisites, to satisfactorily verify in order to apply extension up to 2,5 years, are the following ones:

- Review of service records
- Review of test records of:
  - lubricating oil analysis (for oil lubricated shafts), or
  - fresh water sample test (for closed system fresh water lubricated shafts)
- Oil sample examination (for oil lubricated shafts), or fresh water sample test (for closed system fresh water lubricated shafts)
- Verification of no reported repairs by grinding or welding of shaft and/or propeller
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

b) Extension up to 1 year The

survey is to consist of:

- Visual inspection of all the accessible parts of the shafting system
- Verification that the propeller is free of damages which may cause the propeller to be out of balance
- Verification of the effectiveness of the inboard seal and outboard seals.

Prerequisites, to satisfactorily verify in order to apply extension up to 1 year, are the following ones:

- Review of the previous weardown and/or clearance recordings
- Review of service records
- Review of test records of:
  - lubricating oil analysis (for oil lubricated shafts), or
  - fresh water sample test (for closed system fresh water lubricated shafts)
- Oil sample examination (for oil lubricated shafts), or fresh water sample test (for closed system fresh water lubricated shafts)
- Verification of no reported repairs by grinding or welding of shaft and/or propeller
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

c) Extension up to 3 months

The survey is to consist of:

- Visual inspection of all the accessible parts of the shafting system
- Verification of the effectiveness of the inboard seal.

Prerequisites, to satisfactorily verify in order to apply extension up to 3 month, are the following ones:

- Review of the previous weardown and/or clearance recordings
- Review of service records
- Review of test records of:
  - lubricating oil analysis (for oil lubricated shafts), or
  - fresh water sample test (for closed system fresh water lubricated shafts)
- Oil sample examination (for oil lubricated shafts), or fresh water sample test (for closed system fresh water lubricated shafts)
- Verification of no reported repairs by grinding or welding of shaft and/or propeller
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

3.2.5 Oil lubricated shafts

a) Survey intervals (see Table 1)

For surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

1) Flanged propeller connection

The following methods are applicable:

- method 1 every 5 years, or
- method 2 every 5 years (prerequisites have to be fulfilled), or
- method 3 every 5 years (prerequisites have to be fulfilled).

2) Keyless propeller connection

The following methods are applicable:

- method 1 every 5 years, or
- method 2 every 5 years (prerequisites have to be fulfilled), or
- method 3 every 5 years (prerequisites have to be fulfilled).

The maximum interval between two surveys carried out according to method 1 or method 2 shall not exceed 15 years, except in the case when one extension for no more than three months is granted.

3) Keyed propeller connection

The following methods are applicable:

- method 1 every 5 years, or
- method 2 every 5 years (prerequisites have to be fulfilled).

b) Survey extensions (see Table 1)

For all types of propeller connections, the interval between two consecutive surveys may be extended after execution of the extension survey, as follows:

- Extension up to a maximum of 2,5 years

  No more than one “2,5 year extension” can be granted. No further extension, of other type, can be granted.
- Extension up to a maximum of 1 year

  No more than two consecutive “one year extension” can be granted. In the event an additional extension is requested, the requirements of the “2,5 year extension” are to be carried out and the shaft survey due date, prior to the previous extension(s), is extended for a maximum of 2,5 years.
- Extension up to a maximum of 3 months

  No more than one “three month extension” can be granted. In the event an additional extension is requested, the requirements of the “one year extension” or “2,5 year extension” are to be carried out and the shaft survey due date, prior to the previous extension, is extended for a maximum of one year or 2,5 years.

The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date.

If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date the extension survey was completed.

Table 1 : Survey intervals for oil lubricated shafts (closed systems)

	Flanged propeller coupling	Keyless propeller coupling	Keyed propeller coupling
Every five years	method 1 or method 2 or method 3	method 1 or method 2 or method 3	method 1 or method 2
Extension 2,5 Y	yes	yes	yes
Extension 1 Y	yes	yes	yes
Extension 3 M	yes	yes	yes

3.2.6 Closed loop system fresh water lubricated shafts

The maximum interval between two surveys carried out according to method 1 shall not exceed 15 years. An extension for no more than three months can be granted.

a) Survey intervals (see Table 2)

For surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

1) Flanged propeller connection

The following methods are applicable:

- method 1 every 5 years, or
- method 2 every 5 years (prerequisites have to be fulfilled), or
- method 3 every 5 years (prerequisites have to be fulfilled).

2) Keyless propeller connection

The following methods are applicable:

- method 1 every 5 years, or
- method 2 every 5 years (prerequisites have to be fulfilled), or
- method 3 every 5 years (prerequisites have to be fulfilled).

3) Keyed propeller connection

The following methods are applicable:

- method 1 every 5 years, or
- method 2 every 5 years (prerequisites have to be fulfilled).

b) Survey extensions

For all types of propeller connections, the interval between two consecutive surveys may be extended after execution of the extension survey, as follows:

- Extension up to a maximum of 2,5 years

  No more than one “2,5 year extension” can be granted. No further extension, of other type, can be granted.

- Extension up to a maximum of 1 year

  No more than two consecutive “one year extension” can be granted. In the event an additional extension is requested, the requirements of the “2,5 year extension” are to be carried out and the shaft survey due date, prior to the previous extension(s), is extended for a maximum of 2,5 years.

- Extension up to a maximum of 3 months

  No more than one “three month extension” can be granted. In the event an additional extension is requested, the requirements of the “one year extension” or “2,5 year extension” are to be carried out and the shaft survey due date, prior to the previous extension, is extended for a maximum of one year or 2,5 years.

The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date.

If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date the extension survey was completed.

The maximum interval between two surveys carried out according to method 1 shall not exceed 15 years, except in the case when one extension for no more than three months is granted.

3.3 Water lubricated shafts (open systems)

3.3.1 Shaft survey - Method 4

The survey is to consist in:

- Drawing the shaft and examining the entire shaft (including liners, corrosion protection system and stress reducing features, where provided), inboard seal system and bearings
- For keyed and keyless connections:
  - removing the propeller to expose the forward end of the taper
  - performing a non-destructive examination (NDE) by an approved surface crack detection method all around the shaft in way of the forward portion of the taper section, including the keyway (if fitted). For shaft provided with liners, the NDE shall be extended to the after edge of the liner
- For flanged connection:

  Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs, or when deemed necessary by the Surveyor, the coupling bolts and the flange radius are to be examined by means of an approved surface crack detection method
- Checking and recording the bearing clearances
- Verifying that the propeller is free of damages which may cause the propeller to be out of balance
- Verifying the satisfactory conditions of inboard seal during reinstallation of the shaft and the propeller.

3.3.2 Shaft extension surveys - Extension types

a) Extension up to 1 year The

survey is to consist of:

- Visual inspection of all the accessible parts of the shafting system
- Verification that the propeller is free of damages which may cause the propeller to be out of balance
- Checking and recording of the clearances of bearing
- Verification of the effectiveness of the inboard seal.

Prerequisites, to satisfactorily verify in order to apply extension up to 1 year, are the following ones:

- Review of the previous clearance recordings
- Service records
- Verification of no reported repairs by grinding or welding of shaft and/or propeller
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

b) Extension up to 3 months

The survey is to consist of:

- Visual inspection of all the accessible parts of the shafting system
- Verification that the propeller is free of damages which may cause the propeller to be out of balance
- Verification of the effectiveness of the inboard seal.

Prerequisites, to satisfactorily verify in order to apply extension up to 3 months, are the following ones:

- Review of the previous clearance recordings
- Service records
- Verification of no reported repairs by grinding or welding of shaft and/or propeller
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

3.3.3 3.3.3Shaft survey intervals

a) Survey intervals (see Table 3)

The following survey intervals according to method 4 are applicable to all types of propeller connections:

- for keyless propeller connections, the maximum interval between two consecutive dismantling and verifications of the shaft cone by means of non-destructive examination (NDE) shall not exceed 15 years
- for surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

1) Configurations allowing 5 year intervals
   - single shaft operating exclusively in fresh water
   - single shaft provided with adequate means of corrosion protection, single corrosion resistant shaft
   - all kinds of multiple shafts arrangements.
2) Other systems

   Shaft not belonging to one of the configurations listed in item 1) has to be surveyed according to method 4 every 3 years.

b) Survey extensions (see Table 3)

For all types of propeller connections, the interval between two consecutive surveys may be extended after execution of the extension survey, as follows:

- Extension up to a maximum of 1 year

  No more than one “one year extension” can be granted. No further extension, of other type, can be granted.

- Extension up to a maximum of 3 months

  No more than one “three month extension” can be granted. In the event an additional extension is requested, the requirements of the “one year extension” are to be carried out and the shaft survey due date, prior to the previous extension, is extended for a maximum of one year.

The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date.

If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date the extension survey was completed.

Table 3 : Survey intervals for water lubricated shafts (open systems)

	All kinds of propeller coupling	
• Single shaft operating exclusively in fresh water • Single shaft provided with adequate means of corrosion protection, single corrosion resistant shaft • All kinds of multiple shaft arrangements	Every five years	Method 4
	Extension 1 Y	yes
	Extension 3 M	yes

	All kinds of propeller coupling	
Other shaft configuration	Every three years	Method 4
	Extension 1 Y	yes
	Extension 3 M	yes

Section 6 Boiler Survey

1 Steam boilers

1.1

1.1.1 Steam boilers, superheaters and economisers are to be examined internally on water-steam side and fire side and externally with the periodicity indicated in this Volume. To this end, boilers are to be emptied and suitably prepared for the examination, and the water-steam side and fire side are to be cleaned and cleared of soot. Where necessary, the external surfaces are to be made accessible for inspection by removal of insulation and lining.

1.1.2 Subject to the results of this visual examination, the Surveyor may require:

- non-destructive tests for detection of possible defects in critical areas of plating and shells, pipes and stays
- thickness measurements of plating and shells, furnaces, pipes and stays.

If appropriate, a new working pressure may be fixed by QRS.

When situated inside boiler combustion chambers, steam pipes of cylindrical boilers are to be examined at their ends, and if deemed necessary by the Surveyor, a sample pipe is to be removed for examination.

1.1.3 If the internal examination is not carried out for practicable reasons, the parts subject to pressure are to be submitted to a hydraulic test.

1.1.4 Boiler supports and securing arrangements (fixed and sliding seating, chocks, rolling stays, if any, etc.) are to be examined.

Boiler accessories and mountings (such as valves and studs, water level indicators, safety valves) are to be examined at each survey and opened out as considered necessary by QRS.

Forced circulation pumps of fired steam generators are, wherever possible, to be opened up.

Fuel supply pipes between pumps and burners, fuel tank valves, pipes and deck control gear are to be examined.

1.1.5 When direct visual internal inspection is not feasible due to limited size of the internal spaces, such as for small boilers and/or narrow spaces, this may be replaced by a hydrostatic pressure test or by alternative verifications as determined by QRS.

1.1.6 Upon completion of the internal survey, the boiler is to be examined under steam and fuel oil burners and safety devices checked under working conditions.

The adjustment of the safety valves is to be verified during each boiler internal examination.

Boiler safety valve and its relieving gear are to be examined and tested to verify satisfactory operation.

However, for exhaust gas heated economisers, if steam cannot be raised at port, it is the Chief Engineer's responsibility to set the safety valves at sea and the results are to be recorded in the log book for review by QRS.

1.1.7 Review of the following records since the last boiler survey is to be carried out as part of the survey:

- operation
- maintenance
- repair history
- feedwater chemistry.

1.1.8 In addition to the above requirements, in exhaust gas heated economisers of the shell type, accessible welded joints are to be subjected to a visual examination for cracking. Non-destructive testing may be required for this purpose.

1.1.9 For electrical steam generators, in addition to the above requirements on the water-steam side, the following items are to be verified:

- condition of the electrical insulation resistance of the heating elements
- verification of proper operation and functioning of indication, remote control, automatic alarm and safety devices
- verification of absence of signs of corrosion and leakage of water
- opening-up of forced circulation pumps, wherever possible.

2 Thermal oil heaters

2.1

2.1.1 Thermal oil heaters are to be internally and externally examined. The heater tubes are to be visually examined, and the tightness of the installation (including flange connections, valves and pumps) is to be checked through a test at the working pressure.

2.1.2 Thermal oil heater supports and securing arrangements are to be examined.

Heater accessories and mountings are to be externally and (as needed) internally examined. Forced

circulation pumps are, wherever possible, to be opened up.

Fuel supply pipes between pumps and burners, fuel tank valves, pipes and deck control gear are to be examined.

2.1.3 The following safety devices and instrumentation are to be examined and tested:

- thermal fluid temperature safety device and control
- thermal fluid flow meter
- device for low thermal fluid level in the expansion tank
- other regulation and safety systems.

2.1.4 Where repairs and/or renewal of components exposed to pressure are performed, a pressure test is to be carried out to 1,5 times the working pressure.

2.1.5 Upon completion of the survey, the thermal oil heater is to be examined under working conditions, with particular attention to safety devices and controls of the plant.

Appendix 1 Class Requirements and Surveys of Laid-up Ships

1 General

1.1

1.1.1 In order to maintain its class during a normal operation period, a ship is to be submitted to the surveys described in Chapter 1 at their due dates and to the satisfaction of QRS, and is to be free of overdue surveys and conditions of class during the considered period.

1.1.2 When a ship stops trading and is put out of commission for a certain period, for example when laid-up, the normal survey requirements may no longer apply provided that the Owner notifies QRS of this fact. The Owner is also to submit a lay-up maintenance program to QRS for approval.

1.1.3 The lay-up maintenance program includes:

- the safety conditions to be kept throughout the lay-up period
- the measures taken to preserve the maintenance of the ship throughout the lay-up period
- the survey requirements to be complied with for lay-up, maintenance of class in lay-up and re-commissioning.

2 Safety conditions

2.1

2.1.1 Power supply

Adequate power supply is to be supplied, or readily available, all around the clock, either from independent means on board the ship or from shore.

The following safety conditions are to be kept throughout the lay-up period.

2.1.2 Manning

Watch personnel are to be provided. The number of the watch personnel will depend on the size of the ship, the lay-up site and mooring arrangements, the shore assistance available in case of fire, leakage or flooding, the maintenance required to provide adequate preservation. A permanent shore communication installation (radio, telephone) is also to be available.

2.1.3 Fire protection and fire fighting

The following is to be complied with:

- automatic fire alarm systems, where provided, are to be in working order and in operation
- fire-fighting installations are to be tested regularly and readily available
- the fire main is to be readily available and periodically tested under pressure
- ventilation trunks, air inlets and watertight doors are to be kept closed.

2.1.4 Protection against explosion

Cargo spaces and piping systems are to be cleaned and ventilated to prevent gas from forming any pockets. An inert

gas system in operation is recommended for the cargo spaces of oil and chemical tankers.

All flammable materials, sludge, etc. are to be removed from the ship's bilge, tank tops, double bottom tanks, engine room, pump rooms and similar spaces.

Hot work is not be carried out during lay-up, unless special precautionary measures are taken.

2.1.5 Safety equipment

All the equipment usually recommended for the safety of the watch personnel is to be provided, kept in working order and tested regularly.

The usual life-saving equipment such as liferafts, life-buoys, breathing apparatus, oxygen masks and distress signals is to be provided and made accessible.

The requirements of the flag Administration and of the local port authorities of the lay-up site are usually to be applied.

2.1.6 Emergency power

The emergency source of power, emergency generator and/or emergency air compressor are to be kept in working order and tested weekly.

3 Preservation measures for lay-up and maintenance

3.1 General

3.1.1 A lay-up log-book is to be kept on board, in which the maintenance work and tests carried out during the lay-up period are to be entered with the corresponding dates. The nature and frequency of the maintenance, inspections and tests are also to be defined in the lay-up log book.

3.1.2 The following measures for preservation and maintenance during the lay-up period are to be taken by Owners according to the type of ship, hull equipment, machinery installations and the specific cases of lay-up conditions.

3.2 Exposed parts of the hull

3.2.1 Underwater parts of the hull are to be protected against corrosion. It is advisable to provide an impressed current cathodic protection system where the quantity of corrosive waste discharge is particularly high. When such systems are provided they are to be serviced and checked at regular intervals. The condition of sacrificial anodes is to be evaluated at the annual lay-up condition surveys.

3.2.2 The coating of the hull above the waterline, exposed decks, access doors or covers on exposed decks, and hatch covers is to be maintained in satisfactory condition.

All accesses leading to internal spaces are to be kept closed. All

vent pipes and ventilation trunks are to be kept closed.

3.3 Internal spaces

3.3.1 Cargo tanks and cargo holds are to be emptied, cleaned and kept dry.

Ballast tanks are to be kept either full or empty. When ballast spaces are kept filled with sea water, special care is to be taken to keep such spaces topped up and protected against corrosion. When provided, sacrificial anodes are to be renewed when deemed necessary. The topping up is to be regularly verified.

3.3.2 Chain lockers are to be drained, cleaned and kept dry. Coating with bituminous paint is recommended.

3.3.3 Fuel oil and lubricating oil tanks are to be drained regularly.

Lubricating oil analysis is to be performed regularly and the oil renewed when the result is not satisfactory. Prior to being refilled, tanks are to be cleaned.

Empty lubricating oil tanks are to be cleaned and kept dry.

Fresh water or distilled water tanks are to be kept full or empty. Empty tanks are to be cleaned and kept dry. Where cement wash is used as a protective sheathing, this is to be examined and repaired prior to filling.

3.3.4 The bilge and tank top in engine rooms are to be cleaned and kept dry. Hull

sea inlet and outlet valves not in use are to be kept closed.

3.4 Deck fittings

3.4.1 The windlass, capstans and winches are to be regularly greased and turned once a week. All

wire cables are to be kept greased.

Visible parts of chains are to be coal-tarred and examined regularly.

Chocks and hawse pipes are to be coated with bituminous paint or equivalent if deemed necessary.

Cargo piping on deck is to be drained, blown through if deemed necessary and kept dry by opening up drains. Electrical

machinery and navigational equipment are to be protected by watertight covers.

3.5 Machinery

3.5.1 Machinery spaces

The air temperature inside the machinery spaces is normally to be kept above 0°C. Humidity

is to be kept as low as possible and within acceptable limits.

3.5.2 Machinery - General

Exposed mechanical parts of machinery are to be greased.

All rotating machinery such as diesel engines, reciprocating engines, pumps, turbines, electric motors and generators are to be turned at regular intervals with a limited number of revolutions (the lubricating oil system should be put in operation or proper priming applied). Units are not to be stopped in the same position as the previous one.

Bearing boxes are to be emptied, cleaned and refilled with new oil.

3.5.3 Main turbines

Turbines are to be kept dry.

All steam inlets are to be sealed.

Expansion arrangements (sliding feet) are to be suitably greased.

Electric heaters are to be put inside the turbines. Heat drying is to be made in open circuit, all valves shut and gland closing devices withdrawn.

Turbines are to be turned weekly, the lubricating oil system being put in service. The shaft line is to be stopped after turning an integer number of revolutions plus one quarter of a revolution.

3.5.4 Reduction gears

For large reduction gears, a fan activating the circulation of hot air in closed circuit with air hoses is to be fitted (intake at lower part of casing and discharge at upper part).

3.5.5 Auxiliary turbine-driven machinery

Stators are to be drained and kept dry. Shaft

sealing glands are to be lubricated.

Lubricating oil is to be analysed and renewed when deemed necessary. Prior to oil renewal, the oil casings are to be cleaned. Exhaust

steam pipes are to be kept dry.

Stuffing boxes are to be dismantled.

Turbines are to be turned weekly an integer number of revolutions plus one quarter of a revolution.

3.5.6 Condensers and heat exchangers

Condensers and heat exchangers are to be drained and kept dry.

Desiccant is to be placed in steam spaces.

Water sides are to be washed with fresh water.

The condition of the zinc anodes is to be periodically checked.

When tubes are fitted with plastic or fibre packing, water sides are to be filled with alkaline distilled water.

When tubes are expanded or fitted with metal packing, water sides are to be provided with desiccants and kept dry.

3.5.7 Auxiliary machinery

Air receivers are to be drained, opened up and cleaned. Pressure relief valves are to be cleaned and slightly lubricated.

Air compressor crankcases are to be drained, cleaned and refilled with clean oil. Cylinders and valves are to be lubricated. Coolers are to be drained and dried. Air drains are to be opened and the system dried.

Air start lines are to be drained and dried.

Hot-wells/return tanks are to be drained and dried. De-

aerators are to be drained and dried.

Feed pumps and extraction pumps are to be drained and dried. Air

ejectors are to be drained and dried.

Main circulation pumps are to be drained and dried. Evaporators

are to be drained, cleaned and dried.

3.5.8 Piping

Pipes not in use are to be drained and kept dry.

3.5.9 Diesel engines

Daily tank fuel oil outlet pipes and all injection equipment are to be filled with filtered gas oil.

Fresh water circuits are to be filled with water mixed with rust inhibitors. Fresh water pH is to be checked monthly. Oil of

hydraulic regulators is to be replaced.

Sea water cooling pipes are to be drained. Crankcases

are to be provided with desiccant.

Starting valves are to be lubricated (internally and externally).

Motor oil is to be sprayed in cylinders and on all external parts liable to corrosion. Cams and

cylinders are to be motor oil sprayed monthly.

Turbo-compressor/charger ball bearings are to be oil sprayed and rotated for an integer number of revolutions plus one quarter of a revolution.

Engine air inlets and exhaust gas pipes are to be sealed.

Scavenge spaces are to be cleaned Engines

are to be turned weekly.

3.5.10 Shaft lines

Shaft lines are to be coated with grease.

Shaft bearing cooling pipes are to be drained.

For sea water lubricated propeller shafts, the packing gland of the engine room stuffing box is to be tightened.

For oil lubricated sterntubes, lubricating oil is to be analysed and renewed if not satisfactory. The oil level in the tank is to be verified regularly.

Propeller shaft lines are to be rotated an integer number of revolutions plus one quarter of a revolution.

3.6 Electrical installations

3.6.1 Main and secondary switchboards, sub-feeder panels, fuse panels and starters are to be made tight. Desiccant is to be provided.

Contacts of relays, breakers and switch-breakers are to be coated with neutral vaseline. Bearings of

generators are to be cleaned of old grease and protected with new oil or grease. Carbon brushes are

to be lifted off their commutations.

3.6.2 Electrical insulation of each item is to be kept at a minimum 200,000 Ohms and general insulation is to be not less than 50,000 Ohms. Local electric heating may be necessary to improve the level of insulation, particularly in the generators/ alternators and large motors.

A insulation resistance test is to be performed regularly.

3.7 Steering gear

3.7.1 Exposed mechanical parts are to be greased or oil sprayed.

For electrical parts the same preservation measures given in [3.6] are to be taken. It is

recommended that the steering gear should be operated monthly.

3.8 Boilers

3.8.1 Smoke sides of boilers are to be swept, washed clean with basic hot water and hot air dried.

3.8.2 Water and steam sides should preferably be preserved using the dry method, keeping the moisture at the lowest possible level, the ideal level being between 30% and 35%. It is advisable to ensure that no residual water remains to cause rapid corrosion. Drum doors are to be kept closed.

In other cases, it is advisable to keep the boilers, superheaters and economisers filled with water having a pH around 10,5. Hydrazine hydrate treatment of the water is preferable to reduce risks of corrosion caused by dissolved oxygen. The water is to be regularly analysed.

3.8.3 Air heaters are to be cleaned and kept dry.

Uptake, shell and fan outlets are to be cleaned and kept closed with watertight hoods. Burners are to

be dismantled, and atomisers greased.

Desiccant is to be provided in furnaces where deemed necessary. Expansion

arrangements (sliding feet) are to be suitably greased.

The internal condition of boilers is to be checked every three months.

3.8.4 Boilers may also be preserved sealed with inert gas (nitrogen), provided that cocks and valves are tight and the installation allows an internal pressure of at least 0,05 bar to be maintained to prevent air penetration. Regular checks of the overpressure are to be carried out and results recorded in the log-book.

3.9 Automated installation

3.9.1 Recommendations for electronic components are the same as those given for electrical installations.

For pneumatic parts the manufacturers' recommendations are to be followed and the system is to be checked regularly.

Pressure, temperature or level sensors are generally not affected by damage when not used. However, when available, the manufacturers' recommendations are to be followed.

4 Lay-up site and mooring arrangements

4.1 General

4.1.1 The choice and suitability of the lay-up site, as well as the type of mooring conditions, the mooring arrangements and their efficiency during the lay-up period remain the responsibility of the Owner.

However, at the Owner's request, the mooring arrangement may be reviewed by QRS.

4.2 Recommendations for the lay-up site

4.2.1 The following recommendations are to be considered by Owners regarding the choice and suitability of the lay-up site. The site should be:

- sheltered from open sea, strong currents and waves
- not exposed to whirling winds or turbulent tidal waves
- not exposed to moving ice
- clear of corrosive waste waters
- provided with adequate ship/shore communications.

4.3 Recommendations for the mooring arrangements

4.3.1 The following recommendations are to be considered by Owners with respect to the mooring arrangements:

- ground holding should be adequate
- vessels laid-up to buoys or anchored should be moored in such a way as to be prevented from swinging with normal wind and tidal changes
- chain cables should not be subject to cross-contact or twisting and stern anchorage should generally be provided
- laid-up ships should be in ballast condition in order to reduce the effects of wind. Due consideration should be given to the still water bending moment. For guidance, normal ballast draft should be roughly between 30% and 50% of the maximum draft.

4.3.2 Ships should normally be moored singly. However, when several ships are moored together, the following provisions are to be made:

- ships are to be moored bow to stern
- ships are to be of approximately the same size
- the number of ships moored together is, in principle, not to exceed six
- breast-lines are to be of similar elasticity
- fenders are to be provided.

4.4 Review of the mooring arrangements

4.4.1 At the Owners' request, the mooring arrangements may be reviewed by QRS.

4.4.2 The proposal for the mooring arrangements is in such case to be submitted by the Owner and is to include the following information.

a) Mooring site:
   - geographical area (to be specified on a map)
   - characteristics of the sea bottom
   - water depth
   - preferential angular sectors (effects of wind / tide / current) indicated according to statistical studies
   - wave characteristics (amplitude, periods)

b) Geometry of mooring arrangements:
   - ship's position and direction
   - shore anchorage
   - diagram showing mooring equipment (fore and aft)
   - angle between chain cables and ship's centreline

c) Characteristics of mooring equipment:
- maximum holding strength of each anchor
- type of mooring lines (chains, cables, sinkers, etc.)
- length of each section
- weight of each section
- mechanical characteristics of each section (breaking load)
- weight of sinkers.

4.4.3 On completion of the installation, the mooring arrangements are to be surveyed by QRS. When the ship is anchored, the underwater installation is to be inspected by a diver whose report is to be presented to QRS.

4.4.4 It is the responsibility of the Owners to ascertain the efficiency of the mooring arrangements during the lay-up period. The mooring arrangements are to be re-examined at regular intervals (at least each year when the ship is anchored) and when abnormal weather conditions occur at the lay-up site.

5 Surveys

5.1 Laying-up survey

5.1.1 At the beginning of the lay-up period a laying-up survey is to be carried out whose scope is to verify that the safety conditions, preservation measures, lay-up site and mooring arrangements are in accordance with the program agreed by QRS.

5.1.2 Upon satisfactory completion of this survey, a memorandum is issued to confirm that the ship has been placed in lay-up, which is subsequently to be kept on board.

5.2 Annual lay-up condition survey

5.2.1 An annual lay-up condition survey is to be performed in lieu of the normal annual class surveys. The purpose of this survey is to ascertain that the lay-up maintenance program implemented is continuously complied with.

5.2.2 It is to be checked that the arrangements made for the lay-up are unchanged and that the maintenance work and tests are carried out in accordance with the maintenance manual and recorded in the lay-up log-book.

5.2.3 Upon satisfactory completion of the survey, the Certificate of Classification is endorsed.

5.3 Re-commissioning survey

5.3.1 Owners are to make the necessary arrangements to remove the temporary lay-up installations provided for preservation measures and the protective materials and coatings (oil, grease, inhibitors, desiccants), before the survey is commenced.

It is the Owners' responsibility to verify that the ship parts that are not covered by class are reactivated in satisfactory operational condition.

5.3.2 The scope of the re-commissioning survey is to include:
- a general examination of the hull, deck fittings, safety systems, machinery installations (including boilers whose survey is not due) and steering gear
- all periodical surveys due at the date of re-commissioning or which became overdue during the lay-up period
- dealing with the conditions of class due at the date of recommissioning or which became due during the lay-up period.

5.3.3 For the hull the following is to be carried out:
- examination of shell plating above the waterline, deck plating, hatch covers and coamings
- examination of load line items
- overall survey of all cargo tanks/holds
- overall survey of representative ballast tanks when the lay-up period does not exceed two years
- overall survey of all ballast tanks when the lay-up period is two years and over
- function tests of bilge and ballast systems.

5.3.4 For the deck fittings the following is to be carried out:
- examination of the fire main under working pressure
- where possible, examination of deck piping under working pressure
- function tests of class items
- checking inert gas installation under working condition after inspection of water seal and function test of deck non-return valve and pressure/vacuum valves.

5.3.5 For machinery installations the following is to be checked:

- the analysis of lubricating oil of main engines, auxiliary engines, reduction gears, main thrust bearings and sterntube
- the general condition of crankcase, crankshaft, piston rods and connecting rods of diesel engines
- the crankshaft deflections of diesel engines. In addition when engines have been laid-up for more than two years, one piston is to be disconnected and one liner is to be removed for examination. Dismantling is to be extended if deemed necessary
- the condition of blades of turbines through the inspection doors
- the condition of the water side of condensers and heat exchangers
- the condition of expansion arrangements
- the condition of reduction gears through the inspection doors
- the condition after overhauling of pressure relief devices
- the test of bilge level alarms, when fitted.

5.3.6 The main and emergency electrical installations are to be tested. The parallel shedding of main generators and main switchboard safety devices are to be checked. An insulation resistance test of the electrical installation is to be performed.

5.3.7 For the fire prevention, detection and fire-fighting systems, the following is to be examined and/or tested:

- remote control for quick closing of fuel oil valves, stopping of fuel oil pumps and ventilation systems, closing of fire doors and watertight doors
- fire detectors and alarms
- fire-fighting equipment.

5.3.8 The automated installation is to be checked for proper operation.

5.3.9 When classed, the installations for refrigerated cargo are to be examined under working conditions. Where the lay-up period exceeds two years, representative components of the installation are to be dismantled.

5.3.10 For cargo installations on liquefied gas carriers, the following is to be carried out:

- inspection of the primary barrier in tanks
- for membrane tanks, a global gas test of tanks whose results are to be compared with those obtained at ship's delivery
- testing of gas piping at working pressure using inert gas.

A Surveyor of QRS is to attend the first cooling down and loading of the ship.

5.3.11 For other specific classed installations, the Owners are to submit a survey program to QRS.

5.3.12 On completion of the above surveys, sea trials are to be performed in the presence of a Surveyor of QRS. The sea trials are to include:

- verification of the satisfactory performance of the deck installations, main propulsion system and essential auxiliaries, including a test of the safety devices
- an anchoring test
- complete tests of steering gear
- full head and full astern tests
- tests of automated machinery systems, where applicable.

5.3.13 Upon satisfactory completion of the surveys, a memorandum is issued to confirm the carrying out of all relevant surveys and the recommissioning of the ship.

CHAPTER 3
SCOPE OF SURVEYS IN RESPECT OF THE DIFFERENT SERVICES OF SHIPS

Section 1 General

1 General

1.1

1.1.1 The purpose of this Chapter is to give details on the scope of surveys of certain ships which, due to the service notation and/or the additional service feature assigned, and related equipment, need specific requirements to be verified for the maintenance of their class.

1.1.2 Owners are reminded that a general examination of the ship having the same scope of an annual survey is to be carried out at the completion of the class renewal survey. Where specific requirements are given in this Chapter for the class renewal survey, they are additional to the applicable requirements for the annual survey.

2 Service notations and/or additional service features subject to additional surveys

2.1

2.1.1 The specific requirements detailed in this Chapter are linked to the service notation(s) and/or the additional service feature(s) assigned to the ship at the request of the Owner. Where a ship has more than one service notation, the specific requirements linked to each one are applicable, insofar as they are not contradictory (in such case, the most stringent requirement will be applied).

2.1.2 Table 1 indicates which service notations and/or the additional service features are subject to specific requirements, and in which Section or Article they are specified.

Table 1: Service notations and/or additional service features for which specific requirements are applicable

Service notation and/or additional service feature assigned	Type of surveys affected by these specific requirements
bulk carrier ESP **bulk carrier BC-A ESP bulk carrier BC-B ESP bulk carrier BC-C ESP** **self-unloading bulk carrier ESP**	annual survey intermediate survey class renewal survey ESP
oil tanker ESP	annual survey intermediate survey class renewal survey ESP
oil storage service	hull class renewal survey ESP
chemical tanker ESP	annual survey intermediate survey class renewal survey ESP
liquefied gas carrier **liquefied gas carrier - FSRU** **liquefied gas carrier - FSU**	annual survey intermediate survey class renewal survey
general cargo ship	annual survey intermediate survey class renewal survey
container ship or ship **equipped for carriage of containers**	annual survey class renewal survey

Service notation and/or additional service feature assigned	Type of surveys affected by these specific requirements
livestock carrier	annual survey class renewal survey
hopper dredger	annual survey class renewal survey
tug **salvage tug** **escort tug**	annual survey class renewal survey
supply	annual survey intermediate survey class renewal survey
fire-fighting	annual survey class renewal survey
oil recovery	annual survey class renewal survey
anchor handling	annual survey class renewal survey
cable laying	annual survey class renewal survey
lifting	annual survey class renewal survey
fishing vessel	annual survey class renewal survey
yacht **charter-yacht**	intermediate survey class renewal survey
semi-submersible cargo ship	annual survey intermediate survey class renewal survey
LNGfuel, **CNGfuel**, **LPGfuel** **methanolfuel** **ammoniafuel** **LFPfuel**	annual survey intermediate survey class renewal survey

Section 2 Single Skin and Double Skin Bulk Carriers

1 General

1.1 Application

1.1.1 The requirements of this Section apply to all self-propelled ships which have been assigned one of the following service notations:

- **bulk carrier ESP** (whether of single or double skin construction)
- **bulk carrier BC-A ESP** (whether of single or double skin construction)
- **bulk carrier BC-B ESP** (whether of single or double skin construction)
- **bulk carrier BC-C ESP** (whether of single or double skin construction)
- **self-unloading bulk carrier ESP**

1.1.2 The requirements apply to the surveys of the 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 requirements contain the minimum extent of examination, thickness measurements and tank testing. When substantial corrosion and/or structural defects are found, the survey is to be extended and is to include additional close-up surveys when necessary.

1.1.4 In any kind of survey, such as class renewal, intermediate, annual or other surveys having the same scope, thickness measurements, when required by Table 6, of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys.

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

1.1.6 When, in any survey, thickness measurements are required:

- the thickness measurement firm is to be part of the survey planning meeting to be held prior to commencing the survey.

1.1.7 Special consideration may be given to the extent of close-up surveys and/or thickness measurements in cargo holds as required below for class renewal, intermediate or annual surveys, when all internal and external surfaces of hatch coamings and hatch covers, and all internal surfaces of the cargo holds, excluding the flat tank top areas and the hopper tank sloped plating approximately 300 mm below the side shell frame end brackets, have protective coating in good condition.

The above special consideration may also be given to existing bulk carriers, where Owners elect to coat or recoat cargo holds, in accordance with the Manufacturers' recommendations. However, prior to re-coating the cargo holds, scantlings are to be assessed in the presence of a Surveyor of QRS.

1.2 Documentation on board

1.2.1 The Owner is to obtain, supply and maintain documentation on board as specified, which is to be readily available for examination by the Surveyor.

The documentation is to be kept on board for the lifetime of the ship.

1.2.2 A survey report file is to be a part of the documentation on board consisting of:

- reports of structural surveys
- hull condition evaluation report (summarizing the results of class renewal surveys)
- thickness measurement reports.

The survey report file is also to be available in the Owner's management office.

1.2.3 The following additional supporting documentation is to be available on board:

- survey program until such time as the class renewal survey or intermediate survey, as applicable, has been completed
- main structural plans of cargo holds and ballast tanks (for CSR ships, these plans are to include, for each structural element, both the as-built and the renewal thicknesses. Any thickness for voluntary addition is also to be clearly indicated on the plans. The midship section plan to be supplied on board the ship is to include the minimum allowable hull girder sectional properties for hold transverse section in all cargo holds)
- previous repair history
- cargo and ballast history

- extent of use of inert gas plant and tank cleaning procedures
- ship's personnel reports on:
  - structural deterioration/defects in general
  - leakage in bulkheads and piping systems
  - condition of corrosion prevention system, if any
- any other information that may help to identify critical structural areas and/or suspect areas requiring inspection.

1.2.4 Prior to survey, the Surveyor examines the documentation on board and its contents, which are used as a basis for the survey.

1.2.5 For bulk carriers subject to SOLAS Chapter II-1 Part A-1 Regulation 3-10, on completion of the survey, the Surveyor is to verify that any addition and/or renewal of materials used for the construction of the hull structure is/are documented.

1.3 Reporting and evaluation of surveys

1.3.1 The data and information on the structural condition of the ship collected during survey are evaluated for acceptability and structural integrity of the ship's cargo area.

1.3.2 For CSR bulk carriers, the ship longitudinal strength is to be evaluated, using thickness of the 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 3rd renewal survey, if this one is carried out before the ship reaches 15 years), in accordance with the criteria for longitudinal strength of the ship hull girder for CSR bulk carriers and Oil Tankers, as applicable.

1.3.3 The result of evaluation of the ship longitudinal strength, after renewal or reinforcement work of structural members, if carried out as a result of initial evaluation, is to be reported as a part of the hull condition evaluation report.

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

1.3.5 A hull condition evaluation report (summarizing the results of class renewal surveys) is issued by QRS to the Owner, who is to place it on board the ship for reference at future surveys. The hull condition evaluation report is endorsed by QRS.

1.4 Conditions for survey

1.4.1 To enable the attending surveyors to carry out the survey, provisions for proper and safe access are to be agreed between the Owner and QRS.

Details of the means of access are to be provided in the survey planning questionnaire.

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 is not to proceed.

1.5 Access to structures

1.5.1 For overall surveys, means are to be provided to enable the Surveyor to examine the hull structure in a safe and practical way.

1.5.2 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, is/are to be provided:
- permanent staging and passages through structures
- temporary staging and passages through structures
- hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
- portable ladders
- boats or rafts
- other equivalent means.

1.5.3 For close-up surveys of the cargo hold shell frames of bulk carriers less than 100,000 dwt, one or more of the following means for access, acceptable to the Surveyor, is/are to be provided:
- permanent staging and passages through structures
- temporary staging and passages through structures
- 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
- hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
- boats or rafts provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water
- other equivalent means.

1.5.4 For close-up surveys of the cargo hold shell frames of bulk carriers 100,000 dwt and above, the use of portable ladders is not accepted, and one or more of the following means for access, acceptable to the Surveyor, is/are to be provided:

a) Annual surveys, intermediate surveys for ships less than ten years of age and class renewal surveys for ships five years of age or less:
   - permanent staging and passages through structures
   - temporary staging and passages through structures
   - hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
   - boats or rafts provided the structural capacity of the hold is sufficient to withstand static loads at all levels of water
   - other equivalent means.

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

c) Notwithstanding the above requirements:
   1) 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 survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately the 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 at annual survey of cargo holds for single skin bulk carriers between 10 and 15 years
      - close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately the 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 at annual survey of cargo holds for single skin bulk carriers over 15 years.
   2) The use of hydraulic arm vehicles or aerial lifts (“Cherry picker”) 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.

2 Annual survey

2.1 General

2.1.1 The survey is to 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 should 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.

2.2 Hatch covers and coamings, weather decks

2.2.1 Confirmation is to be obtained that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

2.2.2 A thorough survey of cargo hatch covers and coamings is only possible by examination in the open as well as closed positions and is to include verification of proper opening and closing operation. 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, are to be surveyed open, closed and in operation to the full extent on each direction, including:

a) stowage and securing in open condition

b) proper fit and efficiency of sealing in closed condition, and

c) operational testing of hydraulic and power components, wires, chains, and link drives.

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

2.2.3 If there are indications of difficulty in operating and securing hatch covers, additional sets at the discretion of the Surveyor, are to be tested in operation.

2.2.4 Where the cargo hatch securing system does not function properly, repairs are to be carried out under the supervision of QRS.

2.2.5 For each cargo hatch cover set, the following items are to be surveyed:

a) cover panels, including side plates, and stiffener attachments that may be accessible in the open position by close-up survey (for corrosion, cracks, deformation)

b) sealing arrangements of perimeter and cross joints (gaskets for condition and permanent deformation, gasket lips, compression bars, drainage channels and non return valves)

c) clamping devices, retaining bars, cleating (for wastage, adjustment, and condition of rubber components)

d) closed cover locating devices (for distortion and attachment)

e) chain or rope pulleys

f) guides

g) guide rails and track wheels

h) stoppers

i) wires, chains, tensioners, and gypsies

j) hydraulic system, electrical safety devices and interlocks, and

k) end and interpanel hinges, pins and stools where fitted.

2.2.6 At each hatchway, the coamings, with plating stiffeners and brackets, are to be checked for corrosion, cracks and deformation, especially of the coaming tops, including close-up survey.

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

2.2.8 Where portable covers, wooden or steel pontoons are fitted, checking the satisfactory condition, where applicable, of:

- wooden covers and portable beams, carriers or sockets for the portable beam, and their securing devices
- steel pontoons, including close-up survey of hatchcover plating
- tarpaulins
- cleats, battens and wedges
- hatch securing bars and their securing devices
- loading pads/bars and the side plate edge
- guide plates and chocks
- compression bars, drainage channels and drain pipes (if any).

2.2.9 The annual survey is also to include:

- examination of flame screens on vents to all bunker tanks
- examination of bunker and vent piping systems, including ventilators
- confirmation, when appropriate and as far as practicable when examining internal spaces, that the means of access to cargo and other spaces remain in good condition.
- examination of watertight penetrations as far as practicable.

2.3 Cargo holds

2.3.1 The requirements given in Table 1 for single skin bulk carriers or Table 2 for double skin bulk carriers are to be complied with.

2.4 Ballast tanks

2.4.1 Ballast tanks are to be internally examined when required as a consequence of the results of the class renewal survey or the intermediate survey.

2.4.2 When considered necessary by the Surveyor or where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements is to be increased in accordance with Table 7 to Table 11 for single skin bulk carriers or Table 12 to Table 15 for double skin bulk carriers. These extended thickness measurements are to be carried out before the survey is credited as completed.

Suspect areas identified at previous surveys are to be examined.

Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For ships built under the 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.

2.5 Annual Surveys

Where this level of survey reveals the need for remedial measures, the survey is to be extended to include a close-up survey of all 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.
Where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that substantial corrosion is present, the extent of thickness measurements is to be increased in accordance with Table 7 to Table 11. These extended thickness measurements are to be carried out before the annual survey is credited as completed. Suspect areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

Table 1 : Annual survey of cargo holds for single skin bulk carriers

Age of ship (in years at time of annual survey)	
10 < age 15	age > 15
Overall survey of all cargo holds Close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately the 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. Examination of all piping and penetrations, including overboard piping, in cargo holds	Overall survey of all cargo holds Close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately the 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. Examination of all piping and penetrations, including overboard piping, in cargo holds

Table 2 : Annual survey of cargo holds for double skin bulk carriers

Age of ship (in years at time of annual survey)	
10 < age 15	age > 15
Overall survey of two selected cargo holds Examination of all piping and penetrations, including overboard piping, in cargo holds	Overall survey of all cargo holds Examination of all piping and penetrations, including overboard piping, in cargo holds

3 Intermediate survey

3.1 Ships 10 years of age or less

3.1.1 The requirements for survey of cargo holds are given below for single skin bulk carriers and for double skin bulk carriers are to be complied with.

- Overall Survey of all Cargo Holds.
- Close-up survey in the forward cargo hold and one other cargo hold, to establish condition of at least 25% of the side shell frames.
- Examination of suspect areas for the transverse bulkheads.
- Thickness measurements sufficient to determine general and local corrosion levels in areas subject to close-up survey.

3.1.2 The requirements for survey of salt water ballast tanks for single skin bulk carriers and for double skin bulk carriers are found here below:

- Overall survey of representative water ballast spaces selected by the Surveyor. The selection is to include fore and aft peak tanks and a few other tanks, considering the total number and type of ballast tanks.
- Overall and close-up survey of suspect areas identified at previous surveys.
- The minimum requirements for thickness measurements are areas found to be suspect areas at previous surveys.
- Overall survey of representative water ballast tanks selected by the Surveyor. The selection is to include fore and aft peak tanks and a few other tanks, considering the total number and type of ballast tanks.

3.2 Ships between 10 and 15 years of age

3.2.1 The scope of intermediate survey of ships between 10 and 15 years of age is the scope of the preceding class renewal survey of hull, with bottom survey in dry condition or bottom in water survey as applicable. However, internal examination of fuel oil tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.

3.3 Intermediate Survey of Cargo Holds and Ballast Tanks for Single Skin Bulk Carriers

- If overall survey reveals no visible structural defects, examination may be limited to verification of corrosion prevention system
- Where poor coating condition is found in water ballast tanks the examination is to be extended to other ballast tanks of the same type.
- For ballast tanks, where a hard protective coating is found in poor condition, the tanks are to be internally examined at annuals.
- Thickness measurements to be carried out if required by attending surveyor.
- Where substantial corrosion is found, extent of measurements is to be increased according to Tables 11 and 15.

3.4 Ships over 15 years of age

3.4.1 The scope of intermediate survey of ships over 15 years of age is the scope of the preceding class renewal survey of hull, with bottom survey in dry condition. However, internal examination of fuel oil tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.

The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and water ballast tanks are to be carried out during the bottom survey in accordance with the applicable requirements for intermediate surveys, if not already performed.

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

For Ballast tanks, if survey reveals no visible structural defects, the examination may be limited to verification of corrosion prevention system.

Where poor coating condition and corrosion are found the examination is to be extended to other ballast tanks of the same type. In ballast tanks other than double bottom tanks, where hard protective coating is found in poor condition, the tanks in question are to be examined and thickness measurements carried out as necessary at annual surveys. Where extensive corrosion exists, thickness measurements are to be carried out. Where substantial corrosion is found, the extent of thickness measurements is to be increased in accordance with Table 12 to Table 15.

4 Class renewal survey

4.1 Survey program and preparation for survey

4.1.1 The Owner in cooperation with QRS is to work out a specific Survey Program prior to the commencement of any part of:

- the class renewal survey
- the intermediate survey for bulk carriers over 10 years of age.

The survey program is to be in a written format. The survey is not to commence until the Survey Program has been agreed.

Prior to the development of the Survey Program, the survey planning questionnaire is to be completed by the Owner and forwarded to QRS.

The survey program at intermediate survey may consist of the survey program at the previous class renewal survey supplemented by the hull condition evaluation report of that class renewal survey and later relevant survey reports.

The survey program is to be worked out taking into account any amendments to the survey requirements after the last class renewal survey carried out.

4.1.2 In developing the survey program, the following documentation is to be collected and consulted with a view to selecting holds, tanks, areas and structural elements to be examined:

a) survey status and basic ship information

b) documentation on board

c) main structural plans (scantling drawings), including information on use of high tensile steels (HTS)

d) relevant previous survey and inspection reports from both QRS and the Owner

e) information regarding the use of ship's holds and tanks, typical cargoes and other relevant data

f) information regarding corrosion prevention level on the newbuilding

g) information regarding the relevant maintenance level during operation.

4.1.3 The submitted Survey Program is to account for and comply, as a minimum, with the requirements for close-up survey, thickness measurement and tank testing, respectively, and is to include relevant information including at least:

a) basic ship information and particulars

b) main structural plans (scantling drawings), including information regarding use of high tensile steels (HTS)

c) plan of holds and tanks

d) list of holds and tanks with information on use, protection and condition of coating

e) conditions for survey (e.g. information regarding hold and tank cleaning, gas freeing, ventilation, lighting, etc.)

f) provisions and methods for access to structures

g) equipment for surveys

h) nomination of holds and tanks and areas for close-up surveys

i) nomination of sections for thickness measurements

j) nomination of tanks for tank testing

k) damage experience related to the ship in question.

4.1.4 QRS is to advise the Owner of the maximum acceptable structural corrosion diminution levels applicable to the ship.

4.2 Survey planning meeting

4.2.1 The establishment of proper preparation and the close co-operation between the attending surveyor(s) and the owner's representatives onboard 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 are to be held regularly.

4.2.2 Prior to commencement of any part of the renewal and intermediate survey, a survey planning meeting is to 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 program are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out.

4.2.3 The following is an indicative list of items that are to be addressed in the meeting:

a) schedule of the ship (voyage, docking and undocking, periods alongside, cargo and ballast operations)

b) provisions and arrangements for thickness measurements

c) extent of the thickness measurements

d) acceptance criteria (refer to the list of minimum thicknesses)

e) extent of close-up survey and thickness measurements considering the coating condition and suspect areas/areas of substantial corrosion

f) execution of thickness measurements

g) taking representative readings in general and where uneven corrosion/pitting is found

h) mapping of areas of substantial corrosion, and

i) communication between attending surveyor(s), the thickness measurement firm operator(s) and owner representative(s) concerning findings.

4.3 Scope of survey

4.3.1 In addition to the requirements of annual surveys, the class renewal survey is to include examination, tests and checks of sufficient extent to ensure that the hull and related piping is in satisfactory condition for the new period of class to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

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

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

4.3.4 The survey extent of ballast tanks converted to void spaces will be specially considered by QRS in relation to the requirements for ballast tanks.

4.3.5 A bottom survey in dry condition is to be a part of the class renewal survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks are to be carried out during this bottom survey in accordance with the applicable requirements for class renewal surveys, if not already performed.

4.3.6 Where provided, the condition of the corrosion prevention system of ballast tanks is to be examined.

For ballast tanks, excluding double bottom tanks, where a hard protective coating is found in poor condition, and it is not renewed, where 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 are to be examined at annual surveys. Thickness measurement are to be carried out as deemed necessary by the Surveyor.

When such a 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 surveys. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement are to be carried out.

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

4.4 Hatch covers and coamings

4.4.1 A survey of the items listed in Section 2 is to be carried out, in addition to all hatch covers and coamings.

4.4.2 Checking of the satisfactory operation of all mechanically operated hatch covers is to be made, including:

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

4.4.3 Checking the effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent.

4.4.4 The close-up survey and thickness measurements in accordance with the requirements given in Table 4, Table 5, and Table 6, respectively, are to be carried out.

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

4.5 Overall and close-up surveys

4.5.1 An overall survey of all tanks and spaces is to be carried out at each class renewal survey. Fuel oil tanks in the cargo length area are to be surveyed as per Table 3.

4.5.2 The minimum requirements for close-up surveys are given in Table 4 for single skin bulk carriers, and in Table 5 for double skin bulk carriers.

4.5.3 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.

4.5.4 For areas in spaces where hard protective coatings are found to be in a good condition, the extent of close-up surveys according to Table 4 for single skin bulk carriers Table 5 for double skin bulk carriers may be specially considered.

Table 3: Requirements for internal examination of fuel oil tanks in the cargo length area

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 & subsequent age > 15
none	one	two	half (min. two)

Table 4: Requirements for close-up survey at class renewal survey of single skin bulk carriers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
25% of shell frames in the forward cargo hold at representative positions Selected shell frames in all remaining cargo holds	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 For bulk carriers 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	All shell frames in the forward and one other selected cargo hold and 50% of shell frames in each of the remaining cargo holds including upper and lower end attachments and adjacent shell plating	All shell frames in all cargo holds including upper and lower end attachments and adjacent shell plating

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
One transverse web with associated plating and longitudinals in two representative water ballast tanks of each type	One transverse web with associated plating and longitudinals in each water ballast tank Forward and aft transverse bulkheads in one ballast tank, including stiffening system	All transverse webs with associated plating and longitudinals in each water ballast tank All transverse bulkheads in ballast tanks, including stiffening system	Areas to as for class renewal survey for ships between 10 and 15 years of age
Two selected cargo hold transverse bulkheads ●	All cargo hold transverse bulkheads ●	All cargo hold transverse bulkheads ●	
All cargo hold hatch covers and coamings	All cargo hold hatch covers and coamings	All cargo hold hatch covers and coamings	
	All deck plating and underdeck structure inside line of hatch openings between all cargo hold hatches	All deck plating and underdeck structure inside line of hatch openings between all cargo hold hatches	

Table 5: Requirements for close-up survey at class renewal survey of double skin bulk carriers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
One transverse web with associated plating and longitudinals in two representative water ballast tanks of each type (this is to include the foremost topside and double side water ballast tanks on either side)	One transverse web with associated plating and longitudinals as applicable in each water ballast tank 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	All transverse webs with associated plating and longitudinals as applicable in each water ballast tank All transverse bulkheads including stiffening system in each water ballast tank	All transverse webs with associated plating and longitudinals as applicable in each water ballast tank All transverse bulkheads including stiffening system in each water ballast tank
	25% of ordinary transverse frames for transverse framing system or 25% of longitudinals for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in the foremost double side tanks	25% of ordinary transverse frames for transverse framing system or 25% of longitudinals for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in all double side tanks	All ordinary transverse frames for transverse framing system or all longitudinals for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in all double side tanks
Two selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted ●	One transverse bulkhead in each cargo hold, including internal structure of upper and lower stools, where fitted ●	All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted ●	Areas ● to as for class renewal survey for ships between 10 and 15 years of age
All cargo hold hatch covers and coamings (platings and stiffeners)	All cargo hold hatch covers and coamings (platings and stiffeners)	All cargo hold hatch covers and coamings (platings and stiffeners)	
	All deck plating and underdeck structure inside line of hatch openings between all cargo hold hatches	All deck plating and underdeck structure inside line of hatch openings between all cargo hold hatches	

4.6 Thickness measurements

4.6.1 The minimum requirements for thickness measurements at class renewal survey are given in Table 6.

Table 6 : Requirements for thickness measurements at class renewal survey of bulk carriers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age ✪15	Class renewal survey No.4 and subsequent age > 15
Suspect areas	Suspect areas	Suspect areas	Suspect areas
	Within the cargo length area: • two transverse sections of deck plating outside line of cargo hatch openings	Within the cargo length area: • each deck plate outside line of cargo hatch openings • two transverse sections, one in the amidship area, outside line of cargo hatch openings	Within the cargo length area: • each deck plate outside line of cargo hatch openings • three transverse sections, one in the amidship area, outside line of cargo hatch openings • each bottom plate
	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 4 or Table 5, as applicable	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 4 or Table 5, as applicable	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 4 or Table 5, as applicable
	Wind and water strakes in way of the transverse sections considered above	All wind and water strakes within the cargo area	All wind and water strakes, full length
	Selected wind and water strakes outside the cargo area	Selected wind and water strakes outside the cargo area	
		Additional thickness measurements are to be taken on the transverse watertight bulkhead between the two foremost cargo holds on ships as per surveyor requirements.	Additional thickness measurements are to be taken on the transverse watertight bulkhead between the two foremost cargo holds on ships as per surveyor requirements.
	Additional thickness measurements are to be taken on the side shell frames and brackets on ships if required by attending surveyor	Additional thickness measurements are to be taken on the side shell frames and brackets on ships if required by attending surveyor	Additional thickness measurements are to be taken on the side shell frames and brackets on ships if required by attending surveyor

4.6.2 Provisions for extended measurements for areas with substantial corrosion are given in Table 7 to Table 15 and as may be additionally specified in the survey program. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

may be:

- 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
- required to be measured at annual intervals.

4.6.3 The Surveyor may further extend the thickness measurements as deemed necessary.

4.6.4 When pitting is found on bottom plating and its intensity is 20% or more, thickness measurements are to be extended in order to determine the actual plate thickness out of the pits and the depth of the pits. Where the wastage is in the substantial corrosion range or the average depth of pitting is 1/3 or more of the actual plate thickness, the pitted plate is to be considered as a substantially corroded area.

4.6.5 For areas in tanks where hard protective coatings are found to be in a good condition, the extent of thickness measurements according to Table 6 may be specially considered by QRS.

Table 7 : Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of single skin bulk carriers within the cargo area

BOTTOM AND SIDE SHELL STRUCTURES		
Structural member	Extent of measurement	Pattern of measurement
Bottom and side shell plating	Suspect plate, plus 4 adjacent plates See other tables for particulars on gauging in way of tanks and cargo holds	5-point pattern for each panel between longitudinals
Bottom and side shell longitudinals	Minimum of 3 longitudinals in way of suspect areas	3 measurements in line across web 3 measurements on flange

Table 8: Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of single skin bulk carriers within the cargo area

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	5-point pattern between stiffeners over one meter length 5-point pattern between stiffeners over one meter 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 bulkheads fitted with lower stool)	5-point pattern over 1 m^2 of plating 5-point pattern over 1 m^2 of plating

Table 9: Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of single skin bulk carriers within the cargo area

DECK STRUCTURE AND HATCH COVERS		
Structural member	Extent of measurement	Pattern of measurement
Cross deck strip plating	Suspect cross deck strip plating	5-point pattern between underdeck stiffeners over one meter length
Underdeck stiffeners	Transverse members Longitudinal members	5-point pattern at each end and mid-span 5-point pattern on both web and flange
Hatch covers	Skirt: 3 locations on each side and each end 3 longitudinal bands, outboard strakes and centreline strake	5-point pattern at each location 5-point measurement each band
Hatch coamings	Both sides and ends of coaming: one band lower 1/3 and one band upper 2/3 of coaming	5-point measurement each band
Topside water ballast tanks	Transverse watertight bulkhead: (a) lower 1/3 of bulkhead (b) upper 2/3 of bulkhead (c) stiffeners	 (a) 5-point pattern over 1 m^2 of plating (b) 5-point pattern over 1 m^2 of plating (c) 5-point pattern over 1 m length
	Two representative transverse wash bulkheads: (a) lower 1/3 of bulkhead (b) upper 2/3 of bulkhead (c) stiffeners	 (a) 5-point pattern over 1 m^2 of plating (b) 5-point pattern over 1 m^2 of plating (c) 5-point pattern over 1 m length
	Three representative bays of sloped plating: (a) lower 1/3 of tank (b) upper 2/3 of tank	 (a) 5-point pattern over 1 m^2 of plating (b) 5-point pattern over 1 m^2 of plating
	Longitudinals: suspect and adjacent	5-point pattern both web and flange over 1 m length
Main deck plating	Suspect plates and adjacent	5-point pattern over 1 m^2 of plating
Main deck longitudinals	Minimum of 3 longitudinals where plating measured	5-point pattern both web and flange over 1 m length
Web frames/transverses	Suspect plates	5-point pattern over 1 m^2 of plating

Table 10: Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of single skin bulk carriers within the cargo area

DOUBLE BOTTOM AND HOPPER STRUCTURE		
Structural member	Extent of measurement	Pattern of measurement
Inner bottom plating	Suspect plate plus all adjacent plates	5-point pattern for each panel between longitudinals over one meter length
Inner bottom longitudinals	Three longitudinals where plates measured	3 measurements in line across and 3 measurements on flange
Longitudinal girders and transverse floors	Suspect plates	5-point pattern over approximately 1 m^2 of plating
Watertight bulkheads (floors and girders)	(a) lower 1/3 of tank (b) upper 2/3 of tank	(a) 5-point pattern over 1 m^2 of plating (b) 5-point pattern alternate plates over 1 m^2 of plating
Transverse web frames	Suspect plate	5-point pattern over 1 m^2 of plating

Table 11 : Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of single skin bulk carriers within the cargo area

CARGO HOLDS		
Structural member	Extent of measurement	Pattern of measurement
Side shell frames	Suspect frame and each adjacent	(a) At each end and mid-span: 5-point pattern of both web and flange (b) 5-point pattern within 25 mm of welded attachment to both shell and lower sloped plate

Table 12 : Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of double skin bulk carriers within the cargo length area

BOTTOM, INNER BOTTOM AND HOPPER STRUCTURE		
Structural member	Extent of measurement	Pattern of measurement
Bottom, inner bottom and hopper structure plating	Minimum of 3 bays across double bottom tank, including aft bay Measurements around and under all suction bell mouths	5-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across flange and 3 measurements on the vertical web
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 1 measurement between each panel stiffener, or a minimum of 3 measurements
Bottom floors, including the watertight ones	3 floors in the bays where bottom plating measured, with measurements at both ends and middle	5-point pattern over 2 square meter area
Hopper structure web frame ring	3 floors in the bays where bottom plating measured	5-point pattern over 1 square meter of plating Single measurements on flange
Hopper structure transverse watertight bulkhead or swash bulkhead	• lower 1/3 of bulkhead • upper 2/3 of bulkhead • stiffeners (minimum of 3)	5-point pattern over 1 square meter of plating 5-point pattern over 2 square meter of plating for web, 5-point pattern over span (2 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

Table 13: Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of double skin bulk carriers within the cargo length area

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	5-point pattern between underdeck stiffeners over 1 meter length
Underdeck stiffeners	Transverse members Longitudinal members	5-point pattern at each end and mid span 5-point pattern on both web and flange
Hatch covers	Side and end skirts, each 3 locations 3 longitudinal bands: 2 outboard strakes and 1 centreline strake	5-point pattern at each location 5- point measurement each band
Hatch coamings	Each side and end of coaming, one band lower 1/ 3, one band upper 2/3 of coaming	5-point measurement each band, end or side coaming
Topside ballast tanks	a) Watertight transverse bulkheads: • lower 1/3 of bulkhead • upper 2/3 of bulkhead • stiffeners	 5-point pattern over 1 square meter of plating 5-point pattern over 1 square meter of plating 5- point pattern over 1 meter length
Topside ballast tanks	b) Two representative swash transverse bulkheads: • lower 1/3 of bulkhead • upper 2/3 of bulkhead • stiffeners	 5-point pattern over 1 square meter of plating 5- point pattern over 1 square meter of plating 5-point pattern over 1 meter length
Topside ballast tanks	c) Three representative bays of slope plating: • lower 1/3 of tank • upper 2/3 of tank	2 5-point pattern over 1 square meter of plating 5- point pattern over 1 square meter of plating
Topside ballast tanks	d) Longitudinals, suspect and adjacent	5-point pattern on both web and flange over 1 meter length
Main deck plating	Suspect plates and adjacent (4)	5-point pattern over 1 square meter of plating
Main deck longitudinals	Suspect plates	5-point pattern on both web and flange over 1 meter length
Web frames / Transverses	Suspect plates	5-point pattern over 1 square meter

4.6.6 For single skin bulk carriers, 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 water ballast tanks is to be carried out. For double skin bulk carriers, representative thickness measurement to determine both general and local levels of corrosion in the transverse web frames in all water ballast tanks is to be carried out.

Thickness measurements is also to be carried out to determine the corrosion levels on the transverse bulkhead plating. The extent of thickness measurements may be specially considered provided the Surveyor is satisfied by the close-up survey, that there is no structural diminution, and the hard protective coating where applied remains efficient.

4.7 Tank testing

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

4.7.2 The Surveyor may extend the tank testing as deemed necessary.

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

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

Boundaries of fuel oil tanks are to 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.

4.7.4 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 tanktop is carried out.

Table 14: Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of double skin bulk carriers within the cargo length area

STRUCTURE IN DOUBLE SIDE SPACES OF DOUBLE SKIN BULK 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 3 bays (along the tank) • plating between every third pair of longitudinals in same 3 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 3 bays • every third transverse frame/longitudinal in same 3 bays	 • 3 measurements across web and 1 measurement on flange • 3 measurements across web and 1 measurement on flange
Transverse frames / longitudinals: • brackets	 Minimum of 3 at top, middle and bottom of tank in same 3 bays	 5-point pattern over area of bracket
Vertical web and transverse bulkheads: • strakes in way of horizontal girders • other strakes	 • minimum of 2 webs and both transverse bulkheads • minimum of 2 webs and both transverse bulkheads	 • 5-point pattern over approx. 2 square meter area • 2 measurements between each pair of vertical stiffeners
Horizontal girders	Plating on each girder in a minimum of 3 bays	2 measurements between each pair of longitudinal girder stiffeners
Panel stiffening	Where applicable	Single measurements

Table 15 : Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of double skin bulk carriers within the cargo length area

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 band within 25 mm of welded connection to shelf plate	• 5-point pattern between stiffeners over 1 meter length • 5-point pattern between stiffeners over 1 meter length
Transverse bulkheads	• transverse band at approx. 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)	• 5-point pattern over 1 square meter of plating • 5-point pattern over 1 square meter of plating

Section 3 Oil Tankers

1 General

1.1 Application

1.1.1 The requirements of this Section apply to all self-propelled ships which have been assigned one of the following service notations:

- **oil tanker ESP** (whether of single or double hull construction)

1.1.2 Ships granted with the service notation **oil storage service** are only concerned by the requirements laid down in [6] for class hull renewal surveys.

1.1.3 The requirements for hull surveys apply to the surveys of the hull structure and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels and void spaces within the cargo area and all ballast tanks.

1.1.4 The requirements contain the minimum extent of examination, thickness measurements and tank testing. When substantial corrosion, and/or structural defects are found, the survey is to be extended and is to include additional close-up surveys when necessary.

1.1.5 In any kind of survey, such as class renewal, intermediate, annual or other surveys having the same scope, thickness measurements, when required by Table 3, of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys.

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

1.1.7 When, in any survey, thickness measurements are required:

- the thickness measurement firm is to be part of the survey planning meeting to be held prior to commencing the survey.

1.2 Documentation on board

1.2.1 The Owner is to obtain, supply and maintain documentation on board as specified in these rules, which is to be readily available for examination by the Surveyor. The documentation is to be kept on board for the lifetime of the ship.

1.2.2 A survey report file is to be a part of the documentation on board consisting of:

- reports of structural surveys
- hull condition evaluation report (summarizing the results of class renewal surveys)
- thickness measurement reports.

The survey report file is also to be available in the Owner's management office.

1.2.3 The following additional supporting documentation is to be available on board:

- main structural plans of cargo and ballast tanks (for CSR ships, these plans are to include, for each structural element, both the as-built and the renewal thicknesses. Any thickness for voluntary addition is also to be clearly indicated on the plans. The midship section plan to be supplied on board the ship is to include the minimum allowable hull girder sectional properties for the tank transverse section in all cargo tanks)
- previous repair history
- cargo and ballast history
- extent of use of inert gas system and tank cleaning procedures
- ship’s personnel reports on:
  - structural deterioration/defects in general
  - leakage in bulkheads and piping systems
  - condition of coatings or corrosion prevention systems, if any
- survey program, until such time as the class renewal survey or intermediate survey, as applicable, has been completed
- any other information that may help to identify critical structural areas and/or suspect areas requiring inspection.

1.2.4 Prior to survey, the Surveyor examines the documentation on board and its contents, which are used as a basis for the survey.

1.2.5 For oil tankers subject to SOLAS Chapter II-1 Part A-1 Regulation 3-10, on completion of the survey, the Surveyor is to verify that any addition and/or renewal of materials used for the construction of the hull structure is/are documented.

1.3 Reporting and evaluation of surveys

1.3.1 The data and information on the structural condition of the ship collected during survey are evaluated for acceptability and structural integrity of the ship's cargo area.

1.3.2 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 is to be evaluated by using the thickness of structural members measured, renewed and reinforced, as appropriate, during the class renewal survey 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 Chapter 3.

The final result of evaluation of the ship's longitudinal strength, after renewal or reinforcement work of structural members, if carried out as a result of initial evaluation, is to be reported as a part of the hull condition evaluation report.

1.3.3 When a survey is split between different survey stations, a report is to 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, are to be made available to the next attending Surveyor(s), prior to continuing or completing the survey.

1.3.4 A hull condition evaluation report (summarizing the results of class renewal surveys) is issued by QRS to the Owner, who is to place it on board the ship for reference at future surveys. The hull condition evaluation report is endorsed by QRS.

1.4 Conditions for survey

1.4.1 In order to enable the attending surveyor(s) to carry out the survey, provisions for proper and safe access are to be agreed between the Owner and QRS.

Details of the means of access are to be provided in the survey planning questionnaire.

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 is not to proceed.

1.5 Access to structures

1.5.1 For overall survey, means are to be provided to enable the surveyor(s) to examine the hull structure in a safe and practical way.

1.5.2 For close-up survey, one or more of the following means for access, acceptable to the Surveyor, is to be provided:

- permanent staging and passages through structures
- temporary staging and passages through structures
- hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
- boats or rafts
- portable ladders
- other equivalent means.

2 Annual survey - Hull items

2.1 General

2.1.1 The survey is to 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 should 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.

2.2 Weather decks

2.2.1 The survey is to include:

- examination of cargo tank openings, including gaskets, covers, coamings and screens
- examination of cargo tank pressure/vacuum valves and flame screens
- examination of flame screens on vents to all bunker, oily-ballast and oily slop tanks and void spaces
- examination of cargo, crude oil washing, bunker, ballast and vent piping systems, including remote control valves, safety valves and various safety devices, as well as vent masts and headers
- confirmation that wheelhouse doors and windows, sidescuttles and windows in superstructure and deckhouse ends facing the cargo area are in satisfactory condition
- confirmation that the requisite arrangements to regain steering capability in the event of the prescribed single failure are being maintained
- examination of the cargo tank venting, purging and gas freeing systems and other ventilation systems
- examination of watertight penetrations as far as practicable.

2.3 Cargo pump rooms and pipe tunnels

2.3.1 The survey is to include:

- examination of all pump room bulkheads and pipe tunnels (if any) for signs of oil leakage or fractures and, in particular, the sealing arrangements of penetrations in these bulkheads
- examination of the condition of all piping systems, in cargo pump rooms and pipe tunnels (if any)
- examination of the bilge and ballast arrangements.

2.4 Ballast tanks

2.4.1 Ballast tanks are to be internally examined as a results of the class renewal survey or the intermediate survey.

2.4.2 When considered necessary by the Surveyor, or when extensive corrosion exists, thickness measurements are to be carried out and if the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements of Table 4 or Table 5. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

2.4.3 For ships built under the Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out.

2.4.4 For ships with dedicated ballast water tanks, confirmation, through documentary evidence, that the corrosion prevention system fitted to these dedicated ballast water tanks has been maintained.

2.5 Emergency towing arrangement

2.5.1 The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made, without prior approval from QRS, to the equipment and arrangements fitted on board.

2.5.2 The survey is to include:

- an examination, as far as practicable, of the emergency towing arrangement
- confirmation that the aft towing arrangement is pre-rigged and forward chafing gear is secured to the strong-point
- confirmation of the proper functioning of the light, where it is provided, on the pick-up gear marker buoy.

2.6 Safe access to tanker bows

2.6.1 The access to bow arrangement is to be examined, as applicable.

2.7 Means of access

2.7.1 When appropriate and as far as practicable when examining internal spaces, the condition of the means of access to cargo and other spaces is to be ascertained.

2.8 Coating systems

2.8.1 When appropriate, confirmation that the coating system in cargo oil tanks of crude oil tankers, is maintained and that in- service maintenance and repair activities are recorded in the coating technical file.

3 Annual survey - Cargo machinery items

3.1 Cargo area and cargo pump rooms

3.1.1 The Owner or his representative is to declare to the attending Surveyor that no modifications or alterations which might impair safety have been made to the various installations in dangerous zones without prior approval from QRS.

The survey is to include:

- check of the protection of cargo pump room, as applicable, and in particular, check of:
  - temperature sensing devices for bulkheads glands and alarms
  - interlock between lighting and ventilation
  - gas detection system
  - bilge level monitoring devices and alarms
- examination of the emergency lighting in cargo pump rooms of ships constructed after 1st July 2002
- confirmation that potential sources of ignition in or near the cargo pump rooms, such as loose gear, excessive product in bilge, excessive vapours, combustible materials, etc., are eliminated and that access ladders are in satisfactory condition
- examination, as far as practicable, of cargo, bilge, ballast and stripping pumps for excessive gland seal leakage, verification of proper operation of electrical and mechanical remote operating and shutdown devices and operation of the pump room bilge system,

and checking that pump foundations are intact

- confirmation that the ventilation system, including portable equipment, if any, of all spaces in the cargo area (including cargo pump rooms) is operational, ducting is intact, dampers are operational and screens are clean
- confirmation that electrical equipment in dangerous zones, cargo pump rooms and other spaces is in satisfactory condition and has been properly maintained
- confirmation that the remote operation of the cargo pump room bilge system is satisfactory
- examination of the cargo heating system, as appropriate
- examination of the cargo-transfer arrangement and confirmation that the ship's cargo hoses are suitable for their intended purpose and in satisfactory condition
- confirmation that any special arrangement made for bow or stern loading/unloading is in satisfactory condition and test of the means of communication and remote shutdown of the cargo pumps.

3.2 Instrumentation and safety devices

3.2.1 The survey is to include:

- examination of cargo tank gauging devices, high level alarms and valves associated with overflow control
- verification that installed pressure gauges on cargo discharge lines are properly operational
- confirmation that the required gas detection instruments are on board and satisfactory arrangements have been made for the supply of any required vapour detection tubes
- confirmation that at least one (1) portable instrument for measuring oxygen and one (1) for measuring flammable vapour concentrations, together with a sufficient set of spares, and suitable means of calibration of these instruments are available on board
- examination of the arrangements for gas measurement in double-hull spaces and double bottom spaces, including the fitting of permanent gas sampling lines, where appropriate
- examination as far as possible, and testing of the fixed hydrocarbon gas detection system
- confirmation that devices provided for measuring the temperature of the cargo, if any, operate satisfactorily.

3.3 Fire-fighting systems in cargo area

3.3.1 The survey is to include:

- external examination of piping and cut-out valves of fixed fire-fighting systems related to cargo tanks and cargo pump rooms
- confirmation, as far as practicable and when appropriate, that the remote means for closing the various openings are operable
- examination of the appropriate portable fire-extinguishing equipment for the cargoes to be carried
- examination of fire-fighting systems of any type fitted on board such as deck foam, water-spraying, etc., as applicable.

3.4 Inert gas system

3.4.1 The survey is to include:

- external examination of the whole system, to check the condition of all piping, including vent piping above the upper deck in the cargo tank area and overboard discharges through the shell so far as practicable, and associated components to verify, in particular, the absence of signs of corrosion and leakage of gas, water or other liquid from inert gas and water piping systems or from the pressure/vacuum breaking device
- check of proper operation of both inert gas blowers
- check of proper operation of ventilation system required for scrubber room (if any)
- check of deck water seal for automatic water filling and draining
- check of absence of water carry over in the inert gas from the deck water seal and check of the condition of the non-return valve
- check of proper operation of all remotely operated or automatically controlled valves and, in particular, of the flue gas isolating valve located on the inert gas supply main after the blowers
- check of proper operation of the interlocking feature fitted to prevent soot blowers from operating when the inert gas system is working
- check that the gas pressure regulating valve automatically closes when gas blowers are stopped
- check, as far as practicable and using simulated conditions where necessary, of the following alarms and safety devices of the inert gas system:
  - high oxygen content of gas in the inert gas main
  - low gas pressure in the inert gas main
  - low pressure in the supply to the deck water seal
  - high temperature of gas in the inert gas main, including automatic shutdown devices
  - low water pressure to the scrubber, including automatic shutdown devices
  - accuracy of portable and fixed oxygen measuring equipment by means of calibration gases
  - high water level in the scrubber, including automatic shutdown devices
  - failure of the inert gas blowers
  - failure of the power supply to the automatic control system for the gas regulating valve and to the instrumentation for continuous indication and permanent recording of pressure and oxygen content in the inert gas main

- high pressure of gas in the inert gas main

- check, when practicable, of the proper operation of the inert gas system on completion of the checks listed above.

4 Intermediate survey - Hull items

4.1 General

4.1.1 The survey of weather decks is to include:

- examination, as far as applicable, of cargo, crude oil washing, bunker, ballast, steam and vent piping systems as well as vent masts and headers. 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. Particular attention is to be paid to repairs such as welded doublers
- confirmation, if applicable, that cargo pipes are electrically bonded to the hull
- examination of vent line drainage arrangements.

4.1.2 For ships built under the Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out.

4.2 Ships between 5 and 10 years of age

4.2.1 For single hull oil tankers, all ballast tanks are to be examined.

When considered necessary by the Surveyor, thickness measurements and testing are to be carried out to ensure that the structural integrity remains effective.

4.2.2 For double hull oil tankers, an overall survey of representative salt water ballast tanks selected by the Surveyor is to be carried out.

If such overall survey reveals no visible structural defects, the examination may be limited to a verification that the hard protective coating remains in good condition.

4.2.3 A ballast tank is to be examined at subsequent annual surveys where:

- a hard protective coating has not been applied from the time of construction, or
- a soft or semi-hard coating has been applied, or
- substantial corrosion is found within the tank, or
- 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 measurement is to be carried out as deemed necessary by the Surveyor.

4.2.4 In addition to the requirements above, suspect areas identified at previous surveys are to be examined.

4.3 Ships between 10 and 15 years of age

4.3.1 The scope of intermediate survey of ships between 10 and 15 years of age is the scope of the preceding class renewal survey of hull, with bottom survey in dry condition or bottom in water survey as applicable. However, pressure testing of all cargo and ballast tanks and the requirements for longitudinal strength evaluation of hull girder are not required unless deemed necessary by the attending Surveyor.

4.4 Ships over 15 years of age

4.4.1 The scope of intermediate survey of ships over 15 years of age is the scope of the preceding class renewal survey of hull, with bottom survey in dry condition, except that pressure testing of ballast and cargo tanks and the requirements for longitudinal strength evaluation of hull girder is not required unless deemed necessary by the Surveyor.

The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks are to be carried out during the bottom survey in accordance with the applicable requirements for intermediate surveys, if not already performed.

Lower portions of the cargo and ballast tanks are the parts below light ballast water line.

5 Intermediate survey - Cargo machinery items

5.1 Cargo area and cargo pump rooms

5.1.1 A general examination of the electrical equipment and cables in dangerous zones such as cargo pump rooms and areas adjacent to cargo tanks is to be carried out for defective and non-certified safe type electrical equipment and fixtures, non- approved lighting and fixtures, and improperly installed or defective or dead-end wiring.

5.1.2 The electrical insulation resistance of the electrical equipment and circuits terminating in or passing through the dangerous zones is to be tested; however, in cases where a proper record of testing is maintained, consideration may be given to accepting recent test readings effected by the ship's personnel.

5.1.3 The satisfactory condition of the cargo heating system is to be verified.

5.2 Inert gas system

5.2.1 The following is to be carried out:

- main parts such as the scrubber, washing machines, blowers, deck water seal and non-return valve are to be opened out as considered necessary and examined
- gas distribution lines and shut-off valves, including soot blower interlocking devices, are to be examined as deemed necessary
- all automatic shutdown devices and alarms are to be examined and tested.

6 Class renewal survey - Hull items

6.1 Survey program and preparation for hull survey

6.1.1 The Owner in cooperation with QRS is to work out a specific Survey Program prior to the commencement of any part of:

- the class renewal survey
- the intermediate survey for oil tankers over 10 years of age.

The survey program is to be in a written format. The survey is not to commence until the Survey Program has been agreed. Prior to the development of the Survey Program, the survey planning questionnaire is to be completed by the Owner and forwarded to QRS.

The survey program at intermediate survey may consist of the survey program at the previous class renewal survey supplemented by the hull condition evaluation report of that class renewal survey and later relevant survey reports.

The survey program is to be worked out taking into account any amendments to the survey requirements after the last class renewal survey carried out.

6.1.2 In developing the survey program, the following documentation is to be collected and consulted with a view to selecting tanks, areas and structural elements to be examined:

a) survey status and basic ship information

b) documentation on board

c) main structural plans of cargo and ballast tanks (scantlings drawings), including information regarding use of high-tensile steels (HTS)

d) Hull Condition Evaluation Report

e) relevant previous damage and repair history

f) relevant previous survey and inspection reports from both QRS and the Owner

g) cargo and ballast history for the last 3 years, including carriage of cargo under heated conditions

h) details of the inert gas plant and tank cleaning procedures

i) information and other relevant data regarding conversion or modification of the ship's cargo and ballast tanks since the time of construction

j) description and history of the coating and corrosion protection system (including previous class notations), if any

k) inspections by the Owner's personnel during the last 3 years with reference to structural deterioration in general, leakages in tank boundaries and piping and condition of the coating and corrosion protection system if any

l) 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

m) any other information that will help identify suspect areas and critical structural areas.

6.1.3 The submitted survey program is to account for and comply, as a minimum, with the requirements of Table 1 or Table 2, Table 3 and Table 6, for close-up survey, thickness measurements and tank testing, respectively, and is to include relevant information including at least:

a) basic ship information and particulars

b) main structural plans of cargo and ballast tanks (scantling drawings), including information regarding use of high tensile steels (HTS)

c) arrangement of tanks

d) list of tanks with information on their use, extent of coatings and corrosion protection systems

e) conditions for survey (e.g., information regarding tank cleaning, gas freeing, ventilation, lighting, etc.)

f) provisions and methods for access to structures

g) equipment for surveys

h) identification of tanks and areas for close-up survey

i) identification of areas and sections for thickness measurement

j) identification of tanks for tank testing

k) identification of the thickness measurement firm

l) damage experience related to the ship in question, and

m) critical structural areas and suspect areas, where relevant.

6.1.4 QRS is to advise the Owner of the maximum acceptable structural corrosion diminution levels applicable to the ship.

6.2 Survey planning meeting

6.2.1 The establishment of proper preparation and the close co-operation between the attending surveyor(s) and the owner's representatives onboard 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 are to be held regularly.

6.2.2 Prior to commencement of any part of the renewal and intermediate survey, a survey planning meeting is to be held between the attending surveyor(s), the owner's representative in attendance, the thickness measurement firm operator (as applicable) 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 program are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out.

Table 1 : Close-up survey at class renewal survey of single hull oil tankers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
One web frame ring : - in a ballast wing tank, if any, or - in a cargo wing tank used primarily for water ballast	All web frame rings : - in a ballast wing tank, if any, or - in a cargo wing tank used primarily for water ballast	All web frame rings in all ballast tanks All web frame rings in a cargo wing tank A minimum of 30% of all web frame rings in each remaining cargo wing tank	As class renewal survey for ships between 10 and 15 years of age Additional transverse areas as deemed necessary by QRS
One deck transverse in a cargo tank	One deck transverse : - in each remaining ballast tank, if any - in a cargo wing tank - in two cargo centre tanks		
	Both transverse bulkheads : - in a wing ballast tank, if any, or - in a cargo wing tank used primarily for water ballast	All transverse bulkheads in all cargo and ballast tanks	
One transverse bulkhead in a ballast tank One transverse bulkhead in a cargo wing tank One transverse bulkhead in a cargo centre tank	One transverse bulkhead in each remaining ballast tank One transverse bulkhead in a cargo wing tank One transverse bulkhead in two cargo centre tanks		
		A minimum of 30% of deck and bottom transverses in each cargo centre tank	
		Additional web frame ring(s) , as considered necessary by the Surveyor	

6.2.3 The following is an indicative list of items that are to be addressed in the meeting:

a) schedule of the ship (voyage, docking and undocking, periods alongside, cargo and ballast operations)

b) provisions and arrangements for thickness measurements

c) extent of the thickness measurements

d) acceptance criteria (refer to the list of minimum thicknesses)

e) extent of close-up survey and thickness measurements considering the coating condition and suspect areas/areas of substantial corrosion

f) execution of thickness measurements

g) taking representative readings in general and where uneven corrosion/pitting is found

h) mapping of areas of substantial corrosion, and

i) communication between attending surveyor(s), the thickness measurement firm operator(s) and owner representative(s) concerning findings.

6.3 Scope of survey

6.3.1 In addition to the requirements of annual surveys, the class renewal survey is to include examination, tests and checks of sufficient extent to ensure that the hull and related piping are in satisfactory condition for the new period of class to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

6.3.2 All cargo tanks, ballast tanks, including double bottom tanks, pump rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

6.3.3 A bottom survey in dry condition is to be a part of the class renewal survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and ballast tanks are to be carried out during this bottom survey in accordance with the applicable requirements for class renewal surveys, if not already performed.

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

6.3.4 Where provided, the condition of the corrosion prevention system of cargo tanks is to be examined. A

ballast tank is to be examined at subsequent annual surveys where:

- a hard protective coating has not been applied from the time of construction, or
- a soft or semi-hard coating has been applied, or
- substantial corrosion is found within the tank, or
- 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 measurement is to be carried out as deemed necessary by the Surveyor.

6.4 Overall and close-up surveys

6.4.1 Each class renewal survey is to include an overall survey of all tanks and spaces.

6.4.2 The minimum requirements for close-up surveys are given in Table 1 for single hull oil tankers or Table 2 for double hull oil tankers.

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

- where tanks have structural arrangements or details which have suffered defects in similar tanks or on similar ships according to available information
- where tanks have structures approved with reduced scantlings.

6.4.4 For areas in tanks where hard protective coatings are found to be in good condition, the extent of close-up surveys required according to Table 1 or Table 2 may be specially considered.

6.5 Thickness measurements

6.5.1 The minimum requirements for thickness measurements at class renewal survey are given in Table 3.

6.5.2 Provisions for extended measurements for areas with substantial corrosion are given in Table 4 for single hull oil tankers or Table 5 for double hull oil tankers and as may be additionally specified in the survey program. These extended thickness measurements are to be carried out before the survey is credited as completed.

Suspect areas identified at previous surveys are to be examined.

Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken. The

Surveyor may further extend the thickness measurements as deemed necessary.

6.5.3 When pitting is found on bottom plating and its intensity is 20% or more, thickness measurements are to be extended in order to determine the actual plate thickness out of the pits and the depth of the pits. Where the wastage is in the substantial corrosion range or the average depth of pitting is 1/3 or more of the actual plate thickness, the pitted plate is to be considered as a substantially corroded area.

6.5.4 For areas in tanks where hard protective coatings are found to be in good condition the extent of thickness measurements according to Table 3 may be specially considered.

6.5.5 On 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, the longitudinal strength of the ship's hull girder is to be evaluated in compliance with the requirements of Chapter 3 on the basis of the thickness of the structures measured, renewed or reinforced, as appropriate, during the class renewal survey.

Table 2 : Close-up survey at class renewal survey of double hull oil tankers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
One web frame in a ballast tank	All web frames in a ballast tank. The knuckle area and the upper part (5 meters approximately) of one web frame in each remaining ballast tank	All web frames in all ballast tanks	As class renewal survey for ships between 10 and 15 years of age. Additional transverse areas as deemed necessary by QRS
One deck transverse in a cargo tank	One deck transverse in two cargo tanks	All web frames □ including deck transverse and cross ties, if fitted, in a cargo tank One web frame □ including deck transverse and cross ties, if fitted, in each remaining cargo tank	
One transverse bulkhead in a ballast tank	One transverse bulkhead in each ballast tank	All transverse bulkheads in all cargo and ballast tanks	
One transverse bulkhead in a cargo wing tank One transverse bulkhead in a cargo centre tank	One transverse bulkhead in a cargo wing tank One transverse bulkhead in two cargo centre tanks		

Table 3 : Thickness measurements at class renewal survey of oil tankers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
Suspect areas	Suspect areas	Suspect areas	Suspect areas
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)	Within the cargo area: • each deck plate • 1 transverse section	Within the cargo area: • each deck plate • 2 transverse sections • all wind and water strakes	Within the cargo area: • each deck plate • 3 transverse sections • each bottom plate
Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 1	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 1 and Table 2	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 1 and Table 2	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 1 and Table 2
	Selected wind and water strakes outside the cargo area	Selected wind and water strakes outside the cargo area	All wind and water strakes, full length

Table 5 : Extended thickness measurements at those areas of substantial corrosion Double hull oil tankers

BOTTOM, INNER BOTTOM AND HOPPER STRUCTURE		
Structural member	Extent of measurement	Pattern of measurement
Bottom, inner bottom and hopper structure plating	Minimum of 3 bays across double bottom tank, including aft bay Measurements around and under all suction bell mouths	5-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across flange and 3 measurements on 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 3 measurements
Bottom floors, including the watertight ones	3 floors in bays where bottom plating measured, with measurements at both ends and middle	5-point pattern over 2 square meter area
Hopper structure web frame ring	3 floors in bays where bottom plating measured	5-point pattern over about 1 square meter of plating. Single measurements on flange.
Hopper structure transverse watertight bulkhead or swash bulkhead	• lower 1/3 of bulkhead	5-point pattern over about 1 square meter of plating
	• upper 2/3 of bulkhead	5-point pattern over 2 square meter of plating
	• stiffeners (minimum of 3)	For web, 5-point pattern over span (2 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 provided	Single measurements
DECK STRUCTURE		
Structural member	Extent of measurement	Pattern of measurement
Deck plating	2 transverse bands across tank	Minimum of 3 measurements per plate per band
Deck longitudinals	Every third longitudinal in each of 2 bands with a minimum of one longitudinal	3 measurements in line vertically on webs and 2 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 3 measurements. 2 measurements across flange. 5-point pattern on girder/bulkhead brackets.
Deck transverse webs	Minimum of 2 webs, with measurements at both ends and middle of span	5-point pattern over 1 square meter area. Single measurements on flange.
Vertical web and transverse bulkhead in wing ballast tank (2 meters from deck)	Minimum of 2 webs, and both transverse bulkheads	5-point pattern over 1 square meter area
Panel stiffening	Where provided	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 3 bays (along the tank) Plating between every third pair of longitudinals in same 3 bays	 Single measurement Single measurement
Side shell and longitudinal bulkhead longitudinals on: • upper strake • all other strakes	 Each longitudinal in same 3 bays Every third longitudinal in same 3 bays	 3 measurements across web and 1 measurement on flange 3 measurements across web and 1 measurement on flange
Longitudinal brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5-point pattern over area of bracket
Vertical web and transverse bulkheads (excluding deckhead area): • strakes in way of horizontal girders • other strakes	 Minimum of 2 webs and both transverse bulkheads Minimum of 2 webs and both transverse bulkheads	 5-point pattern over 2 square meter area 2 measurements between each pair of vertical stiffeners
Horizontal girders	Plating on each girder in a minimum of 3 bays	2 measurements between each pair of longitudinal girder stiffeners
Panel stiffening	Where provided	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 3 bays	Single measurement
All other strakes	Plating between every third pair of longitudinals in same 3 bays	Single measurement
Longitudinals on deckhead and bottom strakes	Each longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
All other longitudinals	Every third longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
Longitudinal brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5-point pattern over area of bracket
Web frames and cross ties	3 webs with minimum of 3 locations on each web, including in way of cross tie connections	5-point pattern over approximately 2 square meter area of webs, plus single measurements on flanges of web frame and cross ties
Lower end brackets (opposite side of web frame)	Minimum of 3 brackets	5-point pattern over approximately 2 square meter 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 25mm of welded connection to inner bottom/deck plating • Transverse band within 25mm of welded connection to shelf plate	5-point pattern between stiffeners over 1 meter length
Deckhead and bottom strakes, and strakes in way of horizontal stringers	Plating between pair of stiffeners at 3 locations: approximately 1/4, 1/2 and 3/4 width of tank	5-point pattern between stiffeners over 1 meter 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	5-point pattern over about 1 square meter of plating
Stiffeners	Minimum of 3 typical stiffeners	For web, 5-point pattern over span between bracket connections (2 measurements across web at each bracket connection and one at centre of span). For flange, single measurements at each bracket toe and at centre of span
Brackets	Minimum of 3 at top, middle and bottom of tank	5-point pattern over area of bracket
Horizontal stringers	All stringers with measurements at both ends and middle	5-point pattern over 1 square meter of area plus single measurements near bracket toes and on flange

Table 6 : Tank testing at class renewal survey of oil tankers

Age of ship (in years at time of class renewal survey)	
Class renewal survey No.1 age 5	Class renewal survey No.2 and subsequent age > 5
All ballast tank boundaries	All ballast tank boundaries
Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, pump rooms or cofferdams	All cargo tank bulkheads

6.6 Tank testing

6.6.1 The requirements for tank testing at class renewal survey are given in Table 6.

6.6.2 Cargo tank testing carried out by the ship's crew under the direction of the Master may be accepted by the Surveyor, provided the following conditions are complied with:

a) a tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the Owner and reviewed by QRS prior to the testing being carried out

b) there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank

c) the tank testing has been satisfactorily carried out, within the class renewal survey window, not more than 3 months prior to the date of the survey on which the overall or close-up survey is completed

d) the satisfactory results of the testing is recorded in the ship's logbook

e) the internal and external conditions of the tanks and associated structures are found satisfactory by the Surveyor at the time of the overall and close-up surveys.

6.6.3 The Surveyor may extend the tank testing as deemed necessary.

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

Boundaries of cargo tanks are to be tested to the highest point that liquid will rise under service conditions

For double hull oil tankers, 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 tanktop is carried out.

6.7 Cargo piping, area and pump rooms

6.7.1 Cargo and crude oil washing piping on deck and cargo and ballast piping systems within the cargo area are to be examined and operationally tested to working pressure to the attending Surveyor’s satisfaction to ensure that their tightness and condition remain satisfactory. Special attention is to be given to any ballast piping in cargo tanks and cargo piping in ballast tanks and void

spaces. Surveyors are to be advised on all occasions when this piping, including valves and fittings, is opened during repair periods and can be examined internally.

The surveyor may require dismantling and/or thickness measurements of piping. A hydraulic test is to be carried out in the event of repair or dismantling or cargo, crude oil washing, or ballast piping, or where doubts arise.

6.7.2 All safety valves on cargo piping and of cargo tanks are to be dismantled for examination, adjusted and, as applicable, resealed.

6.7.3 All cargo pump room boundaries are to be generally examined. All gas-tight shaft sealing devices are to be examined. The bottom of cargo pump rooms is to be presented clean for the examination of stripping devices and gutters.

6.8 Emergency towing arrangement

6.8.1 The survey is to include:

- an examination of the emergency towing arrangement
- confirmation that the arrangement is readily available with aft towing arrangement pre-rigged and forward chafing gear secured to the strong-point
- an examination of the pick-up gear, towing pennant and chafing gear over the full length for possible deterioration. Where the pennant line is stored in a watertight condition and can be confirmed as being maintained, consideration may be given to waiving the requirement to examine the pennant line over the full length
- an examination of the strong-points, fairleads and pedestal roller together with their attachments to the hull structure.

7 Class renewal survey - Cargo machinery items

7.1 Cargo area and cargo pump rooms

7.1.1 Ballast and stripping pumps are to be internally examined and prime movers checked. A working test is to be carried out, as far as practicable.

Maintenance records of cargo pumps are to be made available to the Surveyor.

7.1.2 Where a crude oil washing system is fitted, piping, pumps, valves and deck-mounted washing machines are to be examined and tested for signs of leakage, and anchoring devices of deck-mounted washing machines are to be checked to the Surveyor's satisfaction.

7.1.3 The satisfactory condition of the cargo heating system is to be verified and, if deemed necessary by the Surveyor, the system is to be pressure tested.

7.1.4 An operating test of the remote control of pumps and valves and of automatic closing valves is to be carried out.

7.1.5 A general examination of the electrical equipment and cables in dangerous zones such as cargo pump rooms and areas adjacent to cargo tanks is to be carried out for defective and non-certified safe type electrical equipment and fixtures, non- approved lighting and fixtures, and improperly installed or defective or dead-end wiring.

The electrical insulation resistance of the electrical equipment and circuits terminating in or passing through the dangerous zones is to be tested; however, in cases where a proper record of testing is maintained, consideration may be given to accepting recent test readings effected by the ship’s personnel.

7.2 Fire-fighting systems in cargo area

7.2.1 The survey is to include the examination of fire-fighting systems of any type fitted on board for the protection of the cargo area, cargo pump room and other dangerous spaces, such as deck foam, water-spraying systems, etc.

7.3 Inert gas system

7.3.1 In addition to the inspections required at the intermediate survey, the following is to be carried out:

a) an internal examination of:
   - the inert gas generator, where fitted
   - the scrubber
   - the deck water seal including the non-return valve
   - the pressure/vacuum breaking device
   - the cooling water systems including overboard discharge from the scrubber
   - all valves

b) a test to verify the proper operation of the system upon completion of all survey checks.

Section 4 Chemical Tankers

1 General

1.1 Application

1.1.1 The requirements of this Section apply to all self-propelled ships which have been assigned the service notation **chemical tanker ESP**. If such a ship is constructed with both integral and independent tanks, these requirements are applicable only to that portion of the cargo length containing integral tanks. Combined gas carriers/chemical tankers with independent tanks within the hull are to be surveyed as gas carriers.

1.1.2 The requirements apply to the surveys of the hull structure and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels and void spaces within the cargo area and all ballast tanks. These requirements, however, do not apply to independent tanks on deck.

1.1.3 The requirements contain the minimum extent of examination, thickness measurements and tank testing. When substantial corrosion and/or structural defects are found, the survey is to be extended and is to include additional close-up surveys when necessary.

1.1.4 In any kind of survey, such as class renewal, intermediate, annual or other surveys having the same scope, thickness measurements, when required by Table 3, of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys.

1.1.5 Consideration may be given by the attending Surveyor to allow use of Remote Inspection Techniques (RIT) as an alternative to close-up survey. Surveys conducted using a RIT are to be completed to the satisfaction of the attending Surveyor.

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

1.1.7 When, in any survey, thickness measurements are required:

- the thickness measurement firm is to be part of the survey planning meeting to be held prior to commencing the survey.

1.2 Documentation on board

1.2.1 The Owner is to obtain, supply and maintain documentation on board as specified in these rules, which is to be readily available for examination by the Surveyor. The documentation is to be kept on board for the lifetime of the ship.

1.2.2 A survey report file is to be a part of the documentation on board consisting of:

- reports of structural surveys
- hull condition evaluation report (summarizing the results of class renewal surveys)
- thickness measurement reports.

The survey report file is also to be available in the Owner's management office.

1.2.3 The following additional supporting documentation is to be available on board:

- survey program, until such time as the class renewal survey or intermediate survey, as applicable, has been completed
- main structural plans of cargo and ballast tanks
- previous repair history
- cargo and ballast history
- extent of use of inert gas system and tank cleaning procedures
- ship’s personnel reports on:
  - structural deterioration/defects in general
  - leakage in bulkheads and piping systems
  - condition of coatings or corrosion prevention systems, if any
- any other information that may help identify critical structural areas and/or suspect areas requiring inspection.

1.2.4 Prior to survey, the Surveyor examines the documentation on board and its contents, which are used as a basis for the survey.

1.3 Reporting and evaluation of surveys

1.3.1 The data and information on the structural condition of the ship collected during survey are evaluated for acceptability and structural integrity of the ship's cargo area.

1.3.2 A hull condition evaluation report (summarizing the results of class renewal surveys) is issued by QRS to the Owner, who is to place it on board the ship for reference at future surveys. The hull condition evaluation report is endorsed by QRS.

1.3.3 When a survey is split between different survey stations, a report is to 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, are to be made available to the next attending Surveyor(s), prior to continuing or completing the survey.

1.4 Conditions for survey

1.4.1 In order to enable the attending surveyors to carry out the survey, provisions for proper and safe access are to be agreed between the Owner and QRS.

Details of the means of access are to be provided in the survey planning questionnaire.

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 is to not proceed.

1.5 Access to structures

1.5.1 For overall survey, means are to be provided to enable the surveyor to examine the hull structure in a safe and practical way.

1.5.2 For close-up survey, one or more of the following means for access, acceptable to the Surveyor, is to be provided:

- permanent staging and passages through structures
- temporary staging and passages through structures
- hydraulic arm vehicles such as conventional cherry pickers, lifts and movable platforms
- boats or rafts
- portable ladders
- other equivalent means.

1.5.3 For surveys conducted by use of remote inspection technique, one or more of the following means for access, acceptable to the Surveyor, is to be provided:

- unmanned robot arm
- remote operated vehicle (ROV)
- unmanned aerial vehicles/drones
- other means acceptable to QRS.

2 Annual survey - Hull items

2.1 General

2.1.1 The survey is to 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 should 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.

2.2 Weather decks

2.2.1 The survey is to include:

- examination of cargo tank openings, including gaskets, covers, coamings and flame screens
- examination of cargo tank vent system, including the pressure/vacuum valves and secondary means to prevent over- or under-pressure and devices to prevent the passage of flames
- examination of flame screens on vents to all bunker tanks
- examination of cargo, bunker, ballast and vent piping systems, including remote control valves, safety valves and various safety devices, as well as vent masts and headers
- confirmation that wheelhouse doors and windows, sidescuttles and windows in superstructure and deckhouse ends facing the cargo area are in satisfactory condition
- confirmation that pumps, valves and pipelines are identified and distinctively marked.

- examination of watertight penetrations as far as practicable.

2.3 Cargo pump rooms and pipe tunnels

2.3.1 The survey is to include:

- examination of all pump room bulkheads and pipe tunnels (if any) for signs of chemical cargo leakage or fractures and, in particular, the sealing arrangements of penetrations in pump room bulkheads
- examination of the condition of all piping systems, in cargo pump rooms and pipe tunnels (if any)
- examination of the bilge and ballast arrangements and confirmation that pumps and pipelines are identified.

2.4 Ballast tanks

2.4.1 Ballast tanks are to be internally examined when required as a consequence of the results of the class renewal survey or the intermediate survey.

2.4.2 When considered necessary by the Surveyor or when extensive corrosion exists, thickness measurements are to be carried out and if the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements is to be increased in accordance with Table 4. These extended thickness measurements are to be carried out before the survey is credited as completed.

Suspect areas identified at previous surveys are to be examined.

Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

2.5 Emergency towing arrangement

2.5.1 The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made, without prior approval from QRS, to the equipment and arrangements fitted on board.

2.5.2 The survey is to include:

- an examination, as far as practicable, of the emergency towing arrangement
- confirmation that the aft towing arrangement is prerigged and forward chafing gear is secured to the strong-point
- confirmation of the proper functioning of the light, where it is provided, on the pick-up gear marker buoy.

3 Annual survey - Cargo machinery items

3.1 Cargo area and cargo pump rooms

3.1.1 The Owner or his representative is to declare to the attending Surveyor that no modifications or alterations which might impair safety have been made to the various installations in dangerous zones without prior approval from QRS.

The survey is to include:

- confirmation that potential sources of ignition in or near the cargo pump rooms, such as loose gear, excessive product in bilge, excessive vapours, combustible materials, etc., are eliminated and that access ladders are in satisfactory condition
- examination, as far as practicable, of cargo, bilge, ballast and stripping pumps for excessive gland seal leakage, verification of proper operation of electrical and mechanical remote operating and shutdown devices and operation of the pump room bilge system, and checking that pump foundations are intact
- confirmation that the ventilation system, including portable equipment, if any, of all spaces in the cargo area (including cargo pump rooms) is operational, ducting is intact, dampers are operational and screens are clean
- confirmation that electrical equipment in dangerous zones, cargo pump rooms and other spaces is in satisfactory condition and has been properly maintained
- confirmation that the remote operation of the cargo pump room bilge system is satisfactory
- confirmation that cargo pump room rescue arrangements are in order
- confirmation that removable pipe lengths or other approved equipment necessary for cargo separation are available and in satisfactory condition
- examination of the cargo heating/cooling system and sampling arrangements where required
- examination of the cargo-transfer arrangement and confirmation that the ship's cargo hoses are suitable for their intended purpose and in satisfactory condition and, where appropriate, type approved or marked with date of testing
- confirmation that any special arrangement made for bow or stern loading/unloading is in satisfactory condition and test of the means of communications and the remote shutdown for the cargo pumps

3.2 Instrumentation and safety devices

3.2.1 The survey is to include the following items, as far as required or fitted:

- confirmation that installed pressure gauges on cargo discharge lines are properly operational
- examination of gauging devices, high level alarms and valves associated with overflow control
- confirmation that devices provided for measuring the temperature of the cargo and associated alarms operate satisfactorily
- confirmation that the required gas detection instruments are on board and satisfactory arrangements have been made for the supply of any required vapour detection tubes.

3.3 Fire-fighting systems in cargo area

3.3.1 The survey is to include:

- external examination of piping and cut-out valves of fixed fire-fighting systems related to cargo tanks and cargo pump rooms
- confirmation, as far as practicable and when appropriate, that the remote means for closing the various openings are operable
- examination of the appropriate portable fire-extinguishing equipment for the chemical cargoes to be carried out
- examination of fire-fighting systems of any type fitted on board such as deck foam, water-spraying, etc. as applicable.

3.4 Inert gas system and inert/padding/ drying gas

3.4.1 If an inert gas system such as that installed on board oil tankers is fitted, the requirements of Chapter 3 are to be complied with.

3.4.2 If an inert gas system consisting of a gas container package is fitted, arrangements are to be made for sufficient inert or padding gas to be carried to compensate for normal losses and means are to be provided for monitoring of ullage spaces.

3.4.3 If drying gas is necessary to supply the cargo spaces, arrangements are to be made for sufficient drying gas to be carried to compensate for normal losses and means are to be provided for monitoring of ullage spaces.

3.4.4 When drying agents are used on air inlets to cargo tanks, it is to be verified that arrangements are made for sufficient medium to be carried.

4 Intermediate survey - Hull items

4.1 General

4.1.1 For weather decks, an examination as far as applicable of cargo, bunker, ballast, steam and vent piping systems as well as vent masts and headers is to 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.

The survey is also to include:

- confirmation that the pipelines and independent cargo tanks where applicable, are electrically bonded to the hull
- examination of vent line drainage arrangements.

4.2 Ships between 5 and 10 years of age

4.2.1 For ballast tanks, an overall survey of representative tanks selected by the Surveyor is to be carried out. If such inspection reveals no visible structural defects, the examination may be limited to a verification that the hard protective coating remains in good condition.

4.2.2 A ballast tank is to be examined at subsequent annual surveys where:

- a hard protective coating has not been applied from the time of construction, or
- a soft or semi-hard coating has been applied, or
- substantial corrosion is found within the tank, or
- 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 are to be examined.

4.3 Ships between 10 and 15 years of age

4.3.1 The scope of intermediate survey of ships between 10 and 15 years of age is the scope of the preceding class renewal survey of hull, as detailed in Article [6] with bottom survey in dry condition or bottom in water survey as applicable. However, pressure testing of all cargo and ballast tanks are not required unless deemed necessary by the attending Surveyor.

4.4 Ships over 15 years of age

4.4.1 The scope of intermediate survey of ships over 15 years of age is the scope of the preceding class renewal survey of hull, as detailed in [6] with bottom survey in dry condition, except that pressure testing of ballast and cargo tanks is not required unless deemed necessary by the Surveyor.

The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks are to be carried out during the bottom survey in accordance with the applicable requirements for intermediate surveys, if not already performed.

Lower portions of the cargo and ballast tanks are the parts below light ballast water line.

5 Intermediate survey - Cargo machinery items

5.1 Cargo area and cargo pump rooms

5.1.1 A general examination of the electrical equipment and cables in dangerous zones such as cargo pump rooms and areas adjacent to cargo tanks is to be carried out for defective and non-certified safe type electrical equipment, non-approved lighting and fixtures, and improperly installed or defective or dead-end wiring.

5.1.2 The electrical insulation resistance of the electrical equipment and circuits terminating in or passing through the dangerous zones is to be tested; however, in cases where a proper record of testing is maintained, consideration may be given to accepting recent test readings effected by the ship's personnel.

5.1.3 The satisfactory condition of the cargo heating/cooling system is to be verified.

5.1.4 The spares for cargo area mechanical ventilation fans are to be available on board.

5.2 Inert gas system

5.2.1 If an inert gas system such as that installed on board oil tankers is fitted, the requirements given in Chapter 3 for intermediate survey of oil tankers are to be complied with.

5.2.2 For ships fitted with another type of inert gas producing system, the main parts such as the inert gas generator, deck water seal or equivalent back flow arrangement, segregation devices, as fitted are to be overhauled for examination and alarms are to be tested.

Inert gas producer isolating valves, when fitted, are to be dismantled for examination.

5.3 Personnel protection

5.3.1 The survey is to include:

- confirmation that the protective clothing for crew engaged in loading and discharging operations and its stowage is in satisfactory condition
- confirmation that the required safety equipment and associated breathing apparatus and associated air supplies and, when appropriate, emergency escape respiratory and eye protection are in a satisfactory condition and properly stowed
- confirmation that the medical first-aid equipment, including stretchers and oxygen resuscitation equipment are in a satisfactory condition
- confirmation that arrangements have been made for the antidotes for the cargoes actually carried to be on board
- confirmation that decontamination arrangements and eyewashes are operational
- confirmation that the required gas detection instruments are on board and that arrangements have been made for the supply of the appropriate vapour detection tubes
- confirmation that the arrangements for the stowage of cargo samples are satisfactory.

6 Class renewal survey - Hull items

6.1 Survey program and preparation for survey

6.1.1 The Owner in cooperation with Society is to work out a specific Survey Program prior to the commencement of any part of:

- the class renewal survey
- the intermediate survey for chemical tankers over 10 years of age.

The survey program is to be in a written format.

Prior to the development of the survey program, the survey planning questionnaire is to be completed by the Owner, and forwarded to QRS.

The survey program at intermediate survey may consist of the survey program at the previous class renewal survey supplemented by the hull condition evaluation report of that class renewal survey and later relevant survey reports.

The survey program is to be worked out taking into account any amendments to the survey requirements after the last class renewal survey carried out.

6.1.2 In developing the Survey Program, the following documentation is to be collected and consulted with a view to selecting tanks, areas, and structural elements to be examined:

a) survey status and basic ship information

b) documentation on board

c) main structural plans of cargo and ballast tanks (scantling drawings), including information on use of high tensile steels (HTS), clad steel and stainless steel

d) hull condition evaluation report

e) relevant previous damage and repair history

f) relevant previous survey and inspection reports from both QRS and the Owner

g) information regarding the use of the ship's tanks, typical cargoes and other relevant data

h) details of the inert gas plant and tank cleaning procedures

i) information and other relevant data regarding conversion or modification of the ship's cargo and ballast tanks since the time of construction

j) description and history of the coating and the corrosion prevention system (previous class notations), if any

k) inspections by 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 coating and corrosion prevention system, if any

l) 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

m) any other information that will help identify suspect areas and critical structural areas.

6.1.3 The submitted Survey Program is to account for and comply, as a minimum, with the requirements for close-up surveys, thickness measurements, tank testing and pipe testing and is to include relevant information including at least:

a) basic ship information and particulars

b) main structural plans (scantling drawings), including information on the use of high tensile steels (HTS), clad steel and stainless steel

c) plan of tanks

d) list of tanks with information on their use, corrosion prevention and condition of coating

e) conditions for survey (e.g., information regarding tank cleaning, gas freeing, ventilation, lighting, etc.)

f) provisions and methods for access to structures

g) equipment for surveys

h) nomination of tanks and areas for close-up surveys

i) nomination of sections and areas for thickness measurements

j) nomination of tanks for tank testing, and the pipes that are to undergo pipe testing

k) identification of the thickness measurement firm

l) damage experience related to the ship in question

m) critical structural areas and suspect areas, where relevant.

6.1.4 The survey program is also to include the maximum acceptable structural corrosion diminution levels applicable to the ship. QRS will advise the Owner of this information.

6.2 Survey planning meeting

6.2.1 Proper preparation and close co-operation between the attending surveyor(s) and the Owner's representatives onboard 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 are to be held regularly.

6.2.2 Prior to commencement of any part of the renewal and intermediate survey, a survey planning meeting is to 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 program are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out.

Table 1 : Requirements for close-up survey at class renewal survey of single skin chemical tankers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age ⭘15	Class renewal survey No.4 and subsequent age > 15
One web frame ring: - in a ballast wing tank	All web frame rings: - in a ballast wing tank, or - in a double bottom ballast tank	All web frame rings: - in all ballast tanks - in a cargo wing tank One web frame ring: - in each remaining cargo tank	As class renewal survey for ships between 10 and 15 years of age Additional transverse areas as deemed necessary by QRS
One deck transverse: - in a cargo tank or on deck	One deck transverse: - in each remaining ballast tank or on deck - in a cargo wing tank or on deck - in two cargo centre tanks or on deck		
	Both transverse bulkheads: - in a ballast wing tank	All transverse bulkheads: - in all cargo tanks - in all ballast tanks	
Lower part of one transverse bulkhead: - in a ballast tank - in a cargo wing tank - in a cargo centre tank	Lower part of one transverse bulkhead : - in each remaining ballast tank - in two cargo centre tanks - in a cargo wing tank		

Table 2 : Requirements for close-up survey at class renewal survey of double skin chemical tankers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age ✪15	Class renewal survey No.4 and subsequent age > 15
One web frame ring : - in a ballast double hull tank	All web frame rings : - in a ballast wing tank, or - in a ballast double hull tank The knuckle area and the upper part (3 meters approximately) of one web frame in each remaining ballast tank	All web frame rings: - in all ballast tanks - in a cargo wing tank One web frame ring: - in each remaining cargo tank	As class renewal survey for ships between 10 and 15 years of age Additional transverse areas as deemed necessary by QRS
One deck transverse: - in a cargo tank or on deck	One deck transverse: - in two cargo tanks		
One transverse bulkhead: - in a ballast tank	One transverse bulkhead : - in each ballast tank	All transverse bulkheads: - in all cargo tanks - in all ballast tanks	
One transverse bulkhead: - in a cargo wing tank - in a cargo centre tank	One transverse bulkhead: - in a cargo wing tank - in two cargo centre tanks		

6.2.3 The following is an indicative list of items that are to be addressed in the meeting:

- schedule of the ship (voyage, docking and undocking, periods alongside, cargo and ballast operations)
- provisions and arrangements for thickness measurements
- extent of the thickness measurements
- acceptance criteria (refer to the list of minimum thicknesses)
- extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion
- execution of thickness measurements
- taking representative readings in general and where uneven corrosion/pitting is found
- mapping of areas of substantial corrosion; and
- communication between attending surveyor(s), the thickness measurement firm operator(s) and owner representative(s) concerning findings.

6.3 Scope of survey

6.3.1 In addition to the requirements of annual surveys, the class renewal survey is to include examination, tests and checks of sufficient extent to ensure that the hull and related piping are in satisfactory condition for the new period of class to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

6.3.2 All cargo tanks, ballast tanks, including double bottom tanks, pump rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing] to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

6.3.3 a bottom survey in dry condition is to be a part of the class renewal survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and ballast tanks are to be carried out during this bottom survey in accordance with the applicable requirements for class renewal surveys, if not already performed.

Lower portions of the cargo and ballast tanks are the parts below light ballast water line.

6.3.4 Where provided, the condition of the corrosion prevention system of cargo tanks is to be examined. A ballast tank is to be examined at subsequent annual surveys where:

- a hard protective coating has not been applied from the time of construction, or
- a soft or semi-hard coating has been applied, or
- substantial corrosion is found within the tank, or
- 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 are to be carried out as considered necessary by the Surveyor.

6.3.5 In the case of independent cargo tanks, the survey consists of:

- an external examination of cargo tanks
- an examination of cargo tank supports, chocks, keys and the adjacent hull structure with non-destructive testing if deemed necessary.

6.3.6 The Owner or his representative is to declare to the attending Surveyor that the arrangements in cargo tanks (including coating) related to the transported products are suitable for the purpose.

6.4 Overall and close-up surveys

6.4.1 Each class renewal survey is to include an overall survey of all tanks and all spaces.

6.4.2 The minimum requirements for close-up surveys are given in Table 1 and Table 2.

6.4.3 The survey of stainless steel tanks may be carried out as an overall survey supplemented by close-up survey as deemed necessary by the Surveyor.

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

- where tanks have structural arrangements or details which have suffered defects in similar spaces or on similar ships according to available information
- where tanks have structures approved with reduced scantlings.

6.4.5 For areas in tanks where hard protective coatings are found to be in good condition, the extent of close-up surveys required according to Table 1 and Table 2 may be specially considered.

6.5 Thickness measurements

6.5.1 The minimum requirements for thickness measurements at class renewal survey are given in Table 3. Thickness measurement of stainless-steel hull structure and piping may be waived, except for clad steel plating.

6.5.2 Provisions for extended measurements for areas with substantial corrosion are given in Table 4 and as may be additionally specified in the survey program. These extended thickness measurements are to be carried out before the survey is credited as completed.

Suspect areas identified at previous class renewal surveys are to be examined.

Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken. The

Surveyor may further extend the thickness measurements as deemed necessary.

Table 3 : Requirements for thickness measurements at class renewal survey of chemical tankers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
Suspect areas	Suspect areas	Suspect areas	Suspect areas
	Within the cargo area: • each deck plate • one transverse section	Within the cargo area: • each deck plate • two transverse sections • selected bottom plates • all wind and water strakes	Within the cargo area: • each deck plate • three transverse sections • each bottom plate
	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 1 or Table 2, as applicable	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 1 or Table 2, as applicable	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 1 or Table 2, as applicable
	Selected wind and water strakes outside the cargo area	Selected wind and water strakes outside the cargo area	All wind and water strakes full length

Table 4: Extended thickness measurements at those areas of substantial corrosion Class renewal survey of chemical 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 3 bays across tank, including aft bay Measurements around and under all suction bell mouths	5-point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper structure longitudinals	Minimum of 3 longitudinals in each bay where bottom plating measured	3 measurements in line across the flange and 3 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 3 measurements 2 measurements across face flat where fitted
Bottom floors, including the watertight ones	3 floors in bays where bottom plating measured, with measurements at both ends and middle	5-point pattern over 2 m^2 area
Hopper structure web frame ring	3 floors in bays where bottom plating measured	5-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	• 5-point pattern over 1 m^2 of plating
	• upper 2/3 of bulkhead	• 5-point pattern over 2 m^2 of plating
	• stiffeners (minimum of 3)	• For web, 5-point pattern over span (2 measurements across web at each end and 1 at centre of span). For flange, single measurements at each end and centre of span
Panel stiffening	Where applicable	Single measurements

DECK STRUCTURE		
Structural member	Extent of measurement	Pattern of measurement
Deck plating	2 transverse bands across tank	Minimum of 3 measurements per plate per band
Deck longitudinals	Every third longitudinal in each of 2 bands with a minimum of one longitudinal	3 measurements in line vertically on webs and 2 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 3 measurements 2 measurements across flange 5-point pattern on girder/bulkhead brackets
Deck transverse webs	Minimum of 2 webs, with measurements at both ends and middle of span	5-point pattern over 1 m^2 area Single measurements on flange
Vertical web and transverse bulkhead in wing ballast tank for double hull design (2 meters from deck)	Minimum of 2 webs, and both transverse bulkheads	5-point pattern over 1 m^2 area
Panel stiffening	Where applicable	Single measurements

SIDE SHELL AND LONGITUDINAL BULKHEADS		
Structural member	Extent of measurement	Pattern of measurement
Side shell and longitudinal bulkhead plating: • deckhead and bottom strakes and strakes in way of the horizontal girders • all other strakes	• Plating between each pair of longitudinals in a minimum of 3 bays (along the tank) • Plating between every third pair of longitudinals in same 3 bays	Single measurement
Side shell and longitudinal bulkhead longitudinals on: • deckhead and bottom strakes • all other strakes	• Each longitudinal in same 3 bays • Every third longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
Longitudinals - brackets	Minimum of 3 at top, middle and bottom of tank in same 3 bays	5-point pattern over area of bracket
Vertical web and transverse bulkheads of double side tanks (excluding deck area): • strakes in way of horizontal girders • other strakes	• Minimum of 2 webs and both transverse bulkheads • Minimum of 2 webs and both transverse bulkheads	• 5-point pattern over approximately 2 m^2 area • 2 measurements between each pair of vertical stiffeners
Web frames and cross ties for other tanks than double side tanks	3 webs with minimum of 3 locations on each web, including in way of cross tie connections and lower end bracket	5-point pattern over approximately 2 m^2 area of webs, plus single measurements on flanges of web frame and cross ties
Horizontal girders	Plating on each girder in a minimum of 3 bays	2 measurements between each pair of longitudinal girder stiffeners
Panel stiffening	Where applicable	Single measurements

TRANSVERSE WATERTIGHT AND SWASH BULKHEADS		
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	5-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 3 locations: approximately 1/4, 1/2 and 3/4 width of tank	5-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	5-point pattern over about 1 m^2 of plating
Stiffeners	Minimum of 3 typical stiffeners	For web, 5-point pattern over span between bracket connections (2 measurements across web at each bracket connection and 1 at centre of span). For flange, single measurements at each bracket toe and at centre of span
Brackets	Minimum of 3 at top, middle and bottom of tank	5-point pattern over area of bracket
Horizontal stringers	All stringers with measurements at both ends and middle	5-point pattern over 1 m^2 area, plus single measurements near bracket toes and on flanges
Deep webs and girders	Measurements at toe of bracket and at centre of span	For web, 5 point pattern over about 1 m^2. 3 measurements across face flat

6.5.3 When pitting is found on bottom plating and its intensity is 20% or more, thickness measurements are to be extended in order to determine the actual plate thickness out of the pits and the depth of the pits. Where the wastage is in the substantial corrosion range or the average depth of pitting is 1/3 or more of the actual plate thickness, the pitted plate is to be considered as a substantially corroded area.

6.5.4 For areas in tanks where hard protective coatings are found to be in good condition, the extent of thickness measurements according to Table 3 may be specially considered by QRS.

6.6 Tank testing

6.6.1 The requirements for tank testing at class renewal survey are given in Table 5.

Table 5 : Requirements for tank testing at class renewal survey of chemical tankers

Age of ship (in years at time of class renewal survey)	
Class renewal survey No.1 age 5	Class renewal survey No.2 and subsequent age >5
All ballast tank boundaries	All ballast tank boundaries
Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, pump rooms or cofferdams	All cargo tank bulkheads

6.6.2 Cargo tank testing carried out by the ship's crew under the direction of the Master may be accepted by the Surveyor, provided the following conditions are complied with:

a) a tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the Owner and reviewed by QRS prior to the testing being carried out

b) there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank

c) the tank testing has been satisfactorily carried out within the class renewal survey window, not more than 3 months prior to the date of the survey on which the overall or close-up survey is completed

d) the satisfactory results of the testing is recorded in the ship's logbook

e) the internal and external conditions of the tanks and associated structures are found satisfactory by the Surveyor at the time of the overall and close-up surveys.

6.6.3 The Surveyor may extend the tank testing as deemed necessary.

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

Boundaries of cargo tanks are to be tested to the highest point that liquid will rise under service conditions.

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.

6.7 Cargo piping, cargo pump rooms and cargo tanks

6.7.1 Cargo piping on deck and cargo and ballast piping within tanks are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory. Special attention is to be given to any ballast piping in cargo tanks and cargo piping in ballast tanks and void spaces. Surveyors are to be advised on all occasions when this piping, including valves and fittings, is opened during repair periods and can be examined internally.

The Surveyor may require dismantling and/or thickness measurements of piping. A hydraulic test is to be carried out in the event of repair or dismantling of cargo or ballast piping, or where doubts arise.

Vent line drainage arrangements are to be examined.

6.7.2 It is to be verified that cargo piping and independent cargo tanks, where applicable, are electrically bonded to the hull.

6.7.3 For ships over 10 years of age, selected steel cargo pipes outside cargo tanks, cargo/slop discharge pipes passing through ballast tanks and void spaces and ballast pipes passing through cargo tanks are to be:

- subjected to thickness measurement at random, or selected pipe lengths are to be opened for internal inspection
- pressure tested to the maximum working pressure.

6.7.4 All safety valves on cargo piping and of cargo tanks are to be dismantled for examination, adjusted and, as applicable, resealed.

6.7.5 All cargo pump room boundaries are to be generally examined. All gas-tight shaft sealing devices are to be examined. The bottom of cargo pump rooms is to be presented clean for the examination of stripping devices and gutters.

6.8 Emergency towing arrangement

6.8.1 The survey is to include:

- an examination of the emergency towing arrangement
- confirmation that the arrangement is readily available with aft towing arrangement pre-rigged and forward chafing gear secured to the strong-point
- an examination of the pick-up gear, towing pennant and chafing gear over the full length for possible deterioration. Where the pennant line is stored in a watertight condition and can be confirmed as being maintained, consideration may be given to waiving the requirement to examine the pennant line over the full length
- an examination of the strong-points, fairleads and pedestal roller together with their attachments to the hull structure.

7 Class renewal survey - Cargo machinery items

7.1 Cargo area and cargo pump rooms

7.1.1 Ballast and stripping pumps are to be internally examined and prime movers checked. A working test is to be carried out.

Maintenance records of cargo pumps are to be made available to the Surveyor.

7.1.2 Where a washing system is fitted, piping, pumps, valves and deck-mounted washing machines are to be examined and tested for signs of leakage, and anchoring devices of deck-mounted washing machines are to be checked to the Surveyor's satisfaction.

7.1.3 The satisfactory condition of the cargo heating/cooling system is to be verified and, if deemed necessary by the Surveyor, the system is to be pressure tested.

7.1.4 Spares for cargo area mechanical ventilation fans are to be available on board.

7.1.5 Heat exchangers and anti-sparking fans are to be examined.

7.1.6 An operating test of the remote control of pumps and valves and of automatic closing valves is to be carried out.

7.1.7 A general examination of the electrical equipment and cables in dangerous zones such as cargo pump rooms and areas adjacent to cargo tanks is to be carried out for defective and non-certified safe type electrical equipment, non-approved lighting and fixtures, and improperly installed or defective or dead-end wiring.

The electrical insulation resistance of the electrical equipment and circuits terminating in or passing through the dangerous zones is to be tested; however, in cases where a proper record of testing is maintained, consideration may be given to accepting recent test readings effected by the ship's personnel.

7.2 Fire-fighting systems in cargo area

7.2.1 The survey is to include the examination of fire-fighting systems of any type fitted on board for the protection of the cargo area, cargo pump room and other dangerous spaces, such as deck foam, water-spraying and dry powder systems.

7.3 Inert gas system

7.3.1 If an inert gas system such as that installed on board oil tankers is fitted, the requirements given in Chapter 3 for class renewal survey of oil tankers are to be complied with.

7.4 Personnel protection

7.4.1 The requirements given in Chapter 5 are to be complied with.

Section 5 Liquefied Gas Carriers

1 General

1.1 Application

1.1.1 The requirements of this Section apply after construction to all self-propelled ships which have been assigned one of the following service notations:

- **liquefied gas carrier**
- **liquefied gas carrier - FSRU**
- **liquefied gas carrier - FSU**

1.1.2 The requirements apply to:

- the surveys of installations and equipment related to the carriage and handling of liquefied and revaporised gas when applicable, and
- the surveys of hull structure and related piping systems in way of cargo tanks, pump rooms, compressor rooms, cofferdams, pipe tunnels, void spaces and fuel oil tanks within the cargo area, and
- the surveys of all ballast tanks, and
- when fitted: revaporisation area and area of equipment for non permanent mooring, and for unloading to single buoy.

1.1.3 The requirements contain the minimum extent of examination, thickness measurements and tank testing. When substantial corrosion, and/or structural defects are found, the survey is to be extended and is to include additional close-up surveys when necessary.

1.1.4 In any kind of survey, such as class renewal, intermediate, annual or other surveys having the same scope, thickness measurements, when required by Table 3, of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys.

1.1.5 Consideration may be given by the attending Surveyor to allow use of remote inspection techniques (RIT) as an alternative to close-up survey. Surveys conducted using a RIT are to be completed to the satisfaction of the attending Surveyor.

When RIT is used for a close-up survey, temporary means of access for the corresponding thickness measurements as specified in this section is to be provided unless such RIT is also able to carry out the required thickness measurements.

For surveys conducted by use of a remote inspection technique, one or more of the following means of access, acceptable to the Surveyor, is to be provided:

- unmanned robot arm
- remote operated vehicle (ROV)
- unmanned aerial vehicles/drones
- other means acceptable to QRS.

1.1.6 When, in any survey, thickness measurements are required:

- the procedure detailed in Chapter 1 is to be applied
- the thickness measurement operator is to attend the survey planning meeting held prior to commencing the survey.

2 Annual survey - Hull items

2.1 General

2.1.1 The annual survey of cargo containment and cargo handling systems is preferably carried out during loading or unloading operations. Access to cargo tanks and/or inerted hold spaces is normally not required.

2.1.2 Gas plant operational record (log) entries since the last survey are to be examined in order to check the past performance of the system and to establish whether certain parts have shown any irregularities in operation. The boil-off rate, the hours per day of the reliquefaction plants and the inert gas consumption are also to be considered.

2.1.3 The relevant instruction and information material such as cargo handling plans, filling limit information, cooling down procedures, are to be verified as being onboard.

2.1.4 Examination of the condition of all piping systems

2.2 Weather decks and suspect areas

2.2.1 Examination of flame screens on vents to all bunker tanks.

2.2.2 Examination the cargo, bunker, ballast and vent piping systems, including PRVs, vacuum relief valves, vent masts and protective screens.

2.2.3 Suspect areas identified at previous surveys are to be examined. Thickness measurements are to be taken of the areas of substantial corrosion and the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion, as per the requirements of Table 4.

These extended thickness measurements are to be carried out before the annual survey is credited as completed.

2.3 Cargo handling rooms and piping

2.3.1 The survey is to include:

- examination of cargo pump rooms, compressor rooms and cargo control rooms and, as far as practicable, pipe tunnels if fitted
- examination of the cargo machinery spaces and turret compartments, including their escape routes
- examination of all pump room and compressor room bulkheads for signs of leakage or fractures and, in particular, the sealing arrangements of all penetrations of pump room and compressor room bulkheads
- examination of all accessible gas-tight bulkhead penetrations including gas-tight shaft sealings
- examination of the sealing arrangements for tanks or tank domes penetrating decks or tank covers
- examination of the means for accomplishing gas tightness of the wheelhouse doors and windows. All windows and sidescuttles within the area required to be of the fixed type (non-opening) are to be examined for gas tightness. The closing devices for all air intakes and openings into accommodation spaces, service spaces, machinery spaces, control stations and approved openings in superstructures and deckhouses facing the cargo area or bow and stern loading/unloading arrangements, are to be examined
- examination of cargo and process piping, including the expansion arrangements, insulation from the hull structure, pressure relief and drainage arrangements and water curtain protection as appropriate
- examination of venting systems, including vent masts and protective screens, for cargo tanks, interbarrier spaces, hold spaces, fuel tanks and ballast tanks
- examination of cargo tank and interbarrier space relief valves and associated safety systems and alarms
- confirmation that the certificate for the relief valve opening/closing pressures is on board and that the cargo tank relief valves are sealed
- examination of drip trays or insulation for deck protection against cargo leakage
- confirmation of proper maintenance of arrangements for the airlocks
- confirmation that all accessible cargo piping systems are electrically bonded to the hull
- visual examination of arrangements for burning methane boil-off as far as practicable.

2.4 Other arrangements or devices

2.4.1 The survey is to include:

- confirmation that any liquid and vapour hoses are suitable for their intended purpose and in satisfactory condition and, where appropriate, type-approved or marked with date of testing
- confirmation that any special arrangement made for bow or stern loading/unloading is satisfactory
- confirmation that any special arrangements to survive conditions of damage are satisfactory
- examination, where applicable, of the alternative design and arrangements for the segregation of the cargo area, in accordance with the test, inspection and maintenance requirements, if any, specified in the approved documentation

2.5 Ballast tanks

2.5.1 Ballast tanks are to be internally examined when required as a consequence of the results of the class renewal survey or the intermediate survey.

2.5.2 When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, then the extent of thickness measurements are to be increased to determine the extent of areas of substantial corrosion in accordance with the requirements given in Table 4. These extended thickness measurements are to be carried out before the annual survey is credited as completed.

2.6 Emergency towing arrangement

2.6.1 The Owner or his representative is to declare to the attending Surveyor that no significant alterations have been made, without prior approval from QRS, to the equipment and arrangements fitted on board.

2.6.2 The survey is to include:

- an examination, as far as practicable, of the emergency towing arrangement
- confirmation that the aft towing arrangement is pre-rigged and forward chafing gear is secured to the strong-point
- confirmation of the proper functioning of the light, where it is provided, on the pick-up gear marker buoy.

3 Annual survey - Cargo machinery items

3.1 Cargo area and cargo pump rooms

3.1.1 The survey is to include:

- examination of mechanical ventilation fans in gas-dangerous spaces and zones
- examination, as far as practicable, and confirmation of the satisfactory operation of the arrangements for the artificial ventilation of spaces in the cargo area normally entered during operation
- examination and confirmation of the arrangements for the artificial ventilation of spaces normally entered other than above
- examination, as far as possible during operation, of the cargo handling piping and machinery, e.g. cargo and process piping, cargo heat exchangers, vaporizers, pumps, compressors and hoses.
- confirmation that fixed and/or portable ventilation arrangements provided for spaces not normally entered are satisfactory
- confirmation that the manually operated ESD (emergency shutdown) system together with the automatic shutdown of the cargo pumps and compressors are satisfactory
- examination of the gas detection safety arrangements for cargo control rooms and of the measures taken to exclude ignition sources when such spaces are classified as hazardous areas
- examination of cargo (if accessible), bilge, ballast and stripping pumps for excessive gland seal leakage
- confirmation that electrical equipment in hazardous areas is in satisfactory condition and has been properly maintained
- examination, as far as possible, of arrangements for the use of cargo as fuel, and associated instrumentation and safety devices.
- confirmation that, if fitted, cargo reliquefaction or refrigeration equipment is in satisfactory condition
- confirmation that relevant instruction and information material such as cargo handling plans, filling limit information, cooling down procedures, etc., is available on board.

3.2 Instrumentation and safety devices

3.2.1 The survey is to include:

- confirmation that installed pressure gauges on cargo discharge lines are operational
- confirmation that cargo tank liquid level gauges are operational and that high level alarms as well as automatic shut-off systems are satisfactory
- confirmation that the temperature indicating equipment of the cargo containment system and associated alarms are satisfactory
- examination of the logbooks for confirmation that the emergency shutdown system has been tested
- confirmation that cargo tank, hold and insulation space pressure gauging systems and associated alarms are satisfactory
- examination, and testing as appropriate, of fixed gas detection equipment
- examination of the arrangements for the cargo pressure / temperature control including, when fitted, the thermal oxidation systems and any refrigeration system and confirming that any associated safety measures and alarms are satisfactory
- confirmation of the availability and suitability of the portable gas detection equipment and instruments for measuring oxygen levels

3.3 Fire-fighting systems in cargo area

3.3.1 The survey is to include:

- examination of fire-fighting systems of any type fitted on board for the protection of the cargo area, cargo pump room, cargo compressor room and other dangerous spaces, such as deck foam, water-spraying and dry powder systems, as applicable in accordance with the relevant requirements, including testing of the remote means of starting one main fire pump
- examination of the fixed fire-fighting system for the enclosed cargo machinery spaces, and the enclosed cargo motor room within the cargo area, and confirmation that its means of operation is clearly marked
- examination of the appropriate fire-extinguishing system for the enclosed cargo machinery spaces for ships that are dedicated to the carriage of a restricted number of cargoes and the internal water spray system for the turret compartments and confirmation that their means of operation is clearly marked.

3.4 Environmental control for cargo containment systems

3.4.1 The survey is to include:

- the examinations and tests as provided for the annual survey of inert gas systems of oil tankers
- confirmation that the use of inert gas has not increased beyond that needed to compensate for normal losses by examining records of inert gas usage
- confirmation that arrangements are made for sufficient inert gas to be carried to compensate for normal losses and that means are provided for monitoring the spaces
- confirmation that the means for prevention of backflow of cargo vapour to gas-safe spaces are in satisfactory operating condition
- confirmation that any air drying system and any interbarrier and hold space purging inert gas system are satisfactory
- for membrane containment systems normal operation of the nitrogen control system for insulation and interbarrier spaces shall be confirmed to the Surveyor by the Master.

4 Intermediate survey - Hull items

4.1 General

4.1.1 A survey planning meeting is to be held prior to the commencement of the survey.

4.2 Weather decks, cargo handling rooms and piping

4.2.1 The survey is to include:

- examination, as far as applicable, of cargo and process, liquid nitrogen (if any), ballast, stripping and vent piping systems as well as vent masts and headers. If upon examination there is any doubt as to the condition of the piping, pressure testing, thickness measurement or both may be required
- examination of vent line drainage arrangements
- confirmation that cargo pipes and independent cargo tanks, where applicable, are electrically bonded to the hull.

4.3 Ballast tanks

4.3.1 The requirements for survey of ballast tanks given in Table 1 are to be complied with.

4.3.2 For ships having independent tanks of type C, with a midship section similar to that of a general cargo ship, the extent of close-up surveys may be specially considered by QRS.

Table 1 : Intermediate survey of ballast tanks for liquefied gas carriers

Age of ship (in years at time of intermediate survey)		
5 < age 10	10 < age 15	age > 15
Overall survey of representative ballast tanks, selected by the attending Surveyor	Overall survey of all ballast tanks	Overall survey of all ballast tanks
	Close-up survey of: - all web frames and both transverse bulkheads in a representative ballast tank - the upper part of one web frame in another representative ballast tank - one transverse bulkhead in another representative ballast tank	Close-up survey of all web frames and both transverse bulkheads in two representative ballast tanks

5 Intermediate survey - Cargo machinery items

5.1 General

5.1.1 The aim of the intermediate survey is to supplement the annual survey by testing cargo handling installations with related automatic control, alarm and safety systems for correct functioning.

5.1.2 The intermediate survey is preferably to be carried out with the ship in a gas-free condition. In fact, the extent of the testing required for the intermediate survey will normally be such that the survey cannot be carried out during a loading or discharging operation.

5.2 Cargo area and cargo pump rooms

5.2.1 Electrical equipment and cables in hazardous areas and zones such as cargo machinery spaces and areas adjacent to and above cargo tanks are to be examined for defective equipment, fixtures and cables as far as practicable and tested with particular regard to:

- protective earthing (spot check)
- integrity of enclosures
- damage of outer sheath of cables
- function test of pressurised equipment and associated alarms
- test of systems for de-energising non-certified safe electrical equipment located in spaces protected by air-locks, such as electric motor rooms, cargo control rooms, etc.

5.2.2 The electrical insulation resistance of the electrical equipment and circuits in dangerous zones is to be measured. These measurements are only to be effected when the ship is in a gas-free or inerted condition. Where a proper record of testing is maintained, consideration may be given to accepting recent readings by the ship’s personnel.

5.2.3 The survey also consists of:

- confirmation that the cargo heating/cooling system is in satisfactory condition
- confirmation that spares are provided for cargo area mechanical ventilation fans
- confirmation that the heating system of the hull structure is in satisfactory working condition
- general examination and test of leakage detection systems in interbarrier and hold spaces.

5.3 Instrumentation and safety devices

5.3.1 The survey is to include:

- examination of the installed pressure gauging systems on cargo discharge lines, cargo tanks, holds and insulation spaces and associated alarms
- examination of the cargo tank liquid level gauges and high level alarms as well as automatic shut-off systems
- examination of the temperature indicating equipment of the cargo containment system and associated alarms
- test of the above-mentioned instrumentation by changing pressure, level and temperature as applicable and comparing with test instruments. Simulated tests may be accepted for sensors which are not accessible or located within cargo tanks or inerted hold spaces. The test is to include alarm and safety functions
- examination, as far as practicable, of the piping of the gas detection system for corrosion and damage. The integrity of the suction lines between suction points and analysing units is to be verified as far as possible
- calibration of gas detectors or verification thereof with sample gases
- confirmation that two sets of portable gas detection equipment suitable for the cargoes to be carried and a suitable instrument for measuring oxygen levels are provided
- test of the manually operated emergency shutdown system (without flow in the pipelines) to verify that the system will cause the cargo pumps and compressors to stop.

5.3.2 The arrangements for the use of cargo as fuel are to be examined, when applicable. It is to be tested, as far as practicable, that the gas supply to the machinery space is cut-off should the exhaust ventilation not be functioning correctly and that master gas fuel valve may be remotely closed from within the machinery space.

The instrumentation and safety systems for burning cargo as fuel are to be examined.

5.4 Inert gas system

5.4.1 If an inert gas system such as that installed on board oil tankers is fitted, the requirements for intermediate survey of oil tankers are to be complied with.

5.4.2 In the case of low temperature liquid nitrogen storage, the plant and its associated arrangements for protecting the hull structure against liquid nitrogen leakage are to be examined.

5.5 Personnel protection

5.5.1 The survey is to include:

- confirmation that two complete sets of safety equipment each permitting personnel to enter and work in a gas-filled space are provided and properly stowed
- confirmation that the requisite supply of compressed air is provided and examination, when applicable, of the arrangements for any special air compressor and low-pressure air line system
- confirmation that the medical first-aid equipment, including stretchers and oxygen resuscitation equipment and antidotes, when available, for the products to be carried are provided
- confirmation that respiratory and eye protection suitable for emergency escape purposes are provided
- confirmation that decontamination arrangements and eyewashes are operational
- examination, when applicable, of the arrangements to protect personnel against the effects of a major cargo release by a special suitably designed and equipped space within the accommodation spaces.

6 Class renewal survey - Hull items

6.1 Preparation for survey

6.1.1 The Owner is to provide the necessary facilities for a safe and practical execution of the surveys, including the means of providing access to structures for close-up survey, thickness measurements and tank testing. All other provisions regarding procedures for thickness measurements, conditions for survey, access to structures, equipment for survey and survey at sea or at anchorage, respectively, are also to be complied with.

6.2 Survey program

6.2.1 A specific survey program is recommended to be worked out in advance of the class renewal survey by the Owner in cooperation with QRS.

6.2.2 The survey program is recommended to include conditions for survey, access to structures and equipment for surveys, taking into account the minimum requirements of Table 2 and Table 3 for close-up survey and thickness measurements, and tank testing.

6.3 Scope of survey

6.3.1 A survey planning meeting is to be held prior to the commencement of the survey.

6.3.2 In addition to the requirements of annual surveys, the class renewal survey is to include examination, tests and checks of sufficient extent to ensure that the hull and related piping, are in satisfactory condition and fit for the intended purpose for the new period of class to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

6.3.3 Ballast tanks, including double bottom tanks, pump rooms, compressor rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing, to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

6.3.4 All piping systems within the above spaces, are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory.

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

6.3.6 A bottom survey in dry condition is to be a part of the class renewal survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and water ballast tanks are to be carried out in accordance with the applicable requirements for class renewal surveys, if not already performed.

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

6.3.7 Where provided, the condition of the corrosion prevention system of ballast tanks is to be examined.

For ballast tanks, excluding double bottom tanks, where a hard protective coating is found in poor condition and it is not renewed, where soft or semi-hard coating has been applied, or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined at annual intervals. Thickness measurements are to be carried out as deemed necessary by the Surveyor.

When such breakdown of hard protective coating is found in double bottom ballast tanks and it is not renewed, 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 may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

6.3.8 Where the hard protective coating in ballast tanks is found to be in a good condition, the extent of close-up surveys and thickness measurements may be specially considered.

Table 2: Requirements for close-up survey of ballast tanks at class renewal survey of liquefied gas carriers

Age of ship (in years at time of class renewal survey)		
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 and subsequent age > 10
One web frame in a representative ballast tank of the topside, hopper side and double hull side type	All web frames in a ballast tank, which is to be a double hull side tank or a topside tank. If such tanks are not fitted, another ballast tank is to be selected	All web frames in all ballast tanks
	One web frame in each remaining ballast tank	
One transverse bulkhead, in a ballast tank	One transverse bulkhead in each ballast tank	All transverse bulkheads in all ballast tanks

6.4 Overall and close-up surveys

6.4.1 An overall survey of all tanks and spaces, excluding fuel oil, lube oil and fresh water tanks, is to be carried out at each class renewal survey. However, for fuel oil, lube oil and fresh water tanks, the requirements given in Chapter 2 are to be complied with.

6.4.2 Each class renewal survey is to include a close-up examination of sufficient extent to establish the condition of cargo tanks and ballast tanks.

6.4.3 The Surveyor may extend the close-up survey as deemed necessary, considering the maintenance of the tanks under survey, the condition of the corrosion prevention system and also in the following cases:

- in particular, in tanks having structural arrangements or details which have suffered defects in similar tanks, or on similar ships according to available information
- in tanks having structures approved with reduced scantlings.

6.4.4 For areas in tanks where hard protective coatings are found to be in good condition, the extent of close-up surveys required according to Table 2 may be specially considered by QRS.

For ships having independent tanks of type C, with a midship section similar to that of a general cargo ship, the extent of close- up surveys of ballast tanks may be specially considered by QRS.

6.5 Thickness measurements

6.5.1 The minimum requirements for thickness measurements at class renewal survey are given in Table 3.

6.5.2 The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion in accordance with the requirements given in Table 4.

6.5.3 For areas in tanks where hard protective coatings are found to be in good condition, the extent of thickness measurements according to Table 3 may be specially considered by QRS.

6.5.4 For ships having independent tanks of type C, with a midship section similar to that of a general cargo ship, the extent of thickness measurements may be increased to the tank top plating to the satisfaction of the Surveyor.

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

Table 3 : Requirements for thickness measurements at class renewal survey of liquefied gas carriers

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
Suspect areas	Suspect areas	Suspect areas	Suspect areas
One section of deck plating for the full beam of the ship within 0,5 L amidships in way of a ballast tank, if any	Within the cargo area: • each deck plate • one transverse section within 0,5 L amidships in way of a ballast tank, if any	Within the cargo area: • each deck plate • two transverse sections • all wind and water strakes	Within the cargo area: • each deck plate • three transverse sections • each bottom plate • duct keel plating and internals
Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 2	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 2	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 2	Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 2
	Selected wind and water strakes outside the cargo area	Selected wind and water strakes outside the cargo area	All wind and water strakes full length

Table 4 : Requirements for extent of thickness measurements at those areas of substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
Plating	Suspect area and adjacent plates	5-point pattern over 1 m^2 of plating
Stiffeners	Suspect area	3 measurements each in line across web and flange

6.6 Tank testing

6.6.1 All boundaries of ballast tanks and deep tanks used for water ballast within the cargo area are to be pressure tested. For fuel oil tanks, the representative tanks are to be pressure tested.

6.6.2 The Surveyor may extend the tank testing as deemed necessary.

6.6.3 Tank testing of fuel oil tanks is to be carried out 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.

6.7 Cargo tank structure

6.7.1 All cargo tanks are to be cleaned and examined internally.

6.7.2 When accessible, the outer surface of uninsulated cargo tanks or the outer surface of cargo tank insulation together with any vapour or protective barrier is to be examined. Special attention is to be given to the tank and insulation in way of chocks, supports and keys. Removal of insulation, in part or entirely, may be required in order to verify the condition of the tank or the insulation itself if deemed necessary by the Surveyor.

Where the arrangement is such that the insulation cannot be examined entirely, the surrounding structures of wing tanks, double bottom tanks and cofferdams are to be examined for cold spots when the cargo tanks are in the cold condition, unless voyage records together with the instrumentation give sufficient evidence of the integrity of the insulation system.

6.7.3 Thickness measurements may be required if deemed necessary by the Surveyor.

Close-up surveys are to be carried out in independent cargo tanks of type B and C at those areas where corrosion may develop.

6.7.4 Non-destructive testing is to supplement cargo tank inspection with special attention to be given to the integrity of the main structural members, tank shell and highly stressed parts, including welded connections as deemed necessary by the Surveyor.

However, for type C tanks, this does not mean that non-destructive testing can be dispensed with totally. The

following items are, inter alia, considered highly stressed areas:

- cargo tank supports and anti-rolling or anti-pitching devices
- web frames or stiffening rings
- Y-connection of shell plates and longitudinal bulkhead of bilobe tanks
- swash bulkhead boundaries
- dome and stump connections to the shell plating
- foundations for pumps, towers, ladders, etc.
- pipe connections.

6.7.5 For independent tanks of type B, the extent of non-destructive testing is to be as given in a program specially prepared for the cargo tank design.

6.7.6 The tightness of all cargo tanks is to be verified by an appropriate procedure. Provided that the effectiveness of the ship's gas detection equipment has been confirmed, it will be acceptable to utilise this equipment for the tightness test of independent tanks below deck.

6.7.7 As far as accessible, hold spaces and hull insulation (if provided), secondary barriers and tank supporting structures are to be visually examined. The secondary barrier of tanks is to be checked for its effectiveness by means of a pressure/vacuum test, a visual examination or any other acceptable method.

6.7.8 For membrane, semi-membrane and internal insulation tank systems, inspection and testing are to be carried out in accordance with programmes specially prepared in accordance with an approved method for the actual tank system.

For membrane containment systems, a tightness test of the primary and secondary barriers shall be carried out in accordance with the system designers' procedures and acceptance criteria as approved by QRS. Low differential pressure tests may be used for monitoring the cargo containment system performance, but they are not considered as an acceptable test for the tightness of the secondary barrier.

For membrane containment systems with glued secondary barriers, if the designer's threshold values are exceeded, an investigation is to be carried out and additional testing such as thermographic or acoustic emission testing should be carried out.

6.7.9 All gas-tight bulkheads are to be examined and the effectiveness of gas-tight shaft sealing is to be verified.

6.7.10 It is to be verified that independent cargo tanks are electrically bonded to the hull.

6.7.11 The pressure relief valves for the cargo tanks are to be opened for examination, adjusted, function tested and sealed. If the cargo tanks are equipped with relief valves with non-metallic membranes in the main or pilot valves, these non-metallic membranes are to be replaced. Where a proper record of continuous overhaul and re-testing of individually identifiable relief valves is maintained, consideration may be given to acceptance on the basis of opening, internal examination and testing of a representative sample of valves, including each size and type of liquefied gas or vapour relief valves in use, provided there is evidence in the log-book that the remaining valves have been overhauled and tested since crediting of the previous class renewal survey.

6.8 Weather decks, cargo handling rooms and piping

6.8.1 Piping for cargo and process, liquid nitrogen (if any), ballast, stripping and venting systems is to be examined to the Surveyor's satisfaction and opened as deemed necessary. Insulation is to be removed as deemed necessary to ascertain the condition of the pipes. If the visual examination raises doubts as to the integrity of the pipelines, a pressure test at 1,25 times the MARVS for the pipeline is to be carried out. After reassembly the complete piping systems are to be tested for leaks.

It is to be verified that cargo piping systems are electrically bonded to the hull.

6.8.2 The pressure relief valves on cargo piping are to be function tested. A random selection of valves is to be opened for examination and adjusted.

6.8.3 All cargo pump room, compressor room and control room boundaries are to be generally examined. Gas-tight shaft sealing devices are to be examined. The bottom of cargo pump rooms and cargo compressor rooms is to be presented clean for the examination of stripping devices and gutters.

6.8.4 Pressure/vacuum relief valves, rupture discs and other pressure relief devices for interbarrier spaces and/or hold spaces are to be examined and, if necessary, opened and tested in accordance with their design.

Vent line drainage arrangements are to be examined.

6.9 Emergency towing arrangement

6.9.1 The survey is to include:

- an examination of the emergency towing arrangement
- confirmation that the arrangement is readily available with aft towing arrangement pre-rigged and forward chafing gear secured to the strong-point
- an examination of the pick-up gear, towing pennant and chafing gear over the full length for possible deterioration. Where the pennant line is stored in a watertight condition and can be confirmed as being maintained, consideration may be given to waiving the requirement to examine the pennant line over the full length
- an examination of the strong-points, fairleads and pedestal roller together with their attachments to the hull structure.

7 Class renewal survey - Cargo machinery items

7.1 Cargo area, cargo pump rooms, cargo compressor rooms

7.1.1 Ballast and stripping pumps are to be internally examined and prime movers checked. A working test is to be carried out. Maintenance records of cargo pumps are to be made available to the Surveyor.

7.1.2 Electrical equipment and cables in dangerous zones such as cargo pump rooms, cargo compressor rooms and spaces adjacent to and areas above cargo tanks are to be examined as far as practicable and tested with particular regard to:

- protecting earthing (spot check)
- integrity of enclosures
- damage of outer sheath of cables
- function testing of pressurised equipment and associated alarms
- testing of systems for de-energising non-certified safe electrical equipment located in spaces protected by air-locks, such as electric motor rooms, cargo control rooms, etc.

7.1.3 The electrical insulation resistance of the electrical equipment and circuits in dangerous zones is to be measured. These measurements are only to be effected when the ship is in a gas-free or inerted condition. Where a proper record of testing is maintained, consideration may be given to accepting recent readings by the ship's personnel.

7.1.4 When there is a reliquefaction or refrigeration plant, and/or arrangements for the use of cargo as fuel, the corresponding machinery and equipment, such as cargo pumps, compressors, heat exchangers, condensers and process pressure vessels, are to be surveyed to the same extent as required for similar equipment on board oil tankers at the class renewal survey.

7.1.5 The survey also consists of:

- confirmation that spares are provided for cargo area mechanical ventilation fans
- confirmation that the installation for heating the hull structure is in satisfactory working condition
- general examination and testing of leakage detection systems in interbarrier spaces and hold spaces
- examination of gas detection piping system for corrosion or damage; checking, as far as possible, of the integrity of suction lines between suction points and analysing units
- examination and tests of systems for the removal of water from interbarrier spaces and hold spaces
- examination of portable equipment, such as hoses and spool pieces used for segregation of piping systems for cargo, inert gas and bilge pumping.

7.2 Fire-fighting systems in cargo area

7.2.1 The survey is to include the examination of fire-fighting systems of any type fitted on board for the protection of the cargo area, cargo pump room, cargo compressor room and other dangerous spaces, such as deck foam, water-spraying, dry powder systems etc., as applicable.

7.3 Inert gas system

7.3.1 If an inert gas system such as that installed on board oil tankers is fitted, the requirements given in Chapter 3 are to be complied with.

7.3.2 In the case of low temperature liquid nitrogen storage, the plant and its associated arrangements for protecting the hull structure against liquid nitrogen leakage are to be examined.

7.4 Personnel protection

7.4.1 The requirements given in Chapter 5 are to be complied with.

8 First loaded voyage of ships carrying liquefied natural gases (LNG) in bulk

8.1

8.1.1 The survey requirements for the examination before and after the first loaded voyage for ships assigned with the service notation **liquefied gas carrier**, carrying liquefied natural gases (LNG) in bulk are to be carried out.

Section 6 Ro-Ro Cargo Ships and Pure Car and/or Truck Carriers

1 General

1.1

1.1.1 The requirements of this Section are applicable after construction to all self-propelled ships which have been assigned one of the following service notations:

- **ro-ro cargo ship**
- **PCTC**
- **PCC**

2 Ro-ro cargo ships and pure car and/or truck carriers - Annual survey

2.1 Shell and inner doors

2.1.1 The requirements of this item apply to all shell and inner doors fitted on these ships.

2.1.2 For the scope of survey of shell and inner doors, the following definitions are applicable:

- Securing device: a device used to keep the door closed by preventing it from rotating about its hinges
- Supporting device: a device used to transmit external or internal loads from the door to a securing device and from the securing device to the ship's structure, or a device other than a securing device, such as a hinge, stopper or other fixed device, that transmits loads from the door to the ship's structure
- Locking device: a device that locks a securing device in the closed position.

2.1.3 It is to be checked that the operating procedures for closing the shell and inner doors are kept on board and posted at appropriate places.

When required, the Operating and Maintenance Manual is also to be checked for the verification of its approval and of any modification, reported repairs and proper endorsement by operating personnel.

Confirmation is to be obtained that no unapproved changes have been made to the bow, inner, side shell and stern doors since the last survey.

2.1.4 The structural arrangements as well as welding are to be examined, including:

- plating, primary structure and secondary stiffeners
- hinging arms, hinges and bearings, thrust bearings
- hull and door side supports of securing, supporting and locking devices
- shell plating surrounding the openings and the securing, supporting and locking devices.

Clearances of hinges, bearings and thrust bearings are to be taken, where no dismantling is required. Where the function test is not satisfactory, dismantling may be required to measure the clearances. If dismantling is carried out, a visual examination of hinge pins and bearings together with NDT of the hinge pin is to be carried out. Clearances of securing, supporting and locking devices are to be measured, where indicated in the OMM.

2.1.5 A close-up survey of securing, supporting and locking devices as listed below, including welding, is to be carried out:

- cylinder securing pins, supporting brackets, back-up brackets (where fitted) and their welded connections
- hinge pins, supporting brackets, back-up brackets (where fitted) and their welded connections
- locking hooks, securing pins, supporting brackets, back-up brackets (where fitted) and their welded connections
- locking pins, supporting brackets, back-up brackets (where fitted) and their welded connections
- locating and stopper devices and their welded connections.

2.1.6 A close visual inspection of sealing arrangements (packing material, rubber gaskets, packing retaining bars or channels) is to be carried out. For the tightness hose test.

2.1.7 The drainage arrangements including bilge wells, drain pipes and non-return valves are to be visually examined; confirmation that the provision of means to prevent blockage of drainage arrangements, for closed vehicle and ro-ro spaces and special category spaces where fixed pressure water-spraying systems are used, are satisfactory. A test of the bilge system between the inner and outer doors and that of the vehicle deck is to be carried out.

2.1.8 Function tests are to be carried out as follows, according to the required and/or existing equipment on board:

a) doors are to be examined during a complete opening and closing operation; during this operation, the proper working of hinging arms and hinges, proper engagement of the thrust bearings and proper working of devices for locking the door in open position are to be checked

b) securing, supporting and locking devices are to be examined during a complete opening and closing operation; the following items are to be checked:
   - opening/closing system and securing/locking devices are interlocked in such a way that they can only operate in proper sequence
   - mechanical lock of the securing devices
   - the securing devices remain locked in the event of loss of hydraulic fluid, if they are of hydraulic type

c) indicators of open/closed position of doors and of securing/locking devices at navigation bridge and other remote control stations are to be checked; other safety devices such as isolation of securing/locking hydraulic system from other hydraulic systems, access to operating panels, notice plates and warning indicator lights are to be checked

d) a tightness hose test or equivalent of sealing arrangements is to be carried out

e) a working test of the indicator system is to be carried out, including checking of:
   - visual indicators and audible alarms on the navigation bridge and operating panel
   - lamp test function, fail safe performance, power supply for indicator system
   - proper condition of sensors and their protection from water, ice formation and mechanical damage
   - confirmation that power supply for indicator system is supplied by the emergency source or other secure power supply and is independent of the power supply for operating the doors

f) a working test of the water leakage detection system for inner doors and for the area between the bow door and the inner door (as applicable) is to be carried out and the proper function of audible alarms on the navigation bridge and the engine control room panel (as applicable) is to be ascertained

g) the television surveillance system is to be verified with proper indication on the navigation bridge and engine control room monitors

h) electrical equipment for opening, closing and securing the doors is to be examined.

2.1.9 Non-destructive tests and/or thickness measurements may be required by the Surveyor after visual examination and function test or in cases where cracks or deformations have been found.

2.2 Internal platforms and ramps

2.2.1 The annual survey of internal movable platforms and ramps (excluding those considered as inner doors and covered in [2.1]) and related equipment consists of:

- a general examination of the installation, particular attention being paid to the condition of steel cables
- confirmation of the proper operation of platforms/ramps and of mechanical stops and locks
- checking, as far as practicable, of the alarms and safety devices.

2.3 Fire protection, detection and extinction

2.3.1 Within the scope of survey of fire protection, detection and extinction arrangements as required for the annual survey of all ships in Chapter 2, attention is to be given to the particular arrangements related to ro-ro cargo spaces, such as:

- fire detection systems and alarms
- fixed fire-extinguishing arrangements (gas, water-spraying or foam systems)
- means of control provided for closing various openings
- portable fire extinguishers in spaces and at entrances
- ventilation and related safety devices (including remote control on the bridge)
- electrical equipment of a safe type
- examination of the fire protection arrangements in cargo, vehicle and ro-ro spaces, including the fire safety arrangements for vehicle carriers carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo, as applicable, and
- examination and test of the portable gas detectors suitable for the detection of the gas fuel, for vehicle carriers carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo.

3 Ro-ro cargo ships and pure car and/or truck carriers - Class renewal survey

3.1 Shell and inner doors

3.1.1 The class renewal survey is to include, in addition to the requirements of the annual survey as required in [2], examination, tests and checks of sufficient extent to verify that the bow, inner, side shell and stern doors are in satisfactory condition and considered able to remain in compliance with the applicable requirements, subject to proper maintenance and operation in accordance with the Operation and Maintenance Manual (OMM) or the manufacturer's recommendations and the periodical surveys being carried out at the due dates for the five-year period until the next class renewal survey.

3.1.2 The examinations of the doors are to be supplemented by thickness measurements and testing to verify compliance with the applicable requirements so that the structural and weathertight integrity remains effective. The aim of the examination is to identify corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

3.1.3 A close visual inspection of structural arrangements is to be carried out, supplemented by non-destructive tests and/or thickness measurements, as deemed necessary by the Surveyor.

3.1.4 A survey of the items listed in [2.1.4] and [2.1.5], including close-up survey of securing, supporting and locking devices, together with welding, is to be carried out.

Non-destructive testing and thickness measurements are to be carried out on securing, supporting and locking devices, including welding, to the extent considered necessary by the Surveyor. Whenever a crack is found, an examination with NDT is to be carried out in the surrounding area and for similar items, as considered necessary by the Surveyor.

3.1.5 Clearances of hinges, bearings and thrust bearings are to be taken. Unless otherwise specified in the OMM or by the manufacturer's recommendation, the measurement of clearances on ro-ro cargo ships may be limited to representative bearings where dismantling is needed in order to measure the clearances.

If dismantling is carried out, a visual examination of hinge pins and bearings together with NDT of the hinge pins are to be carried out.

3.1.6 Non-return valves of drainage arrangements are to be checked after dismantling.

3.1.7 The maximum thickness diminution of hinging arms, securing, supporting and locking devices is to be treated according to the normal procedure for primary structures, but is not to be more than 15% of the as-built thickness or the maximum corrosion allowance of QRS, whichever is less. Certain designs may be subject to QRS's special consideration.

3.1.8 Checking the effectiveness of sealing arrangements by hose testing or equivalent is to be carried out.

3.2 Internal platforms and ramps

3.2.1 The condition of pulleys, axles, cables and structure of the platforms and ramps is to be checked.

Electric motors and/or hydraulically operated equipment are to be surveyed according to the scope detailed in Chapter 2 for the class renewal survey of machinery installations.

3.3 Fire protection, detection and extinction

3.3.1 Within the scope of survey of fire protection, detection and extinction arrangements as required for the class renewal survey of all ships in Chapter 2, attention is to be given to the arrangements related to ro-ro cargo spaces.

Section 7 General Cargo Ships

1 General

1.1 Application

1.1.1 The requirements of this Section apply to all self-propelled ships which have been assigned the service notation **general cargo ship** or **bulk carrier** (without the **ESP** additional service feature) of 500 GT and above carrying solid cargoes other than dedicated wood chip carriers and dedicated cement carriers.

The requirements of this Section do not apply to general dry cargo ships of double side-skin construction, with double side-skin extending for the length of the cargo area, and over the height of the cargo hold to the upper deck.

In case of ships with hybrid cargo hold arrangements, e.g. with some cargo holds of single-side skin and others of double-side skin, the requirements of this Section are to be applied only to the structure in way of the single-side skin cargo hold region.

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

1.1.3 The requirements contain the minimum extent of examination, thickness measurements and tank testing.

When substantial corrosion and/or structural defects are found, the survey is to be extended and is to include additional close-up surveys when necessary.

1.1.4 In any kind of survey, such as class renewal, intermediate, annual or other surveys having the same scope, thickness measurements, when required by Table 5, of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys.

1.1.5 Consideration may be given by the attending Surveyor to allow use of Remote Inspection Techniques (RIT) as an alternative to close-up survey. Surveys conducted using a RIT are to be completed to the satisfaction of the attending Surveyor.

When RIT is used for a close-up survey, temporary means of access for the corresponding thickness measurements as specified in this section is to be provided unless such RIT is also able to carry out the required thickness measurements.

For surveys conducted by use of a remote inspection technique, one or more of the following means of access, acceptable to the Surveyor, is to be provided:

- unmanned robot arm
- remote operated vehicle (ROV)
- unmanned aerial vehicles/drones
- other means acceptable to QRS.

1.1.6 When, in any survey, thickness measurements are required, the procedure detailed in Chapter 1 is to be applied.

1.2 Reporting and evaluation of surveys

1.2.1 A hull condition evaluation report (summarizing the results of the class renewal surveys) is issued by QRS to the Owner, who is to place it on board the ship for reference at future surveys. The hull condition evaluation report is endorsed by QRS.

2 Annual survey

2.1 General

2.1.1 Suspect areas identified at previous surveys are to be examined. Thickness measurements are to be taken of the areas of substantial corrosion and the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion, as per the requirements of Table 6. These extended thickness measurements are to be carried out before the annual survey is credited as completed.

2.1.2 For ships granted with the additional class notation **OPEN-HATCH**:

- confirmation that the operability and condition of the hold dewatering systems and freeing ports, if they are fitted, have been checked by the crew on a monthly basis and recorded in the ship's log book for annual verification by QRS
- examination of the water-spray system for open-top cargo holds in accordance with the relevant requirements given in Chapter 2.

2.2 Hatch covers and coamings

2.2.1 The annual survey of hatch covers is to be carried out.

In addition to these requirements, a close-up survey of hatch cover and hatch coaming plating and its stiffeners is to be carried out.

2.3 Cargo holds

2.3.1 The requirements given in Table 1 are to be complied with.

2.3.2 Where this level of survey reveals the need for remedial measures, the survey is to be extended to include a close-up survey of all the shell frames and adjacent shell plating of those cargo holds and associated cargo spaces as well as a close-up survey of sufficient extent of all remaining cargo holds. Where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, then the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. Where protective coating in cargo holds is found in good condition, the extent of close-up survey may be reduced.

Table 1 : Annual survey of cargo holds for general cargo ships

Age of ship (in years at time of annual survey)	
10 < age 15	age > 15
Overall survey of one forward and one after cargo hold and their associated 'tweendeck spaces	Overall survey of all cargo holds and 'tweendeck spaces Close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately the lower one third length of side frame at side shell and side frame end attachment and the adjacent shell plating in a forward lower cargo hold and one other selected lower cargo hold Examination of all piping and penetrations, including overboard piping, in all cargo holds

2.4 Ballast tanks

2.4.1 Ballast tanks are to be internally examined at class renewal survey or the intermediate survey.

2.4.2 When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, then the extent of thickness measurements are to be increased to determine the extent of areas of substantial corrosion, in accordance with Table 6. These extended thickness measurements are to be carried out before the annual survey is credited as completed.

3 Intermediate survey

3.1 General

3.1.1 A survey planning meeting is to be held prior to the commencement of the survey.

3.2 Ships 15 years of age or less

3.2.1 The requirements for survey of cargo holds given in Table 2 are to be complied with.

3.2.2 Where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate substantial corrosion, extent of thickness measurements is to be increased in accordance with Table 6.

3.2.3 The requirements for survey of ballast tanks given in Table 3 are to be complied with.

Table 2 : Intermediate survey of cargo holds for general cargo ships

Age of ship (in years at time of intermediate survey)	
5 < age 10	10 < age 15
Overall survey of one forward and one after cargo hold and their associated 'tweendeck spaces Areas found suspect at the previous surveys are to be surveyed	Overall survey of all cargo holds and 'tweendeck spaces Areas found suspect at the previous surveys are to be surveyed

Table 3 : Intermediate survey of ballast tanks for general cargo ships

Age of ship (in years at time of intermediate survey)	
5 < age 10	10 < age 15
Overall survey of representative ballast tanks selected by the Surveyor	Overall survey of all ballast tanks
Areas found suspect at the previous surveys are to be surveyed again	Areas found suspect at the previous surveys are to be surveyed again

3.3 Ships over 15 years of age

3.3.1 The scope of the intermediate survey of ships over 15 years of age is the scope of the preceding class renewal survey of hull, except for thickness measurements of each bottom plate within the cargo length area, and with bottom survey in dry condition or bottom in water-survey as applicable.

However, tank testing, survey of automatic air pipe heads and internal examination of fuel oil, lube oil and fresh water tanks are not required unless deemed necessary by the attending surveyor.

This intermediate survey may be commenced at the second annual survey of the class period and be progressed during the succeeding year with a view to completion at the third annual survey.

4 Class renewal survey

4.1 Preparation for survey

4.1.1 The Owner is to provide the necessary facilities for a safe and practical execution of the surveys, including the means of providing access to structures for close-up survey, thickness measurements and tank testing.

4.2 Scope of survey

4.2.1 A survey planning meeting is to be held prior to the commencement of the survey.

4.2.2 In addition to the requirements of annual surveys, the class renewal survey is to include examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in [4.2.4]are in satisfactory condition and fit for the intended purpose for the new period of class to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

4.2.3 All cargo holds, ballast tanks, including double bottom tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing as required in [4.5] and [4.6] to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deformation, that may be present.

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

4.2.5 The survey extent of ballast tanks converted to void spaces is to be specially considered by QRS in relation to the requirements for ballast tanks.

4.2.6 A bottom survey in dry condition is to be a part of the class renewal survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks are to be carried out in accordance with the applicable requirements for class renewal surveys, if not already performed.

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

4.2.7 Where provided, the condition of the corrosion prevention system of ballast tanks is to be examined.

For ballast tanks, excluding double bottom tanks, where a hard protective coating is found in poor condition and it is not renewed, where soft or semi-hard coating has been applied, or where a hard protective coating was not applied from time of construction, the tanks in question are to be examined at annual intervals. Thickness measurements are to be carried out as found necessary by the Surveyor.

When such breakdown of hard protective coating is found in double bottom ballast tanks and it is not renewed, 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 may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

4.2.8 Where the hard protective coating in tanks is found to be in good condition, the extent of close-up surveys and thickness measurements may be specially considered.

4.2.9 For ships granted with the additional class notation **OPEN-HATCH**:

- examination and complete test of the hold dewatering systems to check their proper functioning
- complete inspection of the open cargo holds
- operational testing and internal examination, as required by the Surveyor, of the relevant pumps for the water-spray system for open-top cargo holds.

4.3 Hatch covers and coamings

4.3.1 The requirements listed in Chapter 2 for all ships are to be complied with.

4.3.2 The close-up survey and thickness measurements in accordance with the requirements given in Table 4 and Table 5, respectively, are to be carried out.

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

4.4 Overall and close-up surveys

4.4.1 An overall survey of all cargo holds, tanks and spaces is to be carried out at each class renewal survey. However, for fuel oil, lube oil and fresh water tanks, the requirements given in Chapter 2, Table 2 are to be complied with.

4.4.2 The minimum requirements for close-up surveys at class renewal survey are given in Table 4.

The Surveyor may extend the close-up survey as deemed necessary considering 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.

For areas in spaces where hard protective coatings are found to be in a good condition, the extent of close-up surveys according to Table 4 may be specially considered.

4.5 Thickness measurements

4.5.1 The minimum requirements for thickness measurements at class renewal survey are given in Table 5.

4.5.2 The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion in accordance with the requirements given in Table 6.

4.5.3 For areas in spaces where hard protective coatings are found to be in a good condition, the extent of thickness measurements according to Table 5 may be specially considered.

Table 4: Requirements for close-up survey at class renewal survey of general cargo ships

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal survey No.2 5 < age 10	Class renewal survey No.3 10 < age 15	Class renewal survey No.4 and subsequent age > 15
Selected shell frames in one forward and one aft cargo hold and associated 'tweendeck spaces	Selected shell frames in all cargo holds and 'tweendeck spaces	All shell frames in the forward lower cargo hold and 25% of shell frames in each of the remaining cargo holds and 'tweendeck spaces including upper and lower end attachments and adjacent shell plating	All shell frames in all cargo holds and 'tweendeck spaces including upper and lower end attachments and adjacent shell plating
One selected cargo hold transverse bulkhead	One transverse bulkhead in each cargo hold Forward and aft transverse bulkheads in one side ballast tank, including stiffening system	All cargo hold transverse bulkheads All transverse bulkheads in ballast tanks, including stiffening system	Areas required for class renewal survey for ships between 10 and 15 years of age
	One transverse web with associated plating and framing in two representative ballast tanks of each type (topside, hopper side, side tank or double bottom tank)	All transverse webs with associated plating and framing in each ballast tank	
All cargo hold hatch covers and coamings (plating and stiffeners)	All cargo hold hatch covers and coamings (plating and stiffeners)	All cargo hold hatch covers and coamings (plating and stiffeners)	
	Selected areas of all deck plating and underdeck structure inside line of hatch openings between cargo hold hatches	All deck plating and underdeck structure inside line of hatch openings between cargo hold hatches	
	Selected areas of inner bottom plating	All areas of inner bottom plating	

Figure 1 : Areas subject to close-up surveys and thickness measurements of general cargo ships
Single deck ship

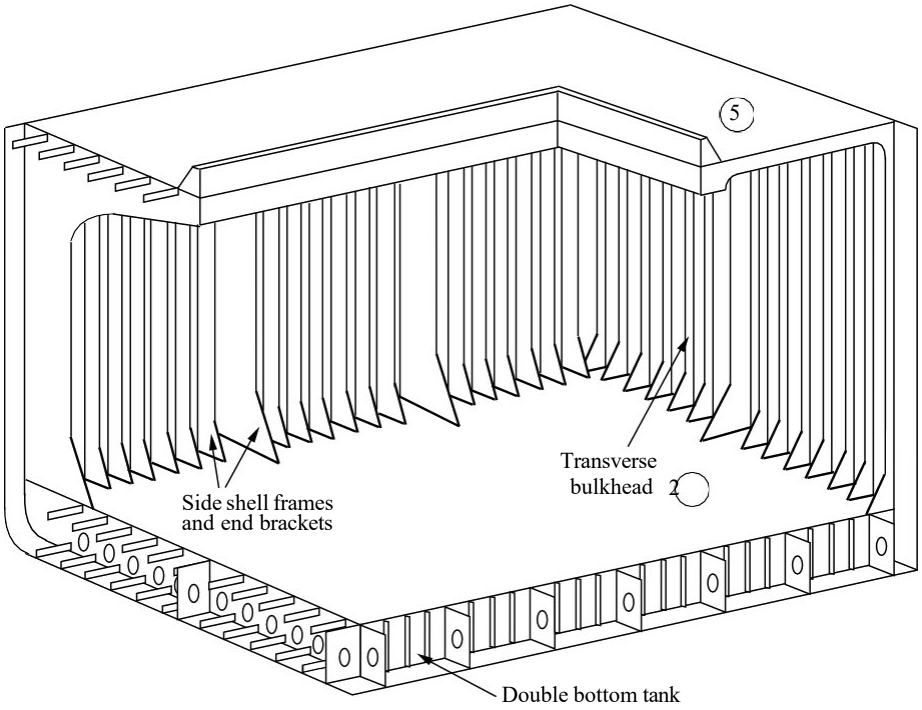

Figure 2 : Areas subject to close-up surveys and thickness measurements of general cargo ships
'Tweendeck ship

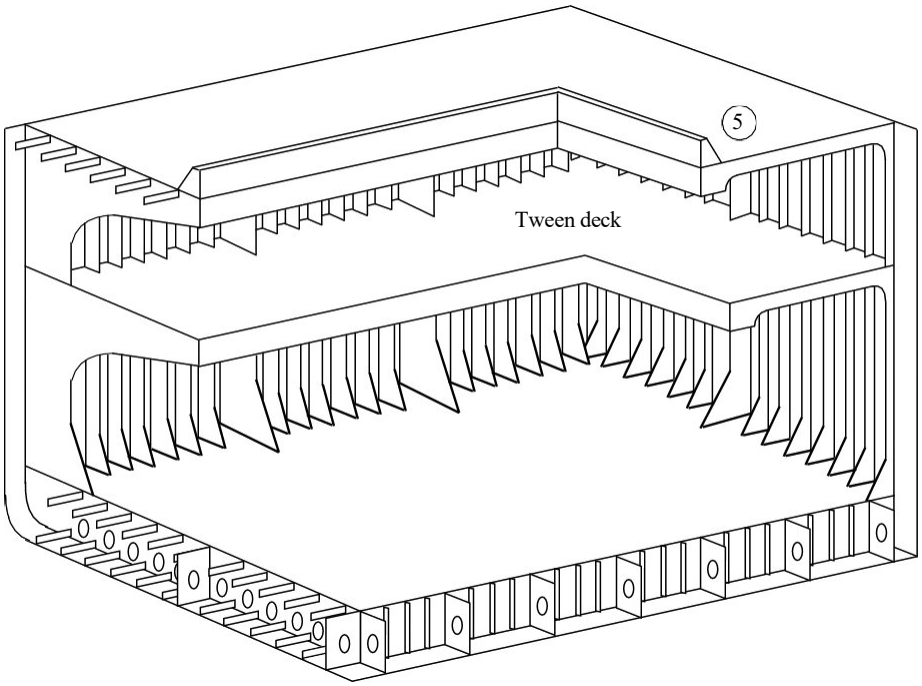

Figure 3 : Areas subject to close-up surveys and thickness measurements of general cargo ships

Single deck ship

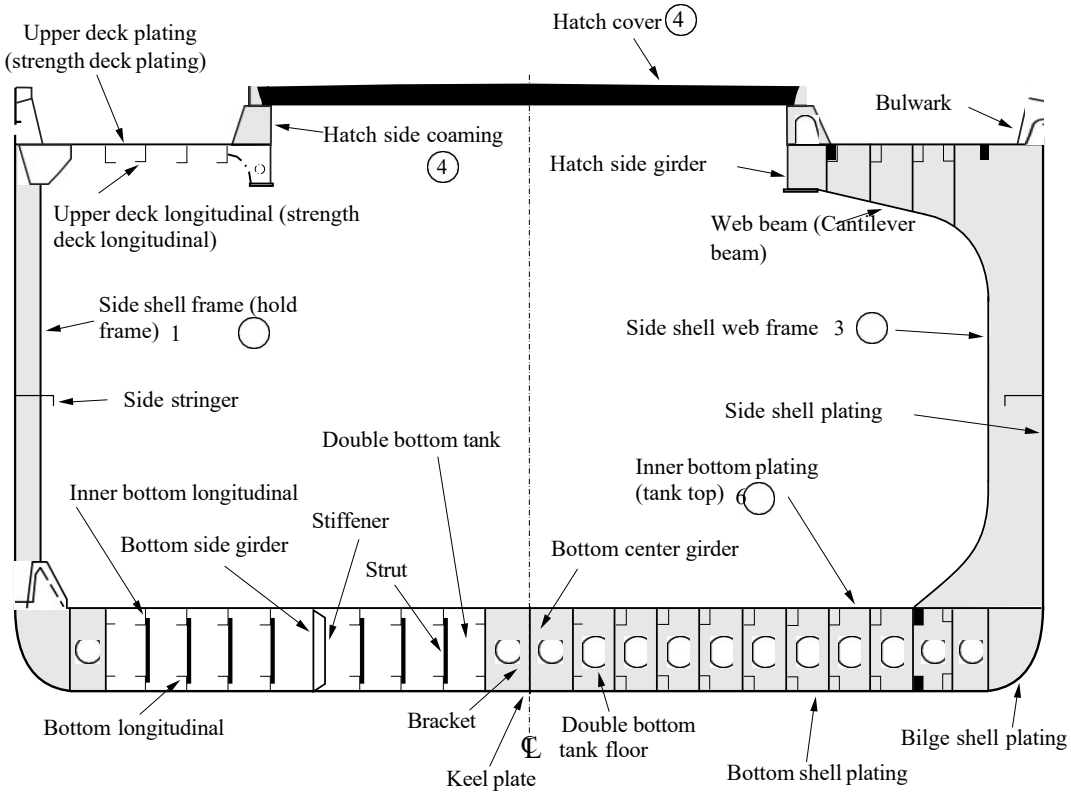

Figure 4 : Areas subject to close-up surveys and thickness measurements of general cargo ships

'Tweendeck ship

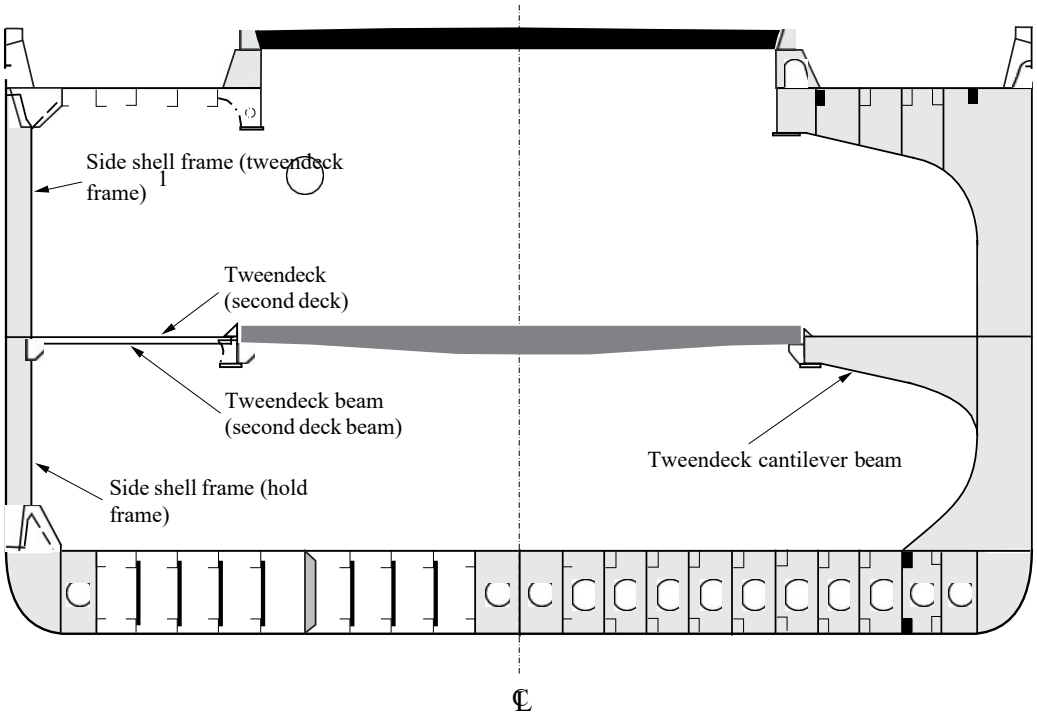

Table 5 : Requirements for thickness measurements at class renewal surveys of general cargo ships

Age of ship (in years at time of class renewal survey)			
Class renewal survey No.1 age 5	Class renewal surveyNo.2 5 < age 10	Class renewal survey No.3 10 < age ⭘15	Class renewal survey No.4 and subsequent age > 15
Suspect areas	Suspect areas	Suspect areas	Suspect areas
	One transverse section of deck plating in way of a cargo space within the amidships 0,5 L	Two transverse sections within the amidships 0,5 L in way of two different cargo spaces Within the cargo length area, each deck plate outside line of cargo hatch openings	Within the cargo length area: • a minimum of three transverse sections within the amidships 0,5 L • each deck plate outside line of cargo hatch openings • each bottom plate, including lower turn of bilge • duct keel or pipe tunnel plating and internals
	Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 4	Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 4	Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 4
		All wind and water strakes within the cargo area	All wind and water strakes full length
		Selected wind and water strakes outside the cargo area	

Table 6 : Requirements for extent of thickness measurements at those areas of substantial corrosion Class renewal survey of general cargo ships

Structural member	Extent of measurement	Pattern of measurement
Plating	Suspect area and adjacent plates	5-point pattern over 1 m^2 of plating
Stiffeners	Suspect area	3 measurements each in line across web and flange

4.6 Tank testing

4.6.1 All boundaries of ballast tanks and deep tanks used for water ballast within the cargo length area are to be pressure tested. For fuel oil tanks, the representative tanks are to be pressure tested.

4.6.2 The Surveyor may extend the tank testing as deemed necessary.

4.6.3 Tank testing of fuel oil tanks is to be carried out 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.

Section 8 Ships using Low Flashpoint Liquid or Gas Fuels

1 General

1.1 Application

1.1.1 The requirements of this Section apply to all self-propelled ships which utilize gas or other low flash points fuels as a fuel for propulsion prime mover/auxiliary power generation arrangements and associated systems, or which have been assigned one of the following additional service features:

- **LNGfuel**,
- **CNGfuel**,
- **LPGfuel**,
- **methanolfuel**,
- **ammoniafuel**, or
- **LFPfuel**.

1.1.2 These requirements are in addition to those laid down in Chapter 2.

These survey requirements do not cover fire protection, fire-fighting installation, and personnel protection equipment.

2 Annual survey - Hull items

2.1 General

2.1.1 The following requirements are to be verified during the survey of the fuel storage, fuel bunkering system and fuel supply system.

2.1.2 The logbooks and operating records are to be examined with regard to correct functioning of the gas detection systems, fuel supply/gas systems, etc. The hours per day of the reliquefaction plant, gas combustion unit, as applicable, the boil-off rate, and nitrogen consumption (for membrane containment systems) are to be considered together with gas detection records.

2.1.3 The manufacturer/builder instructions and manuals covering the operations, safety and maintenance requirements and occupational health hazards relevant to fuel storage, fuel bunkering, and fuel supply and associated systems for the used of the fuel, are to be confirmed as being aboard the vessel.

2.2 Gas related spaces, fuel preparation and handling rooms and piping

2.2.1 The survey is to include:

- examination of portable and fixed drip trays and insulation for the protection of the ship’s structure in the event of a leakage
- examination of electrical bonding arrangements in hazardous areas, including bonded straps where fitted.

2.3 Fuel storage, bunkering and supply systems

2.3.1 The following requirements are to be examined, so far as applicable. Insulation need not to be removed, but any deterioration or evidence of dampness is to be investigated.

2.3.2 For fuel storage, the survey is to include:

- external examination of the storage tanks including secondary barrier if fitted and accessible
- general examination of the fuel storage hold place
- internal examination of tank connection space
- external examination of tank and relief valves
- verification of satisfactory operation of tank monitoring system
- examination and testing of installed bilge alarms and means of drainage of the compartment
- testing of the remote and local closing of the installed main tank valve.

2.3.3 For fuel bunkering system, the survey is to include:

- examination of bunkering stations and the fuel bunkering system
- verification of the satisfactory operation of the fuel bunkering control, monitoring and shutdown systems.

2.3.4 For fuel supply system, during working condition as far as practicable, the survey is to include:

- verification of the satisfactory operation of the fuel supply system control, monitoring and shutdown systems
- testing of the remote and local closing of the master fuel valve for each engine compartment.

3 Annual survey - Gas fuel machinery items

3.1 Control, monitoring and safety systems

3.1.1 The survey is to include:

- confirmation that gas detection and other leakage detection equipment in compartments containing fuel storage, fuel bunkering, and fuel supply equipment or components or associated systems, including indicators and alarms are in satisfactory operating condition
- verification that recalibration of the gas detection systems is done in accordance with the manufacturer's recommendations.
- verification of the satisfactory operation of the control, monitoring and automatic shutdown systems as far as practicable of the fuel supply and bunkering systems
- operational test, as far as practicable, of the shutdown of ESD protected machinery spaces.

3.2 Fuel handling piping, machinery and equipment

3.2.1 The survey is to include:

- examination, as far as practicable, of piping, hoses, emergency shutdown valves, relief valves, machinery and equipment for fuel storage, fuel bunkering, and fuel supply such as venting, compressing, refrigerating, liquefying, heating, cooling or otherwise handling the fuel
- examination of the means for inerting
- confirmation, as far as practicable, of the stopping of pumps and compressors upon emergency shutdown of the system.

3.3 Ventilating systems

3.3.1 The survey is to include:

- examination of the ventilation system, including portable ventilating equipment where fitted, is to be made for spaces containing fuel storage, fuel bunkering, and fuel supply units or components or associated systems, including air locks, pump rooms, compressor rooms, fuel preparation rooms, fuel valve rooms, control rooms and spaces containing gas burning equipment
- operational test, as far as practicable, of alarms, such as differential pressure and loss of pressure, where fitted.

3.4 Hazardous areas

3.4.1 The survey is to include:

- examination of electrical equipment and bulkhead/deck penetrations including access openings in hazardous areas, for continued suitability for their intended service and installation area.

4 Intermediate survey

4.1 General

4.1.1 In addition to the applicable requirements of the annual surveys, the intermediate survey is also to include:

- random test of gas detectors, temperature sensors, pressure sensors, level indicators, and other equipment providing input to the fuel safety system, to confirm their satisfactory operating condition
- verification of the proper response of the fuel safety system upon fault conditions.

5 Class renewal survey - Hull items

5.1 General

5.1.1 The class renewal survey is to include, in addition to the requirements of the annual surveys, examinations, tests and checks of sufficient extent to ensure that the fuel installations are in satisfactory condition and fit for intended purpose for the new period of class to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

5.2 Fuel handling and piping

5.2.1 All piping for fuel storage, fuel bunkering, and fuel supply such as venting, compressing, refrigerating, liquefying, heating, storing, burning or otherwise handling the fuel and liquid nitrogen installations are to be examined.

5.2.2 Removal of insulation from the piping and opening for examination may be required.

5.2.3 Where deemed suspect, a hydrostatic test to 1,25 times the maximum allowable relief valve setting (MARVS) for the pipeline is to be carried out.

5.2.4 After reassembly, the complete piping is to be tested for leaks.

5.2.5 Where water cannot be tolerated and the piping cannot be dried prior to putting the system into service, the surveyor may accept alternative fluids or alternative means of testing.

5.3 Fuel valves

5.3.1 All emergency shutdown valves, check valves, block and bleed valves, master gas valves, remote operating valves, isolating valves for pressure relief valves in the fuel storage, fuel bunkering, and fuel supply piping systems are to be examined and proven operable.

5.3.2 A random selection of valves is to be opened for examination.

5.4 Pressure relief valves

5.4.1 Fuel storage tank pressure relief valves

The survey is to include:

- opening for examination, adjustment and function test of the pressure relief valves for the fuel storage tanks
- if the tanks are equipped with relief valves with non-metallic membranes in the main or pilot valves, replacement of such non-metallic membranes.

5.4.2 Fuel supply and bunkering piping pressure relief valves

The survey is to include:

- opening for examination, adjustment and function test of pressure relief valves for the fuel supply and bunkering piping
- where a proper record of continuous overhaul and retesting of individually identifiable relief valves is maintained, consideration will be given to acceptance on the basis of opening, internal examination, and testing of a representative sampling of valves, including each size and type of liquefied gas or vapor relief valve in use, provided there is logbook evidence that the remaining valves have been overhauled and tested since crediting the previous class renewal survey.

5.4.3 Pressure/vacuum relief valves

The survey is to include:

- opening, examination, test and readjustment as necessary, depending on their design, of the pressure/vacuum relief valves, rupture disc and other pressure relief devices for interbarrier spaces and hold spaces.

5.5 Fuel storage tanks

5.5.1 Fuel storage tanks are to be examined in accordance with an approved survey plan.

5.5.2 Liquefied gas fuel storage tanks are to be examined based on a survey/inspection plan, in which requirements for the survey of liquefied gas fuel containment systems are to be in accordance with the requirements laid down in Chapter 3, except as noted below:

- the tank insulation and tank support arrangements shall be visually examined. Non-destructive testing may be required if conditions raise doubt to the structural integrity
- vacuum insulated independent fuel storage tanks of type C without access openings need not be examined internally. Where fitted, the vacuum monitoring system shall be examined and records should be reviewed.

6 Class renewal survey - Gas fuel machinery items

6.1 Fuel handling equipment

6.1.1 Fuel pumps, compressors, process pressure vessels, inert gas generators, heat exchangers and other components used in connection with fuel handling are to be examined accordingly.

6.2 Electrical equipment

6.2.1 The survey is to include:

- examination of electrical equipment to include the physical condition of electrical cables and supports, intrinsically safe, explosion proof, or increased features of electrical equipment
- function testing of pressurized equipment and associated alarms
- testing of systems for de-energizing electrical equipment which is not certified for use in hazardous areas
- electrical insulation resistance test of the circuit terminating in, or passing through, the hazardous zones and spaces is to be carried out.

6.3 Safety systems

6.3.1 Gas detectors, temperature sensors, pressure sensors, level indicators, and other equipment providing input to the fuel safety system are to be tested to confirm satisfactory operating condition.

6.3.2 Proper response of the fuel safety system upon fault conditions is to be verified.

6.3.3 Pressure, temperature and level indicating equipment are to be calibrated in accordance with the manufacturer's requirements.

Appendix 1 Oil Tanker Longitudinal Strength Assessment

1 General

1.1

1.1.1 The criteria indicated in this Appendix are to be used for the evaluation of longitudinal strength of the ship's hull girder.

1.1.2 In order that ship's longitudinal strength to be evaluated can be recognized as valid, fillet welding between longitudinal internal members and hull envelopes are to be in sound condition so as to keep integrity of longitudinal internal members with hull envelopes.

2 Evaluation of longitudinal strength

2.1 Application

2.1.1 The requirements given in this Article apply to ships contracted for construction before 1st July 2022. For ships contracted for construction on or after 1st July 2022.

2.2 Transverse sectional areas

2.2.1 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 are to be calculated by using the thickness measured, renewed or reinforced, as appropriate, during the class renewal survey.

2.2.2 If the diminution of sectional areas of either deck or bottom flange exceeds 10% of their respective as-built area (original sectional area when the ship was built), either one of the following measures is to be taken:

a) 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

b) to calculate the actual section moduli of transverse section of the ship's hull girder by using the thickness measured, renewed or reinforced, as appropriate, during the class renewal survey.

2.3 Transverse section modulus

2.3.1 The actual section modulus of the transverse section of the ship's hull girder calculated in accordance with item b) is not to be less than 90% of the required section modulus for new buildings, whichever is the greater.

2.4 Calculation criteria of section modulus

2.4.1 When calculating the transverse section modulus of the ship's hull girder, the requirements of these rules must be applied.

3 Sampling method of thickness measurements

3.1 Extent of evaluation

3.1.1 Longitudinal strength should 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.

3.2 Sampling method of thickness measurements

3.2.1 Transverse sections should be chosen such that thickness measurements can be taken for as many different tanks in corrosive environment 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 sea water should be selected where present.

3.2.2 The minimum number of transverse sections to be sampled should be in accordance with the requirements for the current class renewal survey. The transverse sections should be located where the largest thickness reductions are suspected to occur or are revealed from deck and bottom plating measurements required in Chapter 3 Table 5 and should be clear of areas which have been locally renewed or reinforced.

3.2.3 At least two points should be measured on each deck plate and/or bottom shell plate required to be measured within the cargo area in accordance with the requirements for the current class renewal survey.

3.2.4 Within 0,1 D (where D is the ship’s moulded depth) of the deck and the bottom at each transverse section to be measured, every longitudinal and

girder should be measured on the web and face plate, and every plate should be measured at one point between longitudinals.

3.2.5 For longitudinal members required to be measured at each transverse section, every longitudinal and girder should be measured on the web and face plate, and every plate should be measured at least in one point per strake.

3.2.6 The thickness of each component should be determined by averaging all of the measurements in way of the transverse section on each component.

3.3 Additional measurements

3.3.1 Where one or more of the transverse sections are found to be deficient in respect of the longitudinal strength requirements given in this Appendix, the number of transverse sections for thickness measurements should 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 0,5 L region should be sampled.

3.3.2 Additional thickness measurements should also be performed on one transverse section forward and one aft of each repaired area to the extent necessary to ensure that the areas bordering the repaired section also comply with the requirements of this Appendix.

3.4 Repair methods

3.4.1 The minimum continuous length of a renewed or reinforced structural member should be not less than twice the spacing of the primary members in way. In addition, the thickness diminution in way of the butt joint of each joining member forward and aft of the replaced member (plates, stiffeners, girder webs and flanges, etc.) should not be within the substantial corrosion range (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 should be provided.

3.4.2 Alternative repair methods involving the fitting of straps or structural member modification should be subject to special consideration. In considering the fitting of straps, it should be limited to the following conditions:

- to restore and/or increase longitudinal strength;
- the thickness diminution of the deck or bottom plating to be reinforced should not be within the substantial corrosion range (75% of the allowable diminution associated with the deck plating)
- the alignment and arrangement, including the termination of the straps, is in accordance with a standard recognized by QRS
- the straps are continuous over the entire 0,5 L amidships length; and
- continuous fillet welding and full penetration welds are used at butt welding and, depending on the width of the strap, slot welds. The welding procedures applied must be acceptable to QRS.

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

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