CLASS RULES FOR EXISTING SHIPS

MACOSNAR CORPORATION CLASS

TECHNICAL DEPARTMENT

APPROVED BY: GENERAL MANAGER

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SECTION 1. CLASS SURVEYS

1.1 GENERAL INSTRUCTIONS

1.1.1 In order to maintain the class of a ship it is a requirement that Periodical Surveys are carried out as laid down in the Rules and Regulations for the Classification of Steel Ships (hereinafter referred to as the Rules for Ships or RSTE).

1.1.2 Upon completion of the Initial Surveys of existing ships submitted for classification, Certificates of First Entry of Classification will be issued.

1.1.3 A Certificate of Class valid for five years from the date of Initial and subsequent Special Surveys, or completion of the Continuous Survey cycle, will also be issued by the MCO. To maintain validity this Certificate is to be endorsed at the Annual and Intermediate Surveys. The Surveyors' attention is drawn to the following:

(a) In accordance with the Rules for Ships, class will be automatically suspended and the Certificate becomes invalid if not endorsed within three months of the due date of the Annual or Intermediate Survey.
(b) The Certificate of Class expires on the due date of the Special Survey. Consideration may be given at the discretion of the MCO to any exceptional circumstances justifying an extension to the Special Survey completion date for a maximum period of three months beyond the validity of the Certificate.
(c) Prior to the endorsement of the Certificate of Class, all overdue hull and machinery surveys are to be dealt with or postponed by agreement.
(d) Under normal circumstances the Annual or Intermediate Survey is to be held in conjunction with the Periodical Load line Inspection and the Safety Construction Annual Survey.

1.1.4 Upon completion of the Special Survey or the cycle of Continuous Survey Hull, the Certificate of Class will be renewed.

1.1.5 A Master List of surveyable items will be prepared for each ship and a copy issued to the Owner. A Quarterly Notice (computer print-out or on-line document) will also be prepared, giving details of the survey status, overdue surveys and surveys due in the next six months, together with any applicable Conditions of Class.

1.1.6 An Owner will normally be advised of forthcoming surveys by means of a letter or the Quarterly Notice and his attention drawn to the fact that non- compliance with classification requirements may lead to class suspension which will also jeopardize the validity of certain Statutory Certificates and ultimately result in the withdrawal of such certificates by the National Administration or Certifying Authority.

1.1.7 Possession of valid certificates required by certain International Conventions will also be a prerequisite of classification. Non-compliance with this requirement may also jeopardize the class of the ship.

1.1.8 Oil tankers, chemical tankers, combination carriers and bulk cargo ships will be subject to Enhanced Surveys for which special requirements prevail for on board documentation, planning and preparation for survey, thickness measurement, Close-up Survey, corrosion prevention systems, reporting of corrosion and survey check lists.

1.1.9 Existing ships subject to the Enhanced Survey Programme will have the ESP notation added upon completion of the first Special Survey.

1.1.10 Periodical Surveys and survey items are to be dealt with by the due date and, whilst attending on board, Surveyors will review the survey status with the Owner.

1.1.11 The Certificate of Class will not be endorsed on completion of Annual or Intermediate Survey if any other Periodical Surveys or survey items are overdue and postponement cannot be agreed.

1.1.12 The classification status of a ship and the agreement to requests for postponement of Periodical Surveys or survey items are generally to the discretion of the Head Office after considering all the relevant information and the Surveyors' recommendations.

1.1.13 Attending Surveyors have strictly limited authority to agree to a postponement of specific Periodical Surveys or survey

items without reference to the Head Office (see paragraphs' 3.3.2 – 3.3.5) .

1.1.14 Conditions of Class are to be dealt with at the due date or extended by agreement. The Owner will be informed that class will be jeopardized and subject to a suspension procedure if Conditions of Class are not met by the due date, or further extended by agreement (see also Subs 5.2).

1.1.15 Immediate advice is to be sent to Head Office if a ship leaves port without being submitted to any survey which the MCO had decided must be held for maintenance of class before commencement of the voyage (see paragraph 3.1.6).

1.1.16 When differences of opinion arise between an Owner and the local Surveyor, the case is to be referred to Head Office.

1.2 RESPONSIBILITIES OF THE OWNER

1.2.1 It is the Owner's responsibility to ensure that ships are prepared and submitted for survey when necessary and, in the normal course of events, Surveyors attend on board only when requested to do so by the Owner or his representative.

1.2.2 The Owner is to advise the MCO of any damage, defect or breakdown, which may affect classification. If a Surveyor becomes aware of any such damage, defect or breakdown and he has not been requested to attend, the Owner's attention should be drawn to this Rule requirement.

1.2.3 All repairs necessary for the ship to retain her class are to be carried out to the satisfaction of the Surveyors.

1.2.4 When repairs have been effected at a port where the services of a Surveyor to the MCO are not available, the Owner is required to arrange for the repairs to be examined by one of the Society´s Surveyors at the earliest opportunity thereafter.

1.2.5 It is the Owner´s responsibility to ensure that the ship has on board the required International Convention Certificates, possession of which is a prerequisite of classification (see also paragraph 1.1.7).

1.3 SUBCONTRACTED SERVICES

1.3.1 Only recognized firms engaged in thickness measurement on ships, testing of hatches with ultrasonic equipment, In-Water Surveys and examination of ro-ro bow, stern, side and inner doors, which have been approved are to be subcontracted as service suppliers for these functions.

1.4 SURVEYOR'S ACTUATION

1.4.1 It is assumed that, during performance of tests required by any Survey, the attending Surveyor will not carry out any operations of any system, machinery item or equipment, their controls or alarms, including lamp tests. All operations are to be carried out by qualified crew members upon the Surveyor´s guidance or requirements.

SECTION 2. PREPARATIONS FOR SURVEYS

2.1 GENERAL INSTRUCTIONS

2.1.1 Surveyors are to keep themselves informed of ships arriving in their port or area under his responsibility, in order to ensure that satisfactory attention is given to any overdue and due classification and statutory surveys and/or Conditions of Class. In this respect full use is to be made of the office records.

2.1.2 Before performing a survey, all available records are to be consulted, including the Memoranda and relevant memos, so that Surveyors are familiar with the current survey status and are in a position to draw the Owner's attention to any surveys, including Conditions of Class, which are overdue, due, or become due in the nearest future.

2.1.3 Hull, Machinery and Statutory Surveys are to be harmonized. Guidance is to be given to the Owner on requirements to be carried out with the purpose of preventing unnecessary expenses and inconveniences.

2.1.4 Memos are issued for the information of Surveyors and contains details of defects which have been found in the structure or machinery of a ship classed with the MCO or a previous Classification Society.

2.1.5 No references to memos are be made in any classification reports or certificates. If the Surveyor wishes to refer to any case quoted in memo, this is to be done in a separate communication to Head Office (hereinafter HO).

2.1.6 In cases where the degree of opening up of machinery is uncertain, Surveyors should ensure that the persons responsible are made aware as soon as possible of the extent of preparation required for survey. The Rules do not state the precise amount of opening up for each item, since this will depend frequently on details of construction, reported faults or obvious signs of defect. It is expected, therefore, that Surveyors will use their experience, judgment and any knowledge of the past history of the installation, or similar installations, when deciding how extensive the opening up should be.

2.1.7 Owners are to be advised that, so far as possible, the preparation for survey of cargo spaces, tanks, other spaces, machinery, boilers and other items is to be made in advance of the Surveyor's visit on board so as to minimize delays and expenses.

2.1.8 All surveys are to be undertaken by Surveyors with sufficient experience and competence.

2.1.9 All Surveyors undertaking Annual, Intermediate and Special Surveys or attending substantial repairs to ships must be fully eligible/authorized.

2.1.10 On ships with a deadweight of 20000 tons and above subject to ESP, starting with Special Survey III, all Special and Intermediate hull surveys are to be carried out by at least two Exclusive Surveyors jointly.

2.1.11 Though each attending Surveyor is not required to perform all aspects of the required survey, the attending Surveyors are required to consult with each other and to carry out joint examinations to the extent necessary to agree on actions required to complete the survey (i.e. with respect to Overall Surveys, Close-up Surveys, renewals, repairs and conditions of class) and to co-sign the Survey Report.

2.1.12 Thickness measurement alone may be witnessed by a single Exclusive Surveyor. This requires the Surveyor to be on board, while measurements are taken, to the extent necessary to control the process.

2.1.13 Due consideration is to be given to the attendance of more than one Surveyor when renewal or periodical classification or statutory surveys are being undertaken on those ships with a Port State Control detention history, or whose history indicates that the ship may be liable to detention, as indicated in the Memoranda.

2.1.14 The preparation for survey of oil tankers, chemical tankers, combination carriers and bulk cargo ships is to be effected in accordance with Ch 2. During Special and Intermediate Surveys of other ships, means are to be provided wherever necessary to enable the Surveyor to carry out a sufficiently close examination of the structure in a safe and practical way.

2.1.15 For Close-up Surveys, in addition to the above, one or more of the following means of access, acceptable to the Surveyor, is to be provided:

(a) Permanent stages and passages through structures.
(b) Temporary stages and passages through structures.
(c) Lifts and movable platforms.

(d) Boats and rafts.
(e) Other equivalent means.

2.1.16 Prior to the commencement of the survey, the Surveyor is to ensure that, where applicable, the following plans and information are available for use:
(a) Main structural plans.
(b) Cargo and ballast history.
(c) Previous repair history.
(d) Reports on structural defects in general.
(e) Reports on leakage in bulkheads and piping systems.
(f) Condition of coatings or corrosion protection systems, if any.
(g) Extent of use of inert gas plant when same is a part of an approved corrosion control system.

2.2 SAFETY MEASURES

2.2.1 Surveyors are to satisfy themselves that adequate precautions are taken to ensure safety during surveys. Surveyors are urged to assure themselves that hazards have been reduced to a minimum before surveys are undertaken. Due attention is to be given to the condition of gangways, staging and ladders, as well as to safety factors to be observed before entering tanks, crankcases, boilers, pressure vessels, etc.

2.2.2 Surveyors should fully recognize the dangers associated with entering any space with limited openings and/or unfavorable ventilation, e.g. an enclosed space. Authorization to enter any such space must always be obtained from the ship's Master or nominated responsible person who, prior to sanctioning entry, is to establish the potential hazards and have made appropriate arrangements, such as testing of the atmosphere within the space for oxygen depletion or enrichment and flammable and/or toxic substances, ensuring there is an adequate illumination and continuous ventilation, communications, and rescue/resuscitation equipment as necessary.

2.2.3 When oil tankers, chemical tankers and gas carriers are surveyed, reference may also be made to such guides as the *International Safety Guide for Oil Tankers and Terminals* (ISGOTT), the *International Chamber of Shipping's Tanker Safety Guide* (Chemicals) and *Tanker Safety Guide* (Liquefied Gas) for guidance with regard to special hazards which may be encountered when specific cargoes are carried. The *International Maritime Dangerous Goods Code* (IMDG Code) also contains information on potential hazards posed by cargoes which a hold or tank may have contained.

2.3 REQUESTS FOR SPECIFIC SURVEYORS

2.3.1 Requests for the attendance of specified Surveyors to carry out classification surveys outside their own ports/areas will be resisted.

2.3.2 A request for a specific Surveyor may be granted, provided the following requirements are strictly applied:
(a) The attendance is to be limited to the Classification and authorized Statutory Surveys.
(b) The responsibility for the performance and technical adequacy of the survey rests with the Surveyor in charge of the district in which the survey is held and, accordingly, the visiting Surveyor is to liaise fully with the local Surveyor.
(c) The Owner is to pay for all the additional costs involved.
(d) Panama HO is to be advised, in advance, of full details of any such proposed attendance, including the name of the nominated Surveyor.

2.4 SURVEYS AT SEA

2.4.1 All requests for surveys at sea are to be referred to HO at an early date.

2.4.2 Each request for survey at sea will be examined on its merits and, when considered favorable, the travel, route and the port most suitable to provide a Surveyor for the voyage will be decided.

2.4.3 The Owner will be given an indication of the fees which are likely to be incurred.

2.4.4 Upon acceptance of the request to provide a Surveyor, the selected port is to establish direct contact with the Owner for up-to-date information regarding the ETA of the ship and the Agent's address at the embarkation port, the proposed route and destination.

2.4.5 As far as possible the travel arrangements for the Surveyor are to be made locally and the requirements for visas and inoculations are to be ascertained from local embassies or consulates.

2.4.6 The technical aspects of a survey at sea do not differ from those of In-port Surveys and the Surveyors will be guided by existing Rules, Manuals and other applicable documents.

2.5 MAJOR CONVERSIONS

2.5.1 Major conversions of existing ships are considered to be works which:

(a) Substantially alter a ship's dimensions or carrying capacity.
(b) Change a ship's type or primary function.
(c) Substantially increase a ship's service life.
(d) Substantially affect the sub-division.
(e) Involve re-engining with a different type of main engine.
(f) Involve installation of a different arrangement of propulsion system.

2.5.2 A Request for Service, together with a scope of the work to be undertaken are to be submitted to HO as soon as possible, and in all cases before the commencement of the work.

2.5.3 An annotated Major Conversion Checklist provided by HO is to be used in each case to ensure the control and monitoring of the contract to completion.

2.5.4 Effective co-ordination of all classification and statutory requirements is essential and is to be controlled by the local Surveyor/Office with contract reviews conducted strictly in accordance with the Society´s Quality Procedures. In this respect, it will be necessary to nominate a Local Project Leader to undertake co-ordination and control responsibilities.

2.5.5 It is of particular importance that all aspects requiring plan approval are identified at an early stage and controlled thereafter. Work undertaken by plan approval offices are sent directly to the Local Project Leader, with a copy to HO. Fees are to be advised on a continuous basis.

SECTION 3. PERFORMANCE OF SURVEYS

3.1 GENERAL INSTRUCTIONS

3.1.1 It is important to attend before repairs, alterations or additions are commenced in order that the reason for the work may be fully understood.

3.1.2 It is necessary to distinguish between repairs on account of damage and those attributable to wear and tear, and to determine whether work is being effected at the instigation of the Owner himself or in accordance with previous recommendations by the Surveyors to the MCO.

3.1.3 If it is considered that repairs are required the Owner's Representative they are to be advised without delay.

3.1.4 If the Owner feels that the Surveyor's recommendations are unreasonable, he is entitled to ask for further attendance by a Regional, Senior or Principal Surveyor. In the event of continued disagreement the Owner may appeal to Head Office but, should the original opinion of the Surveyor be upheld, the Owner is responsible for all fees and costs in connection with the additional survey.

3.1.5 When, in the opinion of the Surveyor, essential repairs are not being done, or are being improperly carried out, the Owner is to be promptly advised. If this unsatisfactory situation continues HO is to be advised urgently, and the Owner be made aware that this has been done and that the MCO may take action in respect of class.

3.1.6 Immediate advice must be sent to HO if a ship leaves port without the Surveyor's recommendations having been carried out (see paragraph 1.1.15) or if a ship departs from port without being in possession of the required International Convention Certificates referred to in paragraph 1.1.6.

3.1.7 Any structural or machinery alterations will be subject to the Surveyor's approval.

3.1.8 Any alterations when considered necessary, advice should be sought from HO before work is commenced.

3.1.9 Where it is considered necessary to recommend additional strengthening to the hull structure or any essential machinery because of suspected weakness, HO is to be advised or consulted so that the circumstances may be fully investigated.

3.2 SALES SURVEYS

3.2.1 The Surveyor attending the ship must, from the beginning, know the identity and interest of all persons attending the survey.

3.2.2 Recommendations and observations are to be made only to the Owner or his representative. This is particularly important at dockings for change of ownership where the Surveyor may be accompanied by both the Owner's and Buyer's representatives.

3.2.3 The Surveyor is to be specially careful during Sales surveys not to be unduly influenced by the Buyer's representative in his recommendations for repairs. For example, re-assessment of defects already noted in the Memoranda, which result in the Owner being faced with having to effect repairs before being able to sell the ship with 'clean' certificates, are not to be undertaken unless the Surveyor is convinced that such re-assessment is necessary. It should be remembered that usually, when repairs to underwater parts are made at docking, they will be to the Owner's account and entail the Owner paying for the dry-docking.

3.2.4 The Rules state that, at Docking Surveys, the Surveyor is to examine the ship so far as is necessary and practicable in order to satisfy himself as to its general condition. At normal dry-dockings it is expected that, in addition to the examination of the underwater parts, the Surveyor will make a general inspection on board.

3.2.5 At dockings for sale purposes, unless specifically requested by the Owner or if the docking is required for maintenance of class, generally the Surveyor should confine his attention to the dry-dock items only.

3.2.6 If the Buyer's representative makes any verbal allegations regarding ship´s defects to the Surveyor, the latter will request that this be brought to the attention of the Owner.

3.2.7 Any written communication received from the Buyer which refers to alleged defects is to be handed to the Owner's representative and this action communicated to the Buyer's representative. However, the Surveyor is to discuss the allegations with the Owner's representative and draw his attention to the Rules for Ships as regards that any damage, defect, breakdown or grounding,

which could invalidate the conditions for which a class has been assigned, is to be reported to the MCO without delay (RSTE Pt I, Ch 4/1.2.1).

3.2.8 If the Owner declines to allow an examination of the alleged defect the Surveyor will immediately report the circumstances to the MCO Head Office.

3.2.9 Any surveys on behalf of the Buyer are to be commenced prior to the sale only with the consent of the Owner. Any recommendations arising from such surveys will also be conveyed to the Owner's representative, unless there is a written agreement to the contrary.

3.2.10 Surveyors are reminded that there is an increasing tendency among Owners and their legal advisers to scrutinize much more closely the results of sale and purchase surveys. When hull or machinery defects, discovered after the purchase, are considered to have been present at the time of sale, attempts may be made to obtain compensation from Society.

3.3 PARTIAL SURVEYS AND POSTPONEMENT OF SURVEYS

3.3.1 When doubts arise as to the efficiency of an inaccessible structure, the removal of cargo, fuel or ballast as necessary will be recommended. Surveyors at the port where the survey is to be completed are to be advised of any partial survey held, and the recommendations made.

3.3.2 During attendance for all classification surveys the Surveyor is to review the classification status and establish that all other due or overdue Periodical Surveys have been dealt with or have been postponed by agreement.

3.3.3 When a survey can only be partially held due to cargo, fuel or ballast on board, the Surveyors are to report on the condition of the hull, machinery, or equipment, so far as examined and the extent of examination is to be clearly indicated in a Survey Report.

3.3.4 Circumstances may exist when it is not practical for the Owners to present items for survey and, under these circumstances, Surveyors are to undertake a General Examination and testing/review as required, after obtaining confirmation from the Master or Chief Engineer that the item remains efficient, and may agree to a postponement of Survey for a period not exceeding **three months** from the due date of the survey.

3.3.5 The items which may be postponed in these circumstances without reference to HO are the following:

(a) Main, auxiliary and domestic boilers, steam generators. Additional requirements: safety devices are to be tested and safety valves to be adjusted. Water treatment records are to be reviewed.

(b) Exhaust gas economizers, hot water heaters. Additional requirements: safety valves are to be adjusted by the Chief Engineer and a confirmatory statement received for record purposes.

(c) Thermal oil heaters, steam pipes.

3.3.6 CSM and CSH items are not to be postponed beyond the completion date of the cycle without reference to HO.

3.3.7 When a postponement has been agreed the items should be included on an Interim Certificate under the heading 'Postponement of Survey' and listed within the report. The period of postponement is to be stated.

3.4 UNSCHEDULED SURVEYS

3.4.1 If a Surveyor becomes aware of matters which may adversely affect classification and which have not been brought to his attention (by the Owner) details are to be forwarded to HO, which may require an Unscheduled Survey.

3.4.2 Whenever a Surveyor has concerns regarding an Owner's commitment or ability to properly maintain his ship between Periodical Surveys, details are to be forwarded to the HO with a recommendation that an Unscheduled Survey be carried out prior to the next Periodical Survey.

3.4.3 Unscheduled surveys will be considered by the HO in accordance with of the Rules (*RSTE Pt I Ch 4 Subs 1.4*).

3.4.4 Unscheduled Surveys are not to be carried out unless authorized by the MCO Head Office.

3.4.5 The Unscheduled Survey is to comprise the equivalent of Annual Surveys for Class, Safety Construction, Load Lines, Safety Equipment and MARPOL, whether or not the pertinent Statutory certificate has been issued by the MCO.

3.4.6 An experienced Surveyor, holding the relevant Certificate of Authorization, is to be assigned to the Unscheduled Survey. If no such Surveyor is available in the port, arrangements are to be made for the attendance of a Surveyor from another office.

3.4.7 A fee is to be charged based on time spent plus any other expenses such as transportation and lodging.

3.4.8 When major deficiencies are found and not rectified, the HO is to be advised immediately. If the deficiencies concern items covered by a Certificate not issued by the MCO, the issuing entity is to be advised immediately, and the advice confirmed in writing as soon as practicable.

3.4.9 Unscheduled Surveys are to be reported as *HULL – Unscheduled*. The Report contents is not to include any reference to Office instructions nor the MSUR but is to be fully detailed in respect of the extent of the survey carried out and the results.

3.4.10 A separate Confidential Report on the standard of the ship and standards of maintenance on board is to be forwarded without delay to the MCO Head Office.

3.4.11 The date of the last visit of the survey, with the report control number, is to be added to the Memorandum, e.g.: '*Unscheduled Survey carried out: Date/Control number*'.

3.4.12 Any deficiencies found and not dealt with immediately, and not made subject to a Condition of Class are to be added to the Memorandum (H), e.g.: 'Unscheduled Survey carried out: Date/Control number. The following deficiencies remain to be dealt with: (list deficiencies).'

SECTION 4. LAID-UP SHIPS

4.1 GENERAL INSTRUCTIONS

4.1.1 Ships which are laid-up after having spent a period of time in service will be maintained in class with the descriptive notation **Laid-up**

4.1.2 On the due date of the periodical surveys, the Owner will be given the option of having the ship disclassed or carrying out Annual Condition Surveys to maintain the class (see also *RSTE I Ch4 Subs 1.1*).

4.2 MAINTENANCE OF CLASS DURING LAY-UP

4.2.1 Vessels laid-up in accordance with the MCO requirements prior to surveys becoming due need not be suspended when these surveys become overdue. However, vessels which are laid-up after their class being suspended as a result of surveys becoming overdue will remain suspended until the overdue surveys are completed.

4.2.2 Annual Condition Surveys are to include items in *RSTE I Ch 4 /1.1.3*. However, each case may be considered individually.

4.2.3 During the Annual Condition Surveys detailed examinations of hull and machinery will not normally be required, but Surveyors are expected to advise HO of any unusual circumstances which might require some items to be specially examined.

4.3 RECOMMISSIONING AFTER LAY-UP

4.3.1 In all cases the requirements are to be requested from HO.

4.3.2 Each case of recommissioning after lay-up may be considered on its merits. However, the classification requirements for ships which have been laid-up for more than **3 months** will generally include:

(a) All overdue Classification Surveys are to be brought up to date.
(b) Any Conditions of Class are to be dealt with.
(c) Main and essential auxiliary machinery including steering machinery is to be examined under working conditions.
(d) Pumping arrangements are to be tested with particular attention to bilges.
(e) Insulation resistance of the electrical installation is to be measured.

4.3.3 When a ship has been laid-up, overdue surveys may be postponed by the MCO until arrival at a suitable port, provided the following requirements are met:

(a) Full details of alternative proposals are to be forwarded to HO for consideration.
(b) Items in *paragraph 4.3.2* are to be examined/tested and found satisfactory.
(c) No cargo may be carried in the meantime.

4.3.4 Attention is to be paid to the condition of boilers before fires are lit, and the condition of the lubricating oil system before circulation pumps are started.

4.4 NEW SHIPS COMMISSIONED AFTER LAY-UP

4.4.1 When a ship has been laid-up on completion of construction without entering service the MCO, at its discretion, may assign survey records from the date of commissioning.

4.4.2 For new ships being commissioned after lay-up, in general the following requirements are to be met:

(a) Main and essential auxiliary machinery including steering machinery is to be examined under working conditions coupled with functional tests of essential automatic controls and alarms.
(b) Opening out of machinery need be effected as is considered necessary by the Surveyor, in order to satisfy himself that no deterioration has taken place during the lay-up period.
(c) Main and auxiliary boilers, exhaust gas economizers and steam heated steam generators are to be examined internally. Safety valves and principal mountings opened up for examination.
(d) Safety valves are to be adjusted under steam and examination of oil burning arrangements and remote controls held under working conditions.
(e) Where an oil gland is fitted to the screwshaft, it should be dismantled for examination of aft end of stern bush and shaft in way.
(f) The pumping arrangements are to be tested, with particular attention to bilges.
(g) The insulation resistance of the electrical installation is to be measured.
(h) The hull is to be reported in all respects free from deterioration and the examination may be required to include a Docking Survey.

4.4.3 In all cases of new ships commissioned after lay- up, specific instructions will be issued by HO.

SECTION 5. POSTPONEMENT OF REPAIRS

5.1 GENERAL INSTRUCTIONS

5.1.1 When it is considered that, for whatever reasons, any part of the hull structure, or main or auxiliary machinery is to be rectified, repaired or renewed, the Owner's representative must be advised without delay.

5.1.2 When impracticable to deal with any item in paragraph, before the ship leaves port and the Surveyor is fully satisfied that there is a sound technical reason for postponement, he must decide the maximum period for which permanent repairs may be postponed without impairing the ship´s safety:

5.1.3 Postponement of permanent repairs may require the completion of immediate temporary repairs to the satisfaction of the Surveyor. In cases of any doubt, advice is to be sought urgently from HO.

5.1.4 Damages or defects, the repair of which may be postponed, fall into two categories, Conditions of Class and Memoranda Entries.

5.1.5 It should be borne in mind that repairs required for classification may affect the status of statutory Certificates. In case of doubt, advice is to be sought urgently from HO.

5.2 CONDITIONS OF CLASS

5.2.1 A **Condition of Class** is a recommendation made in the case of a defective or damaged surveyed item which is not so serious or urgent as to necessitate immediate permanent repairs or withdrawal of class but which is sufficiently serious to require rectification within a prescribed period in order to maintain class. In general, Conditions of Class are not to be agreed to where proper facilities for full and permanent repairs are available.

5.2.2 With few exceptions, Conditions of Class may be divided into two categories:

(a) Defects or damages of such a serious nature that a remedial action within a prescribed short period of time is required, e.g. a direct voyage between the port of survey and a port of repair.

(b) Defects of a less serious nature than above.

The expiry dates of Condition of Class covered by subparagraph (b) should, whenever technically justifiable, be harmonized with the next Periodical Classification Survey.

5.2.3 In general, for machinery items Conditions of Class are not to have a due date extending more than 12 months from the date of survey.

5.2.4 If the due date of the next Docking Survey is considerably in advance of the date of Special Survey, where possible, recommendations for postponement are to be harmonized with the due date of the next Docking Survey. However, the first possible and practicable date for dealing with the repair should always be recommended.

5.2.5 Postponement of damage repairs or surveys after grounding, which necessitate docking, are at the discretion of the Surveyor, but the maximum deferment in the first instance is not to be beyond the due date of the Special Survey or Docking Survey, whichever is the earliest.

5.2.6 It is highly desirable that all Conditions of Class be satisfactorily dealt with at the Special Surveys of hull and machinery. For this reason Surveyors will not recommend the imposition or continuance of Conditions of Class beyond these due dates without giving the matter the fullest consideration.

5.2.7 After a satisfactory service period, Conditions of Class may sometimes be recommended for deletion or, if thought fit, the record in question may be transferred to the Memoranda.

5.2.8 When *paragraph 5.2.7* applies, the Survey Report must clearly indicate that, in the opinion of the Surveyor, the item in question will not affect the efficiency of the hull structure or the safe working of machinery during any recommended period of postponement.

5.2.9 All recommendations intended as Conditions of Class are to be quoted in Classification Certificates and in the appropriate section for Condition of Class Hull or Machinery of the Report.

5.2.10 The Owner or his representative is to be made fully aware of any intention to impose a Condition of Class and that an Interim Certificate is placed on board the ship for the information of Surveyors attending subsequently. If necessary, a copy of the Survey Report is to be forwarded to the Surveyors at the port at which it is proposed to deal with the Condition of Class.

5.2.11 Owners often apply through the local Surveyors for an extension of the time limit imposed for dealing with a Condition of Class. If the condition was originally recommended by, or the item in question was last examined by, the local Surveyors themselves it is essential that, when transmitting the Owner's request to HO, the Surveyors state their own views as to whether or not the request may reasonably be granted or whether a further examination is to be carried out.

5.2.12 Reference is to be made in all Survey Reports to any due Conditions of Class and the Surveyor is to state what action has been taken with regard to them.

5.2.13 Conditions of Class which are becoming due, which are due or which are overdue at the time of survey are to be dealt with to the satisfaction of the Surveyor. In some cases the only available course of action may be to ascertain the continuing efficiency of the item to which the condition applies with a view to further extending the limit already imposed.

5.2.14 If whilst a ship is under survey an Owner is unable or unwilling to deal with a due Condition of Class and a further postponement cannot be recommended by the Surveyor, the ship's class will be placed in jeopardy. The MCO HO is to be advised immediately.

5.2.15 The situation may arise in which a complete Special Survey has been completed, i.e. all survey able items for a ship of that age have been dealt with, but the Owner has been unable to complete all the required repairs or has been able to carry out only part/temporary repairs for a limited period. Under these circumstances, damages and defects that would normally constitute a Condition of Class may be deferred after the examination and testing required by the Special Survey have been completed, provided that there is a sound technical reason for the postponement.

5.2.16 If the Owner has good reasons for postponing the repair and the Surveyor agrees on technical grounds, then, subject to HO´s approval, the assignment of a notation SS (Special Survey) with a due date may be recommended, provided a report on the technical reasons for the agreement is sent to HO for approval.

5.2.17 Hull damages may be found which are intermediate between Conditions of Class and Memoranda items, i.e. with only minor damage to a limited number of stiffening members. Defining them as either one depends on the location of the damage and its extent, as well as on its severity. Age, size, type and general condition of the ship are also relevant.

5.2.18 When assessing the importance of damages covered by *paragraph 5.2.17*, the Surveyor will be guided by the following considerations:

(a) The internal distortion is not to be great and not to compromise the structural efficiency of the hull girder or of the local structure.

(b) The location of the damage is to be taken into account. Deflection of bottom plating between floors in the midship half body, for example, has a detrimental effect on the strength of the girder and similarly, damage to the sheerstrake or stringer within the midship half length may also influence the strength of the hull girder. Damage of the bottom forward due to pounding and ice damage may also be included within this category. Repair of damages of the above nature cannot be left to the Owner's convenience in the first instance and are to be annotated as Conditions of Class.

(c) After a suitable period (e.g., one year) the Surveyors may recommend that the Condition of Class be deleted if no deterioration is observed, or additional intermediate stiffening can be fitted to support the minor damage to the limited number of stiffening members. The damage will then be noted in the Memoranda and permanent repairs can then be left to the Owner's convenience.

5.3 MEMORANDA ENTRIES

5.3.1 Minor hull damages in Memoranda entries are often called blemishes. They are usually indentations of plating with very minor distortion of the stiffening members.

5.3.2 The repair of blemishes can be left to the Owner's convenience, and they do not constitute a Condition of Class. They are to be reported for inclusion in the Memoranda (hull) and will not be noted on the Interim Certificate.

5.3.3 When examination of machinery reveals blemishes of a minor character which do not affect its efficient operation and may, therefore, properly be left to the initiative or discretion of the Owner. Similarly, a defective part may be repaired in such a manner that the Surveyor does not consider re-examination or renewal necessary. Nevertheless, the attending Surveyor may feel obliged

to place such blemishes on record in case they arouse comment at future surveys. Under these circumstances an appropriate entry into the Memoranda (machinery) is to be made.

5.3.4 In addition to conveying information regarding blemishes, the course of surveys, barred speed ranges, Master List changes and other general matters, the Memoranda may also be used by Surveyors when they wish to draw the attention of their colleagues at subsequent surveys to items which they feel should receive more than normal attention but which are nevertheless not sufficiently serious to warrant the recording of a Condition of Class.

5.3.5 Entries in the Memoranda will continue to be, as a rule, special information about hull and machinery items or information for Surveyors on incidence of surveys, etc.

5.3.6 At all surveys where practicable, but in any case during Docking Surveys, it will be necessary for the Surveyors to consider all the items listed in the Memoranda, including the damages or blemishes, in order to confirm that the items listed continue not to degrade the ship's structure or machinery installation.

SECTION 6. REINSTATEMENT OF CLASS − RECLASSIFICATION

6.1 GENERAL INSTRUCTIONS

6.1.1 The MCO may suspend or withdraw class due to non-compliance with the provisions of the Rules for Ships, or at the Owner's request.

6.2 REINSTATEMENT OF CLASS OR RECLASSIFICATION

6.2.1 All applications for reinstatement of class or reclassification are to be referred to the attention of the MCO Head Office at Panama

6.2.2 No Initial Surveys are to be commenced until the Surveyors have been advised of the survey or other requirements by HO.

6.2.3 The procedure for reinstatement of class or reclassification for ships currently classed with another Classification Society is to be pursued in accordance with RSTE Pt I Ch 2 Sec 3.

6.2.4 Upon completion of any surveys required under the present Subsection, the Surveyors are to report to HO by means of Hull or Machinery First Entry Reports any modifications, major repairs or alterations to the hull structure or machinery installation carried out since suspension or withdrawal of class.

HULL
PART 1, CHAPTER 2

8 SURVEY AFTER GROUNDING

8.1 Scope of survey after grounding

9 SCOPE OF SURVEY FOR PARTICULAR SERVICE NOTATIONS

9.1 General instructions
9.2 Scope of surveys for container ship´s or ship´s for the carriage of containers.
9.3 Scope of surveys for dredging vessel´s
9.4 Scope of surveys for tugs, salvage tugs and escort tugs
9.5 Scope of surveys for oil recovery ship´s

10 SURVEYOR GUIDANCE NOTES

10.1 General instructions
10.2 Steel used in repairs
10.3 Welding
10.4 Temporary repairs
10.5 Doubling plates
10.6 Repairs to double bottom tank top
10.7 Repairs of rudder stocks and stern frames
10.8 Repair of twisted rudder stocks
10.9 Repair of bilge keels
10.10 Anchor and chain cables – test and examinations
10.11 Bottom shell repairs afloat
10.12 Repairs at sea

HULL
PART 1, CHAPTER 2

SECTION 1. GENERAL INSTRUCTIONS

1.1 APPLICATIONS

1.1.1 This section sets forth the requirements to the hull of steel ships with purpose, dimensions and design corresponding with the scope of the Rules for Ships.

1.1.2 The survey of hulls of ships with purpose, dimensions and design different from the above mentioned Rules will be performed in accordance with special instructions from the MCO HO and verified in each case.

1.2 DEFINITIONS AND EXPLANATIONS

1.2.1 For the purpose of this Chapter, the following definitions have been adopted:

Coating Condition (see also MESP Ch 1 /1.1.3) is defined as follows:
− **GOOD**: With only spot rusting, affecting not more than 20% of areas under consideration, e.g. on a deck transverse, side transverse, on the total area of plating and stiffeners on the longitudinal structure between these components, etc.
− **FAIR**: Local breakdown at edges of stiffeners and weld connection and/or light rusting affecting 20 % or more of areas under consideration.
− **POOR**: General breakdown of coating affecting 20% or more of areas under consideration or hard scale affecting 10% or more of area under consideration.

Critical areas: Locations vulnerable to substantial corrosion, buckling and/or fatigue cracking

Pitting intensity: The surface area affected by pitting within the area of the plate panel under consideration, as a percentage of the total area of that plate panel.

Prompt and thorough repair: 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.

Protective coating: Is usually to be a hard coating. Other systems (e.g. soft coatings) may be considered acceptable as alternatives provided they are applied and properly maintained in compliance with the manufacturer's specification.

Representative spaces: Spaces which may be expected to reflect the condition of other spaces of similar type and service and with similar corrosion prevention systems. When selecting representative spaces account should be taken of the service and repair history on board and identifiable critical areas.

Substantial corrosion: An extent of corrosion such that assessment of corrosion patterns indicates wastage in excess of 75% of allowable margins, but within acceptable limits.

1.3 SURVEY CONDITIONS

1.3.1 Depending of the survey type, the scope of examinations, inspections, tests and measurements, as well as their procedure and dates may be modified where necessary. Such modifications may be based on the manufacturer's data concerning service life, intervals between examinations and the technical conditions data according with the ship's documents and the experience gathered by the MCO.

1.3.2 Surveys are to be carried out within the intervals specified in *RSTE I Ch 2 Sec 5*.

1.3.3 At all types of surveys the ship's hull is to be prepared for the survey with access, opening and dismantling ensured where necessary.

1.3.4 Spaces, compartments and tanks being examined are to be free of cargo, ships stores clean and ventilated, fuel and lubricating oil tanks clean and gas free.

1.3.5 Oil tankers (including ore/oil ships and ore/bulk/oil ships), chemical tankers and dry bulk cargo ships are to be subjected to the Enhanced Survey Programme (ESP).

1.3.6 The ESP programme encompasses the hull structure and piping systems of cargo holds and tanks, cofferdams, pipe tunnels, void spaces, topside tanks, side tanks and double bottom tanks, etc., in way of the cargo length area and all salt-water ballast tanks. These requirements influence survey procedures at the Special Survey, Intermediate Survey and, in some cases, the Annual Survey.

1.3.7 At survey of cargo tanks of tankers, chemical tankers, ore/oil ships and ore/bulk/oil ships, the conditions, means and equipment are to be provided for a safe execution of a survey. Tanks and spaces are to be gas free up to the tolerable vapor concentration for the relevant products.

1.3.8 Cargo and ballast tanks are to be clean and free of water, scale, dirt, oil residues, etc and significant illumination shall be provided for a thorough examination of structure.

1.3.9 The performance of cargo holds and tanks, ballast tanks survey at sea may be accepted, provided that the Surveyor is given all the necessary assistance from the personnel on board, the conditions and means for the survey comply with *paragraphs 1.3.7* and *1.3.8* and the following requirements are met:

(a) A communication system is to be arranged between the survey party in the tank and the responsible officer on deck.
(b) If a boat or raft is used, the communication system is also to include the personnel in charge of the ballast pump.
(c) If a boat or raft is used an appropriate lifejacket is to be available for all participants. The boat or raft is to have a satisfactory stability, even with one damaged floating chamber.
(d) Explosimetres, oxygen-metres, breathing equipment and lifelines are to be at hand.

1.3.10 Survey of tanks by means of boats or rafts may only be undertaken at the sole discretion of the Surveyor, taking into account the existing safety condition and the response in reasonable weather conditions.

1.3.11 Provisions to be made for sufficient illumination in the spaces and compartments subject to examination.

1.3.12 In some cases it may be required to dismantle the structure and equipment or remove a solid ballast if the same obstruct the accesses to the examined area.

1.4 SURVEY PROGRAMMES

1.4.1 Owners operating ESP ships will be reminded by the MCO of the requirement to prepare and submit a Survey Programme (often referred to as a *Planning Document*) in advance of the Special Survey. These reminders are issued at 12 months and, where applicable, 9 months prior to the Special Survey due date. Whenever necessary, the content and objectives of the Survey Programme may be discussed between the Owner and the Local Surveyor.

1.4.2 Survey Programmes will be received by a MCO Local Office or Surveyor (i.e., local to the Owners) and agreed by the HO.

1.4.3 In the unlikely event that a ship should arrive at the port of survey without an agreed Programme, the Local/Regional Office for the port of survey will review and agree the Survey Programme and forward copies to the Owners and HO for record purposes, in order to avoid delaying the survey. In such cases, the reasons for not submitting the Survey Programme sufficiently in advance are to be advised to HO.

1.4.4 An Executive Summary will be issued by HO following the completion of the Special Survey and evaluation of the related survey report(s). It is therefore imperative that reports contain sufficient information to define the full extent of Close-up Survey,

substantial corrosion areas, if any, and also the condition of protective coating system in salt water ballast tanks, cargo oil tanks and cargo holds.

1.4.5 Where repairs to hull which may affect classification are to be carried out by raiding crew during a voyage, they are to be planned in advance. A complete repair procedure including the extent of proposed repairs and the need for the Surveyor's attendance during the voyage is to be submitted for consideration and agreed upon by the MCO reasonably in advance. Failure to notify in advance of the repairs may result in a suspension of class.

SECTION 2. CLOSE-UP SURVEYS

2.1 GENERAL INSTRUCTIONS

2.1.1 Close-up Survey is defined as a survey where the structural components are within the close visual inspection range of the Surveyor, i.e., normally within reach of hand.

2.1.2 For the Close-up Survey one or more of the following means of access to the Surveyor's satisfaction are to be provided:
(a) Permanent staging and passage through structure.
(b) Temporary staging and passage through structure.
(c) Lifts and movable platforms.
(d) Boats and rafts.
(e) Other equivalent means.

2.1.3 For Close-up Surveys the structure is to be cleaned of rust.

2.1.4 The Surveyor may extend the Close-up Survey, if deemed necessary, taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system, and the following:
(a) Structural arrangements or details which have suffered defects in similar spaces or on similar ships.
(b) Spaces which have structures approved with reduced scantlings in association with an approved corrosion control system (c.c.).

2.1.5 For areas in tanks where coatings are found to be in GOOD condition, as defined in 1.2, the extent of Close-up Surveys may be specially considered.

2.1.6 The locations and extent of Close-up Survey and thickness measurements may be found in *RSTE I Ch 3 Sec 11 & Ch 5 Sec 2*, with additional information available in the *Manual for Enhanced Surveys Programme (MESP).*

2.1.7 The results of Close-up Survey are to be reported in sufficient detail. In the case of those ships where Enhanced Surveys are carried out, this information will be included in the survey file which is to be retained on-board the ship.

SECTION 3. ANNUAL SURVEYS

3.1 GENERAL INSTRUCTIONS

3.1.1 Annual Surveys are to be undertaken within three months before or after each annual anniversary date of the crediting of the previous Special Survey or original construction date. For vessels on Continuous Survey, all Continuous Survey requirements for items due are generally to be completed each year. The Annual Survey will not be credited and the Certificate of Class will not be endorsed unless Continuous Survey items which are due or overdue at the time of the Annual Survey are either completed or granted an extension.

3.1.2 All of the requirements of Special Survey Hull, except for tank testing, will be required each year for the first four years of each five-year cycle. At the fifth year, a complete Special Survey Hull, including tank testing will be required.

3.1.3 For steel barges carried aboard ships, not having a Load Line Certificate, an Annual Survey will not be required provided that in addition to the regular Special Survey at five-year intervals, an Intermediate Survey, equivalent in scope to a Special Survey, is carried out about midway between Special Surveys.

3.1.4 Annual Surveys are to be held, generally, simultaneously with statutory annual or other relevant statutory surveys, wherever

is practicable.

3.1.5 At the Annual Survey the Surveyor is to check the ship's hull and deck machinery in order to be satisfied as to its general conditions.

3.1.6 The Survey Checklist will be used when carrying out the survey. The Checklist has been prepared in accordance with the requirements of the Rules and fig *3.1.6.*

3.1.7 The general requirements for the Annual Survey Hull are shown in table *3.1.7*, in accordance with the type of vessel.

3.1.8 Additional requirements for Annual Survey for general dry bulk cargo vessels are given in table *3.1.8.*

3.1.9 Additional requirements for Annual Survey of ballast tanks are given in table *3.1.9.*

3.1.10 Ballast tanks are to be internally examined, and gauged as necessary if extensive corrosion is found, when this is required as a consequence of the results of the Special Survey or Intermediate Survey. Those tanks which may require to be examined annually are indicated in the Survey Report.

3.1.11 Surveyors are to check that Statutory Certificates are valid at the time of the classification survey and the expiry dates of these certificates and the issuing authority are to be recorded on the Survey Checklist. If a Certificate is to expire shortly after the date of the survey or if the Certificate has already expired, the Renewal Survey is to be held concurrently with the Annual Survey.

3.1.12 The Surveyor is to examine the ship at Annual Surveys so far as is necessary and practicable, in order to satisfy himself as to its general condition. The intention of the Rules is that Surveyors should be satisfied, in general, with the efficiency of the ship.

3.1.13 If cargo spaces are cleared Surveyors are to carry out some internal inspections in order to satisfy themselves regarding their general condition. If any parts of the structure are found to be materially reduced or otherwise defective, special attention is also to be paid to the corresponding structure in other spaces and any defects are to be made good or an appropriate Condition of Class imposed.

3.1.14 In the case of an incomplete survey the outstanding items are to be noted on the Survey Report, an Interim Certificate will be extended and the new date of the survey is to be recommended for assignment upon completion. Items are not to be reported as outstanding when they have been examined and found to require remedial action which cannot be dealt with at the time of survey. A suitably worded Condition of Class is to be imposed.

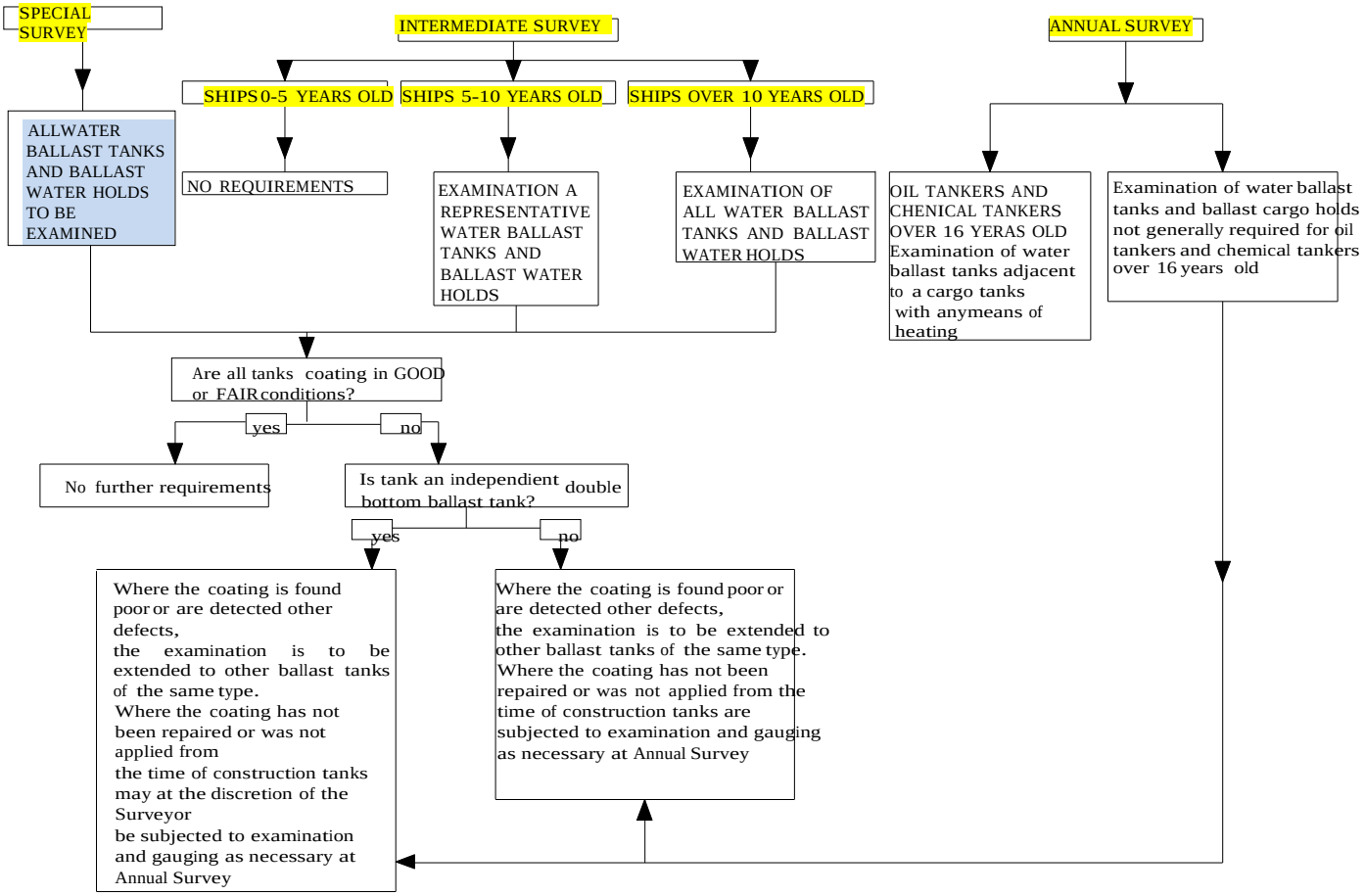


Fig 3.1.6 Annual and Intermediate Survey requirements for cargo holds/tanks structural examination

Table 3.1.7 General requirements for Annual Hull Survey for different types of vessels

Type of vessel	Region	
All types of vessels	Upper weather deck structure	- Conditions of superstructure deck, weather deck plating and ventilators coaming and air pipes. - All air pipes exposed heads installed on exposed decks. - External superstructure bulkheads. - Side, bow and stern watertight doors. - Side scuttles and deadlights, chutes and others open, together with all superstructure closing appliances and flaming screens. - Exposed casing, fiddly openings skylights, flush deck scuttle. - Anchoring and mooring equipment is to be examined so far as is practicable. - The Surveyor is to be satisfied regarding the freeboard marks on the ship's side.
All types of vessels	Firefighting constructions and equipment	- Verification that no significant changes have been made to the arrangement of structural fire protection. - Verification of the operation of manual and automatic doors where fitted. - Verification that fire control plans are properly posted. - Examination, and testing as feasible, of the fire and/or smoke detection and alarm system(s). - Examination of fire main system, and confirmation that each fire pump, including the emergency fire pump can be operated separately so that the 2 required powerful jets of water can be produced from different hydrants. - Verification that fire-hoses, nozzles, applicators and spanners are in good working condition and situated at their respective locations. - Examination of fixed fire-fighting systems controls, piping, instructions and marking, checking for evidence of proper maintenance and servicing, including date of last tests. - Verification that all portable and semi-portable fire-extinguishers are in their stowed positions, checking for evidence of proper maintenance and servicing, conducting random checks for evidence of discharged containers. - Verification, so far as practicable, that the remote control for stopping fans and machinery and shutting off fuel supplies in machinery spaces and, where fitted, the remote controls for stopping fans in accommodation spaces and the means of cutting off power to the galley are in good working order. - Examination of the closing arrangements of ventilators, funnel annular spaces, skylights, doorways and tunnels, where applicable. - Verification that the firemen's outfits are complete and in good condition. - Examination of the electrical installation in areas which may contain flammable gas or vapour or combustible dust to verify it is in good condition and has been properly maintained.

Table 3.1.7 (Cont.)

All types of vessels	Steering gear system	- Main steering gear system is to be checked in operation, as well as auxiliary system and their arrangement, including their associated equipment and control system, and verify that log book entries have been made in accordance with statutory requirements
	Loading program (instrument)	- Existence of loading program approved by the MCO. - Concordance between the loading program and the real situation of the vessel.
General dry cargo vessels	Cargo hatch cover	- Cargo hatch cover and their comings - The efficient operating conditions of mechanical operating hatch covers, including: stowage, fit, securing, sealing, operational test of hydraulic or other power components - Test for thickness and to confirm the satisfactory conditions of drainage channels, tracks and wheels. - Cargo hatch cover of the portable type are to be examined to confirm that the pontoon are in good structural conditions as well as the cover and closing appliances.
	Cargo holds	- For ships with more than 10 years old: Overall Survey of one forward and ones after cargo hold and their associated tweendeck spaces. Where considered necessary by the Surveyor a thickness measurement is to be carried out. If the result of the thickness measurement indicates a substantial corrosion, the extent of the thickness measurement is to be extended according with *table 5.4.16*.
Oil tankers, including ore/bulk/oil ships and ore/oil ship	Cargo tanks area	- Examination of cargo tank openings including gaskets, covers, coamings and screens. - Examination of cargo tank venting arrangements including secondary means of venting, or over/under pressure alarms where fitted, with associated pressure/vacuum valves and flame screens. - Examination of flame screens on vents to all bunker, oily ballast and oily slop tanks and void spaces, so far as is practicable. - Examination of cargo, crude oil washing, bunker, ballast and vent piping systems together with flame arresters and pressure/vacuum valves, as applicable above the upper deck within the cargo tank area, including vent masts and headers. - Verification that no potential sources of ignition such as loose gear, excessive products in the bilges, excessive vapours, combustible materials, etc., are present in or near the cargo pump room and that access ladders are in good condition. - Examination of cargo pump rooms and pipe tunnels (where fitted) and examination of all pump room bulkheads for signs of leakage or fractures and, in particular, the sealing arrangements of all penetrations in these bulkheads. - Verification that the pump room ventilation system is operational, ducting intact, dampers operational and screens are clean.

Table 3.1.7 (Cont.)

Oil tankers, including ore/bulk/oil ships and ore/oil ship	Cargo tanks area	- External examination of the piping and cut out valves of cargo tank and cargo pump room fixed fire-fighting system. - Verification of the deck foam and deck sprinkler systems. - Examination of the condition of all piping systems in the cargo pump room so far as is practicable. - Examination, so far as is 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 pump room bilge system, and checking that pump foundations are intact. - Verification that installed pressure gauges on cargo discharge lines and level indicator systems are operational. - Verification that at least one portable instrument for measuring flammable vapour concentrations is available, together with a sufficient set of spares and a suitable means of calibration. - Examination of any inert gas system, if fitted. - Verification that any special arrangements made for bow or stern loading and unloading are in good condition.
	Ballast tanks area	- For ships greater than 15 years of age, all ballast tanks adjacent to (i.e. with a common plane boundary) a cargo tank with any means of heating are to be examined. Thickness measurement is to be carried out where considered necessary by the Surveyor. - Special consideration may be given by the Surveyor to those tanks or spaces where the coatings are found in GOOD condition, at the previous Intermediate or Special Survey. - For ballast tanks, in areas where substantial corrosion, has been noted then additional thickness measurements are to be carried out in accordance with *tables 5.5.17-1* to *5.5.17-9*, as applicable. The survey will not be considered complete until these additional thickness measurements have been carried out.
Chemical tankers	General Arrangement	- Examination of gauging devices, high level alarms and valves associated with overflow control. - Verification of devices for measuring the temperature of the cargo and associated alarms. - Examination of the cargo heating/cooling system sampling arrangements where fitted. - Verification that wheelhouse doors and windows, side scuttles and windows in superstructure and deckhouse ends facing the cargo area are in good condition. - Verification that pump discharge pressure gauges fitted outside the cargo pump rooms are satisfactory. - Verification that pumps, valves and pipelines are identified and distinctively marked. - Verification that the remote operation of the cargo pump room bilge system is satisfactory. - Verification of cargo pump room rescue arrangements.

Table 3.1.7
(Cont.)

Chemical tankers	General Arrangement	- Examination of gauging devices, high level alarms and valves associated with overflow control. - Verification that devices provided for measuring the temperature of the cargo and associated alarms are satisfactory. - Examination of the cargo heating/cooling system sampling arrangements where fitted. - Verification that wheelhouse doors and windows, side scuttles and windows in superstructure and deckhouse ends facing the cargo area are in good condition. - Verification that pump discharge pressure gauges fitted outside the cargo pump rooms are satisfactory. - Verification that pumps, valves and pipelines are identified and distinctively marked. - Verification that the remote operation of the cargo pump room bilge system is satisfactory. - Verification that cargo pump room rescue arrangements are in order. - Verification that removable pipe lengths or other approved equipment necessary for cargo separation are available, and satisfactory. - Verification that the ventilation system including portable equipment, if any, of all spaces in the cargo area is operational. - Verification that arrangements are made for sufficient inert/padding/drying gas to be carried to compensate for normal losses and that means are provided for monitoring of ullage spaces. - Verification that arrangements are made for sufficient medium to be carried where drying agents are used on air inlets to cargo tanks.
		- Verification that suitable protective clothing is available for crew engaged in loading and discharging operations and that suitable storage is maintained. - Verification that the requisite safety equipment and associated breathing apparatus with requisite air supplies and emergency escape respiratory and eye protection, if required, are in good condition and are properly stowed. - Verification that medical first aid equipment including stretchers and oxygen resuscitation is in good condition and that satisfactory arrangements are made for antidotes for cargoes actually carried to be on board. - Verification that decontamination arrangements are operational. - Verification that the requisite gas detection instruments are on board and that satisfactory arrangements are made for the supply of any required vapour detection tubes. - Verification that the cargo sample stowage arrangements are in good condition.

Table 3.1.7 (Cont.)

Chemical tankers	Ballast tanks area	(a) For ships of more than 15 years of age, all ballast tanks adjacent to a cargo tank with any means of heating are to be examined. Thickness measurement is to be carried out where considered necessary by the Surveyor. Special consideration may be given by the Surveyor to those tanks or spaces where the coatings are found in GOOD condition at the previous Intermediate or Special Survey. (b) For ballast tanks, in areas where substantial corrosion,, has been noted then additional measurements are to be carried out in accordance with *tables 5.6.15-1* to *5.6.15-4*. The survey will not be considered complete until these additional thickness measurements have been carried out.
Chemical tankers	Inert gas system	(a) Examination of the condition of piping including vent piping above the upper deck in the cargo tank area and overboard discharges through the shell so far as practicable, together with components for signs of corrosion or gas leakage/effluent leakage. (b) Verification of the operation of both inert gas blowers. (c) Checking the scrubber room ventilation system. (d) Checking so far as is practicable, of the deck water seal for automatic filling and draining and checking for presence of water carry-over. Checking the operation of the non-return valve. (e) Testing of all remotely operated or automatically controlled valves including the flue gas isolating valve(s). (f) Checking the interlocking features of soot blowers. (g) Checking that gas pressure regulating valve automatically closes when the inert gas blowers are secured. (h) Checking, the following alarms and safety devices of the inert gas system using simulated conditions where necessary: - 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. - Low water pressure to the scrubber. - Accuracy of portable and fixed oxygen measuring equipment by means of calibration gas.
Dry bulk cargo ships	Cargo holds	(a) Examination of cargo holds according with the following requirements: - For ships less than 10 years old: An Overall Survey of the forward and aft cargo hold. If the survey reveals the need of remedial measures, then the Survey is to be extended to include all cargo holds. - For ships 10-15 years old: An Overall Survey of all cargo holds. Close-up Survey of at least 25% of the cargo holds side frames, their lower end attachment and adjacent shell plating in the forward cargo hold. If the survey reveals the need of remedial measures, it is to be extended to include a Close-up Survey of all the cargo holds side frames and adjacent shell plating of that hold, as well as a Close-up Survey of a sufficient extent of all remaining cargo holds.

Table 3.1.7 (Cont.)

Dry bulk cargo ships	Cargo holds	- When deemed necessary by the Surveyor, a thickness measurement is to be carried out. If the results of thickness measurement indicate substantial corrosion, the extent of thickness measurement is to be done according with requirements of *tables 5.7.13-1* to *5.7.13-4*. - For ships older than 15 years: An Overall Survey of all cargo holds. Close-up Survey of at least 25 % of the cargo holds side frames, their lower end attachment and adjacent shell plating in the forward cargo hold and other selected cargo hold. If the survey reveal the need of remedial measures, the Survey is to be extended to include a Close-up Survey of all the cargo holds side frames and adjacent shell plating of that hold, as well as a Close-up Survey of sufficient extend of all remaining cargo holds. When considered necessary by a Surveyor, a thickness measurement is to be carried out. If the results of thickness measurement indicates substantial corrosion, then the extend of thickness measurement is to be done according with requirements of *tables 5.7.13-1* to *5.7.13-4*.
Ro-Ro & other ships with bow doors, inner doors, side doors and stern doors	Doors	- Verification of the operation of doors and their power units. - Examination of the door structure and surrounding ship structure. - Examination of the door sealing arrangements including gaskets and retaining bars. - Examination of the door cleating, locking and securing arrangements. - Examination of the door hinging arrangements. - Verification of the local and/or remote control of the securing devices/cleats. - Examination of all equipment associated with the opening, closing and securing of the door, e.g. wire ropes, chains, sheaves, rollers, guides, shackles, etc. - Verification of the tightness of the doors. - Examination and testing of remote control panels and associated indicator lights, closed circuit television systems, water leakage indicator lights and alarm systems. - Examination of the required notice boards and verification of log entries. - Verification of the satisfactory testing of the bilge systems for the space between the inner and outer bow doors and of the vehicle deck. - Verification that the approved Operation and Maintenance Manual is on board and satisfactorily maintained.

Table 3.1.8 Additional requirements for Annual Surveys of dry bulk cargo vessels

Ships 5 - 10 years old	Ships 10 -15 years old	Ships >15 years old
1. Close-up examination of steel hatch covers, coamings and stiffeners where hatch covers or coamings undergo substantial repairs the strength of securing devices should be upgraded to comply with the requirements of **Annex 13 of IMO Resolution A.744(18).** 2. Close-up Survey and thickness measurement of areas identified with substantial corrosion at the previous Special Survey.		
Overall Survey of the forward cargo hold and an aft cargo hold.	Overall Survey of all cargo holds. Close-up Survey of at **least 25%** of the cargo hold side shell frames, their lower end attachments, and adjacent shell plating in the forward cargo hold.	Overall Survey of all cargo holds. Close-up Survey of at **least 25%** of the cargo hold side shell frames, their lower end attachments, and adjacent shell plating in the forward cargo hold and one other selected cargo hold

NOTES:

1. Where the survey reveals the need for remedial measures, it is to be extended to include all cargo holds.
2. Close-up Survey is required with the area of the lower one-third of the length of the cargo hold side shell frames.
3. Where the survey reveals the need for remedial measures, it is to be extended to include a Close-up Survey of all the cargo hold side shell frames and adjacent shell plating of that cargo hold, as well as a Close-up Survey of sufficient extent of all remaining cargo holds.
4. When considered necessary, thickness measurement is to be carried out. Where the results of thickness measurement indicate **substantial corrosion,** the extent of thickness measurement is to be in accordance with requirements of *tables 5.7.13-1* to *5.7.13-4*, where applicable.
5. Where protective coatings are found in GOOD condition, the extent of the Close-up Survey and thickness measurement may be specially considered. Prior to any coating or recoating of cargo holds, scantlings are to be confirmed by thickness measurement with the Surveyor in attendance.

Table 3.1.9 Additional requirements for Annual Survey of ballast tanks

Ships 5 - 10 years old	Ships 10- 15 years old	Ships >15 years old
1. Close-up Survey and thickness measurements of areas identified with substantial corrosion at the previous Special Survey. *2.* Examination of details as per *3.1.5.* *3.* Examination of ballast tanks identified as a result of previous surveys (Intermediate or Special).		
No specific requirements	No specific requirements	All ballast tanks adjacent (i.e. with a common boundary) to cargo tanks with any means of heating are to be examined internally.

NOTES:

1. When considered necessary, thickness measurement is to be carried out. Where the results of thickness measurements indicate **substantial corrosion**, the extent of the thickness measurement should be in accordance with ***tables 5.6.15-1, 5.6.15-2, 5.6.15-3* and *5.6.15-4***
2. If the protective coatings had been found in **GOOD** condition at the previous Intermediate or Special Survey, special consideration may be given by the attending Surveyor.

3.2 ANNUAL SURVEY OF ALL VESSELS – SPECIAL INSTRUCTIONS

3.2.1 During the examination the following particularities of the fire fighting constructions and equipment are to be taken into account:

(a) Except for hull structural arrangements and essential shipboard engineering systems required under normal operating conditions, included in the Rules to harmonize with SOLAS requirements, fire protection, detection and extinction arrangements in ships to which the SOLAS Regulations apply are under the responsibility of the Government of the flag State and are not to be surveyed for classification.

(b) In ships to which SOLAS Regulations do not apply, the fire protection, detection and extinction are classification matters and are to be examined as required by the relevant checklist.

(c) If fire equipment is found to be seriously defective, an Interim Certificate is not to be issued unless suitable temporary alternative arrangements are provided.

(d) Before an Interim Certificate is issued, the Owner's proposals regarding the temporary alternative arrangements are to be submitted to HO. Under exceptional circumstances this may mean detaining the ship unduly. In such cases, the Surveyor is to satisfy himself regarding the adequacy of the temporary alternative arrangements taking into account the Owner's proposals for permanent replacement or repair. When it has been agreed that such temporary arrangements are acceptable, the restoration to Rule standards of any defective appliance or equipment will constitute a condition of class with limited duration at the discretion of the Surveyors. If the ship leaves port without compliance, HO is to be advised immediately.

(e) After any fire on board a ship, it will be necessary that the Surveyor examines fire-fighting arrangements to ensure that all equipment remains, or has been placed, in a satisfactory condition before the ship proceeds to sea.

(f) The Surveyors, by using due diligence, can assist Owners by identifying potential fire hazards. In addition to the obvious need to separate combustible materials from ignition sources, the following due attention is to be paid to the following:
   (i) Cleanliness; excessive oil s pills; accumulation of oily rags; oil seepage; full drip trays and bilges.
   (ii) Sounding pipes. All self-closing cocks on short sounding pipes are to be checked frequently for correct operation.
   (iii) Air vent and breather pipes from storage and service tanks for lubricating and hydraulic oil that terminate in machinery spaces. It should be confirmed that such pipes are located with the open ends positioned so that any issuing oil cannot come into contact with electrical equipment or heated surfaces.

(g) To obviate potential fire hazards Surveyors are to ensure that the standard to which the installation was originally built is maintained and advise the Owner at once when a serious fire risk is discovered, so that corrective measures may be undertaken.

3.2.2 Where *Loading Instrument* appears in the class or descriptive notations or in the Memoranda (Hull), the Loading Programme is to be tested annually using the endorsed test conditions (identified by the MCO HO stamp) held on board the ship. The attending Surveyor is to witness the test condition data being input to the computer by the ship's personnel and compare the results obtained to those of the test conditions. If the results obtained are not identical to the endorsed test conditions, or within the stated tolerances, or if there are deficiencies in the hardware, then:

(a) A Condition of Class is to be recommended if the Loading Programme has been fitted as a Class requirement.

(b) A Hull Memoranda is to be entered if the Loading Programme is fitted as an Owner requirement.

(c) The Condition of Class or Hull Memoranda are to identify the area of non-compliance.

(d) Where an installed Loading Programme has no identification of having previously been examined by Surveyors to the MCO, the fact is to be reported to HO immediately.

3.2.3 Ships having undertaken major alterations or conversions affecting longitudinal strength and/or stability, such as lengthening or removal of decks, will generally be considered as new ships with respect to Loading Programmes. In all those cases details are to be forwarded to HO, which will coordinate the work.

3.2.4 Ships which have been refitted with a Loading Programme will require it to be examined as a class requirement or as an Owner requirement, whichever appropriate.

3.2.5 When an on-board Loading Programme is upgraded or replaced by a new system, it is to be examined and a new certificate is to be issued.

3.2.6 The anchoring and mooring equipment is to be examined as far as is practicable. Surveyors are to examine the anchors, chain cables and windlass as far as is practicable in order to confirm the equipment is in satisfactory condition. For those ships where mooring ropes are required in accordance with the Rules the Surveyor should also examine the mooring ropes to confirm their satisfactory condition.

3.2.7 Where a cover or seal of sufficient strength and proper design, is fitted over the spur ling pipe to the chain locker while the ship is at sea. Attention is to be paid to the means of preventing a heavy ingress of water through the spur ling pipe tops and, if necessary, the Owner's and ship's officers' attention is to be drawn to this point. A common method of cementing these up and lashing around a canvas cover has proved to be unsatisfactory in very large ships where lateral movement of the anchor chain cable has broken up the cement. A satisfactory arrangement consists of fitting steel plates, in halves, hooked over the spur ling pipe tops and protected by a canvas cover securely lashed

3.3 ANNUAL SURVEY OF GENERAL DRY CARGO SHIPS - SPECIAL INSTRUCTIONS

3.3.1 Cargo holds are to be surveyed in accordance with the *tables 3.1.6* and *3.1.7*. If any parts of the structure are found to be materially reduced or otherwise defective, special attention is also to be paid to corresponding structure in all other cargo holds and any defects to be made good or a suitable condition of class imposed.

3.3.2 During the examination of steel hatch cover following particularities are to be taken into account:

(a) After the examination the Surveyor is to be satisfied as to the efficient condition of the means of ensuring weathertightness of steel hatch covers.

(b) Complaints of damage to cargo due to seepage of water through supposedly weathertight steel hatch covers indicate that Surveyors are to pay special attention to this item and the condition of the sealing gasket is to be verified, particularly at cross joints (hatch cover gasket permanent deflection is to be less than 50% of the design compression or 5 mm, whichever is the smaller).

(c) The Surveyors are to pay particular attention to possible deterioration in the thickness of the top, side and end plating of each section of the covers. End plating, in way of the cross joints, is specially vulnerable to corrosion due to the difficulty in cleaning and painting and arrangements are to be made for each end plate to receive special attention during the surveys.

(d) Attention is also to be given to the cross joint gasket retaining bars and drainage channels which also suffer from neglect. If considered necessary a chalk test may be carried out and, on completion of the examinations, the covers are be hose tested or other established means such as ultrasonic detection used.

(e) For ships whose hatch covers are not required to have gaskets, hose testing will not be required.

(f) Care is to be specially taken when examining cross joints of steel hatch covers in the stowed position to ensure that the covers are stable and restrained from movement.

(g) Surveyors are to include the following information on the Survey Report, when repairs are found necessary to covers at Annual or Periodical Surveys. In cases where repairs are being affected or recommended, the condition of the following items prior to repair:

  (i) Gasket retaining bars.
  (ii) Compression bars.
  (iii) Gasket material, its condition, resilience and if permanent grooving is apparent.
  (iv) Alignment of compression bars upon the gasket specially at cross joints.
  (v) Wear of linkages, etc., which may result in misalignment of adjacent panels.
  (vi) Tracks, rollers, wheels, etc., wear of which can result in misalignment of adjacent panels or inability of the compression bar to compress the gasket.
  (vii) Side and end cleats.
  (viii) Cross joint cleats and their alignment with respect to adjacent panels.

3.3.3 Where renewal of gaskets is required, the Surveyor is to ensure that the condition of all retaining and compression bars in way is satisfactory. Where the foregoing items are found efficient and no repairs are required, details of the condition need not be reported.

3.3.4 If the Surveyor finds that he cannot carry out any part of the examination in paragraph 3.3.3 to his satisfaction, he is to advise HO of the circumstances.

3.3.5 In cases where a ship's commitments are such that all the required repairs to steel hatch covers cannot be completed before leaving port, the Surveyors is to remember that the efficiency of closing appliances is a requirement of the LL-66 Convention, as well as a Class item.

3.3.6 In case the ship has to sail, and provided the strength of the covers is not in question, the weathertightness of the hatch covers can be ensured by the fitting of two tarpaulins of adequate strength and size to cover each of the affected hatches, after the closing and fastening of the steel covers.

3.3.7 Tarpaulins are to be secured in place by a circumferential lashing together with transverse lashings attached to eye plates welded in suitable positions on coamings or deck and protected against chafing by padding of cross joint wedges, wheels, etc. When this arrangement is adopted on ships with B-60 freeboards, the draught may need to be restricted and instructions from HO are to be requested.

3.3.8 The arrangement in paragraph 3.3.7 will be acceptable only as a last resort and will be valid solely for a single voyage to a repair port. Prior to agreement, details of the defects and method of securing hatch covers and tarpaulins are to be submitted for approval.

3.3.9 In ships whose cargoes are carried exclusively in closed containers, hose testing is of diminished importance and need not be carried out at Annual Surveys provided that it is carried out at Docking Surveys and Special Surveys, when major repairs are involved, or when the Surveyor suspects that the weathertightness of covers may have been impaired.

3.3.10 When Owners propose the fitting of tarpaulins as a permanent repair they are to be advised that this would entail a full

conversion to pontoon covers. This necessitates the removal of all proud fittings plus the provision of side and end coamings to contain the covers and battening arrangements. *Fig 3.3.10* indicates typical arrangements and fittings which are required to be detached to permit smooth fitting of tarpaulins, also new coamings and cleating which are required.

3.3.11 If the ship is not fitted with cargo lifting gear, the rolling facility is to be kept, and since rollers and cleating arrangements would prevent an efficient closure by tarpaulins, their use could not be considered as definitive, and repairs to maintain the original arrangements would be required.

3.3.12 Before any agreement is made with the Owners in relation with the fitting of tarpaulins, the following information is to be submitted urgently to HO, and is to include the Surveyor's findings as regards:

(a) Thickness measurement of beams, girders, top, side and end plating of the covers with a view to a strength assessment. If general wastage of these items is found, a complete renewal of the covers in the form of pontoons will probably be required.

(b) The extent of deterioration of gasket retaining bars, compression bars, gasketing, cleating, etc., is to be ascertained.

(c) Proposed battening arrangements. If the conversion is carried out, a Report is to be placed on board and copied to HO together with copies of the approved plans.

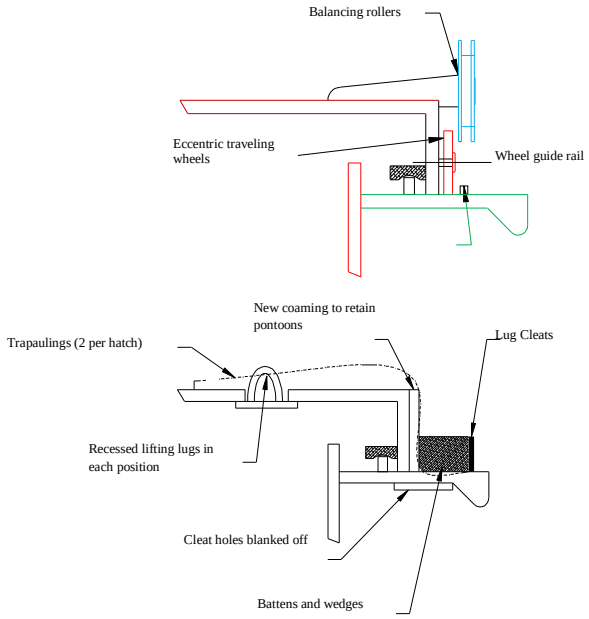


Fig 3.3.10 Fitting of tarpaulins

3.3.13 Water ballast tanks are to be surveyed in accordance with *tables 3.1.7* and *3.1.9*.

3.4 BULK CARRIERS - SPECIAL INSTRUCTIONS

3.4.1 Cargo holds of bulk carriers are to be surveyed in accordance with the Rules (*RSTE VII Ch 7*) and as indicated in *tables 3.1.7* and *3.1.9*.

3.4.2 If any parts of the structure are found to be materially reduced or otherwise defective, special attention is also to be paid to corresponding structure in all other cargo holds and any defects are to be made good or a suitable Condition of Class imposed. To avoid the possibility of the same holds being examined at successive surveys, the holds which have been examined are to be reported in the Survey Report.

3.4.3 Hatch covers of bulk carrier holds are to be examined in accordance with the requirements of *Subs 3.3*.

3.5 ANNUAL SURVEY OF RO-RO SHIPS AND SHIPS WITH BOW, INNER, SIDE AND STERN DOORS - SPECIAL INSTRUCTIONS

3.5.1 The Rules (*RSTE VII Ch 9*) set forth the requirements for bow, inner, side and stern doors. At Annual Surveys doors and associated equipment are to be examined to confirm their satisfactory condition.

3.5.2 Particular attention is to be paid to the structure in way of the door sealing arrangements, hinging, cleating and securing arrangements for any signs of cracks, corrosion and deformation.

3.5.3 The survey of *ro-ro passenger* ships is to be based on the following guidelines:

(a) An approved Operating and Maintenance Manual (OMM) will be required for the ship.
(b) The maximum compression of the door seals as stated in the OMM and gasketing is to be renewed wherever any signs of cracks or hardening are noted.
(c) The opening/closing and securing/locking devices for the doors are to be interlocked so they may only operate in the proper sequence.
(d) The maximum clearance values for the bearings of door hinges and for the bow door thrust bearing will be as indicated in the OMM.
(e) For the indicator systems, it will be required that visible indication and sound alarms be positioned on the navigation bridge and on operating panels. It should not be possible to turn off indicator lights, which are to have a lamp test function and power is to be supplied by the emergency source. Fail-safe performance is to be as stated in the OMM. Sensors are to be protected from water, ice and mechanical damage.
(f) A television surveillance system is to be provided for all doors, and monitors to be sited on the navigation bridge and engine room. Position of bow and inner doors, and position of securing devices is to be monitored.
(g) Water leakage sound alarms for bow doors and other doors are to be posted on the navigation bridge and the engine room.

3.5.4 For **ro-ro cargo ships** the following guidelines may be applied:

(a) The maximum compression of door seals is not to exceed 10% of packing thickness.
(b) The maximum clearance values for the bearings in door hinges should not exceed the design value plus 2 mm.
(c) A water leakage detection system with a sound alarm is to be arranged to provide an indication to the navigating bridge.

SECTION 4. INTERMEDIATE SURVEYS

4.1 GENERAL INSTRUCTIONS

4.1.1. The Rules for Ships (*Pt I Ch 2 Sec 5*) require the Intermediate Survey to be held at the intervals specified therein. However, this Survey may be started at the second and completed at the third Annual Survey of the ship. This is acceptable provided that the full requirements of an Annual Survey are held within three months before or after the second anniversary and the additional items required for the Intermediate Survey are completed by three months after the third anniversary, by which time a further Annual Survey is to be held.

4.1.2 The scope of Intermediate Hull Survey is given in table *4.1.2*.

4.1.3 Additional scope of hull survey, depending on the ship's age is given in tables *4.1.3-1* for chemical tankers and *4.1.3-2* for ships with less than 5 years old.

4.1.4 Intermediate Surveys of oil tankers and bulk carriers are to be carried out in accordance with the Enhanced Survey Programme. In this case, it may be necessary to take the measurements of the residual thickness of the framing and bulkhead elements bounding ballast and cargo compartments, in the area of substantial corrosion wear of the under deck framing girders and upper strakes of transverse and longitudinal bulkheads, the sections of the shell plating in the area of cargo, stripping and bilge system suctions branch pipes, bilge wells for the bilge waters, the transverse bulkhead shelves, the longitudinal framing longitudinal bulkheads ,etc.

4.1.5 The performance of the compartment thickness test is usually not required. However, being doubtful about the survey result, the Surveyor may demand the performance of all the necessary tests.

4.1.6 The survey checklist is to be used when carrying out the Survey. *Tables 3.1.7, 3.1.9* and *4.1.2* and *fig 3.1.4* may be used as additional guidelines.

4.1.7 Where water ballast spaces and cargo spaces are required to be examined, the preparation for survey is to be of a similar

standard and extent as that required for Special Survey.

4.1.8 Upon satisfactory completion of the Intermediate Survey the Certificate of Class is to be endorsed in the appropriate section.

4.1.9 In the case of an incomplete survey the Certificate of Class is not to be endorsed; the outstanding items for completion of survey are to be noted on the Interim Certificate and the new date of survey is to be recommended for assignment on completion.

4.1.10 Where deemed necessary by the Surveyor as a result of the Overall and Close-up Survey, the survey is to be extended to include a Close-up Survey of all the side shell frames and adjacent shell plating of all cargo holds, as well as a Close-up Survey of sufficient extent of all remaining cargo holds.

4.1.11 Thickness measurement is to be carried out of sufficient extent to determine the level of corrosion of those areas subject to Close-up Survey. Where the results of thickness measurement indicate substantial corrosion, the extent of thickness measurement are to be in accordance with *Sec 5, tables 5.7.13-1* to *5.7.13-4*, as applicable.

4.1.12 Where protective coatings are found to be in GOOD condition, as defined in *paragraph 1.2.1*, the extent of Close-up Survey and thickness measurement may be specially considered. Prior to any coating or recoating of cargo holds, scantlings are to be confirmed by thickness measurement with the surveyor in attendance.

4.1.13 Testing of cargo holds and ballast tanks is not a requirement, but may be requested when deemed necessary by the attending Surveyor.

4.1.14 Pressure testing and/or thickness measurements may be requested if deemed necessary by the Surveyor.

4.1.15 If the ship is not in a gas free condition, the results of previous recorded insulation testing may be accepted

4.1.16 If no visible structural defects are noted, the examination may be limited to verification that the protective coatings remain efficient.

4.1.17 If the protective coating is found to be in POOR condition, or where no protective coating was applied, the examination is to be extended to other ballast tanks of the same type.

4.1.18 If the protective coating is found to be in POOR condition according with *paragraph 1.2.1*, or not applied and it is not renewed/applied, the tanks will be required to be examined and thickness measurements carried out as considered necessary on an annual basis.

4.1.19 Where the results of the thickness measurements indicate substantial corrosion, the extent of the thickness measurements is to be taken in accordance with *tables 5.5.17-1* to *5.5.17.4* as applicable.

Table 4.1.2 Scope of Intermediate Hull Survey for different types of vessels

All vessels		Requirements of *Sec 3*, are to be met as far as applicable.
	Water ballast tanks	(a) A general examination of water ballast tanks. If such examination reveals no visible structural damage, then the examination may be limited to a verification of protective coating. (b) When considered necessary by the Surveyor, thickness measurement of structure will be carried out.
	Anchoring and mooring system	Anchors are to be partially lowered and raised using the windlass.
	Electrical generating set	Electrical generating set will be inspected under working conditions.

General dry cargo vessels	General	(a) An Annual Survey commensurate with the age of the ship is to be held (*Sec 3*). (b) Close-up Survey and thickness measurement of areas identified with substantial corrosion at the previous Special Survey. (c) Thickness measurement of those areas subject to Close-up Survey.
	Water ballast tanks (For ships > 5 years age)	(a) An internal examination of representative water ballast tanks is to be carried out. (b) In those tanks where the protective coating is to be found in POOR condition, according with *paragraph 1.2.1* and it has not been repaired, where a soft coating has been applied or where a protective coating was not applied from the time of construction maintenance of class will be subject to the spaces in question being examined and gauged as necessary at Annual Surveys.
	Water ballast tanks (For ships up to 10 years age)	(a) A survey to the same extent as the previous Special Survey. (b) Pressure testing of cargo and ballast tanks is to be carried out if deemed necessary by the attending Surveyor.
	Cargo holds (For ships up to 10 years age)	An Overall Survey of one forward and one after cargo hold and their associated tweendeck spaces.
	Cargo holds (For ships 10- 15 years old)	(a) An Overall Survey of all cargo holds. (b) Close-up Survey to establish the condition of at least 25% of the cargo hold side shell frames, including their upper and lower end attachments, adjacent shell plating and the transverse bulkheads in the forward cargo hold and one other selected cargo hold.

Table 4.1.2 (Cont.)

	Cargo holds (For ships ≥15 years)	A survey to the same extent as previous Special Survey, including: - Hull girder thickness measurements. - Overall Survey, assessment of coatings, Close-up Survey and thickness measurement of all S.W. ballast tanks and cargo holds. - Overall Survey of all remaining spaces within the cargo hold length, including voids/duct keel/cofferdam spaces. - Examination of all piping systems passing through all spaces within the cargo hold length.
Oil tankers, including ore/bulk/oil ships and ore/oil ship	General arrangement	(a) An Annual Survey commensurate with the age of the ship is to be held. Scope of survey is to be in accordance with *Sec 3*. (b) An examination of cargo, crude oil washing, bunker, ballast, steam and vent piping on the weather decks, 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, gauged, or both. (c) A General Examination within the areas deemed as dangerous, such as cargo pump rooms and spaces adjacent to and zones above cargo tanks, for defective and non-certified safe-type electrical equipment, improperly installed, defective and dead-end wiring. (d) An electrical insulation resistance test of the circuits terminating in, or passing through, the dangerous areas is to be carried out. If the ship is not in a gas free condition the results of previously recorded test readings may be accepted.
	Water ballast tanks	All salt-water ballast tanks where a protective coating is found to be in POOR condition, and it has not been repaired, where a soft coating has been applied or where a protective coating was not applied from the time of construction, the tank in question is to be examined and gauged as necessary at Annual Surveys.
	Tanks (For ships > 5 years of age and up to 10 years)	(a) Overall Survey of representative salt-water ballast tanks, as selected by the Surveyor is to be carried out. (b) For tanks where a protective coating is found to be in POOR condition, according with *paragraph 1.2.1*, or other defects are found, where a soft coating has been applied or where a protective coating was not applied from the time of construction, the examination is to be extended to other ballast tanks of the same type.
	Tanks (For ships > 10 years)	(a) Overall Survey of at least two representative cargo tanks. (b) Overall Survey of all salt-water ballast tanks, including any combined cargo/ballast tanks. (c) Close-up Survey of salt-water ballast tanks to the same extent as the previous Special Survey and of two combined cargo/ballast tanks. Where protective coatings are found to be in GOOD condition, the extent of Close-up Survey may be specially considered. (d) In areas where substantial corrosion has been noted then additional measurements are to be carried out in accordance with *tables 5.5.15-1* to *5.5.15-9* as applicable. The survey will not be considered complete until these additional thickness measurements have been carried out. (e) Machinery and boiler spaces including tank tops, bilges and cofferdams, sea suctions and overboard are to be generally examined.

Table 4.1.2 (Cont.)

	Tanks (for ships ≥15 years age)	(a) A Docking Survey is to be a part of the Intermediate Survey. (b) The intermediate survey should be at the same extent as the previous renewal survey. However, pressure testing of cargo and ballast tanks is not required, unless deemed necessary by the attending surveyor.
Chemical tankers	General Arrangement	(a) A General Examination of the areas deemed dangerous, such as cargo pump rooms and spaces adjacent to and zones above cargo tanks, or defective and non-certified safe-type electrical equipment, improperly installed, defective and dead-end wiring. An electrical insulation resistance test of the circuits terminating in, or passing through, the dangerous areas is to be carried out. If the ship is not in a gas free condition the results of previously recorded test readings may be accepted. (b) Examination of vent line drainage arrangements. (c) Verification that cargo heating/cooling system is in good condition. (d) Verification that the ship's cargo hoses are in good condition. (e) Verification that where applicable, pipelines and independent cargo tanks are electrically bonded to the hull. (f) An examination of cargo, cargo washing, bunker, ballast, steam and vent piping on the weather decks, 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 pressure tested, gauged or both.
	Water ballast tanks	All salt-water ballast tanks where a protective coating is found to be in POOR condition, and it has not been repaired, where a soft coating has been applied or where a protective coating was not applied from the time of construction, the tank in question is to be examined and gauged as necessary at Annual Surveys.
	Tanks (For ships >5 years and up to 10 years old)	(a) Overall Survey of representative salt-water ballast tanks, as selected by the Surveyor is to be carried out. (b) For tanks, where a protective coating is found to be in POOR condition, or other defects are found, where a soft coating has been applied or where a protective coating was not applied from the time of construction, the examination is to be extended to other ballast tanks of the same type.

	Tanks (For ships >10 years old)	(a) Overall Survey of at least two representative cargo tanks including general examination of fittings such as valves and instrumentation. (b) Overall Survey of all salt-water ballast tanks, including any combined cargo/ballast tanks. (c) Close-up Survey of salt-water ballast tanks to the same extent as the previous Special Survey and two combined cargo/ballast tanks. Where protective coatings are found to be in GOOD condition, the extent of Close-up Survey may be specially considered. (d) In areas where substantial corrosion has been noted, additional measurements are to be carried out in accordance with *tables 5.6.15-1* to *5.6.15-4*. The survey will not be considered complete until these additional thickness measurements have been carried out.

Table 4.1.2 (Cont.)

	Tanks (For ships ≥15 years old)	(a) A Docking Survey is to be a part of the Intermediate Survey (b) The Overall and Close-up Surveys and thickness measurements, as applicable, of cargo tanks/holds and water ballast tanks are to be performed in accordance with the applicable requirements for Intermediate Surveys, if not already carried out. (c) Pressure testing of cargo and ballast tanks is to be carried out when deemed necessary by the Surveyor. (d) A survey to the same extent as the previous Special Survey (applicable only to Enhanced Surveys).
	Cargo system	(a) Verification that the ship's cargo hoses are approved and in good condition. (b) Verification that where applicable, pipelines and independent cargo tanks are electrically bonded to the hull. (c) An examination of cargo, cargo washing, bunker, ballast, steam and vent piping on the weather decks, as well as vent masts and headers. If upon examination there is any doubt as to the condition of the piping, the piping may require to be pressure tested, gauged or both.
Dry bulk cargo ships	Water ballast tanks	In tanks where the protective coating is to be found in poor conditions and it has not been repaired, where a soft coating has been applied or where a protective coating was not applied from the time of construction the tank in question is to be examined and gauged as necessary at Annual Survey.
Dry bulk cargo ships	Ships up to 5 years old	(a) An Examination of holds in accordance with requirements for general dry cargo vessels. (b) In areas where substantial corrosion has been noted, additional measurements are to be carried out in accordance with *tables 5.7.13-1* to *5.7.13-4*. The survey will not be considered complete until these additional thickness measurements have been carried out. (c) Thickness measurement of those areas subject to Close-up Survey, to determine both general and local corrosion levels. The thickness measurement may be dispensed with provided the Surveyor is satisfied that there is no structural diminution and the protective coating, where provided, remains effective.
	Ships >5 years and up to 10 years old	(a) Overall Survey of representative water ballast tanks, as selected by the Surveyor is to be carried out. (b) For tanks, where a protective coating is found to be in POOR condition or other defects are found, where a soft coating has been applied or where a protective coating was not applied from the time of construction, the examination is to be extended to other ballast tanks of the same type. (c) Overall survey of all cargo holds (d) Close-up Survey to establish the condition of at least 25% of the cargo hold side shell frames, including their upper and lower end attachments, adjacent shell plating and the transverse bulkheads in the forward cargo hold and one other selected cargo hold. (e) Thickness measurement of those areas subject to Close-up Survey, to determine both general and local corrosion levels. The thickness measurement may be dispensed with provided the Surveyor is satisfied that there is no structural diminution and the protective coating, where provided, remains effective.

	Ships ≥ 10 and ≤ 15years old	In addition to the requirements for 5 to 10 years old: (a) All salt water ballast tanks should be examined. (b) Overall survey of all cargo holds. (c) Close-up Survey to establish the condition of at least 25% of the cargo hold side shell frames, including their upper and lower end attachments, adjacent shell plating and the transverse bulkheads of all cargo holds.
	Ships ≥ 15years old)	(a) A Docking Survey is to be a part of the Intermediate Survey. (b) The intermediate survey should be at the same extent as the previous renewal survey. However, pressure testing of tanks and cargo holds used for ballast tanks is not required unless deemed necessary by the attending surveyor.
Ore Carriers	Water ballast tanks	(a) All web frame rings in one ballast wing tank. (b) One deck transverse in each remaining ballast wing tank. (c) Both transverse bulkheads in one ballast wing tank. (d) One transverse bulkhead in each remaining ballast wing tank.
	Cargo holds (For ships 5 - 10 years old)	(a) Overall Survey of all cargo holds. (b) Close-up Survey to establish the condition of at least 25% of the cargo hold side shell frames, including their upper and lower end attachments, adjacent shell plating and the transverse bulkheads in the forward cargo hold and one other selected cargo hold.
	Cargo holds (For ships 10 -15 years old)	(a) Overall Survey of all cargo holds. (b) Close-up Survey to establish the condition of at least 25% of the cargo hold side shell frames, including their upper and lower end
		attachments, adjacent shell plating and the transverse bulkheads of all cargo holds.
	Cargo holds (For ships ≥ 15years old)	A survey to the same extent as previous Special Survey, including: − Hull girder thickness measurements. − Overall Survey, assessment of coatings, Close-up Survey and thickness measurement of all S.W. ballast tanks and cargo holds. − Overall Survey of all remaining spaces within the cargo hold length, including voids/duct keel/cofferdam spaces. − Examination of all piping systems passing through all spaces within the cargo hold length.

Table 4.1.3-1 Additional requirements for Intermediate Surveys of Chemical Tankers proceeding from the ship's age

Ships 5 - 10 years old	Ships 10 -15 years old	Ships >15 years old
An annual Survey commensurate with the age of the ship is to be held (See *Sec 3*). Examination of details as per ***RSTE VII, Ch 6.*** Examination of cargo, washing, bunker, ballast, steam & vent piping systems on the weather deck, including vent masts and headers. General Examination of electrical equipment in areas designated as dangerous and insulation resistance testing.		
	In addition to requirements for ships 5 - 10 years old: – **An Overall Survey of all SW ballast tanks (including combined cargo/ballast tanks).** – **An Overall Survey of two representative cargo tanks, including general examination of fittings (valves and instrumentation, etc.).** – **Close-up Survey of SW ballast tanks to the same extent as previous Special Survey and of two combined cargo/ballast tanks.** – **General Examination of machinery and**	**In addition to the requirements for ships 5 -10 and 10 - 15 years old, a survey to the same extent as the previous Special Survey, including:** – **Hull girder thickness measurements.** – **Overall Survey, assessment of protective coatings, Close-up Survey and thickness measurements of salt water ballast and cargo tanks.** – **Overall Survey of all remaining spaces within the cargo tank length, including the pump room.** – **Examination of ballast piping within cargo tanks.** – **Examination of all other piping systems within the remaining spaces within the cargo tank length, including the pump rooms.**

Table 4.1.3-2. Additional requirements for Intermediate Surveys for all types of vessels less than 5 years old

Ships 0 -5 years old
1. An Annual Survey commensurate with the age of the ship is to be held (see *Sec 3*). 2. Basic requirements as detailed in *table 4.1.2*.
At the first Intermediate Survey, the following examinations are to be carried out: (a) Cargo tanks, other than independent tanks **Type C** (see definition in ***RSTE VII***, *Ch 6, Subs 9. 3*) are to be examined internally and, where possible, externally, and the insulation generally examined. (b) Particular attention is to be given to tower structures and other attachments within the tanks, tank supports and securing arrangements

SECTION 5. SPECIAL SURVEY

5.1 GENERAL INSTRUCTIONS

5.1.1 The survey is to be of a sufficient extent to ensure that the hull and related piping are in satisfactory conditions and fit for their intended purpose, subject to proper maintenance and operation and to Periodical Surveys being carried out as required by the Rules.

5.1.2 Special Surveys are to be held at intervals specified in ***RSTE I Ch 2, Subs 5.3***.

5.1.3 Surveys are to be carried out by Exclusive Surveyors unless alternative arrangements are agreed with HO. Surveyors who are not fully experienced in such surveys are to be joined by an experienced Senior Surveyor.

5.1.4 A Docking Survey in accordance with the requirements of *Sec 6* is to be carried out as part of the Special Survey.

5.1.5 Shipowners are to be notified that the 5-years Certificate of Class expires and class will be automatically suspended from the Certificate expiry date in case the Special Survey has not been completed or is not under attendance for completion by the due date.

5.1.6 If the Special Survey, or the Continuous Survey cycle, is completed more than three months before the due date, then the actual date of completion is to be recommended for assignment. In all other cases the harmonization date is to be recommended.

5.1.7 Under exceptional circumstances may an extension beyond the fifth year be given. All requests for extension are to be referred to the Local Office or Surveyor. In general, any extension would be limited to a maximum of 3 months to enable a ship to complete its voyage, or to 1 month on ships engaged in short voyages.

5.1.8 Upon satisfactory completion of surveys required for an extension of the Special Survey the Certificate of Class will be endorsed in the appropriate section and the validity of the certificate extended as advised by HO.

5.2 PREPARATION FOR SPECIAL SURVEY

5.2.1. The ship is to be prepared for Special Survey in accordance with the requirements of table 5.2.1. The preparation is to be of sufficient extent to facilitate an examination to ascertain any significant corrosion, deformations, fractures and other structural deterioration.

5.2.2 Spaces required to be examined during Special Survey, such as cargo holds, cargo tanks, deep tanks, salt- water ballast tanks, peak tanks, double bottom tanks, bilges, etc., are to be cleared and cleaned as considered necessary in order that a satisfactory Overall Survey can be confirmed. This may require the removal of sludge and scale in order to determine the extent of any corrosion.

5.3 EXAMINATION AND TESTING

5.3.1 All spaces within the hull and superstructures are to be examined.

5.3.2. The requirements for tank internal examination are given in *table 5.3.2*.

5.3.3 For oil tankers, including ore/oil and ore/bulk/oil ships, and chemical tankers, all WB tanks where a protective coating is found to be in POOR condition and it has not been repaired, where a soft coating has been applied, or where a protective coating was not applied from the time of construction, are to be examined and gauged as required by Annual Surveys.

5.3.4 For water ballast tanks on those ships not covered by *paragraph 5.3.3*, where a protective coating is found to be in POOR condition and it has not been repaired, where a soft coating has been applied or where a protective coating was not applied from the time of construction the following requirements will be applicable:

(a) For water ballast tanks, other than independent double bottom tanks, maintenance of class will be subject to the spaces in question being examined and gauged as necessary at Annual Surveys.

(b) For independent double bottom water tanks, maintenance of class may, at the discretion of the Surveyor, be subject to the spaces in question being examined and gauged as necessary at Annual Surveys.

5.3.5 Double bottom, deep, ballast, peak and other tanks, including cargo holds assigned also for the carriage of water ballast, are

to be tested with a head of liquid to the top of air pipes or to the top of hatches for ballast/cargo holds. Boundaries of oil fuel, lubricating oil and fresh water tanks are to be tested with a head of liquid to the maximum filling level of the tank.

5.3.6 Tank testing of oil fuel, lubricating oil and fresh water tanks may be specially considered based upon 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.

5.3.7 Where repairs are effected to the shell plating or bulkheads, any tanks in way are to be tested to the Surveyor's satisfaction on completion of these repairs.

5.3.8 In cases where the inner surface of the bottom plating is covered with cement, asphalt, or other composition, the removal of this covering may be waived, provided that it is inspected, tested by beating or chipping, and found sound and adhering satisfactorily to the steel.

5.3.9 All decks, casings and superstructures are to be examined.

5.3.10 Wood decks or sheathings are to be examined. If decay or rot is found or the wood is excessively worn, the wood is to be renewed. When a wood deck, laid on stringers and ties, has worn by 15 mm or more, it is to be renewed. Special attention is to be given to the condition of the plating under wood decks, sheathing or other deck covering. If such coverings are broken, or are not adhering closely to the plating, sections are to be removed as necessary to ascertain the condition of the plating,

5.3.11 Mechanically operated hatch covers are to be tested to confirm satisfactory operation including stowage, proper fit of sealing arrangements, operation testing of power components, wires and chains.

5.3.12 Masts and standing rigging are to be examined.

5.3.13 The anchoring arrangement is to be examined. If the chain cables are ranged they are to be examined. If any length of chain cable is found to be reduced in mean diameter at its most worn part by 12% or more from its nominal diameter, it is to be renewed. The windlass is to be examined.

5.3.14 On ships fitted with positional mooring equipment, anchors are to be cleaned and examined. Wire rope anchor cables are to be examined and, if cables are found to contain broken, badly corroded or bird caging wires, they are to be renewed.

5.3.15 Chain cables are to be ranged and examined on all ships **over 5 years** old and, if any length is found to be reduced in mean diameter at its most worn part by 12% or more from its nominal diameter it is to be renewed.

5.3.16 The Surveyor is to be satisfied that suitable mooring ropes are provided.

5.3.17 Hand pumps, suctions, watertight doors, air and sounding pipes are to be examined. In addition, the Surveyor is to internally examine air pipe heads in accordance with the requirements of *table 5.3.17*.

5.3.18 Any damage associated with wastage beyond the allowable limit (including buckling, grooving, detachment or fracture), or extensive wastage beyond allowable limits, which in the opinion of the Surveyor affects or may affect the ship's structural, watertight or weathertight integrity, is to be promptly and thoroughly repaired.

5.3.19 Damages or wastage which are considered by the attending Surveyor to not immediately affect the ship's structural or watertight integrity may be temporarily repaired and a suitable condition of class for a short period (**6 months)** is to be imposed.

5.3.20 Where the results of survey identify substantial corrosion or structural defects, and either of which will impair the ship's fitness for continued service, remedial measures are to be implemented before the ship continues in service.

5.4 SPECIAL SURVEY OF GENERAL DRY CARGO SHIPS – SPECIAL INSTRUCTIONS

5.4.1 All cargo holds, water 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 is to be supplemented by Close-up Survey, thickness measurement and testing as deemed necessary, to ensure that the structural integrity remains effective.

5.4.2 The examination is to be sufficient to ascertain substantial corrosion, significant deformation, fractures, damages or other

structural deterioration and, if deemed the Surveyor deems necessary, suitable non-destructive examination may be required.

5.4.3 All piping systems within the tanks and spaces covered by *paragraph 5.4.1* are to be examined and tested under working conditions to ensure that the conditions remain satisfactory.

5.4.4 Where the water ballast tanks have been converted to void spaces the survey extent is to be specially considered, based upon requirements for WB tanks.

5.4.5 Recommended requirements for Close-up Surveys are given in *table 5.4.5*.

5.4.6 For areas in tanks and cargo holds where coatings are found to be in GOOD condition, the extent of Close-up Surveys may be specially considered.

5.4.7 The Surveyor may require measuring the thickness of the material in any portion of the structure where signs of wastage are evident or wastage is normally found. Any parts of the structure which are found defective or excessively reduced in scantlings are to be made good by materials of the approved scantlings and quality.

5.4.8 Minimum requirements for thickness measurements in general dry cargo ships are given in *table 5.4.8*.

5.4.9 Thickness measurements are to be taken in the forward and aft areas of all plates. Where plates cross ballast/cargo tank boundaries separate measurements for the area of plating in way of each type of tank are to be taken.

5.4.10 The plate thickness measurements are to represent the average of multiple measurements taken on each plate and/or stiffener. Where measured plates are renewed, the thicknesses of adjacent plates in the same strake are to be reported.

5.4.11 Thickness measurements are normally to be taken by means of ultrasonic test equipment and are to be carried out by a firm approved in accordance with International Standards by the MCO or any recognized Society.

5.4.12 Thickness measurements are to be witnessed by the Surveyor. The Surveyor is to be on board, to the extent necessary to control the process.

5.4.13 Thickness measurements are to be witnessed by the Surveyor. The Surveyor is to be on board, to the extent necessary to control the process.

5.4.14 Thickness measurements may be carried out in association with the fourth Annual Survey.

5.4.15 The Surveyor may extend the scope of thickness measurement if deemed necessary.

5.4.16 In areas where substantial corrosion has been noted, additional measurements are to be carried out as applicable, in accordance with *table 5.4.16*, to determine the full extent of the corrosion pattern.

5.4.17 Where substantial corrosion is identified and not rectified, this will be subject to re-examination and gauging as necessary at Annual and Intermediate Surveys.

5.4.18 At each Special Survey, thickness measurements are to be taken in way of critical areas, as considered necessary by the Surveyor. Critical areas are to include locations throughout the ship that show substantial corrosion and/or are considered prone to rapid wastage.

5.4.19 Where required by the MCO a check of the buckling capacity of the upper deck is to be carried out for tankers having a length greater than 90 m.

Table 5.2.1 Survey preparation

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)
(1)Holds, tweendecks, peaks, deep tanks, engine and boiler spaces, and other spaces, are to be cleared and cleaned as necessary, and the bilges and limbers all fore and aft are to be cleaned and prepared for examination. Platform plates in engine and boiler spaces are to be lifted as may be necessary for the examination of the structure below. Where necessary, close and spar ceiling, lining and pipe casings are to be removed for examination of the structure (2) In ships with single bottom, a sufficient amount of close ceiling is to be lifted all fore and aft on each side from the bottom and bilges to permit the structure below to be examined	In addition to the requirements for Special Survey I, the following are to be complied with: (1) A sufficient amount of ceiling in the holds and other spaces is to be removed from the bilges and inner bottom to enable the condition of the structure in the bilges, the inner bottom plating, pillar feet, and the bottom plating of bulkheads and tunnel sides to be examined. If the Surveyor deems it necessary, the whole of the ceiling is to be removed (2) In ships with single bottom, the limber boards and ceiling equal to not less than three strakes, all fore and aft on each side are to be removed,	In addition to the requirements for Special Survey II the following is to be complied with: (1) Ceiling in holds is to be removed in order to ascertain that the steelwork is in good condition, free from rust and coated. If the Surveyor is satisfied, after removal of portions of the ceiling then it need not all be removed (2) Portions of wood sheathing, or other covering, on steel decks are to be removed, as considered necessary by the Surveyor, in order to ascertain the condition of the plating
(3) In ships with a double bottom, a sufficient amount of ceiling is to be removed from the bilges and inner bottom to enable the condition of the plating to be ascertained. If it is found that the plating is clean and in good condition, and free from rust, the removal of the remainder of ceiling may be dispensed with. The Surveyor may waive the removal of heavy reinforced compositions if there is no evidence of leakages, cracking or other faults in the composition (4) Where holds are insulated for the purpose of carrying refrigerated cargoes, and the hull in way of the insulation was examined by Surveyors at the time such insulation was fitted, it will be sufficient to remove the limbers and hatches to enable the framing and plating in way to be examined; in other cases, additional insulation is to be removed as necessary to satisfy the Surveyor as to the condition of the structure. (5) The steelwork is to be exposed and cleaned and rust removed as may be required for its proper examination by the Surveyor (6) All tanks are to be cleaned as necessary to permit examination, where this is required by ***table 5.3.2***. (7) Casings or covers of air, sounding, steam and other pipes, spar ceiling and lining in way of the side scuttles are to be removed, as required by the Surveyor	Where the ceiling is fitted in hatches, the whole of the hatches and at least one strake of ceiling in the bilges are to be removed. If the Surveyor deems it necessary the whole of the ceiling and limber boards are to be removed (3) The chain locker is to be cleaned internally. The chain cables are to be ranged for inspection. The anchors are to be cleaned and placed in an accessible position for inspection	(3) Where the holds are insulated for the purpose of carrying refrigerated cargoes, the limbers and hatches are to be lifted and sufficient insulation is to be removed in each of the chambers to enable the Surveyor to satisfy himself of the condition of the framing and plating.

NOTE:
For **Special Survey IV and thereafter** the requirements for Special Survey III are to be complied with and, additionally:
- Where the holds are insulated for the purpose of carrying refrigerated cargoes, the limbers and hatches are to be lifted, and sufficient additional insulation is to be removed in each of the chambers to enable the Surveyor to be satisfied as to the condition of the steel structure, and to enable the thickness of the shell plating to be ascertained as required by *Subs 5.4* .

Table 5.3.2 Tank internal examination requirements

Tank		**Special Survey I** (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV and thereafter** (Ships 20 years old and over)
(1)	Peaks	All tanks	All tanks	All tanks	All tanks
(2)	Salt water ballast	All tanks	All tanks	All tanks	All tanks
(3)	Lubricating oil	None	None	None	One tank
(4)	Fresh water	None	One tank	All tanks	All tanks
(5)	Oil fuel	None	None	None	Two tanks (min)

NOTES:
1. The above requirements apply to all structural tanks only.
2. Where a selected number of tanks are examined, then different tanks are to be examined at each Special Survey on a rotational basis.

Table 5.3.17 Internal examination requirements for automatic air pipe heads installed on exposed decks of all ships other than passenger

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III and thereafter** (Ships $\geq$ 15 years old)
(1) Two air pipe heads, one port and one starboard, on exposed decks in the forward 0.25*L*. (See Notes 1 to 5.)	(1) All air pipe heads on exposed decks in the forward 0.25*L*. (See Notes 1 to 5).	All air pipe heads on exposed decks. (See Notes 1 to 6).
(2) Two air pipe heads, one port and one starboard, on the exposed decks, serving spaces aft of 0.25*L*. (See Notes 1 to 5).	(2) At least 20% of air pipe heads on exposed decks, serving spaces aft of 0.25*L*. (See Notes 1 to 5).	

NOTES:
1. Air pipe heads serving ballast tanks are to be selected where available.
2. The Surveyor is to select which air pipe heads are to be examined.
3. Where considered necessary by the Surveyor as a result of the examinations, the extent of examinations may be extended to include other air pipes heads on exposed decks.
4. Where the inner parts of air pipe head cannot be properly examined due to its design, it is to be removed in order to allow an internal examination.
5. Particular attention is to be given to the condition of the zinc coating in heads constructed from galvanised steel.
6. Exemptions may be granted for air pipe heads where there is documented evidence of their replacement within the previous five years.

Table 5.4.5 Recommended requirements for Close-up Survey - General dry cargo ships

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV and thereafter** (Ships ≥20 years old)
(a) Selected shell frames in one forward and one aft cargo hold and associated tweendeck spaces. (b) One selected cargo hold transverse bulkhead. (c) All cargo holds hatch covers and coamings (plating and stiffeners).	(a) Selected shell frames in all cargo holds and tweendeck spaces. (b) One transverse bulkhead in each cargo hold, including stiffening system. (c) Forward and aft transverse bulkhead in one side ballast tank, including stiffening system. (d) One transverse web with associated plating and framing in two representative water ballast tanks of each type (i.e. topside, hopper side, side tank or double bottom tank). (e) All cargo holds hatch covers and coamings (plating and stiffeners). (f) Selected areas of all deck plating inside the line of hatch openings between cargo hold hatches. (g) Selected areas of inner bottom plating.	(a) All shell frames in the forward lower cargo hold and 25% shell frames in each remaining cargo hold and tweendeck spaces, including their end attachments and adjacent shell plating. (b) All cargo hold transverse bulkheads, including stiffening system. (c) All transverse bulkheads in ballast tanks, including stiffening system. (d) All transverse webs with associated plating and framing in each water ballast tank (i.e. topside, hopper side, side tank or double bottom tank). (e) All cargo holds hatch covers and coamings (plating and stiffeners). (f) All deck plating inside the line of hatch openings between cargo hold hatches. (g) All areas of inner bottom plating.	(a) All shell frames in all cargo holds and tweendeck spaces, including their end attachments and adjacent shell plating. (b) All cargo hold transverse bulkheads, including stiffening system. (c) All transverse bulkheads in ballast tanks, including stiffening system. (d) All transverse webs with associated plating and framing in each water ballast tank (i.e. topside, hopper side, side tank or double bottom tank). (e) All cargo holds hatch covers and coamings (plating and stiffeners). (f) All deck plating inside the line of hatch openings between cargo hold hatches. (g) All areas of inner bottom plating.

NOTES:

1. Close-up Survey of cargo hold transverse bulkheads to be carried out at the following areas:
   - Immediately above the inner bottom and immediately above the tweendeck, as applicable.
   - Mid-height of the bulkhead for the holds without tweendeck.
   - Immediately below the main deck plating and tweendeck plating.
2. Ballast tanks include peak tanks.

TABLE 5.4.9: Minimum requirements of thickness measurement at special surveys – General dry cargo ships

SPECIAL SURVEY AGE ≤ 5 YEARS	SPECIAL SURVEY 5 YEARS < AGE ≤ 10 YEARS	SPECIAL SURVEY 10 YEARS < AGE ≤ 15 YEARS	SPECIAL SURVEY AGE > 15 YEARS
Main structural parts, plates and stiffeners showing signs of wear and tear.	Main structural parts, plates and stiffeners showing signs of wear and tear.	Main structural parts, plates and stiffeners showing signs of wear and tear.	Main structural parts, plates and stiffeners showing signs of wear and tear.
	Within the cargo length area or 0,5 L amidships: - selected deck plates - 1 transverse section - selected tank top plates - selected bottom plates - selected wind and water strakes.	Within the cargo length area or 0,5 L amidships: - each deck plate - 2 transverse section - selected tank top plates - selected bottom plates - all wind and water strakes.	Within the cargo length area or 0,5 L amidships: - each deck plate - 3 transverse section - each tank top plate - each bottom plate - all wind and water strakes.
	Outside the cargo length area or 0,5 L amidships : - selected deck plating - selected wind and water strakes - selected bottom plates.	Outside the cargo length area or 0,5 L amidships : - selected deck plating - selected wind and water strakes - selected bottom plates.	Outside the cargo length area or 0,5 L amidships : - each deck plating - each wind and all water strakes - each bottom plates.
	The two first cargo hold hatch covers and coamings (plates and stiffeners)	All cargo hold hatch covers and coamings (plates and stiffeners)	All cargo hold hatch covers and coamings (plates and stiffeners)
	Collision bulkhead, forward machinery space bulkhead, aft peak bulkheads.	Collision bulkhead, fwd machinery space bulkhead, aft peak bulkhead, selected cargo hold bulkheads (transverse and longitudinal) (plate and stiffeners)	All transverse and longitudinal bulkheads (plates and stiffeners).
		Selected internal structure such as floors and longitudinals, transverse frames, web frames, deck beams, tween-decks, girders, etc.	Selected internal structure as for ships 10 < age ≤ 15 years, number of measurements can be increased as the surveyor deems it necessary.

Table 5.4.9 (Cont.)

NOTES:
1. Thickness measurement locations are to be selected to provide the best representative sampling of areas likely to be most exposed to corrosion, considering cargo and ballast history and arrangement, and condition of protective coatings.
2. A transverse section is to include all longitudinal members such as plating, longitudinals and girders at deck, sides, bottom, inner bottom, hopper side and longitudinal bulkheads, where fitted.
3. Where the protective coating is in GOOD condition, then the extent of thickness measurements of internals may be specially considered at the discretion of the attending Surveyor.

Table 5.4.16 Additional thickness measurement requirements in way of structure with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
Plating	Suspect areas and adjacent plates	5 point pattern over $1m^2$
Stiffeners	Suspect areas	3 measurements each in line across web and flange

5.5 Special Survey of oil tankers, Ore/Oil ships (O/O) and Ore/Bulk/Oil OBO ships) - Special instructions

5.5.1 The requirements of *Secs 3, 4 & 6* are to be complied with as far as it is possible. In general, Hull Surveys are to be carried out in accordance with *RSTE I Ch 5 Sec 3*.

5.5.2 To maintain or assign the ESP notation the requirements of this Subsection apply to surveys of the hull structure and piping systems in way of the cargo tanks, cargo holds, cofferdams, pipe tunnels, void spaces, topside tanks and double bottom tanks and all water ballast tanks.

5.5.3 All cargo tanks, water ballast tanks including double bottom tanks, 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 Close-up Survey, thickness measurement and testing as deemed necessary, to ensure that the structural integrity of the vessel remains effective.

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

(a) Structural arrangements or details which have suffered defects in similar tanks or on similar ships.
(b) Structures approved with reduced scantlings due to an approved corrosion control system.
(c) Cargo oil suction strums are to be removed for examination of the plating unless the arrangements permit inspection without removal.
(d) For tanks where coatings are found to be in a satisfactory condition the extent of the Close-up Survey and thickness measurement may be specially considered at the discretion of the Surveyor.
(e) The upper 3 to 5 m of topside structure, including plating, longitudinals, transverses and their associated connections are to be specially examined.
(f) Waviness of the deck plating may indicate that the thickness of the deck longitudinals has been reduced to a point at which renewal or reinforcement is necessary.
(g) The bottom plating at the ends of longitudinals in midship tanks is to be examined closely for signs of fracture.
(h) The bottom plating at the ends of longitudinals in midship tanks is to be examined closely for signs of fracture initiation.
(i) Attention is to be given to the vertical through brackets or horizontal gussets, including the welding, at the ends of these longitudinals. Any signs of fracture at these parts or elsewhere in the bottom plating are to be reported to HO immediately.
(j) When construction is such that longitudinal framing is continuous through transverse bulkheads forming tank boundaries and in particular when high tensile steels are used, a careful examination is to be made of the welded connections of the longitudinals in order to ascertain their freedom from fractures. In this respect the use of suitable crack detection methods.
(k) Evidence of cracking, buckling or excessive corrosion in the following regions is also to receive close attention:
    (i) Connections of longitudinals to bulkheads.
    (ii) Longitudinals, where passing through webs and transverses.
    (iii) Connections of side and bottom shell longitudinals to webs.
    (iv) Junctions of the brackets from the longitudinal bulkhead to bottom transverses in centre tanks.
    (v) Hard points in corrugated bulkheads, i.e. in way of bracket and other connections.
    (vi) The continuity of deck and bottom longitudinals in way of oil tight transverse bulkheads and also to the scalloped connections.
    (vii) Cross tie junctions.

(viii) Bottom shell plating in way of transverse oil tight bulkheads (grooving).
(ix) Toes of brackets of transverse oil tight bulkhead stringers and also the stringer web plate in way of the brackets.
(x) Inner surfaces of bottom plating (excessive pitting and grooving) with strums removed.
(xi) Longitudinal bulkhead plating and web frame plating, specially at the junction of web frames with horizontal stringers and buttresses, when heated oil is carried in the centre tank adjacent to the wing ballast tanks.

5.5.5 For ships constructed basically with high tensile steel, cracking has been found in the following principal locations:
(a) In the side longitudinals at the intersection between the longitudinals and the transverse bulkheads.
(b) In the side longitudinals at their connection to the transverse web frames in the port and starboard cargo tanks.

5.5.6 If the vertical extent of damage is for about one- half the depth of the ship, centred about the ship's mid-depth, these regions are to receive particular attention.

5.5.7 Examinations during Special Survey are to be sufficient to ascertain all substantial corrosion areas, significant deformation, fractures, damages or other structural deterioration. When deemed necessary by the Surveyor, a suitable non-destructive examination may be required.

5.5.8 All cargo piping on deck, including crude oil washing, cargo and ballast piping within spaces indicated in *paragraph 5.3.3* are to be examined and tested under working conditions to ensure that tightness and condition remain satisfactory.
5.5.9 The extent of survey of combined water ballast/cargo tanks is to be considered on the basis of the records of ballast history, the extent and condition of the corrosion protection system provided, and the extent of structural diminution (corrosion).

5.5.10 Where water ballast tanks have been converted to void spaces the survey's extent is to be based on WB tank requirements.

5.5.11 Condition of anodes in tanks and their attachment to the structure is to be examined.

5.5.12 Where fitted, the strums of the cargo suction pipes are to be removed or lifted to facilitate examination of the shell plating and bulkheads in the vicinity, unless other means for visual inspection of these parts are provided.

5.5.13 Minimum requirements for testing tanks of oil tankers are given in *table 5.5.13*. Where required, the Surveyor may extend the tank testing if deems necessary. Other requirements for tank testing are given in *paragraph 5.3.5*.

5.5.14 Minimum requirements for Close-up Survey, depending of the type of tanker are given in *tables 5.5.14-1* to *5.5.14-4.*

5.5.15 For areas in tanks and cargo holds where coatings are found to be in GOOD condition, the extent of Close-up Surveys may be specially considered.

5.5.16 Minimum requirements for thickness measurements for oil tankers (including single and double hull oil tankers, ore/oil and ore/bulk/oil ships) are given in *table 5.5.16*.

5.5.17 In areas where substantial corrosion, has been noted, additional measurements are to be carried out, as applicable, in accordance with *tables 5.5.17-1* to *5.5.17-9* to determine the full extent of the corrosion pattern. The survey will not be considered complete until these additional thickness measurements have been carried out.

5.5.18 For oil tankers, ore/oil and ore/bulk/oil ships of **130 m in length and upwards** (as defined by the International Convention on Load Lines in force), the ship's longitudinal strength is to be assessed by using the thickness of structural members measured, renewed and reinforced as appropriate, during the Special Surveys carried out after the ship reaches 10 years of age.

5.5.19 For oil tankers having a length of 90 m or greater the allowable thickness diminution of different structural elements is to be not greater than that required for ships Categories 2 & 3 by *RSTE I, Ch 3 tables 11.1.6* and *11.1.8*.

5.5.20 A check is to be made that deck and bottom longitudinal material cross sectional areas have not reduced by more than 10% based on availability of previous thickness measurements.

5.5.21 Where a 10% area reduction is exceeded the case is to be referred to HO for review. In most cases this requirement will be applicable from Special Survey III onwards, with some exceptions, e.g.: ships that were commissioned and taken into service after the date of build and are therefore assigned their Special Survey date later then the date of build. As such ships would be more than 10 years of age at the time of the Special Survey II; they would therefore be required to carry out the evaluation at Special Survey II.

5.5.22 Evaluation of corrosion is to be carried out by the attending Surveyors at Special Survey, soon after completion of the necessary thickness measurements in order that Owners can be advised at an early stage of any remedial repairs/renewals that may be necessary to satisfy the longitudinal strength requirements.

5.5.23 When the actual thickness measurements of individual plates are found to satisfy the residual buckling thickness requirements this is to be indicated in the Survey Report.

5.5.24 When the thickness measurements of individual plates are found to be less than that required for compliance with the residual buckling thickness requirements, and the diminution does not exceed 20%, then the following procedure is to be followed:

(a) Extensive thickness measurements are to be taken on a panel basis to determine accurately the actual mean thickness of individual panels. In this context a panel is deck plating bounded by adjacent deck transverses and two deck longitudinal stiffeners.

(b) If, after extensive measurement, the individual panels of deck plating are found to be deficient, the deck plating may be repaired by reinforcement. This reinforcement is normally performed by adding longitudinal stiffening fitted internally between existing deck longitudinals. The reinforcing longitudinal is to be of scantlings similar to that originally fitted and extend over the full plating and be supported against tripping at the deck transverse.

(c) The above procedure may be adopted where localized individual panels are affected. However, where numerous transversely adjacent areas are affected the matter is to be referred to Head Office.

5.5.25 A comprehensive examination of the bottom of cargo oil tanks is to be carried out and if any parts of the bottom shell plating are found reduced, special attention is also to be paid to corresponding positions in all other cargo tanks. Any defects are to be made good.

5.5.26 Localized shallow pitting less than 50% of the original fitted thickness may be repaired by filling with a suitable epoxy compound which is to be applied in accordance with the manufacturer's instructions.

5.5.27 Isolated deep pits greater than 50% of the original fitted thickness may be repaired by welding, provided the thickness of material left at the pit's bottom exceeds 6 mm.

5.5.28 The pitting must be suitably prepared to permit a repair by welding. The electrodes used are to be of an approved type suitable for the grade of steel to be welded. A minimum of four weld beads are to be deposited in any pit. Inspection of the welds during and after repair is to be supplemented by non-destructive examination methods for finding any surface cracks.

5.5.29 Where the pitting intensity is found to be excessive (above 30%) in association with deep pits (over 50% of the original fitted thickness), or where the thickness of material left at the pit's bottom is less than 6 mm, the affected plating is to be cropped and renewed.

5.5.30 After repairs, the mean thickness of the bottom shell plating across the breadth of the tank is not to be less than 85% of the original Rule thickness.

5.5.31 The welding of internally pitted bottom shell plating may be carried out afloat provided the additional requirements of *Subs 10.11* are complied with.

5.5.32 Full details of the exact nature, location and extent of repairs are to be reported and a suitable note made in the Survey Report in the case of repairs involving the use of epoxy compound.

5.5.33 The permanent repair of bottom shell pitting by fitting large numbers of welded doubling plates will not be acceptable.

5.5.34 The web plate thickness at the junction of each transverse web frame and longitudinal bulkhead web with cross tie structure having continuous face plates in the ballast tanks is to be specially examined at Special Survey I and is to be measured and recorded during Special Survey II and thereafter.

5.5.35 Lightening holes and notches in the vicinity of the cross ties are to be filled in whilst carrying out necessary repairs.

5.5.36 As a means of rigging portable staging to provide access to internal tank structure, the practice of drilling holes in the deck from which staging wires can be suspended has been accepted in principle. For guidance when dealing with such proposals the following are the conditions under which approval may be granted:

(a) The number of holes is to be restricted to the minimum required for efficient operation of the equipment.

(b) The holes are to be situated in relation to possible obstructions such as piping, trunkways, etc., such that they will always be visible

and accessible.

(c) The holes are to be closed by screwed metal plugs with a thread fine enough to provide an adequate number of engaging threads

(d) Plugs are to be provided with a thick washer of suitable material to ensure tightness. Washer is to be impervious to all cargoes which are intended to carry.

(e) In order to protect the threads while the holes are being used for their intended purpose they are to be fitted with a protective sleeve of nylon or other suitable material.

(f) A number of spare plugs are to be provided and maintained on board equal to at least 10% of the total number of holes.

(g) A hose test on one plug is to be carried out to ensure that they are watertight.

Table 5.5.13 Minimum requirements for tank testing - Single hull and double hull oil tankers, ore/oil ships and ore/bulk/oil ships

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III and thereafter** (Ships ≥15 years old)
All ballast tank boundaries	All ballast tank boundaries	All ballast tank boundaries
Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms or cofferdams	Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms or cofferdams	Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms or cofferdams
	All cargo tank bulkheads which form the boundaries of segregated cargoes	All remaining cargo tank bulkheads
NOTE: Tanks are to be tested by filling with water to the top of the hatchways.		

Table 5.5.14-1 Minimum requirements for Close-up Survey - Single hull oil tankers

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV and thereafter** (Ships ≥20 years old)
(a) One web frame ring – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast, see Note 1. (b) One deck transverse – in a cargo tank, see Note 2. (c) One transverse bulkhead, see Note 4: − In a ballast tank. − In a cargo wing tank. − In a cargo centre tank .	(a) All web frame rings – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast, see Note 1. (b) One deck transverse, see Notes 2 and 8: − In each of the remaining ballast tanks, if any. − In a cargo wing tank. − In 2 cargo centre tanks. (c) Both transverse bulkheads – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast, see Note 3 (d) One transverse bulkhead, see Note 4: − In each remaining ballast tank. − In a cargo wing tank. − In 2 cargo centre tanks.	(a) All web frame rings, see Note 1: − In all ballast tanks. − In a cargo wing tank. (b) A minimum of 30% of all web frame rings in each remaining cargo wing tank, see Notes 1 and 8. (c) All transverse bulkheads – in all cargo and ballast tanks, see Note 3. (d) A minimum of 30% of deck and bottom transverses in each cargo centre tank, see Notes 5 and 8. (e) As considered necessary by Surveyor, see Note 6.	(a) As for Special Survey III. (b) Additional transverse areas as deemed necessary by the Surveyor

NOTES:

1. Complete transverse web frame ring includes adjacent structural members.
2. Deck transverse including adjacent deck structural members.
3. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.
4. Transverse bulkhead lower part including girder system and adjacent structural members.
5. Deck and bottom transverse including adjacent structural members.
6. Additional complete transverse web frame ring.
7. Ballast tanks include peak tanks.
8. Within the mid-length of the tank. The 30% is to be rounded up to the next whole number of structural items.

Table 5.5.14-2 Minimum requirements for Close-up Survey - Double hull oil tankers

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV and thereafter** (Ships ≥ 20 years old)
(a) One web frame ring in a complete ballast tank, see Notes 1 & 3. (b) One deck transverse in a cargo tank, see Notes 4 and 12. (c) One transverse bulkhead in a complete ballast tank, see Notes 1 and 6. (d) One transverse bulkhead in a cargo centre tank, see Notes 2 and 7. (e) One transverse bulkhead in a cargo wing tank, see Note 7.	(a) All web frame rings in a complete ballast tank, see Notes 1 & 3. (b) The knuckle area and the upper part (approx. 5 m) of one web frame ring in each remaining ballast tank, see Note 8. (c) One deck transverse in two cargo tanks, see Note 4 (d) One transverse bulkhead in each complete ballast tank, see Notes 1 & 6. (e) One transverse bulkhead in two cargo centre tanks, see Notes 2 & 7. (f) One transverse bulkhead in a cargo wing tank, see Note 7.	(a) All web frame rings all ballast tanks, see Note 3. (b) All web frame rings in a cargo tank, see Notes 9. (c) One web frame ring in each remaining cargo tank, see Note 9. (d) All transverse bulkheads– in all cargo and ballast tanks, see Notes 5 & 6. (e) As considered necessary by the surveyor, see Note 10.	(a) As for Special Survey III. (b) Additional transverse areas if deemed necessary by the Surveyor, see Note 10.

NOTES:

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

Table 5.5.14-3 Minimum requirements for Close-up Survey - Ore/oil ships

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV and thereafter** (Ships ≥20 years old)
(a) One web frame ring – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast, see Note 1. (b) One deck transverse – in a cargo tank, see Note 2. (c) One transverse bulkhead, see Note 4: − In a ballast tank. − In a cargo wing tank. − In a cargo centre tank.	(a) All web frame rings – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast, see Note 1. (b) One deck transverse, see Notes 2 and 8: − In each of the remaining ballast tanks, if any. − In 2 cargo centre tanks. (c) Both transverse bulkheads – in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast, see Note 3. (d) One transverse bulkhead, see Note 4: − In each remaining ballast tank. − In a cargo wing tank. − In 2 cargo centre tanks. (e) Selected cargo hold hatch covers and coamings (plating and stiffeners) (f) Selected areas of deck plating inside line of hatch openings between cargo hold hatches	(a) All web frame rings, see Note 1: − In all ballast tanks. − In a cargo wing tank. (b) One web frame ring – in each remaining cargo wing tank, see Notes 1 & 6. (c) One deck transverse - in each cargo centre tank, see Notes 2 and 6. (d) All transverse bulkheads– in all cargo and ballast tanks, see Note 3. (e) All cargo hold hatch covers and coamings (plating and stiffeners). (f) All deck plating inside line of hatch coamings between cargo hold hatches. (g) As deemed necessary by the Surveyor, see Note 5.	(a) As during Special Survey III. (b) Additional transverse areas if deemed necessary by the Surveyor.

NOTES:
1. Complete transverse web frame ring including adjacent structural members.
2. Deck transverse including adjacent deck structural members.
3. Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.
4. Transverse bulkhead lower part including girder system and adjacent structural members.
5. Additional complete transverse web frame ring.
6. Within the middle one-half of the tank.

Table 5.5.14-4 Minimum requirements for Close-up Survey - Ore/bulk/oil ships

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV and thereafter** (Ships ≥ 20 years old)
(a) 25% of shell frames and their end attachments in the forward cargo hold at representative positions. (b) Selected frames and their end attachments in remaining cargo holds. (c) One transverse web with associated plating and longitudinals in 2 representative water ballast tanks of each (i.e. topside, hopper side or side tank). (d) Two selected cargo hold transverse bulkheads including internal structure of upper and lower stools where fitted. This is to include the aft bulkhead in the forward cargo hold.	(a) 25% of shell frames including their end attachments and adjacent shell plating in all cargo holds. (b) One transverse web with associated plating and longitudinals in each water ballast tank (i.e. topside, hopper side or side tank). (c) Forward and aft transverse bulkhead in 1 side ballast tank, including stiffening system. (d) One transverse bulkhead in each cargo hold including internal structure of upper and lower stools where fitted. This is to include the aft bulkhead in the forward cargo hold. (e) Selected cargo hold hatch covers and coamings (plating and stiffeners). (f) Selected areas of deck plating inside line of hatch openings between cargo hold hatches.	(a) All shell frames in the forward cargo hold and 25% of frames in remaining cargo holds, including their end attachments and adjacent shell plating. (b) All transverse webs with associated plating and longitudinals in each water ballast tank (i.e. topside, hopper side or side tank). (c) All transverse bulkheads in ballast tanks, including stiffening system. (d) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. (e) All cargo hold hatch covers and coamings (plating and stiffeners). (f) All deck plating inside line of hatch openings between cargo hold hatches.	(a) All shell frames including their end attachments and adjacent shell plating in all cargo holds. (b) All transverse webs with associated plating and longitudinals in each water ballast tank (i.e. topside, hopper side or side tank). (c) All transverse bulkheads in ballast tanks, including stiffening system. (d) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. (e) All cargo hold hatch covers and coamings (plating and stiffeners). (f) All deck plating inside line of hatch openings between cargo hold hatches.

NOTES:

1. Ballast tanks include peak tanks.

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

- **Level (a) Immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stool.**
- **Level (b) Immediately above and below the lower stool shelf plate (for those ships fitted with lower stools), and immediately above the line of the shedder plates.**
- **Level (c) About mid-height of the bulkhead.**
- **Level (d) Immediately below the upper deck plating and immediately adjacent to the upper wing tank and immediately below the upper stool shelf plate for those ships fitted with upper stools, or immediately below the topside tanks.**

Table 5.5.16 Minimum thickness measurements – Single hull and double hull oil tankers, ore/oil ships and ore/bulk/oil ships

Special Survey I (Ships 5 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV** (Ships ≥ 20 years old)
(a) 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, or a cargo tank used primarily for water ballast (b) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.5.14-1, 5.5.14-2, 5.5.14-3* **or** *5.5.14-4*. (c) Critical areas, as required by the Surveyor.	(a) Within the cargo tank length: – Each deck plate. – Two transverse sections, see Note 6. (b) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.5.14-1, 5.5.14-2, 5.5.14-3* or *5.5.14-4.* (c) Selected wind and water strakes outside the cargo tank length. (d) All wind and water strakes within the cargo tank length. (e) All cargo hold hatch covers and coamings (plating and stiffeners), see Note 5. (f) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank . (See Notes 1 and 4). (g) Critical areas, as required by the Surveyor .	(a) Within the cargo tank length: – Each deck plate. – Three transverse sections, see Note 6. – Each bottom plate. (b) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.5.14-1, 5.5.14-2, 5.5.14-3* or *5.5.14-4.* (c) Selected wind and water strakes outside the cargo tank length. (d) All wind and water strakes within the cargo tank length. (e) All cargo hold hatch covers and coamings (plating and stiffeners), see Note 5. (f) Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck). (g) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank and aft peak tank, see Notes 1 and 4. (h) All keel plates outside the cargo tank length. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks. (i) Plating of seachests. Additionally, side shell plating in way of overboard discharges, as considered necessary by the Surveyor. (j) Critical areas, as required by the Surveyor.
Special Survey II (Ships 10 years old)		
(a) Within the cargo tank length: – Each deck plate – One transverse section, see Note 6. (b) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.5.14-1, 5.5.14-2, 5.5.14-3* or *5.5.14-4*. (c) Selected wind and water strakes outside the cargo tank length. (d) Critical areas, as required by the Surveyor.		

NOTES:

1. **For areas in tanks where coatings are found to be in GOOD condition, the extent of thickness measurements may be specially considered.**
2. **Transverse sections are to be chosen where the largest reductions are likely to occur, or as revealed by deck plating measurement.**
3. **Where two or three transverse sections are required to be measured, at least one is to include a ballast tank within 0.5*L* amidships.**
4. **Transverse bulkhead complete including stiffening system.**
5. **All cargo hold hatch covers and coamings, where fitted, are to be measured on ore/oil and ore/bulk/oil ships. For oil tankers (including ore/oil and ore/bulk/oil ships), with length ≥ 130 m and age ≥10 years, the longitudinal strength is to be evaluated. In such cases, a minimum of three transverse sections are to be measured within 0.5*L* amidships.**

Table 5.5.17-1 Additional thickness measurements – Single hull oil tankers, ore/oil ships and ore/bulk/oil ships – Bottom structure with substantial corrosion

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

Table 5.5.17-2 Additional thickness measurements – Single hull oil tankers, ore/oil ships and ore/bulk/oil ships – Deck structure with substantial corrosion

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

Table 5.5.17-3 Additional thickness measurements - Single hull oil tankers, ore/oil ships and ore/bulk/oil ships – Shell and longitudinal bulkheads with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Deck head and bottom strakes and strakes in way of stringer platforms	Plating between each pair of longitudinals in a minimum of 3 bays	Single measurement
All other strakes	Plating between every 3rd pair of longitudinals in same 3 bays	Single measurement
Longitudinals – deckhead and bottom strakes	Each longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
Longitudinals – all others	Every third longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
Longitudinals – bracket	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 2 m^2 area, plus single measurements on web frame and cross tie face flats

Table 5.5.17-4 Additional thickness measurements - Single hull oil tankers, ore/oil ships and ore/bulk/oil ships – Transverse bulkheads and swash bulkheads with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Deck head and bottom strakes in way of stringer platforms	Plating between pair of stiffeners at 3 locations: approx. 1/4, 1/2 and 3/4 width of tank	5 point pattern between stiffeners over 1 m length
All other strakes	Plating between pair of stiffeners at middle location	Single measurement
Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange or fabricated connection	5 point pattern over 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 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
Deep webs and girders	Measurements at toe of bracket and at centre of span	For web, 5 point pattern over 1 m^2 area. 3 measurements across face flat
Stringer platforms	All stringers with measurements at middle and both ends	5 point pattern over 1 m^2 area plus single measurements near bracket toes and on face flats

Table 5.5.17-5 Additional requirements for thickness measurement - Double hull oil tankers – Bottom, inner bottom and hopper structure with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Bottom, inner bottom and hopper plating	Minimum of 3 bays across double bottom tank, including aft bay. Measurement around and under all suction strums	5 point pattern for each panel between longitudinals and floors
Bottom, inner bottom and hopper	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 watertight girders	At the fore and aft watertight floors and in centre of tanks	Vertical line of single measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements
Bottom floors, including watertight floors	3 floors in bays where bottom plating measured, with measurements at both ends and middle	5 point pattern over 2 m^2 area
Hopper 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 transverse watertight bulkhead or swash bulkhead	− Lower 1/3 of bulkhead − Upper 2/3 of bulkhead − Stiffeners (minimum of 3).	(i) 5 point pattern over 1 m^2 of plating. (ii) 5 point pattern over 2 m^2 of plating. (iii) For web, 5 point pattern over span (2 measurements across web at each end and 1 at centre of span). For flange, single measurement at each end and centre of span.
Panel stiffening	Where applicable	Single measurements

Table 5.5.17-6 Additional thickness measurements - Double hull oil tankers – Deck structure with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Deck plating	2 transverse bands across tank	Minimum of 3 measurements per plate per band
Deck longitudinals	Every 3rd longitudinal in each of 2 bands with a minimum of 1 longitudinal	3 measurements in line vertically on webs and 2 measurements on flange (if fitted)
Deck girders and brackets (usually in cargo tanks only)	At the fore and aft transverse bulkhead, bracket toes and in centre of tanks	Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across flange. 5 point pattern on girder / bulkhead brackets
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 the flange
Vertical web and transverse bulkhead in wing ballast tank (two metres from	Minimum of 2 webs, and both transverse bulkheads	5 point pattern over 1 m^2 area
Panel stiffening	Where applicable	Single measurements

Table 5.5.17-7 Additional thickness measurements - Double hull oil tankers – Wing ballast tank structure with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Side shell and longitudinal bulkhead plating: **(i) Upper strake and strakes in way of horizontal girders** **(ii) All other strakes**	(i) Plating between each pair of longitudinals in a minimum of 3 bays (along the tank) (ii) Plating between every 3rd pair of longitudinals on same 3 bays	(i) Single measurements (ii) Single measurements
Side shell and longitudinal bulkhead longitudinals on: **(i) Upper strake** **(ii) All other strakes**	(i) Each longitudinal in same 3 bays (ii) Every 3rd longitudinal in same 3 bays	(i) 3 measurements across web and 1 measurement on flange (ii) 3 measurements across web and 1 measurement on flange
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 (excluding deckhead area): **(i) Strakes in way of horizontal**	(i) Minimum of 2 webs and both transverse bulkheads (ii) Minimum of 2 webs and both transverse bulkheads	(i) 5 point pattern over approximately 2 m^2 area (ii) 2 measurements between each pair of vertical stiffeners
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 5.5.17-8 Additional thickness measurements - Double hull oil tankers – Longitudinal bulkhead structure in cargo tanks with substantial corrosion

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

Table 5.5.17-9 Additional thickness measurements - Double hull oil tankers – Transverse watertight and swash bulkhead structure in cargo tanks with substantial corrosion

Structural element	Extent of measurement	Pattern of measurements
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
Deck head and bottom strakes, and strakes in way of horizontal stringers	Plating between pair of stiffeners at 3 locations; approximately ¼, ½ and ¾ width of tank.	5 point pattern between stiffeners over 1 m length
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 approximately 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 measurement at 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

Table 5.6.10 Minimum requirements for tank testing – Chemical tankers

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III and thereafter** (Ships ≥15 years old)
All ballast tank boundaries	All ballast tank boundaries	All ballast tank boundaries
Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms and cofferdams	Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms and cofferdams	Cargo tank boundaries facing ballast tank void spaces, pipe tunnels, oil fuel tanks, pump rooms and cofferdams.
Representative tanks for fresh water, fuel oil and lubricating oil.	All cargo tank bulkheads which form the boundaries of segregated cargoes	All remaining cargo tank bulkheads
NOTE: Tanks are to be tested by filling with water to the top of the hatchways.		

5.6 SPECIAL SURVEY OF CHEMICAL TANKERS – SPECIAL INSTRUCTIONS

5.6.1 The requirements of *Sections 3, 4 and 6* are to be complied with as far as it is possible.

5.6.2 To maintain or assign the ESP notation the surveys to the hull structure and piping systems in way of the cargo holds, cofferdam, pipe tunnels, void spaces, topside tanks and double bottom tanks in way of the cargo hold area and all water ballast tanks, are to be carried out in accordance with the requirements of this Subsection.

5.6.3 All cargo holds, water 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 Close-up Survey, thickness measurement and testing as deemed necessary, to ensure that the structural integrity of the vessel remains effective.

5.6.4 The survey is to be sufficient to ascertain all substantial corrosion areas, significant deformation, fractures, damages or other structural deterioration and, if deemed necessary by the Surveyor, suitable non-destructive examination may be required.

5.6.5 Where substantial corrosion area, as defined in paragraph 1.2.1, is identified and is not rectified, this will be subject to re-examination at Annual and Intermediate Surveys.

5.6.6 All piping systems within the tanks and spaces stated in paragraph 5.6.2 are to be examined and tested under working conditions to ensure that the conditions remain satisfactory.

5.6.7 The survey of stainless steel tanks may be carried out as an Overall Survey supplemented by a Close-up Survey as deemed necessary by the Surveyor.

5.6.8 Where water ballast tanks have been converted to void spaces the survey extent is to be based upon water ballast tank requirements.

5.6.9 Where fitted, the strums of the cargo suction pipes are to be removed or lifted to facilitate examination of the shell plating and bulkheads in the vicinity, unless other means for visual inspection of these parts are provided.

5.6.10 The minimum requirements for tank testing are given in *table 5.6.10*. The remaining requirements for tank testing are given in *paragraph 5.3.5*.

5.6.11 The minimum requirements for Close-up Survey of bulk chemical tankers are given in *table 5.6.11*.

5.6.12 The Surveyor may extend the Close-up Survey, if deemed necessary, taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system, and the following:
(a) Structural arrangements or details which have suffered defects in similar spaces or on similar ships.
(b) Spaces which have structures approved with reduced scantlings in association with an approved corrosion control system.

5.6.13 For areas in tanks and cargo holds where coatings are found to be in GOOD condition, the extent of Close-up Surveys may be specially considered.

5.6.14 The minimum requirements for thickness measurements for chemical tankers are given in *table 5.6.14*.

5.6.15 In areas where substantial corrosion has been noted then additional measurements are to be carried out, as applicable, in accordance with *tables 5.6.15-1, 5.6.15-2, 5.6.15-3* and *5.6.15-4* to determine the full extent of the corrosion pattern. The survey will not be considered complete until these additional thickness measurements have been carried out.

Table 5.6.10 Minimum requirements for Tanks testing requirements - Chemical tankers

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III and thereafter** (Ships15 years old and over)
All ballast tank boundaries	All ballast tank boundaries	All ballast tank boundaries
Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms or cofferdams	Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms or cofferdams	Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, oil fuel tanks, pump rooms or cofferdams
	All cargo tank bulkheads which form the boundaries of segregated cargoes	All remaining cargo tank bulkheads
NOTE: Tanks are to be tested by filling with water to the top of the hatchways.		

Table 5.6.11 Minimum requirements for Close-up Survey - Chemical tankers

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV** (Ships ≥20 years old)
One web frame ring – in a wing ballast tank, if any, or a ballast double hull side tank, see Notes 1 & 8. One deck transverse – in a cargo tank or on deck, see Note 2. One transverse bulkhead, see Note 4: − In a ballast tank. − In a cargo wing tank. − In a cargo centre tank.	All plating and internal structure in a wing ballast tank, if any, or a ballast double hull side tank, see Notes 1 and 8. One deck transverse, see Note 2: − In each of the remaining ballast tanks, or on deck − In a cargo wing tank or on deck − In 2 cargo centre tanks or on deck Both transverse bulkheads – in a wing ballast tank, if any, or a double hull side tank, see Note 3. One transverse bulkhead, *see* Note 4: − In each remaining ballast tank . − In a cargo wing tank. − In 2 cargo centre tanks.	All plating and internal structure, see Note 7: − In all ballast tanks. − In a cargo wing tank. One web frame ring – in each remaining cargo tank, *see* Note 1 All transverse bulkheads – in all cargo tanks, see Note 3. As considered necessary by Surveyor, see Note 5. ¿A qué elemento se refiere este punto?	As for Special Survey III. Additional transverse areas if deemed necessary by the Surveyor.

NOTES:

1. **Complete transverse web frame ring including adjacent structural members.**
2. **Deck transverse including adjacent deck structural members.**
3. **Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure.**
4. **Transverse bulkhead lower part including girder system and adjacent structural members.**
5. **Additional complete transverse web frame ring.**
6. **Ballast tank includes peak tanks.**
7. **Complete tank – including all tank boundaries and internal structure, and external structure on deck in way of the tank where applicable.**
8. **Double hull side tank includes double bottom and side tank even though these tanks may be separated.**

Table 5.6.14 Minimum thickness measurements – Chemical tankers

Special Survey I (Ships 5 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV** (Ships ≥20 years old)
(a) 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) (b) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.6.11*. (c) Critical areas, as required by the Surveyor.	(a) Within the cargo tank length: − Each deck plate. − Two transverse sections. (a) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.6.11*. (b) Selected wind and water strakes outside the cargo tank length . (c) All wind and water strakes within the cargo tank length. (d) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank, see Notes 1 and 4. (e) Critical areas, as required by the Surveyor.	(a) Within the cargo tank length: − Each deck plate. − Three transverse sections. − Each bottom plate. (b) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.6.11*. (c) Selected wind and water strakes outside the cargo tank length. (d) All wind and water strakes within the cargo tank length. (e) Remaining exposed main deck plating not considered in item (1) and representative exposed superstructure deck plating (i.e. poop, bridge and forecastle deck). (f) All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank and aft peak tank, see Notes 1 and 4. (g) All keel plates outside the cargo tank length. Also additional bottom plates in way of cofferdams, machinery space and aft end of tanks. (h) Plating of seachests and side shell plating in way of overboard discharges, as deemed necessary by the Surveyor. (i) Critical areas, as required by the Surveyor.
Special Survey II (Ships 10 years old)		
(a) Within the cargo tank length: − Each deck plate. − One transverse section. (b) Measurements for general assessment and recording of corrosion pattern of the structural members subject to Close-up Survey in accordance with *table 5.6.11*. (c) Selected wind and water strakes outside the cargo tank length. (d) Critical areas, as required by the Surveyor.		

NOTES:

1. **For areas in tanks where coatings are found to be in GOOD condition the extent of thickness measurements may be specially considered.**
2. **Transverse sections are to be chosen where the largest reductions are likely to occur, or as revealed by deck plating measurements.**
3. **Where two or three transverse sections are required to be measured, at least one is to include a ballast tank within 0.5*L* amidships.**
4. **Transverse bulkhead complete including stiffening system.**

Table 5.6.15-1 Additional thickness measurements – Chemical tankers – Bottom structure with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Bottom plating and inner bottom plating	Minimum of 3 bays across tank, including aft bay Measurement around and under all suction strums	5 point pattern for each panel between longitudinals over 1 m length
Bottom longitudinals and inner bottom longitudinals	Minimum of 3 longitudinals in each bay where plating measured	3 measurements in line across flange and 3 measurements on vertical web
Bottom longitudinal girder, transverse floors and web	Suspect plates	5 point pattern over about 1 m^2 area
Watertight floors	− Lower 1/3 of tank − Upper 2/3 of tank	5 point pattern over about 1 m^2 area
Panel stiffening	Where applicable	Single measurements

Table 5.6.15-2 Additional thickness measurements – Chemical tankers – Deck structure with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Deck plating	2 bands across tank	Minimum of 3 measurements per plate per band
Deck longitudinals	Minimum of 3 longitudinals in each 2 bays	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 1 measurement between each panel stiffener, or a minimum of 3 measurements. 2 measurements across face flat. 5 point pattern on girder/bulkhead brackets
Deck transverse webs	Minimum of 2 webs with measurement at both ends and middle of span	5 point pattern over 2 m^2 area. Single measurements on face flat
Panel stiffening	Where applicable	Single measurements

Table 5.6.15-3 Additional thickness measurements – Chemical tankers – Shell and longitudinal bulkheads with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Deckhead and bottom strakes and strakes in way of stringer platforms	Plating between each pair of longitudinals in a minimum of 3 bays	Single measurement
All other strakes	Plating between every 3rd pair of longitudinals in same 3 bays	Single measurement
Longitudinals – deckhead and bottom strakes	Each longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
Longitudinals – all others	Every third longitudinal in same 3 bays	3 measurements across web and 1 measurement on flange
Longitudinals – bracket	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 2 m^2 area, plus single measurements on web frame and cross tie face flats

Table 5.6.15-4 Additional thickness measurements – Chemical tankers – Transverse bulkheads and swash bulkheads with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Deckhead and bottom strakes in way of stringer platforms	Plating between pair of stiffeners at 3 locations: approx. 1/4, 1/2 and 3/4 width of tank	5 point pattern between stiffeners over 1 m length
All other strakes	Plating between pair of stiffeners at middle location	Single measurement
Strakes in corrugated bulkheads	Plating for each change of scantling at centre of panel and at flange or fabricated connection	5 point pattern over 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 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
Deep webs and girders	Measurements at toe of bracket and at centre of span	For web, 5 point pattern over 1 m 2 areas. 3 measurements across face flat
Stringer platforms	All stringers with measurements at middle and both ends	5 point pattern over 1 m^2 area, plus single measurements near bracket toes and on face flats

5.7 SPECIAL SURVEY OF BULK CARRIERS – SPECIAL INSTRUCTIONS

5.7.1 The requirements of *Secs 3, 4* and *6* are to be complied with as far as it is possible. In general, the Hull Surveys are to be carried out in accordance with *RSTE I Ch 5, Sec 2.*

5.7.2 To maintain or assign the ESP notation the surveys to the hull structure and piping systems in way of the cargo holds, cofferdam, pipe tunnels, void spaces, topside tanks and double bottom tanks in way of the cargo hold area and all water ballast tanks, are to be carried out in accordance with the requirements of this Subsection.

5.7.3 All cargo holds, water 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 Close-up Survey, thickness measurement and testing as deemed necessary, to ensure that the structural integrity of the vessel remains effective.

5.7.4 The survey is to be sufficient to ascertain all substantial corrosion areas, significant deformation, fractures, damages or other structural deterioration and, if deemed necessary by the Surveyor, a suitable non-destructive examination may be required.

5.7.5 Where substantial corrosion area, as defined in *paragraph 1.2.1*, is identified and is not rectified, same will be subject to re-examination at Annual and Intermediate Surveys.

5.7.6 All piping systems within the tanks and spaces indicated in *paragraph 5.7.2* are to be examined and tested under working conditions to ensure that the conditions remain satisfactory.

5.7.7 The extent of survey of combined water ballast cargo holds is to be evaluated based on the records of ballast history, the extent and condition of the corrosion protection system provided, and the extent of structural diminution (corrosion).

5.7.8 Where water ballast tanks have been converted to void spaces the survey extent will be based upon water ballast tank requirements.

5.7.9 The minimum requirements for tank testing are given in paragraph 5.3.5. Where required, the Surveyor may extend the tank testing if deemed necessary.

5.7.10 The minimum requirements for Close-up Survey for bulk carrier ships are given in *table 5.7.10*.

5.7.11 For areas in tanks and cargo holds where coatings are found to be in GOOD condition (see *paragraph 1.2.1*) the extent of Close-up Surveys may be specially considered.

5.7.12 The minimum requirements for thickness measurements in bulk carrier ships are given in *table 5.7.12*.

5.7.13 In areas where substantial corrosion, as defined in paragraph 1.2.1, has been noted then additional measurements are to be carried out, as applicable, in accordance with *tables 5.7.13-1, 5.7.13-2, 5.7.13-3 and 5.7.13-4* to determine the full extent of the corrosion pattern. The survey will not be considered complete until these additional thickness measurements have been carried out.

5.7.14 Thickness measurements will be required to determine both general and local levels of corrosion in salt water ballast tanks and in the shell frames and their end attachments in all cargo holds.

5.7.15 Thickness measurements are also to be carried out to determine the corrosion levels on the transverse bulkhead plating.

Table 5.7.10 Minimum requirements for Close-up Survey – Bulk carriers

Special Survey I (Ships 5 years old)	**Special Survey II** (Ships 10 years old)	**Special Survey III** (Ships 15 years old)	**Special Survey IV** (Ships ≥20 years old)
(a) 25% of shell frames and their end attachments in the forward cargo hold at representative positions. Selected frames and their end attachments in remaining cargo holds. (b) One transverse web with associated plating and longitudinals in 2 representative water ballast tanks of each type (i.e. topside, hopper side or side tank). (c) 2 selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. This is to include the aft bulkhead of the forward hold. (d) All cargo hold hatch covers and coamings (plating and stiffeners).	(a) All shell frames in the forward cargo hold and 25% of frames in remaining cargo holds, including their end attachments and adjacent shell plating. (b) One transverse web with associated plating and longitudinals in each water ballast tank (i.e. topside, hopper side or side tank) (c) Forward and aft transverse bulkhead in 1 side ballast tank, including stiffening system . (d) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted. (e) All cargo hold hatch covers and coamings, (plating and stiffeners). (f) Selected areas of deck plating inside line of hatch openings between cargo hold hatches.	(a) All shell frames in the forward cargo hold and 25% of frames in remaining cargo holds, including their end attachments and adjacent shell plating. (b) All transverse webs with associated plating and longitudinals in each water ballast tank (i.e. topside, hopper side or side tank) (c) All transverse bulkheads in ballast tanks, including stiffening system. (d) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. (e) All cargo hold hatch covers and coamings (plating and stiffeners). (f) All deck plating inside line of hatch openings between cargo hold hatches.	(a) All shell frames, including their end attachments and adjacent shell plating, in all cargo holds. (b) All transverse webs with associated plating and longitudinals in each water ballast tank (i.e. topside, hopper side or side tank). (c) All transverse bulkheads in ballast tanks, including stiffening system. (d) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. (e) All cargo hold hatch covers and coamings (plating and stiffeners). (f) All deck plating inside line of hatch openings between cargo hold hatches.

NOTES:

1. **Ballast tanks include peak tanks.**
2. **Close-up Survey of transverse bulkheads is to be carried out at four levels:**
   - **Level (a) Immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stool.**
   - **Level (b) Immediately above and below the lower stool shelf plate (for those ships fitted with lower stools), and immediately above the line of the shedder plates.**
   - **Level (c) About mid-height of the bulkhead.**
   - **Level (d) Immediately below the upper deck plating and immediately adjacent to the upper wing tank and immediately below the upper stool shelf plate for those ships fitted with upper stools, or immediately below the topside tanks.**

Table 5.7.12 Minimum requirements for thickness measurement – Bulk carriers

<table>
<tr>
<td>Special Survey I
(Ships 5 years old)</td>
<td rowspan="2">Special Survey III
(Ships 15 years old)</td>
<td rowspan="2">Special Survey IV and there after
(Ships ≥20 years old)</td>
</tr>
<tr>
<td>(a) Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance table 5.5.10.
(b) Critical areas, as required by the Surveyor.</td>
</tr>
<tr>
<td>Special Survey II
(Ships 10 years old)</td>
<td rowspan="2">(a) Within the cargo length area:
− Each deck plate outside line of cargo hatch openings
− Two transverse sections, outside line of cargo hatch openings. (At least one of the above transverse sections is to be within 0.5L amidships).
(b) Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with table 5.5.10.
(c) All wind and water strakes within the cargo length area.
(d) Selected wind and water strakes outside the cargo length area.
(e) All cargo hatch covers and coamings (plating and stiffeners).
(f) All deck plating inside line of openings between cargo hold hatches.
(g) Critical areas, as required by the Surveyor.</td>
<td rowspan="2">(a) Within the cargo length area:
− Each deck plate outside line of cargo hatch openings.
− Three transverse sections, outside line of cargo hatch openings. (At least 2 of these transverse sections are to be within 0.5L amidships).
− Each bottom plate.
(b) Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with table 5.5.10.
(c) All wind and water strakes within the cargo length area.
(d) Selected wind and water strakes outside the cargo length area.
(e) All cargo hatch covers and coamings (plating and stiffeners).
(f) All deck plating inside line of openings between cargo hold hatches.
(g) Critical areas, as required by the Surveyor.</td>
</tr>
<tr>
<td>(a) Within the cargo length area:
− Two sections of deck plating outside line of cargo hatch openings
(b) Measurement, for general assessment and recording of corrosion pattern, of those structural members subject to Close-up Survey in accordance with table 5.5.10.
(c) Selected cargo hold hatch covers and coamings (plating and stiffeners).
(d) Selected areas of deck plating inside line of openings between cargo hold hatches.
(e) Wind and water strakes in way of the transverse sections considered in item (a).
(f) Critical areas, as required by the Surveyor.</td>
</tr>
<tr>
<td colspan="3">NOTES:
1. For areas in spaces where coatings are found to be in GOOD condition,, the extent of thickness measurement may be specially considered. Prior to any coating or recoating of cargo holds, scantlings are to be confirmed by thickness measurement with the Surveyor in attendance.
2. Transverse sections are to be chosen where the largest reductions are likely to occur, or as revealed by deck plating</td>
</tr>
</table>

Table 5.7.13-1 Additional thickness measurements - Bulk carriers – Shell plating and stiffening with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Bottom and side shell plating	Suspect plate plus four adjacent plates	5 point pattern for each panel between longitudinal
Bottom/side shell	Minimum of three longitudinal in way of suspect areas	3 measurements in line across web and 3 measurements on flange
Side shell frames	Suspect frame and each adjacent	At each end and mid-span: 5 point pattern on both web and flange 5 point pattern within 25 mm of welded attachment to both shell and hopper sloping plate

Table 5.7.13-2 Additional thickness measurements - Bulk carriers – Cargo hold transverse bulkheads with substantial corrosion

Structural element	Extent of measurement	Pattern of measurement
Lower stool	Transverse band within 25 mm of welded connection to inner-bottom	5 point pattern between stiffeners over 1 m length
	Transverse band within 25 mm of welded connection to shelf plate	as above
Transverse bulkhead	Transverse band immediately above lower stool shelf plate	5 point pattern over 1 m length
	Transverse band at approximately mid-height	5 point pattern over 1 m^2 of plating
	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 m^2 of plating

Table 5.7.13-3 Additional thickness measurements - Bulk carriers – Deck structure including cross strips, main cargo hatchways, hatch covers, coamings and topside tanks, with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
Cross deck plating	Suspect cross deck strip plating	5 point pattern between underdeck stiffeners over 1 m length
Underdeck stiffeners	(a) Transverse members (b) Longitudinal member	(a) 5 point pattern at each end and mid-span (b) 5 point pattern on both web and span
Hatch covers	(a) Each side and end plate 3 locations	(a) 5 point pattern at each location
	(b) Hatch cover top plate, 3 longitudinal bands	(b) 5 point measurement each band
Hatch coamings	Each side and end of coaming, one upper and one lower band	5 point measurement each band
Topside salt water ballast tanks	(a) Watertight transverse bulkheads (i) Lower third of bulkhead (ii) Upper 2/3 of bulkhead (iii) Stiffeners	(i) 5 point pattern over 1 m^2 of plating (ii) 5 point pattern over 1 m^2 of plating (iii) 5 point pattern over 1 m length
	(b) Swash transverse bulkheads (i) Lower third of bulkhead (ii)Upper 2/3 of bulkhead (iii) Stiffeners	(i) 5 point pattern over 1 m^2 of plating (ii) 5 point pattern over 1 m^2 of plating (iii) 5 point pattern over 1 m length
	(c) 3 representative bays of the topside sloping plate (i) Lower 1/3 of tank (ii) Upper 2/3 of tank	(i) 5 point pattern over 1 m^2 of plating (ii) 5 point pattern over 1 m^2 of plating
	(d) suspect longitudinals and adjacent plates	5 point pattern both web and flange over 1 m length
Main deck plating	Suspect plates and 4 immediately adjacent plates	5 point pattern over 1m^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 1m^2 of plating

Table 5.7.13-4 Additional thickness measurement - Bulk carriers – Double bottom and hopper structure, with substantial corrosion

Structural member	Extent of measurement	Pattern of measurement
Inner bottom plating	Suspect plate plus all immediately adjacent plates	5 point pattern for each panel between longitudinals over 1 m length
Inner bottom longitudinals	Three longitudinals in way of plates measured	3 measurements in line across web and 3 measurements on flange
Transverse floors and longitudinal girders	Suspect plates	5 point pattern over approximately 1 m^2 of plating
Watertight floors and girders	Lower third of tank Upper third of tank	5 point pattern over 1 m^2 of plating 5 point pattern alternate plates over 1 m^2 of plating
(5) Transverse web frames	Suspect plates	5 point pattern over 1 m^2 of plating

SECTION 6. DOCKING SURVEY

6.1 GENERAL INSTRUCTIONS

6.1.1 One of the two Docking Surveys required in each five year period is to coincide with the Special Survey. At the Docking Survey held in conjunction with the Special Survey, the Surveyor is to draw the Owner's attention to the necessity of examining the chain locker, anchors and chain cable, and, where necessary, to conducting a thickness determination of the underwater shell plating as part of the Special Survey.

6.1.2 When a ship is in dry-dock the holds, cargo tanks and ballast tanks are normally cleared. It is therefore advantageous that, where possible, the Annual or Intermediate Surveys be held at the same time as the Docking Survey to facilitate any inspection of these spaces which the above surveys may require.

6.1.3 Where a ship is in dry-dock or on a slipway she is to be placed on blocks of sufficient height, and proper staging is to be erected as may be necessary, for the examination of the shell including bottom and bow plating, keel, stern, stern frame and rudder.

6.1.4 For **oil tankers** (including ore/oil and OBO ships), **chemical tankers and dry bulk cargo ships over 15 years** of age the intermediate docking between Special Surveys is to be held in dry-dock. Further this survey is to be held as part of the Intermediate Survey.

6.1.5 It is necessary to hose test (or equivalent procedure) the steel hatch covers of container ships at Docking Surveys.

6.1.6 During Docking Surveys particular attention is to be paid to any application or renewal of high resistance paint systems to the underwater portion of the hull. Surveyors are to submit particulars of the maker and coating material to ensure that a suitable record is entered in the Survey Report.

6.1.7 A postponement of a Docking Survey may be granted upon request by the Owner in exclusive cases for a period not exceeding **3 months** from the due date specified for the DS with the purpose of completing Special Surveys, performing a single passage to the repairing yard or docking port or proceeding on the voyage.

6.1.8 Where Docking Survey is to be postponed, the Owner, not earlier than one month before the expiry the date of the DS is to submit a written request to the HO accompanied with the technical justification and statement of due date and place of the ship's submission to the Docking Survey.

6.2 SCOPE OF DOCKING SURVEY

6.2.1 The shell plating is to be examined for excessive corrosion, deterioration due to chafing and for undue unfairness or buckling. Special attention is to be given to the connection between the bilge strakes and the bilge keels.

6.2.2 Special attention is to be paid to the following areas:

(a) External shell plating directly below ship side discharges as heavy corrosion of the external surface of the plating is likely to occur.
(b) External shell plating in the wind and water strakes in way of transverse and longitudinal structure such as web frames, bulkheads or longitudinal where there is evidence of repeated contact with quayside or other fixed structure.
(c) Any such areas identified as area with excessive corrosion, which are to be subject to external Close-up Survey and thickness measurement to determine the extent of material lost to abrasion.
(d) The structure and attachment of bilge keels.
(e) The ends of bilge keels. It is to be confirmed that they terminate on a suitable transverse internal stiffener, are suitably tapered at their ends, and have an efficient welded connection.

6.2.3 Rudder pintle bearing clearances are to be taken by the Surveyor at each dry-docking. Although renewal of bearing or bushes would normally be dealt with at a Special Survey there is no hard and fast rule on this as it sometimes happens that excessive clearance found at a normal Docking Survey will necessitate repair. When evidence of excessive slackness is found, the upper bearings/carrier are to be examined for possible damage.

6.2.4 Where it is intended to use synthetic resin type compounds for the repair of rudder pintles and their housings (gudgeons) then, prior to the repair being commenced or agreed, full details are to be forwarded to HO.

6.2.5 The maximum clearance for synthetic materials is to be in accordance with the manufacturer's recommendations. Alternatively, the maximum clearance for both metallic and synthetic bearings should not exceed 5 + 0.002D [mm], where D is the diameter of the stock or pintle over the liner in mm. There have been instances where rudder bearing clearances have been greater than the permissible limits and owners have requested consideration be given to deferment of repairs. In all such cases these requests should be referred to HO.

6.2.6 When the type of rudder and pintle design prevents clearances being taken afloat and the maximum clearance at a dry-docking, although less than 5 + 0.002D exceeds 4 + 0.002D mm and repairs are not affected, a recommendation should be made that the rudder bearing clearances be specially examined and dealt with as found necessary at the next dry- docking . In these circumstances, an In-water Survey would not be accepted in lieu of the next docking.

6.2.7 If a rudder or stock has to be removed for repair, special attention is to be given to the precise re-alignment of the unit so as to minimize the possibility of subsequent wear to pintles or bearings and their bushes:

6.2.8 To avoid jamming and premature failure, renewed bearings are to have no more than 1.5 mm of clearance. Note is to be taken of the clearances recommended by the Manufacturer, particularly when bush material requires pre-soaking. Final clearances will always be considered in association with any proposed method of lubrication.

6.2.9 When the use of a synthetic rudder bearing material which is not listed is proposed, and confirmation is obtained from the Head Office that the subject material is not a recent addition to the list of approved materials, the Surveyor is to report the Manufacturer's name and material grade and is to require the Manufacturer to forward to the Head Office the physical property data of the material for consideration.

6.2.10 Where applicable, pressure testing of the rudder may be required. The rudder is to be lifted for examination of the pintles if considered necessary by the Surveyor.

6.2.11 Sea connections and overboard discharge valves and cocks and their attachments to the hull are to be examined.

6.2.12 The propeller, stern bush and sea connection fastenings and the gratings at the sea inlets are to be examined. The clearance in the stern bush or the efficiency of the oil glands is to be ascertained.

6.2.13 When chain cables are ranged, the anchors and cables are to be examined by the Surveyor, according with *paragraph 5.3.13* and *table 5.2.1*.

6.2.14 A General Examination of the electrical equipment is to be carried out in areas which may contain flammable gas or vapour and/or combustible dust is to be made to ensure that the integrity of the safe type electrical equipment 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 for oil tankers five years old and over.

6.2.15 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 good order.

6.2.16 Tests are to be carried out to demonstrate the effectiveness of bonding straps for the control of static electricity.

6.2.17 Alarms and interlocks associated with pressurized equipment or spaces are to be tested for correct operation.

SECTION 7. IN-WATER SURVEY

7.1 GENERAL INSTRUCTIONS

7.1.1 The In-water Survey is to provide the information normally obtained from the Docking Survey, so far as is practicable.

7.1.2 The In-water Survey may be used only in the following cases:

(a) As a substitute for a Docking Survey corresponding to an Intermediate Survey, at intervals of 30±6 months if the following conditions are met:
  (i) Self propelled ships are not to be older than 15 years.
  (ii) The design of propeller shaft and stern tube arrangement is to permit the shaft operation for 5 years without extraction.
  (iii) No data are available indicating possible damage to underwater hull.

(b) For floating docks or other similar floating structures, as a substitute for a Docking Survey.

(c) For concrete and berth connected ships as a substitute of docking survey, if the conditions stated in *subparagraph (a)* are observed.

(d) As a substitute for a Docking Survey when deciding on postponement of a Special Survey.

(e) For passenger, wooden and composite ships, as a substitute for a Docking Survey combined with Annual Survey, upon agreement with the MCO, if the conditions stated in *subparagraph (a)* are met, and the paint coat of the underwater hull is observed in a GOOD condition.

(f) As a substitute for an occasional Docking Survey, upon agreement with the MCO in connection with the underwater hull damage.

7.1.3 The In-water Survey is to be carried out at an agreed geographical location under the surveillance of a Surveyor to the MCO, with the ship at a suitable draught in sheltered waters and with weak tidal streams and currents.

7.1.4 The in-water visibility during the IWS is to be good and the hull below the waterline is to be clean. The Surveyor is to be satisfied that the method of pictorial presentation is satisfactory. There is to be a good two-way communication between the Surveyor and the diver.

7.1.5 Prior to the commencement of the In-water Survey, the equipment and procedures for both observing and reporting the survey are to be agreed between the Owners, the Surveyor and the diving firm

7.1.6 The In-water Survey is to be carried out by a qualified diver employed by a firm approved by the MCO.

7.1.7 If the In-water Survey reveals damage or deterioration that requires early attention, the Surveyor may require that the ship be dry-docked in order that a fuller survey can be undertaken and the necessary work carried out.

7.1.8 The Surveyor is entitled to decline from the survey in the following cases:

(a) If the requirements of paragraph 7.1.2 are not met.

(b) If the assessment of the technical conditions of underwater hull elements is impossible due to insufficient water transparency.

(c) Unsatisfactory quality of television picture.

(d) Unstable character of ship elements demonstration by the specialized diver as a result of sea conditions or tide.

(e) Other cases at the Surveyor's discretion.

7.1.9 For oil tankers and bulk carriers 15 years of age or over and subject to the Enhanced Survey Programme (ESP), Underwater Inspections in Lieu of Dry docking will not be permitted at alternate Docking Surveys. Accordingly, all Docking Surveys required by the Rules are to be carried out with the vessel on dry dock.

7.2 SCOPE OF IN-WATER SURVEY

7.2.1 Prior to the commencement of the In-water Survey the Surveyor is to carry out an afloat examination of the hull structure which is to cover:

(a) The inner side shell plating and framing at ends (forepeak, after peak, etc).

(b) The inner side of shell plating and framing in accessible areas in way of machinery room, bottom and sides.

(c) From a float, the exposed part of the steering gear (helmpost, rudder carrier, upper rudder body, rudder heel, rudder stock coupling, rudder head pintles and propulsion unit.

7.2.2 If the results of the afloat examination of the ship from the inside are satisfactory, the Surveyor is to proceed to the in-water hull survey.

7.2.3 During the In-water Survey the following items are to be examined:

(a) Underwater hull.
(b) Bottom and side openings. (c) Sacrificial protection.
(d) Side keels.
(e) Welds and riveted joints. (f) Sterns.
(g) Domes of echo sounder vibrators and hydro acoustical stations.
(h) Damping devices (if installed on broad). (i) Rudder nozzles and stationary nozzles. (j) Rudder body.
(k) Rudder stock sections accessible for examination.
(l) Visible rudder stock pintles sections and conditions for their attachment.
(m) Rudder stock coupling. (n) Drain plugs.
(o) All rudder body weld joints.
(p) Clearance is to be measured in rudder carrier and rudder bearings, in pintles bases, as well as rudder stock sagging.
(q) All propulsion unit components accessible for examination and their fittings.
(r) Conditions of the propeller shaft cone seal.
(s) Detachable blade attachment. (t) Propeller shaft sleeve.
(u) In-water lubricated stern tube arrangement. Clearances are to be measured.

7.2.4 Based on the survey results the Surveyor is to issue a Report. Relevant photos, partial reports and other documents which would be necessary to asses the technical condition of the surveyed items more completely, are to be attached to the Report.

SECTION 8. SURVEY AFTER GROUNDING

8.1 SCOPE OF SURVEY AFTER GROUNDING

8.1.1 Where a ship has grounded, the following points are to be given proper attention and be reported upon:

(a) Soundings are to be taken throughout, at least twice, with the ship in an approximately similar condition.

(b) Bilges are to be examined throughout in the lightweight condition, where practicable, and any tanks are to be examined internally, if considered necessary.

(c) The satisfactory condition of the propelling machinery, pumping arrangements and steering gear is to be confirmed and the steering gear tested.

(d) The windlass, anchors and cables are to be examined if they have been used in efforts to prevent the grounding or in efforts to refloat.

(e) If the grounding has been on sand or mud, the working condition of the condenser, coolers and circulating system (and, if necessary, the boilers) is to be verified.

(f) A Diver's Report is to be furnished if considered necessary.

8.1.2 When damage has been found, arrangements are to be made for temporary or permanent repairs, if considered necessary.

8.1.3 Anchors and cables are to be examined and re- tested if considered necessary.

8.1.4 Arrangements are to be made for the ship to be examined in drydock. If it is considered that the ship is to be drydocked before the due date for the next Docking Survey, the recommendation in the Survey Report should state: "*.....subject to dry-docking (grounding) by....*". In all other cases the recommendation is to be that the ship be specially examined in drydock by due date for possible grounding damage.

SECTION 9. SCOPE OF SURVEY FOR OTHER SERVICE NOTATIONS

9.1 GENERAL INSTRUCTIONS

9.1.1 The requirements of this Section are applicable to ships eligible for one of the following service notations:
(a) Container ship, or ship equipped for the carriage of containers.
(b) Dredging units, i.e. Ships with the service notations Dredger, hopper dredger, hopper unit, split hopper unit, split hopper dredger.
(c) Tug, salvage tug, escort tug. (d) Supply vessel.
(e) Oil recovery ship.

9.1.2 Requirements of the present Section are additional to those given in *Secs 2- 6* for the relevant surveys.

9.2 SCOPE OF SURVEYS FOR CONTAINER SHIPS OR SHIPS FOR THE CARRIAGE OF CONTAINERS

9.2.1 The Annual Survey is to include the following:
(a) Confirmation of the availability of instructions and instruments for stowage of containers, as required or fitted.
(b) Examination of container supports welded to the ship's structure or on to the hatch covers. (c) Examination of cell guides, if fitted.
(d) Examination of container supports welded to the ship's structure or on to the hatch covers, checking for possible cracks and deformations.
(e) Examination of cell guides and associated elements.

9.2.2 For ships with the service notation **Container ship**, examination of the torsion box girder or equivalent structure at the top sides is carried out. Thickness measurements additional to those related to the transverse sections may be required.

9.2.3 Special Survey is to be performed in accordance with *Subs 5.7* , as for a bulk carrier.

9.3 SCOPE OF SURVEYS FOR DREDGING VESSELS

9.3.1 The Annual Survey is to include the following items, as far as required or fitted:
(a) For split hopper unit, split hopper dredger, visual examination, as far as practicable, of superstructure hinges and blocks, deck hinges, hydraulic jacks and associated piping systems and alarms for dredger, hopper dredger, split hopper dredger:
(b) Visual examination, as far as practicable, of attachments of suction piping and lifting systems to the structure and external examination of piping in dredging machinery spaces for absence of corrosion and leakage.
(c) Checking the condition of the dredging machinery space and related equipment with regard to electrical shocks, protection from rotating machinery, fire and explosion hazards.

9.3.2 Special Survey of hopper dredgers and hopper units: is to include the following items:
(a) Visual examination of hopper bottom doors or valves and accessories, such as hinges, actuating rods, hydraulic systems, with dismantling as deemed necessary by the Surveyor for split hopper unit, split hopper dredger.
(b) Visual examination, as far as practicable, of superstructure hinges and blocks, deck hinges, hydraulic jacks and associated piping systems and alarms, with dismantling and/or further checks as deemed necessary by the Surveyor for dredger, hopper dredger, split hopper dredger:
(c) Visual examination, as far as practicable, of attachments of suction piping and lifting systems to the structure and external examination of piping in dredging machinery spaces for absence of corrosion and leakage
(d) Checking the condition of the dredging machinery space and related equipment with regard to electrical shocks, protection from rotating machinery, fire and explosion hazards.

9.4 SCOPE OF SURVEYS FOR TUGS, SALVAGE TUGS AND ESCORT TUGS

9.4.1 The Annual Survey is to include a general external examination of the towing hook or towing winch, as fitted and unhooking device, as far as practicable.

9.4.2 In addition to the requirements of paragraph 9.4.1, for salvage tugs, the availability and satisfactory condition of specific salvage equipment is to be verified.

9.4.3 For tug-barge arrangements, an examination of the accessible parts of the connection system is to be carried out.

9.4.4 The Special Survey of all tugs is to include:

(a) Checking the condition of the connection of the towing hook or towing winch to the structure, including related reinforcements of the structure.
(b) Checking the external condition of the towing hook or towing winch; when applicable, a no-load test of the unhooking device is to be carried out.

9.4.5In addition to the requirements of *paragraph 9.4.4,* the Special Survey of salvage tugs is to include:
(a) Check and working test of specific salvage equipment. (b) Checking by a specialist of the satisfactory condition of the towing lines. A report is to be forwarded to the Surveyor by the Owner and kept on board.

9.4.6 For tug-barge arrangements, a visual examination of components of the connection system is to be carried out, supplemented by thickness measurements and non - destructive tests as deemed necessary by the Surveyor. A connection/disconnection test is to be carried out, including a check of related remote control, safety and alarm devices.

9.5 SCOPE OF SURVEYS FOR OIL RECOVERY SHIPS

9.5.1 The Annual Survey is to include:
(a) Confirmation of the availability of the Operating Manual.
(b) Examination of cargo tank openings, including gaskets, covers, coamings and screens.
(c) A General Examination of cargo, ballast and vent piping systems, including control, gauging, alarm and safety devices.
(d) A General Examination of the cargo pump room, as regards ventilation systems, fire protection, detection and fire-fighting systems, condition of pumps and piping systems, and signs of any oil leakage.
(e) Confirmation that electrical equipment in hazardous areas, cargo pump rooms and other spaces, if fitted, is in satisfactory condition. The Owner or his representative is to state to the Surveyor that this equipment has been properly maintained.
(f) General examination of the dry powder fire extinguishers, as well as of the fixed or semi-fixed foam extinguishing system. The Owner is to produce evidence that the foam concentrates have been periodically tested, either by the Manufacturer or by a competent Organization.
(g) Confirmation of the satisfactory condition of the fixed cargo gas detection system, including related alarms, portable gas detection equipment, and oil flash point measurement equipment.

9.5.2 The Special Survey is to include the following items:
(a) Cargo, ballast, stripping and vent piping is to be examined to the Surveyor's satisfaction. Dismantling and/or thickness measurements may be required. Tightness or working tests are to be carried out.
(b) A hydraulic or hydro-pneumatic test is to be carried out in the event of repair or dismantling of cargo or ballast piping, or if doubts arise.
(c) Vent line drainage arrangements are to be examined.
(d) Electrical bonding of cargo piping to the hull is to be verified.
(e) Safety valves on cargo piping and of cargo tanks are to be opened up for examination, adjusted and, as applicable, resealed.
(f) Ballast and stripping pumps are to be internally examined and prime movers checked. A working test is to be carried out.
(g) Cargo pump room boundaries are to be generally examined.
(h) Gastight shaft sealing devices are to be examined.
(i) The bottom of cargo pump rooms is to be presented clean for the examination of stripping devices and gutters.
(j) 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.
(k) An insulation test of circuits is to be carried out; however, where a proper record of testing is maintained, consideration may be given to accepting recent readings taken by the ship's crew.
(l) Test of fixed foam fire-extinguishing systems, if fitted, is to be carried out at the Surveyor's discretion.
(m) The fixed cargo gas detection system, including associated alarms, portable gas detection equipment, and oil flash-point measurement equipment, is to be tested.

SECTION 10. SURVEYOR GUIDANCE NOTES

10.1 GENERAL INSTRUCTIONS

10.1.1 All repairs are to be carried out to the satisfaction of the Surveyors.

10.1.2 When significant structural repairs are effected afloat, the Surveyors are to advise the Owners that consideration must be given to maintaining the longitudinal and transverse strength of the ship. In case of doubt HO is to be consulted.

10.2 STEEL USED IN REPAIRS

10.2.1 When renewals are required, Surveyors are to ensure themselves that the grade of steel intended for use is in accordance with, or equivalent to, the grades listed on the original approved plans. When such steel is not available, any proposal to utilize steel of an alternative grade is to be referred to HO in the first instance.

10.2.2 Steel used for the repair of classed ships is to be manufactured, tested and certified in accordance with the requirements of the Rules (*RSTE III, Ch 1*).

10.2.3 If steel compliant with *RSTE III-1* is not available, steel of any equivalent grade which has been certified by a recognized Society may be accepted, provided the Surveyors are satisfied with the identification of the material and the documentation.

10.2.4 Steel complying with the requirements of a national or proprietary specification may be accepted subject to the following conditions:

(a) The specification gives reasonable equivalence to the requirements of *RSTE III-1* for the required grade of steel.
(b) The steel has been manufactured at approved works and can be satisfactorily identified with the Manufacturer's test certificate.
(c). Check mechanical tests are carried out in the presence of the Surveyors with satisfactory results. These tests are to include Charpy V-notch impact tests when appropriate for the grade of steel.
(e) Copies of the Manufacturer's test certificate and the results from check material tests are recorded.

10.2.5 When it is not possible to carry out check tests before the repair is completed, a sample is to be retained for subsequent testing before departure of the vessel. The repair is to be considered as incomplete until such tests have been carried out and the results confirmed as satisfactory.

10.2.6 Steel more frequently used in the shipbuilding and ship repairs, according with the classification set forth in *RSTE III, Ch 1* are shown in *table 9.2.6*.

10.3 WELDING

10.3.1 Welding procedure and welding materials are to be in accordance with the Rules (*RSTE III, Ch 2*).

10.3.2 Inspection of welded joints is to be done according with *RSTE III Ch 2 Sec 3*. Visual inspection of welds is to be supplemented with non-destructive examination.

10.3.3 The welding operators' qualification is to be in accordance with the used welding procedure and with *RSTE III Ch 2 Sec 5*.

10.4 TEMPORARY REPAIRS

10.4.1 Temporary repairs will normally be considered only if facilities do not exist for permanent repairs, or if the Owner has other good reasons for postponing permanent repairs.

10.4.2 The Surveyors are to be satisfied that the temporary repairs maintain the local, longitudinal and transverse strength and the watertight integrity of the ship.

10.4.3 The Surveyors are reminded that in all cases of structural damage when immediate permanent repairs are not carried out, consideration is to be given to the possible need for temporary reinforcement of the damaged area in order to maintain the structural integrity.

10.5 DOUBLING PLATES

10.5.1 Doubling plates may be accepted under specific circumstances.

10.5.2 Doubling plates will not be accepted as a permanent repair in the following circumstances:

(a) In way of substantially corroded areas, i.e.: plating and stiffeners corroded to a level equal to or greater than the maximum diminution defined in *paragraph 1.2.1* as "*Substantial corrosion*".
(b) In way of holed shell plating and tank plating.
(c) In way of fractured shell, deck and bulkhead plating.

10.5.3 Where the Surveyors consider that welded doubling plates may be used as a permanent means of repair, the doubling plate is to be satisfactorily attached to the original structure with peripheral welds and slot welds in accordance with the Rules (*RSTE III Ch 2*).

10.5.4 The Surveyors are also to satisfy themselves that faying surfaces are suitably prepared and primed, prior to fitting the doubler.

10.5.5 Where extensive doubling of shell, deck, or bulkhead plating is intended, the Surveyors are to contact HO Panama

Table 9.2.6 Steel frequently used in shipbuilding and ship repairing industry

STEEL GRADE	ISO 630/80 459/2/3-1981	EN 10025-93 10113-93	ASTM A 131	JIS G3106	DIN 17100
A	Fe360B	S235JRG2	A570Gr36	SM41B	St37-2
B	Fe360C	S235J0			St37-3U
D	Fe360D	S235J2G3		SM41C	St37-3N
E					
A32				SM50B	StE380
D32				SM50C	StE420
E32					
A36	Fe510C	S355N/M		SM 53B	St52-3U
D36	Fe510D			SM53B	St52-3UN
E36	E355E	S355NL/ML			
A40	E390CC	S420N/M		SM58	
D40	E39DD				
E40	E390E	S420NL/ML			

10.6 REPAIRS TO DOUBLE BOTTOM TANK TOP

10.6.1 When the inner bottom plating forming a tank top is found to have deteriorated to such an extent as to render the compartment in way unfit for use as a tank, and circumstances do not permit repairs to be effected at the time, all connections for filling the tank are to be disconnected or blanked. However, before recommending that the tank not be used as such until repaired, the effect on the longitudinal strength and also on the ballast draught is to be considered.

10.7 REPAIR OF RUDDER STOCKS AND STERN FRAMES

10.7.1 The Notes in this Subsection are intended for the general guidance of the Surveyors when it is proposed to carry out any form of weld repair to forged or cast steel stern frames and rudder stocks. The Notes do not apply to the weld cladding of the rudder stock or pintles in way of the bearings as an alternative to the fitting of shrunk-on liners

10.7.2 Repairs, except those of an emergency nature, are only to be attempted when the depth and location of the defective area is such as to provide adequate access for welding and inspection.

10.7.3 The welders employed for the repairs are to be experienced and competent to carry out this type of work. Whenever possible, the rudder stock is to be removed from the ship and the repairs carried out in a properly equipped workshop under controlled conditions.

10.7.4 Complete removal of all defective material is essential for a successful repair. However, the material removed is to be the minimum consistent with this and the excavation is to be shaped so as to allow good access for welding. The complete removal of all defective material is to be verified by magnetic particle examination before welding is commenced.

10.7.5 The chemical composition is to be established by reference to the pertinent certificate and the reported analysis compared with the limits given in *RSTE III-1*. If the quoted composition is not within these limits, special consideration is to be given to the welding procedure.

10.7.6 Where certificates are not available, the chemical composition and mechanical properties is to be determined by the analysis of representative drillings. In assessing these results, allowance is to be made for heterogeneous effects and provided the carbon content does not exceed 0.26%, a special consideration of the welding procedure will not be necessary.

10.7.7 Welding consumables are to be of an approved low hydrogen type depositing weld metal with mechanical properties similar to that of forging or casting. The use of Grade H or HH consumables is recommended.

10.7.8 It is recommended that in all cases an adequate area around the repair be pre-heated to about 100°C. This pre-heat is to be maintained until the repair is completed. Pre-heating temperature in excess of 100°C may be required.

10.7.9 As far as is practicable, all welding is to be done in the downhand position. Manual or automatic processes may be used as appropriate.

10.7.10 The repair area is to be checked for freedom from cracks and other defects by magnetic particle examination.

10.7.11 A heat treatment is to be carried out after completion of the repairs. The temperature range is 600 - 650°C with a soaking period of one hour per each 25 mm thickness of the repaired section.

10.7.12 Rudder stocks are to be treated in a furnace properly equipped with means for temperature measurement and control. The furnace is to be large enough to take the entire rudder stock. If welding is confined to a small area, the post weld heat treatment may be restricted to a suitable local area.

10.7.13 Sternframes are to be stress-relieved by heat treatment preferably using electric heating elements and cooling is to be retarded by thermal blankets.

10.7.14 After heat treatment and final machining or grinding has been completed, the repaired area is to be re- examined by a magnetic particle method.

10.7.15 Where the repairs have been carried out satisfactorily in compliance with the above paragraphs, they are not to be made a Condition of Class, but be recorded in the Memoranda. If repairs are considered to be of a temporary nature, a Condition of Class is to be recommended.

10.8 REPAIR OF TWISTED RUDDER STOCKS

10.8.1 When a rudder stock is twisted the extent of the repair will depend on the following paragraph meters:

θ = angle of twist in degrees

L = length of stock over which the twist appears uniform

d = diameter of twisted portion of stock

10.8.2 When θ is less than or equal to L/d the stock may be accepted for further service without any form of heat treatment, provided the Surveyor is satisfied by visual examination that the stock is free from surface cracks or other significant defects.

10.8.3 When θ is greater than L/d but less than or equal to $5L/d$ the stock is to be removed and given a stress relieving heat treatment. A suitable temperature range for this treatment is **600 - 650°C** with a soaking period of not less than **1 hour** per 25 mm of diameter.

10.8.4 When θ is greater than $5L/d$ the stock is to be removed and given either a full annealing or normalizing heat treatment. A suitable temperature range for either of these treatments is **860 - 900°C** with a soaking period of not less than **30 minutes** per 25 mm of diameter. For full annealing the stock is to be cooled slowly in the furnace, while for normalizing, it is to be cooled in air.

10.8.5 The furnace used for the heat treatment is to be sufficiently large to take the entire stock and is to be properly equipped with means for temperature measurement and control.

10.8.6 Where necessary, a new keyway is to be cut and weld repairs are to be carried out and, where possible, are to be

completed prior to heat treatment. In this respect either full annealing or normalizing is acceptable as a post-weld stress relief heat treatment.

10.8.7 Subject to satisfactory results from magnetic particle examination and to compliance with the above requirements for heat treatment, rectification of the rudder stock is to be regarded as permanent and no Condition of Class imposed.

10.8.8 Details of all twisted rudder stocks are to be included in the Survey Report together with a recommendation for noting in the Memoranda where the twist is 3° or more. Where rectification has been carried out, the Report is to include details of the heat treatment procedure adopted.

10.9 REPAIR OF BILGE KEELS

10.9.1 The ends of bilge keels are to be examined. It is to be confirmed that they terminate on a suitable transverse internal stiffener, are suitably tapered at their ends, and have an efficient welded connection.

10.9.2 Butt welds of perpendicular flat bars and bilge keel sections on ships greater than 65 m in length are to have a hole drilled through the connection. This hole is to have a minimum diameter of 25 mm and extend beyond the fore and aft edges of the butt weld.

10.9.3 Where all butt welds have been subjected to non- destructive examination and found satisfactory, the holes may be omitted. In this case, a recommendation is to be made for the insertion of a note in the Survey Report, e.g.: "*Continuous flat bar* (if fitted*) and bilge keel butt welds non- destructive examination* (date) – *stop holes not drilled*".

10.9.4 Where any doubt exists on the integrity of a weld, visual inspection methods are to be supplemented by a non- destructive method.

10.9.5 Where a butt weld of the ground bars, perpendicular flat bars or bilge keels is found to be fractured, ultrasonic or radiographic examination of the remaining butt welds is to be carried out.

10.9.6 Where butt welding of bilge keels or their connections has been repaired, visual inspection of each weld is to be supplemented by ultrasonic or radiographic examination.

10.9.7 Where Owners request postponement of the repair of minor damage to bilge keels and, after careful examination, the Surveyor is fully satisfied that there is sound technical justification for postponement, the repair of blemishes of this nature may be left to the Owner's convenience and be reported for inclusion in the Survey Report.

10.9.8 Where part renewal of bilge keels is considered necessary, the configuration to be employed is to be typical of that previously fitted on the ship, with the incorporation of 25 mm holes as necessary.

10.9.9 Particular attention is to be paid to welding sequences in order to minimize residual stresses.

10.10 ANCHORS AND CHAIN CABLES - TEST AND EXAMINATION

10.10.1 Whenever chain cables are ranged, the Surveyor is to examine them. When cable is required to be ranged for Special Survey in accordance with the requirements of the Rules, it is to be disconnected from the chain locker to facilitate proper examination and thickness measurement of all lengths of the chain cable and shackles.

10.10.2 The Surveyor is to be in attendance when measurements are taken, or is to verify the measurements. If there are any doubts regarding the accuracy and/or validity of final measurements presented, further confirmatory measurements are to be taken in the presence of the Surveyor.

10.10.3 When inspecting anchors and cables, the Surveyor is to look for any signs of defective links or shackles, attention being given to the fit of the shackle pins.

10.10.4 The Surveyor is not to allow the excessive use of oxy/acetylene torches when opening up shackles of special quality steel.

10.10.5 Lugless shackles are to be closely examined for any evidence of cracking. The attention of those responsible for the subsequent shackling up to the cable is to be drawn to the importance of fitting suitable locking pins to the shackle pins.

10.10.6 On certain types of stockless anchors when the fit of the crown pin becomes too slack in the head, allowing excessive lateral movement, it is acceptable to fit sleeves in each end of the head as a temporary repair measure for a short period of time to allow a new crown pin to be prepared. Adequate clearance should, however, be allowed to ensure normal free tripping of the anchor head. Crown pin retaining bolts are to be given special attention whenever anchors and cables are ranged.

10.10.7 When any length of chain cable is so worn that the mean of the major and minor axes at its most worn part is reduced by 12% or more from its nominal diameter, it is to be renewed.

10.10.8 The worn size of each condemned length is to be reported. Chain cable worn to the renewal size is to be removed from the chain locker only if replacement cable is readily available, but if worn cable is to be retained pending replacement, the worn lengths are to be fitted at the locker end of the cable.

10.10.9 Chain cable worn so far below renewal size that it is considered by the Surveyor to be hazardous is to be removed whether or not a replacement cable is available.

10.10.10 In the event that the larger part of the cable is found to be in worn condition that the ship no longer has a sufficient amount to anchor and manoeuvre efficiently with both anchors in use, consideration is to be given to a suitable tug escort being provided for departure and entry at all ports until the equipment is placed in order.

10.10.11 When deciding whether a worn length of cable is to be removed, the general condition of the links is of importance. If there are slack studs, deformed links or links worn into a notch, it is expected that the cable would break at a load far below the nominal breaking strength for the measured diameter, whereas considerable wear which is not accompanied by the above defects may be less significant.

10.10.12 Guide cable reduced by 15% or more from its nominal diameter is to be removed.

10.10.13 Oversize chain cable is generally required to be renewed when the wear down has reached the mean between the renewal limit for cable of Rule diameter and the renewal limit for cable of the size actually fitted. Earlier renewal is to be recommended if the Surveyor considers that the effect of the wear down is such that the cable is not properly seating in the gipsy of the windlass. It is not possible to lay down exact acceptable limits, as much depends on the wear down, if any, of the gipsy itself, and on the gipsy design.

10.10.14 Attention is drawn to the ±2.5% tolerances on all items except the diameter and cross-sectional area of the links, both of which are unlimited on plus tolerance.

10.10.15 The ±2.5% tolerances have been introduced to facilitate proper operation of the windlass and other components, and this will mean that the practice of downgrading worn chain to a nominal size based on the most worn part is not acceptable.

10.10.16 When reporting the loss of anchors or cables, the alleged cause or circumstances attending the loss are to be given together with details of the nature of the damage or defects found. If necessary, such information may be sent to HO.

10.10.17 In cases of loss of an anchor and a large quantity of cable, the following procedure is to be adopted if immediate replacement equipment is not available:

(a) If a spare anchor is carried on board and only part of the equipment of one side has been lost, the remaining cable is to be divided (port and starboard) and the spare anchor fitted to provide working equipment for a short period.

(b) If the remaining cable is insufficient to provide effective working equipment (port and starboard) as may be the case in large vessels or a spare anchor cannot be fitted, a suitable tug escort should be provided for departure and entry at all ports until the equipment is placed in order.

10.10.18 Cable joining shackles, if of the Dee type, are to be arranged with the bow end pointing outboard to minimize damage and to ease the flow if the cable whips when the anchor is let go.

10.10.19 If an anchor joining shackle is fitted in addition to the normal anchor shackle, this is to be arranged with the bow end pointing inboard to facilitate the movement of the anchor shank into the hawse pipe.

10.10.20 When replacement of anchors, chains or hawsers is reported, the particulars of weight or size and test of the articles, and where tested, are to be stated and the appropriate report completed. If repairs are made to chain cable, the affected length is to be re-tested and a certificate issued.

10.10.21 In the case of repair of anchors, the necessity for re-testing would depend on the nature of the repair.

10.10.22 Where anchors and chain cables are replaced and the test certificates are not immediately available; the test marks on the equipment are to be noted for inclusion in the appropriate report.

10.10.23 When chain cables are supplied of a size different from that originally placed on board and for which the windlass was designed, it is to be ascertained that the new cable works satisfactorily over the windlass cable lifters and a note of this included in the Survey Report.

10.10.24 If an anchor of different weight or design from the original is supplied, it is to be ascertained by a test that the housing of the anchor in the hawse pipe is satisfactory.

10.10.25 If the anchor is of a high holding power (HHP) design, it is of particular importance to check that its weight does not exceed the Rule +7% tolerance unless the chain cable is also increased in strength by an appropriate amount.

10.10.26 The report of the anchor chain cable diameter measurements is to be approved and stamped by the Surveyor and filed with the survey records.

10.11 BOTTOM SHELL REPAIRS AFLOAT

10.11.1 When it is intended to carry out welding of internally pitted bottom shell plating with the ship afloat, the Surveyors are to be satisfied that the pitting is adequately prepared in respect of shape, cleanliness and dryness, to permit a welded repair.

10.11.2 Bottom shell repairs afloat will not be accepted under the following circumstances:
(a) Where pitting is closely spaced.
(b) On Grade E or E36 quality steels
(c) Where the thickness of the material left on the bottom of the pit is less than 6 mm

10.11.3 For shell plating of either normal or higher strength steels, consumables are to be selected in accordance with *RSTE III, Ch 2 Sec 4*.

10.11.4 Pits are to be welded in the downhand position, but the selection of the welding consumable is to ensure that the appropriate toughness is achieved under conditions of accelerated cooling provided by the water on the remote side of the parent metal.

10.11.5 Where solid wire/gas shield combinations is used, the low hydrogen approval is a natural consequence of the type of consumable and the 1Y, 2Y and 3Y grading consumables according with *RSTE III Ch 2, Sec 4* will be accepted in this respect. Submerged arc welding will not be acceptable without special consideration by HO.

10.11.6 Whatever process and consumable is used the heat input rate is not to be less than 1.5 kJ/mm. If, for example, welding is carried out with a covered electrode as small as 4 mm diameter, it must be deposited at a controlled rate such that the length of deposited bead does not exceed the electrode length consumed.

10.11.7 Taking into account the rapid cooling effect on the welding due to the presence of water backing the parent material, a random inspection of the first run of the welding, followed by a random inspection of the finished weld, is to be carried out. The random inspection is to be supplemented by NDE methods for the discovery of any surface cracks.

10.12 REPAIRS AT SEA

10.12.1 Repairs at sea are to be kept to a minimum and, are to be discouraged apart from routine maintenance or when repairs are required for continuance of class and the Owner has strong grounds for effecting these by a riding crew.

10.12.2 The procedures governing repairs at sea are to be fully documented, be available to all parties and include a review of:
(a) The intended repair.

(b) Welding techniques.
(c) Supervision and quality control.
(d) Working conditions (i.e., access, lighting, ventilation).

10.12.3 Surveyors are to be fully satisfied on technical grounds that the repairs may be deferred to allow these to be carried out at sea and also that the proposed schedule of work will not impair the watertight integrity of the hull or adversely affect the longitudinal or transverse strength. The necessity for a Surveyor to attend on board for the duration of the voyage may be considered.

10.12.4 When it is apparent that repairs cannot be completed during a single voyage and it is intended to extend these over a number of voyages, before any proposal is agreed full details of the Surveyors findings and recommendations are to be communicated to HO for consideration.

10.12.5 All recommendations regarding the nature and scope of repair work intended during the voyage are to be specific to provide a clear understanding to the Surveyors at the completion port.

10.12.6 The Surveyors are to be satisfied that, from the technical point of view, their recommendations can be properly effected whilst the ship is at sea. Repairs are to be of a similar standard to that which would be achieved at a repair yard.

10.12.7 The Surveyors are to be satisfied that, in terms of qualification and experience, the personnel to be employed in the repair must be capable of achieving a satisfactory standard of workmanship.

10.12.8 The Surveyors are to satisfy themselves that all relevant plans are available and that the materials are acceptable as regards identity, grade and scantlings. The suitability of the welding electrodes, operators, equipment, and supervision are to be established.

10.12.9 The Master is to be reminded of his responsibilities to comply with all relevant statutory safety requirements with regard to the crew, repair personnel, and the ship herself.

10.12.10 Repairs are to be examined at the earliest opportunity after completion, preferably at the next port of call, and a suitably worded Condition of Class is to be imposed.

10.12.11 An Interim Certificate of Class will be placed on board the ship before sailing and the Survey Report, including full details of all recommendations for repairs, is to be sent immediately to HO and to the Surveyors at the port nominated for completion of repairs.

10.12.12 Under normal circumstances, repairs will be examined for completion at the next port and the Condition of Class will be deleted. If at that time the repairs are not completed, or a satisfactory standard of workmanship has not been achieved, the Surveyors at that port should immediately seek advice from HO.

10.13 HULL TERMS & SURVEY TERMS.

- **AFT PEAK BULKHEAD** is a term applied to the first main transverse watertight bulkhead forward of the stern. The aft peak tank is the compartment in the narrow part of the stern aft of this last watertight bulkhead.
- **ABRASION** is the removal of material by mechanical, i.e. rubbing or frictional, means.
- **ACTIVE CORROSI**ON is gradual chemical or electrochemical attack on a metal producing loose scale, by atmosphere, moisture or other agents.
- **ANODE** is the positively charged metal surface and the corroding part of an electrochemical corrosion cell at which the oxidation or loss of electrons occurs. Sacrificial anode or impressed current anode.
- **ANTIFOULING** is paint for use on underwater areas on hulls. Antifouling contains agents who prevent the adhesion and growth of organisms on the hull.
- **ACCOMMODATION LADDER** is a portable set of steps on a ship's side for people boarding from small boats or from a pier.
- **BAY** is the area between adjacent transverse frames or transverse bulkheads.
- **BILGE STRAKE**, is the strake at the turn of bilge extending outward to a point where the side rises vertically.

- **BILGE KEEL**, is a piece of plate set perpendicular to a ship's shell along her bilges for about one third her length to reduce rolling.
- **BLASTING** is the cleaning of a metal surface by a stream of abrasive particles.
- **BLISTER**, is a raised area, often dome shaped, resulting from loss of adhesion between a coating or deposit and the substrate.
- **BRITTLE FRACTURE**, is the separation of a solid accompanied by little or no macroscopic plastic deformation. Typically, brittle fracture occurs by rapid crack propagation with less expenditure of energy than for ductile fracture. Brittle tensile fractures have a bright, granular appearance and exhibit little or no necking.
- **BUCKLING**, is a bulge bend or other wavy condition of the structure caused by in plane compressive stresses and /or shear stresses.
- **BUTT JOINT**, is a joint between two structural members lying in the same plane. Typically a butt joint is used to describe the welded connection between two plates in the transverse direction.
- **BREAST HOOK**, is a triangular plate bracket joining port and starboard side structural members at the stem.
- **BULKHEAD STRUCTURE**, is the transverse or longitudinal bulkhead plating with stiffeners and girders.
- **BULKHEAD DECK**, is the uppermost continuous deck to which transverse watertight bulkheads and shell are carried.
- **CARGO HOLD BULKHEAD**, is a boundary bulkhead separating cargo holds.
- **CARGO PORT**, is a door or port in a ship's side for the loading or discharge of cargo or stores. Also called side port.
- **CASING**, is the covering or bulkhead around any space for protection
- **CARLINGS**, are supports usually of flat plate, welded in a fore and aft direction between transverse deck beams to prevent distortion of the plating.
- **CATHODE**, is the negatively charged metal surface and the non-corroding or protected part of an electrochemical corrosion cell.
- **CATHODIC PROTECTION**, is the partial or complete protection of a metal from corrosion by making it a cathode, using either a galvanic or an impressed current to bring a metal to a potential where it is thermodynamically stable.
- **CAVITATION DAMAGE**, is degradation of metal surfaces, characterized by pitting, in which the pit profile is irregular, occurring when very turbulent fluids are in contact with the metal surface and associated with the formation and collapse of cavities in the liquid at the solid - liquid interface
- **CEILINGS,** is wood sheathing or planking fitted on various parts of the ship such as tank tops, ship's sides and bulkheads to protect the ship's structure from damage and also used to protect the cargo from damage.
- **COAMING**, is the vertical boundary structure of a hatch or skylight.
- **COFFERDAMS**, are spaces between two bulkheads or decks primarily designed as a safeguard against leakage of oil from one compartment to another.
- **CLOSE-UP SURVEY** is a survey where the details of structural members are within the close visual inspection range of the surveyor, i.e. normally within the reach of hand.
- **COATING EVALUATION CRITERIA** is normally an assessment of the extent of damage registered in terms of coating breakdown area and/or rust scales in % of area under consideration, normally the complete tank, with additional information on coating damage to edges and weld connection. Typical coating failures may be given as additional information.
- **COATING**, is. a protective film of thickness usually about 0,2 - 0,5 mm, applied to prevent corrosion mainly via a three main mechanisms; the barrier effect, the cathodic effect or by inhibition / passivation.
- **COLLISION DAMAGE** is damage caused by physical impact between two or more ships used for navigation.
- **CONDITION ASSESSMENT PROGRAMME (CAP)** is a voluntary system, which gives a detailed assessment of a tanker's actual condition at the time of inspection and is available to both charter-parties and owners.
- **CONDITION SURVEY** is a survey normally of limited scope and time and intended to identify any anticipated structural or corrosion related deficiencies and give an overall visual impression of the structural integrity.
- **CONTACT DAMAGE** is damage caused when the ship strikes something other than another ship. (see also 'Grounding').
- **CORROSION FATIGUE** is the process in which a metal fractures prematurely in a trans-crystalline manner under conditions of simultaneous corrosion and repeated cyclic loading of lower stress levels or fewer cycles than would be in the absence of a corrosive environment
- **CORROSION** is the chemical or electrochemical reaction between a material, usually a metal and its environment that produces a deterioration of material and its properties, usually an oxide is formed.
- **CORROSION PREVENTION SYSTEM** is considered a full hard coating; alternatively a full hard coating supplemented by cathodic protection.
- **CRACK** is a fracture type discontinuity without complete separation characterized by a sharp tip and high ratio of length and width to opening displacement.

- **CREVICE CORROSION** is localized corrosion of a metal surface at, or immediately adjacent to, an area that is shielded from full exposure to the environment because of close proximity between the metal and surface of another material. It is usually associated with small volume of stagnant water, within lapped joints under heads of fastenings, under gaskets and packing's, under marine organisms and porous deposits.
- **COLLISION BULKHEAD**, is the foremost main transverse watertight bulkhead.
- **COMPANION WAY**, is a weathertight entrance leading from a ship's deck to spaces below.
- **CONFINED SPACE**, is a space identified by one of the following characteristics: limited openings for entry and exit, unfavorable natural ventilation or not designed for continuous worker occupancy.
- **CROSS DECK**, is the area between cargo hatches.
- Cross Ties are used to support the longitudinal bulkheads of oil tankers against hydrostatic and hydrodynamic loads.
- **CRITICAL STRUCTURAL AREAS** are locations which have been identified from calculations to require monitoring or from the service history of the subject ship or from similar ships to be sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.
- **CUMULATIVE DAMAGE** is an aggregation of damage due to various physical causes, specifically applied to fatigue under various stress ranges and frequencies.
- **DAMAGE SURVEY** is a survey requested as a result of hull damage or other defects.
- **DEAD COVERS**, are plates of bronze or steel working on a hinge serving to protect the glass port light in heavy weather. Also called dead light.
- **DECK HOUSE**, is a structure on the freeboard or superstructure deck not extending from side to side of the ship.
- **DECK STRUCTURE**, is the deck plating with stiffeners, girders and supporting pillars.
- **DEEP TANK**, is a tank extending from the bottom or inner bottom up to or higher than the lowest deck.
- **DEFORMATION** is a change in the form of a structure due to stress, thermal change, change in moisture, or other causes.
- **DELAMINATION** is peeling from undercoat or substrate.
- **DEPOSIT ATTACK** is an attack under, or around, the edge of a local deposit formed on a metal surface in the presence of an electrolyte.
- **DUCTILE FRACTURE** is the separation of a solid accompanied by gross plastic deformation.
- **DISCHARGES**, are any piping leading through the ship's sides for conveying bilge water, circulating water, drains etc. Also called Overboard Discharge.
- **DOUBLE BOTTOM**, is the shell plating with stiffeners below the top of the inner bottom and other elements below and including the inner bottom plating.
- **DUCT KEEL**, is a keel built of plates in box form extending the length of the cargo hold. It is used to house ballast and other piping leading forward which otherwise would have to run through the cargo holds.
- **ENCLOSED SUPERSTRUCTURE**, is the superstructure with bulkheads forward and/or aft fitted with weather-tight doors and closing appliances.
- **EDGE CORROSION** is local corrosion at the free edges of stiffeners, brackets, flanges, manholes etc.
- **ELASTICITY** is the structural member's capability of sustaining stress without permanent deformation
- **ELECTROCHEMICAL CORROSION** is corrosion associated with the passage of an electric current. If the current is produced by the system itself it is called Galvanic Corrosion and if it results from an impressed current it is called Electrolytic Corrosion.
- **EROSION CORROSION** is a combined action involving corrosion and erosion in the presence of a moving corrosive fluid, leading to the accelerated loss of material. Erosion corrosion is characterized by grooves, gullies, waves, valleys etc., usually with directional pattern and with bright surfaces free from corrosion products.
- **EROSION DAMAGE** is the physical removal of material from a surface by mechanical.
- **EXCESSIVE CORROSION** is an extent of corrosion that exceeds the Allowable corrosion.
- **EQUIPMENT NUMBER**, is used by classification societies mainly to determine the size and number of anchors and chain cables.
- **EXTENSIVE CORROSION** is an extent of corrosion consisting of hard and/or loose scale, including pitting, over 70% or more of the area under consideration, accompanied by evidence of thickness diminution.
- **FAIR CONDITION** is a term used to describe the condition of a hard coating; with local breakdown at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition.
- **FAIR** is to smooth or fair up a ship's lines and eliminating irregularities.
- **FATIGUE** is the phenomenon leading to fracture under repeated or fluctuating stresses having a maximum value significantly less than the ultimate tensile strength of the material.

- **FRACTURE** is the propagation of a crack through the thickness of a material. (see 'Brittle' and 'Ductile' Fractures)
- **FLOOR**, is a bottom transverse member.
- **FLUSH DECK SHIP**, is a ship that has no superstructure on the freeboard deck.
- **FORECASTLE** is a short superstructure situated at the bow.
- **FOREPEAK**, is the area of the ship forward of the collision bulkhead.
- **FREEBOARD DECK**, is normally the uppermost complete deck exposed to weather and sea, which has permanent means of closing all exposed openings.
- **FREEING PORT**, is an opening in the bulwarks to allow water shipped on deck to run freely overboard.
- **GANGWAY**, is the raised walkway between superstructure such as between forecastle and bridge or between bridge and poop.
- **GALVANIC CORROSION** is electrochemical accelerated corrosion of a metal because of an electrical contact with a more noble metal or nonmetallic conductor in a corrosive electrolyte.
- **GALVANIZING** is the deposition of zinc on to the surface of steel to provide corrosion protection by both protecting the steel from contact with the environment and giving sacrificial protection.
- **GENERAL CORROSION** appears as non-protective, friable rust of a uniform nature on uncoated surfaces. Rust scale continually breaks off, exposing fresh metal to corrosive attack. Visual judgment of thickness loss is difficult until serious wastage has occurred.
- **GOOD CONDITION** is a term used to describe condition of hard coating; with only minor spot rusting.
- **GROOVING CORROSION** is local corrosion normally adjacent to welding joints along abutting stiffeners and at stiffener or plate butts or seams.
- **GROUNDING** is contact of the ship's bottom with the sea floor
- **GIRLHBELT**, includes, for thickness measurement purposes, all longitudinal members such as plating, longitudinals and girders at the deck, side, bottom, inner bottom and longitudinal bulkheads. For transversely framed ships, a transverse section includes adjacent frames and their end connections in way of transverse section
- **GIRDER**, is a collective term for primary supporting structural members.
- **GUNWALE**, is the upper edge of the ship's sides.
- **GUSSET,** is a triangular plate, usually fitted to distribute forces at a strength connection between two structural members.
- **HATCH COAMING**, is the vertical plating built around the hatchways to prevent water from entering the hold; and to serve as a framework for the hatch covers.
- **HATCH COVERS**, are wooden or steel covers fitted over a hatchway to prevent the ingress of water into the ship s hold and may also be the supporting structure for deck cargo.
- **HATCH WAYS**, are openings, generally rectangular, in a ship's deck affording access into the compartment below. Also called hatches.
- **HOPPER SIDE TANKS**, are tanks used for ballast or for stability when carrying certain cargoes in bulk carriers. Also referred to as topside wing ballast tanks and bottom hopper tanks.
- **HARD COATING** is a coating which chemically converts during its curing process, normally used for new construction, or non-convertible air drying coating which may be used for maintenance purposes. Hard coating can be either organic or inorganic and covers typical marine coatings such as those based on epoxy, coal tar epoxy, polyurethane, chlorinated rubber, vinyl, zinc epoxy, zinc silicate.
- **HOSE TESTING** is carried out to demonstrate the tightness of structures not subject to structural (hydrostatic) or leak testing and to other components that contribute to the watertight integrity of the hull.
- **HYDROPNEUMATIC TESTING** is a combination of hydrostatic and air testing.
- **INDENT** is deformation of structural members caused by out of-plane loads like bottom slamming and bow impact forces, contact with other objects etc.
- **INHIBITORS** are substances used to prevent or retard a chemical or electrochemical reaction, often used to render corrosion products less soluble and thereby tending to stifle electrochemical corrosion processes.
- **INDEPENDENT TANK**, is a self-supporting tank.
- **KEEL,** is the main structural member or backbone of a ship running longitudinal along centerline of bottom. Usually a flat plate stiffened by a vertical plate on its centerline inside the shell.
- **LAMINATION** is an excessively large, laminar, non-metallic inclusion, producing a defect appearing in sheets or strips as segregation or in layers.
- **LAP JOINT** is a joint between two structural members that overlap each other.
- **LEAK TESTING** is an air or other medium test carried out to demonstrate the tightness of the structure.
- **LOCAL CORROSION** is by name local in nature, often appearing at areas with local breakdown of coating or at areas with stress concentrations.

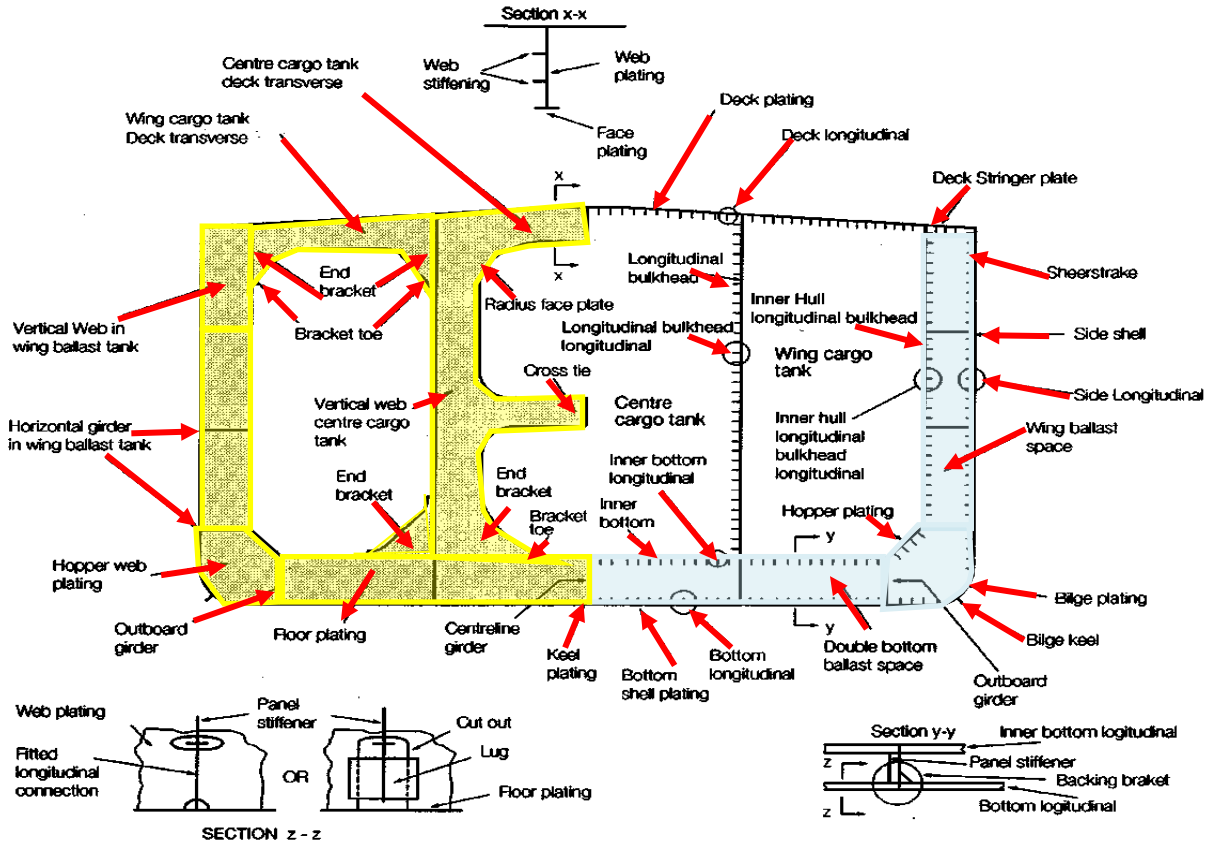
- **LOOSE SCALE** is sheets of rust falling off if the surveyor hits the structure with his test hammer. Loose scale can best be removed by hand or power tool cleaning or a combination of these.
- **MICROBIALLY INFLUENCED CORROSION (MIC) or BACTERIAL CORROSION**, is corrosion which is induced or accelerated by the presence of microorganisms.
- **MINOR CORROSION** is an extent of corrosion with minor spot rusting and such that an assessment of the corrosion pattern indicates wastage generally not exceeding of 30% of the allowable corrosion limits.
- **MARGIN PLATE**, is the outboard strake of the inner bottom and when turned down at the bilge the margin plate forms the outer boundary of the double bottom.
- **MIDSHIP SECTION**, is the cross section through the ship, midway between the forward and after perpendiculars.
- **MILL SCALE** is thick oxide film formed on wrought-metal products which have been hot-rolled or forged and allowed to cool in air, the term is principally applied to steel on which the oxide is essentially magnetic black oxide.
- **NECKING EFFECT** is a term describing local corrosion at junction of plating and stiffeners due to flexure effects caused by reverse, cyclic loading with loss of coating or shedding of scale exposing fresh steel to further corrosion. The corrosion rate may be rather high and accelerates with thinning of the material.
- **OVERALL SURVEY** is survey intended to report on the overall condition of the hull structure and determine the extent of additional close-up surveys.
- **OVERALL CORROSION** is a appears as non-protective, friable rust of a uniform nature on uncoated surfaces. Rust scale continually breaks off, exposing fresh metal to corrosive attack. Visual judgment of thickness loss is difficult until serious wastage has occurred.
- **PAINTING**, a protective film of thickness usually about 0,2 - 0,5 mm, applied to prevent corrosion mainly via a three main mechanisms; the barrier effect, the cathodic effect or by inhibition / passivation.
- **PAINT** can be described as a liquid material capable of being applied or spread over a solid surface on which it subsequently dries or hardens to form a continuous adherent, obliterating film.
- **PAINT CRACKING**, is deep cracks in paint that expose subtrates
- **PIPE TUNNEL**, is the void space running in the midships fore and aft lines between the inner bottom and shell plating forming a protective space for bilge, ballast and other lines extending from the engine room to the holds.
- **POOP**, is the space below an enclosed superstructure at the extreme aft end of a ship.
- **POOP DECK**, is the first deck above the shelter deck at aft end of a ship.
- **PORT LIGHT**, is another term for side light or side scuttle.
- **PERIODICAL SURVEY** is a collective term of classification surveys carried out after the delivery a ship and at prescribed time intervals, i.e. annual, intermediate and renewal/special surveys.
- **PINHOLING** is tiny, deep holes exposing substrate.
- **PINPOINT RUSTING** is local rusting at pinholes or holidays.
- **PITGUARD ANODE** is a sacrificial anode placed just above tank bottom in order to mitigate the general and pitting corrosion process.
- **PITTING CORROSION** is local, random scattered corrosion mainly on horizontal surfaces and at structural details where water is trapped, particularly at bottom of tanks. For coated areas the attack produces deep and small diameter pits which may lead to perforation. Pitting of uncoated areas in tanks, as it progresses, forms shallow but very wide scabby patches (e.g. 300 mm in diameter) and the appearance resembles condition of general corrosion.
- **PLASTICITY** is the property of a material that allows it to be extensively repeatedly deformed without rupture when acted upon by a force sufficient to cause deformation and that allows it to retain its deformed shape after the applied force has been removed.
- **POOR CONDITION**, is a term used to describe condition of hard coating; with general breakdown of coating over 20% or more or hard scale at 10% or more of areas under consideration.
- **REDUCED SCANTLINGS**, are scantlings that are allowed to be reduced because approved corrosion control arrangements have been applied.
- **REPRESENTATIVE SPACES**, is those which are expected to reflect the condition of other spaces of similar type and service and with similar corrosion prevention systems.
- **RUST** is a visible corrosion product consisting of hydrated oxides of iron and is formed on steel surfaces exposed to moist atmospheric conditions.
- **SAG** is excess flow of paint, also called runs or curtains.
- **SCALE** is surface oxidation, consisting of partially adherent layers of corrosion products, left on metals by heating or casting in air or in other oxidizing atmospheres and is the product of the corrosion process of steel with a porous surface layer or flakes, in volume greater than the metal from which it was formed.

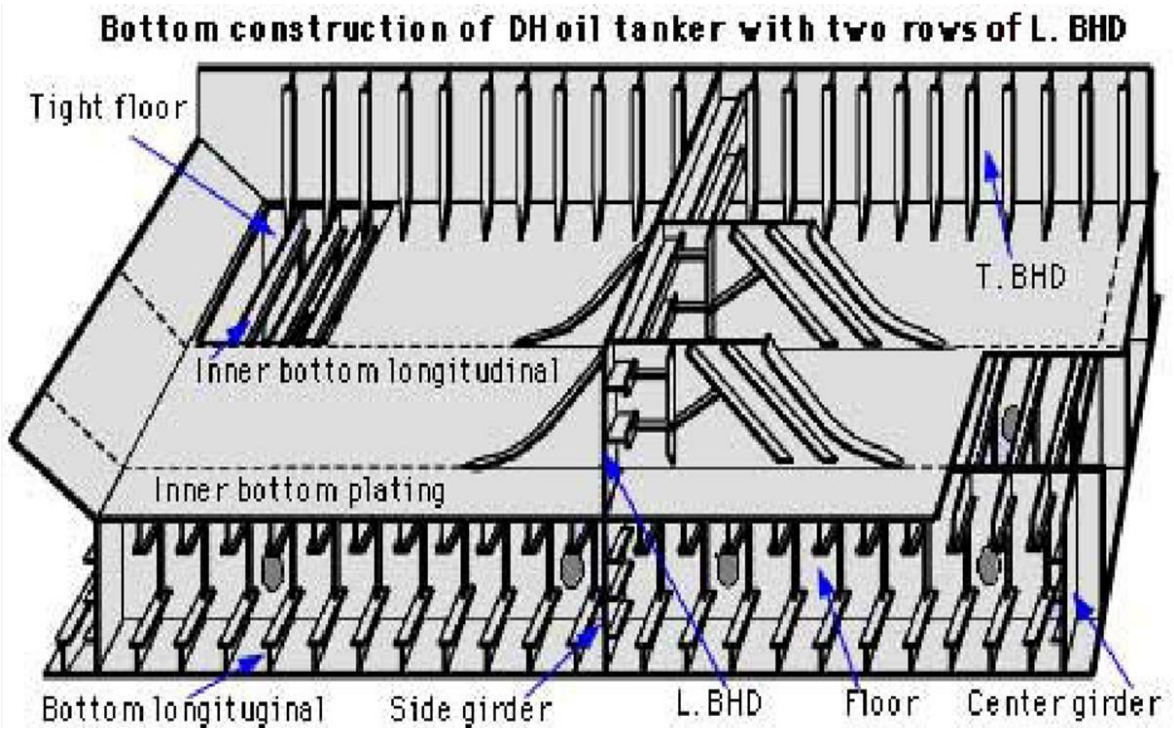
- **SCANTLING** is the dimensions of a ship's structural members as girders, stiffeners and plates.
- **SEAM** is a joint between two structural members lying in the same plane. Typically a seam is used to describe the welded connection of two plates in the longitudinal
- **SHOT-BLASTING**, is the cleaning of a metal surface by a stream of abrasive particles.
- **SCUPPER**, is any opening for carrying off water from a deck, either directly or through piping.
- **SCUTTLE**, is a small opening in a deck or elsewhere, usually fitted with a cover or lid or a door for access to a compartment.
- **SHEDDER PLATES**, are slanted plates fitted in dry cargo holds to prevent undesired pockets of cargo. The term is also commonly applied to slanted plates that are fitted to improve the structural stability of corrugated bulkheads and framing members.
- **SHEER STRAKE**, is the top strake of a ship's side shell plating.
- **SINGLE BOTTOM STRUCTURE**, is the shell plating with stiffeners and girders below the upper turn of bilge.
- **SKYLIGHT**, is adeck opening fitted with or without glass port light and serving as a ventilator for engine room, quarters, etc.
- **SPACE**, is separate compartments including holds and tanks.
- **STAY**, is a term for bulwarks and hatch coaming brackets.
- **STEM**, is the piece of bar or plating at which a ship's outside plating terminates at her forward end.
- **STERN FRAME**, is the heavy strength member in single or triple screw ships, combining the rudder post.
- **STIFFENER** is a collective term for secondary supporting structural members.
- **STOOL** is a structure supporting cargo hold and tank bulkheads.
- **STRAKE** is a course, or row, of shell, deck, bulkhead, or other plating.
- **SEMI-HARD COATING** is a coating that dries or converts in such a way that it stays flexible although hard enough to touch and walk upon.
- **SHOP PRIMER** is a rust preventing paint for temporary protection of steel immediately after blasting for protection of the material surface from corrosion during construction and until the final paint system is applied.
- **SOFT COATING** is a coating that remains soft so that it wears off at low mechanical impact or when touched; often based on oils (vegetable or petroleum) or lanolin (sheep wool grease). Application of soft coating does generally not allow relaxation of the extent of periodical hull survey requirements of ballast tanks.
- **STATUTORY SURVEY** is a collective term of surveys required to meet International Convention requirements such as Load Line, SOLAS and MARPOL.
- **STRAIN** is any forced change in the dimensions of a structural member.
- **STRESS RAISER** is a term used of any notch, crack, hole, corner, groove, attachment or other interruption to smooth flow of stress and strain in structures introduces a concentration of stress.
- **STRESS CORROSION** is the preferential attack of areas under tensile stress in a corrosive environment, where such an environment alone would not have caused corrosion. Tensile stresses may be residual stresses from welding or cold-working or applied working stresses.
- **STRIPE COATING** is used to produce a coating with sufficient film thickness on edges, corners, weld seams and other areas that are difficult to coat using airless spray.
- **STRUCTURAL TESTING** is a hydrostatic test carried out to demonstrate the structural adequacy of design and tightness of tank boundaries.
- **SUBSTANTIAL CORROSION** is an extent of corrosion such that assessment of corrosion pattern indicates wastage in excess of 75% of allowable corrosion, but within allowable corrosion limits.
- **SURVEY** is a collective term for examination, testing and evaluation of results and decision making.
- **SUSPECT AREAS** are locations showing substantial corrosion and/or are considered to be prone to rapid wastage.
- **STRENGTH DECK** is normally the uppermost continuous deck. After special consideration of its effectiveness, another deck may be defined as strength deck.
- **STRINGER PLATE** is the outside strake of deck plating.
- **THOROUGH REPAIR AND PROMPT**, is permanent repair completed at the time of the survey to the satisfaction of the surveyor, therein removing the need for imposition of any associated condition of class
- **SUPERSTRUCTURE** is a decked structure on the freeboard deck extending for at least 92% of the breadth of the ship.
- **SUSPECT AREAS** are locations showing substantial corrosion and/or which are considered by the Surveyor to be prone to rapid wastage.
- **TANK BULKHEAD** is a boundary bulkhead in a tank for liquid cargo, ballast or bunkers.
- **TANK TESTING** is a hydrostatic test carried out to demonstrate the structural adequacy of design and tightness of tank boundaries.
- **TRANSVERSE SECTION** includes, for thickness measurement purposes, all longitudinal members such as plating,

longitudinals and girders at the deck, side, bottom, inner bottom and longitudinal bulkheads. For transversely framed ships, a transverse section includes adjacent frames and their end connections in way of transverse section

- **TOPSIDE WING BALLAST TANKS** are ballast tanks in bulk carriers that normally stretch along the length of the ship's side and occupy the upper corners of the cargo hold.
- **TWEEN DECKS** is an abbreviation of between decks, placed between the upper deck and the tank top in the cargo holds.
- **VOID** is an enclosed empty space in a ship.
- **WASH BULKHEAD** is a perforated or partial bulkhead in a tank.
- **WATERTIGHT BULKHEAD** is a collective term for transverse bulkheads required for subdivision of the hull into watertight compartments.
- **WATERTIGHT** means capable of preventing the passage of water through the structure under a head of water for which the surrounding structure is designed.
- **WEAR** is the deterioration of a surface due to relative motion between it and another.
- **WEATHERTIGHT** means that in any sea condition water will not penetrate into the ship.
- **WELD METAL CORROSION** is a preferential corrosion of the weld deposit due to an
- **WIND AND WATER STRAKES** are the strakes of a ship's side shell plating between the ballast and deepest load waterline.
- **WASTAGE LIMIT** is the acceptable thickness diminution of structural elements.

10.14 Differents figures to be used as a reference for the nomenclature of the hull structure into the reports of the inspect ors.





1	Strength deck plating	10	Sheer strake	19	Deck transverse centre tank
2	Stringer plate	11	Longitudinal bulkhead	20	Bottom transverse centre tank
3	Sheer strake	12	Bottom longitudinals	21	Deck transverse wing tank
4	Side shell plating	13	Bottom girders	22	Side shell vertical web
5	Bilge plating	14	Bilge longitudinals	23	Longitudinal bulkhead vertical web
6	Bottom shell plating	15	Longitudinal bulkhead	24	Bottom transverse wing tank
7	Keel plate	16	Side shell longitudinals	25	Cross ties
8	Deck longitudinals	17	Longitudinal bulkhead	26	Transverse web face plate
9	Deck girders	18	Longitudinal bulkhead		

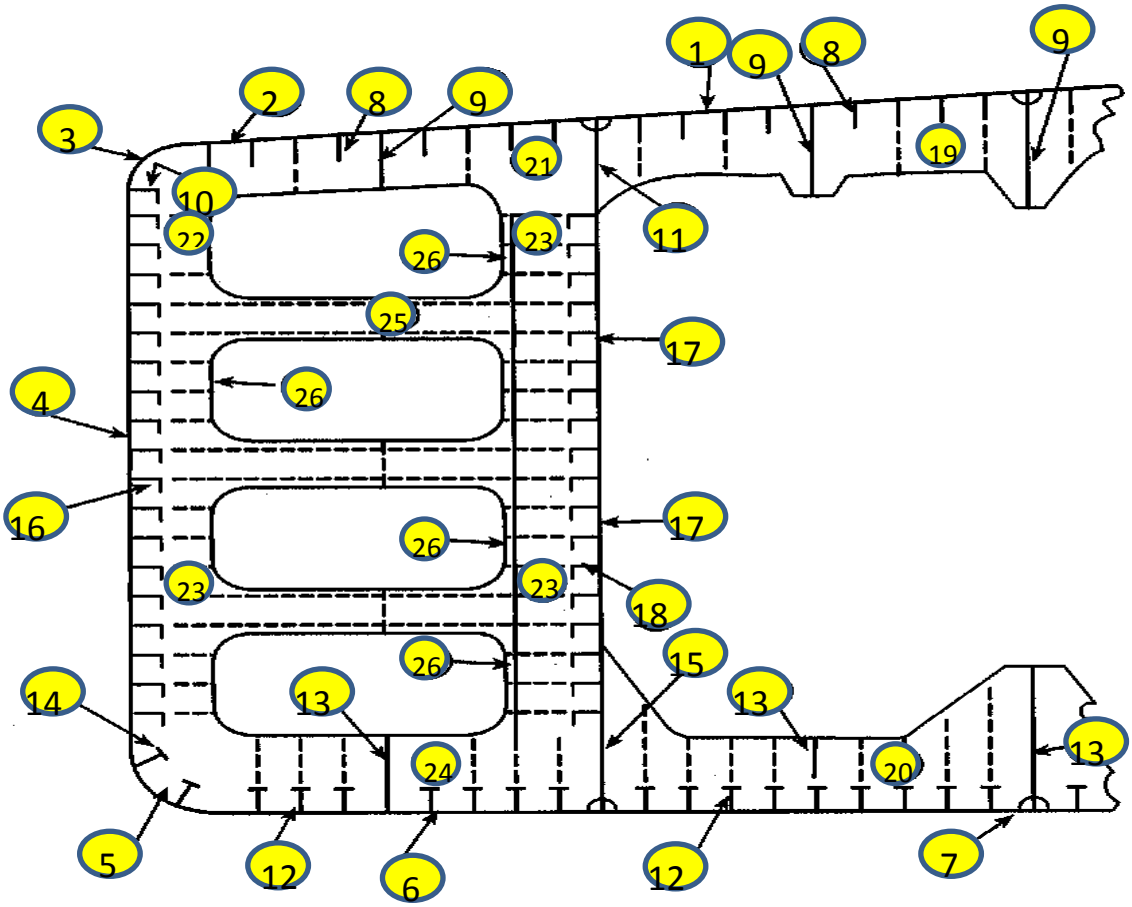
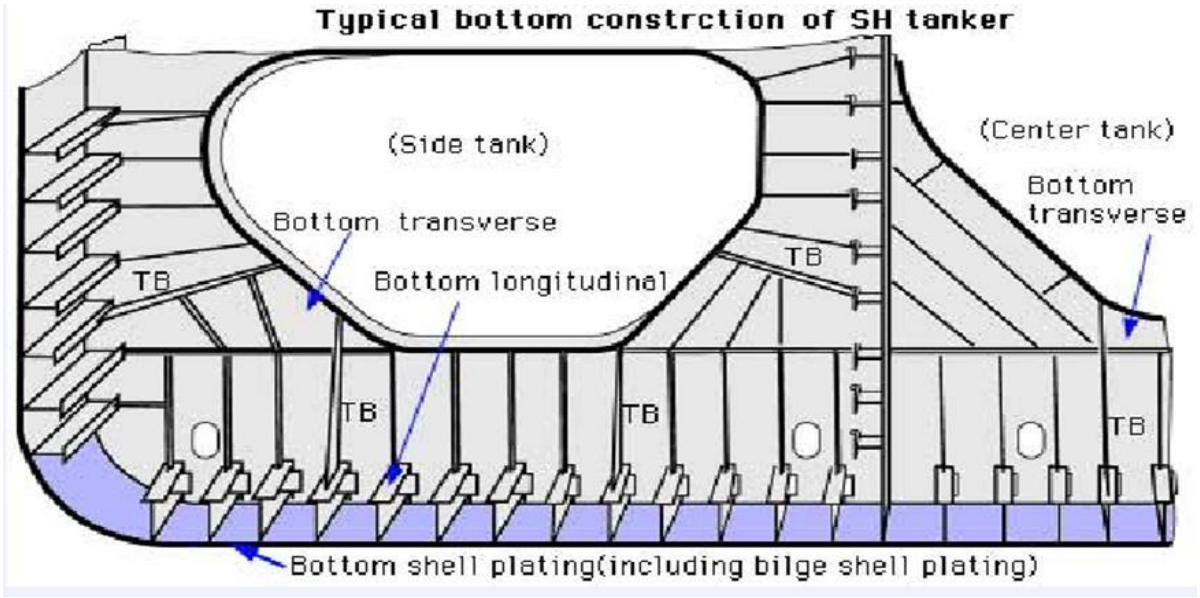
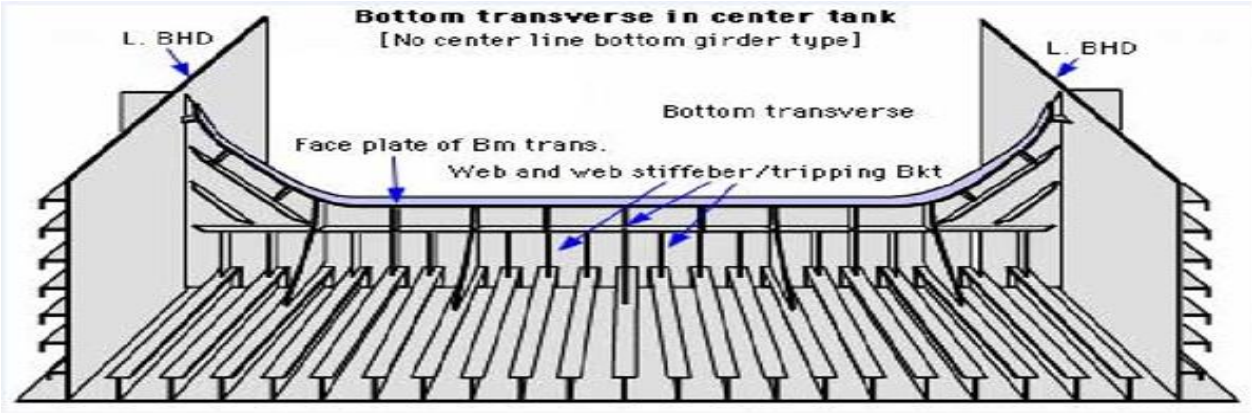


FIGURE N° 2. SINGLE HULL TANKER





1	Strength deck plating	11	Longitudinal bulkhead top strake	21	Deck transverse centre tank
2	Stringer plate	12	Bottom longitudinals	22	Bottom transverse centre tank
3	Sheer strake	13	Bottom girders	23	Deck transverse wing tank
4	Side shell plating	14	Bilge longitudinals	24	Side shell vertical web
5	Bilge plating	15	Longitudinal bulkhead lower strake	25	Longitudinal bulkhead vertical web
6	Bottom shell plating	16	Side shell longitudinals	26	Bottom transverse wing tank
7	Keel plate	17	Longitudinal bulkhead plating	27	Cross ties
8	Deck longitudinals	18	Longitudinal bulkhead longitudinals	28	Transverse web face plate
9	Deck girders	19	Inner bottom plating	29	Double bottom floor
10	Sheer strake longitudinal	20	Inner bottom longitudinals	30	Hatch coamings

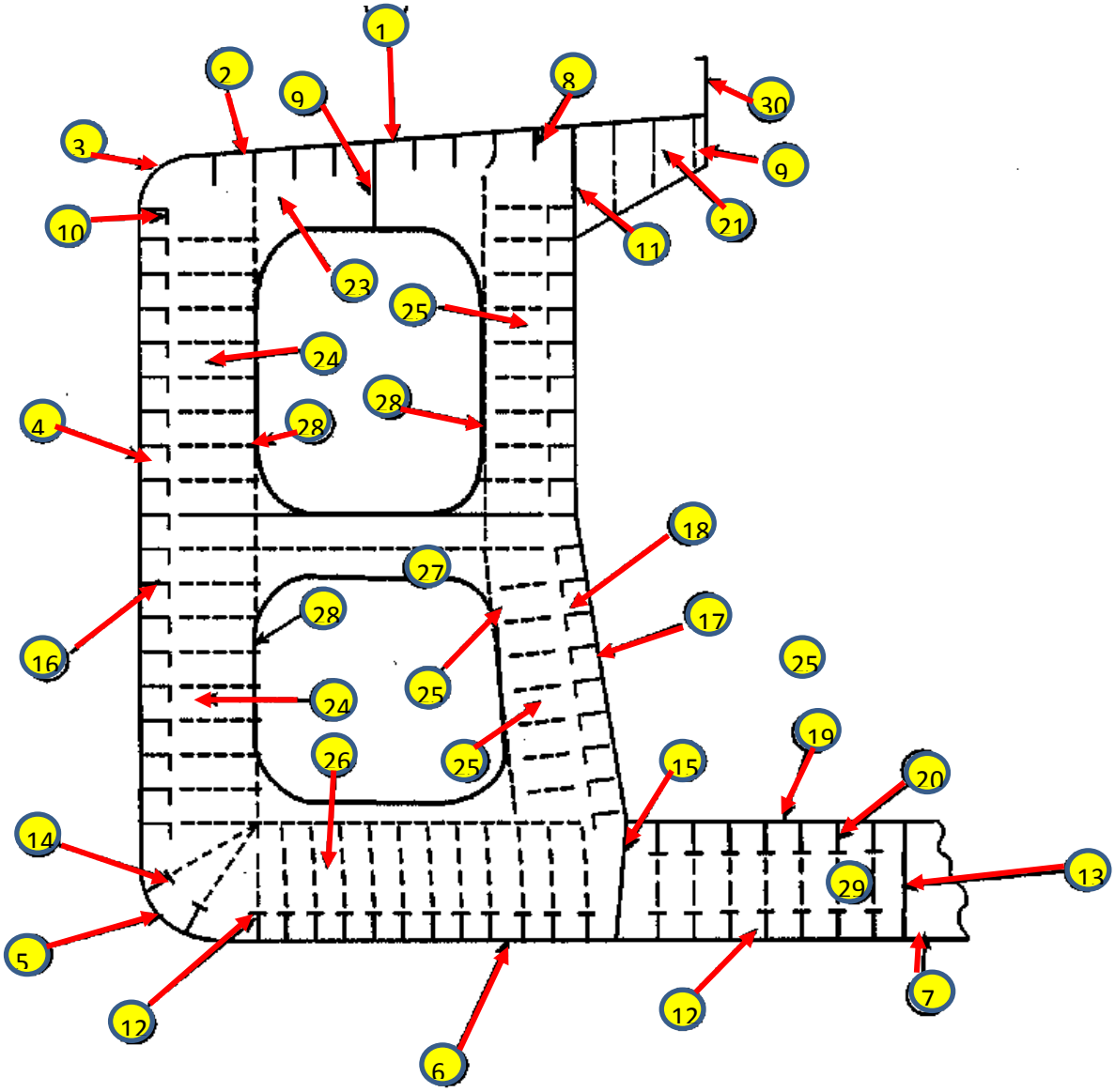


FIGURE N° 3. SINGLE HULL ORE CARIIER & OIL TANKER

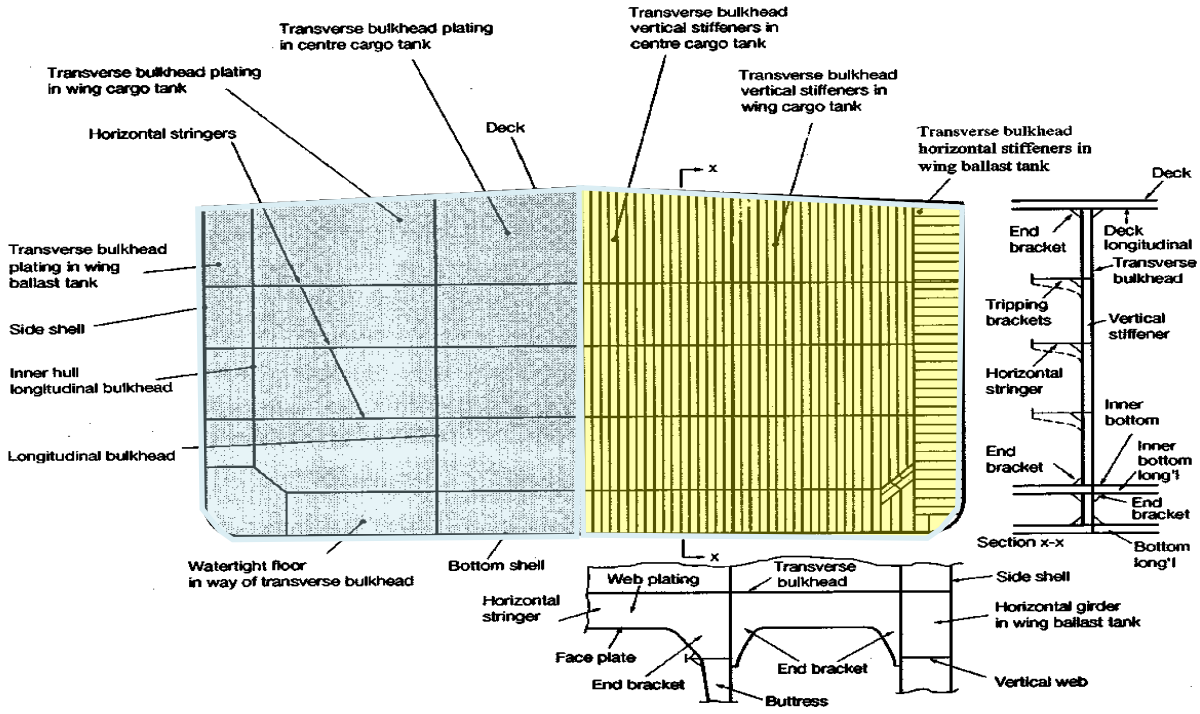
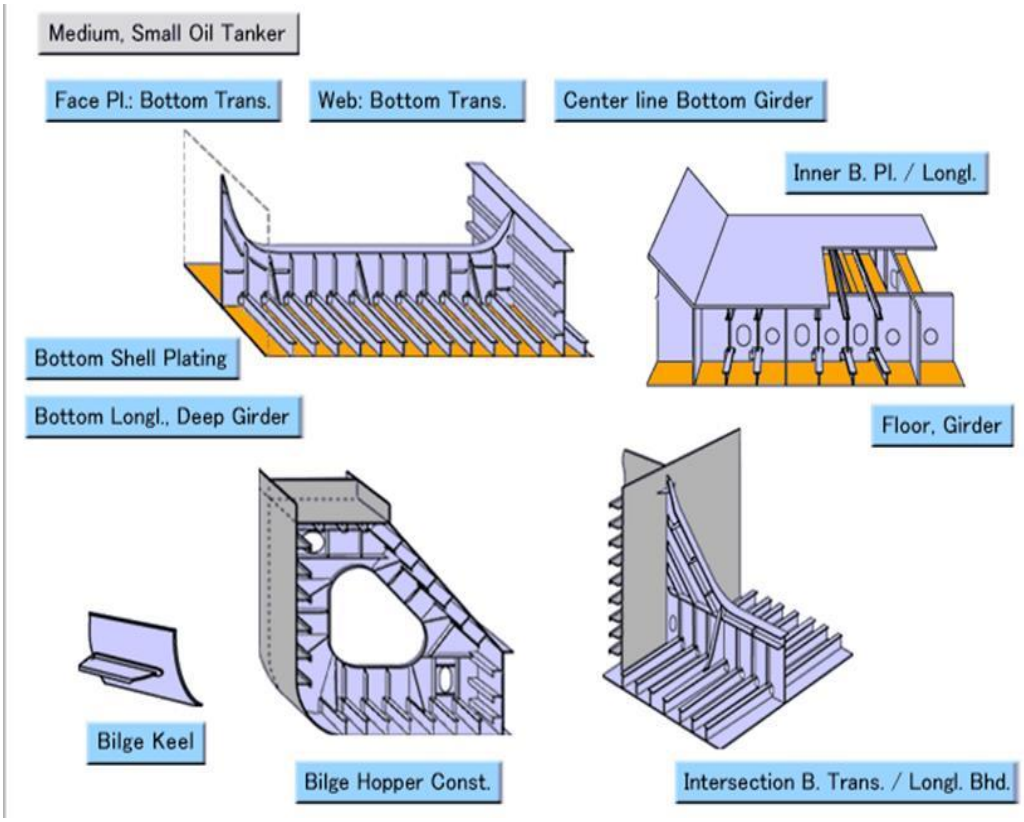


FIGURE N° 4. DOUBLE HULL & MEDIUM SMALL OIL TANKER



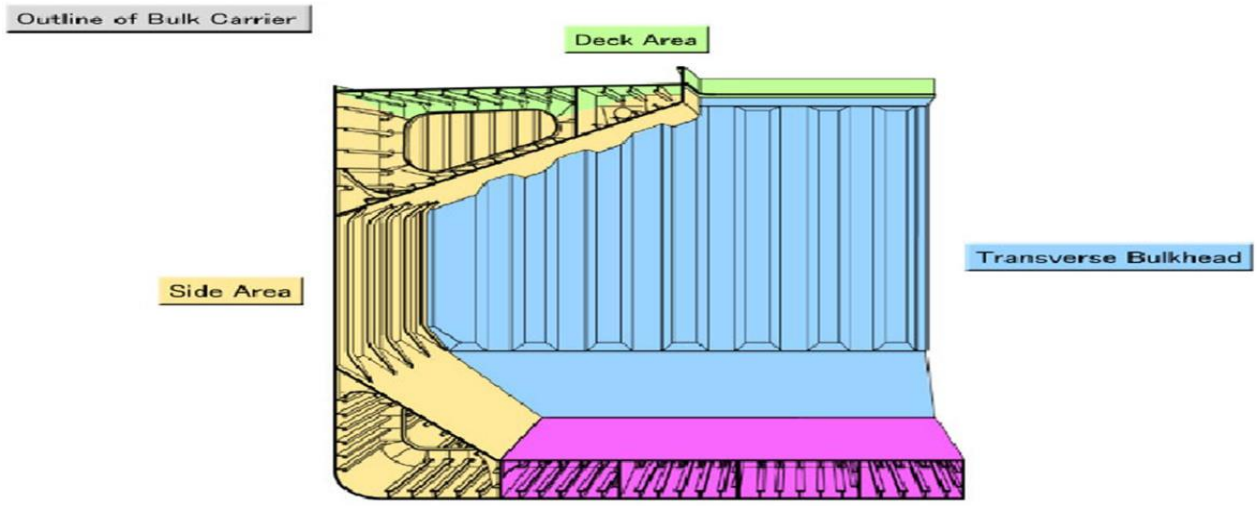
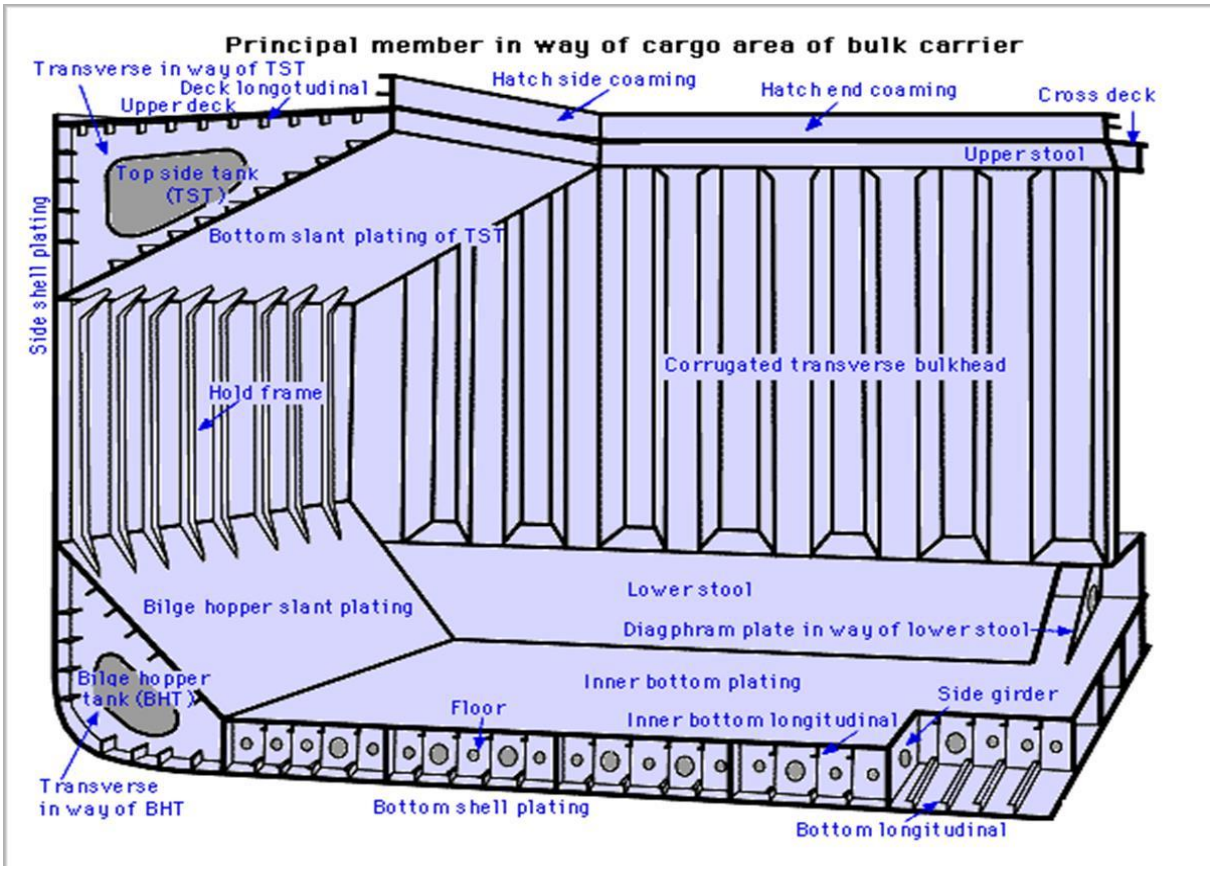


FIGURE N° 5. SINGLE SKIN BULK CARRIER



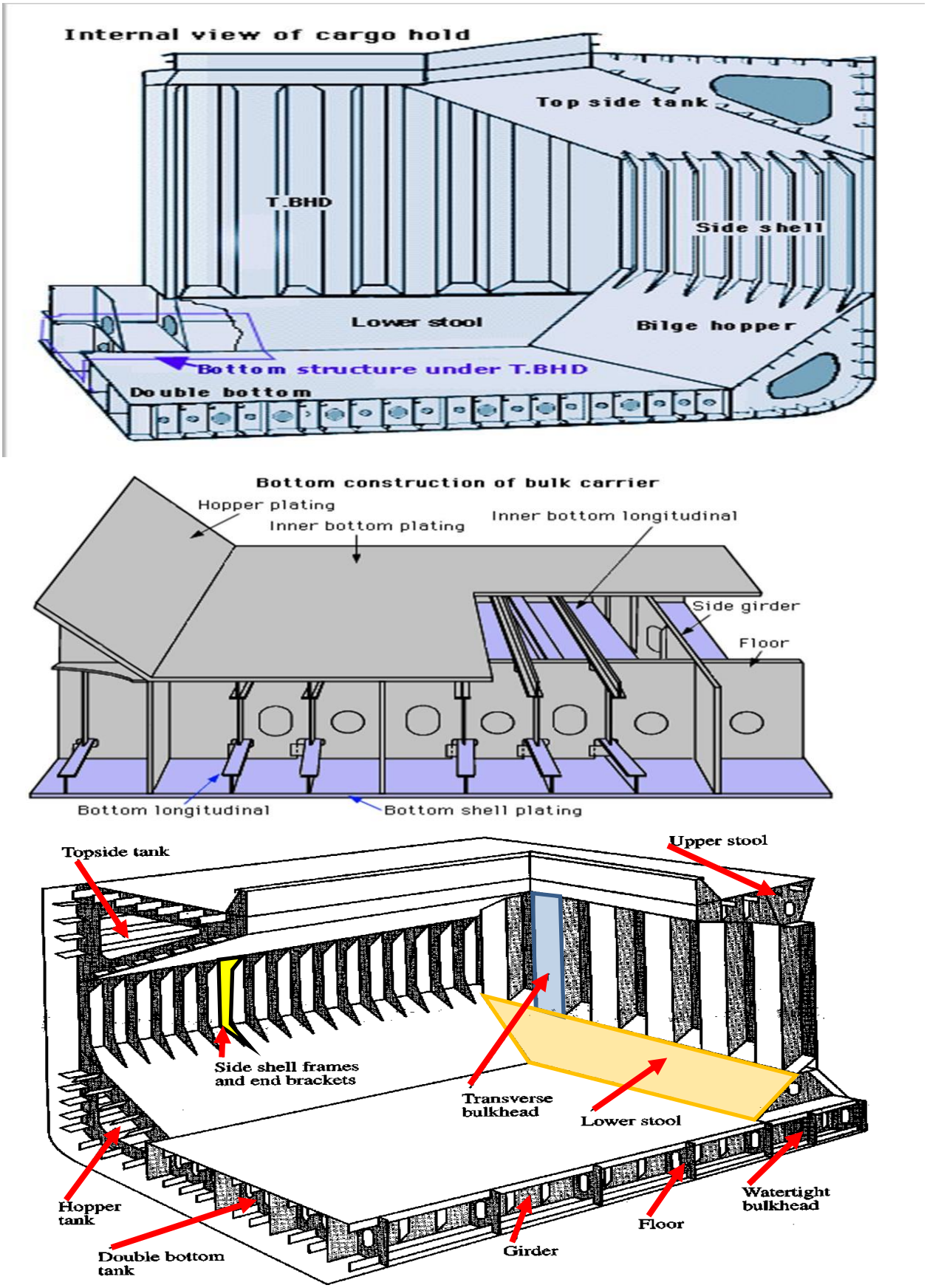


FIGURE N° 6. PARTS OF CARGO HOLD SINGLE SKIN BULK CARRIER

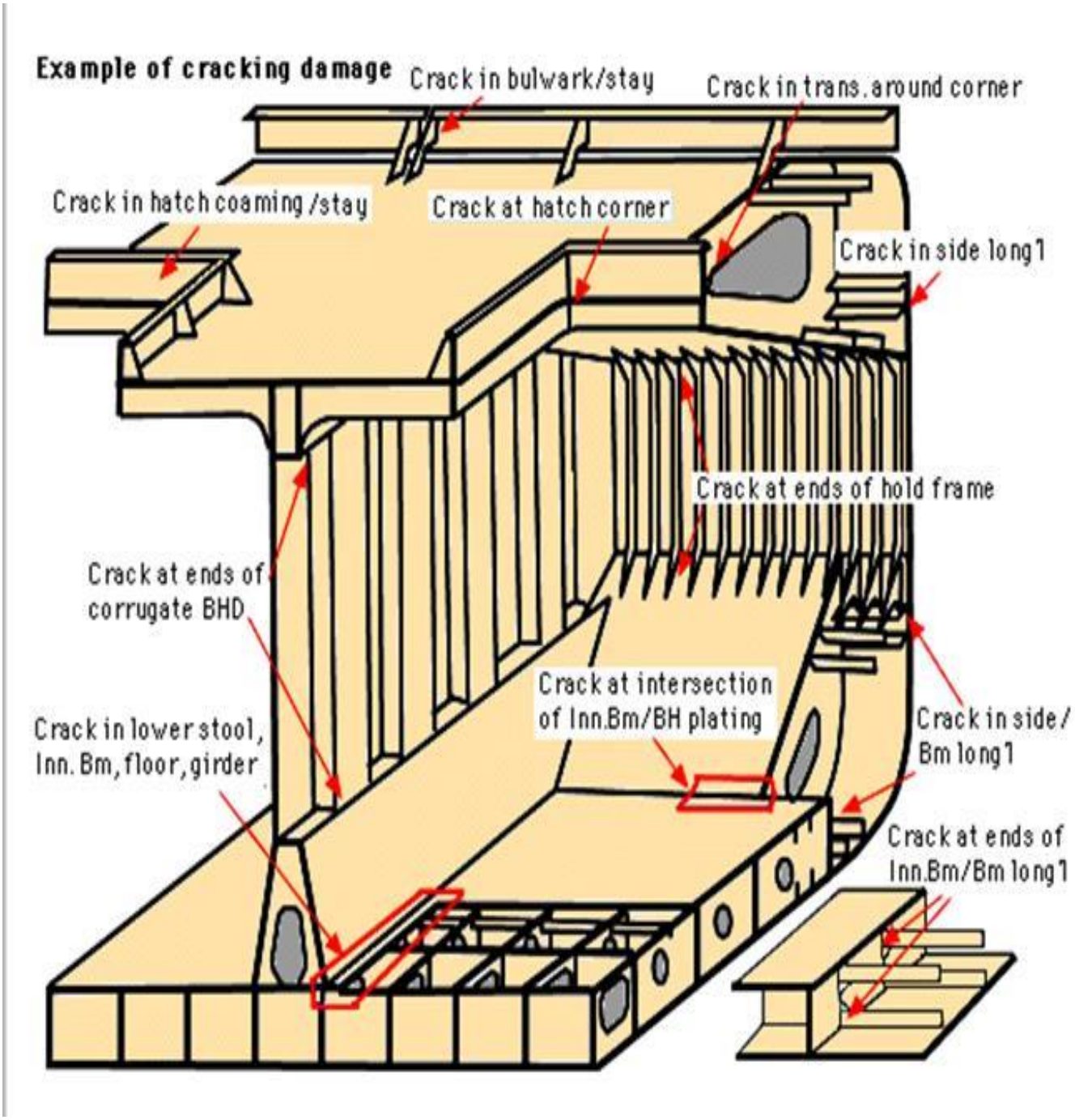


FIGURE N° 7. EXAMPLES OF CRACKING DAMGE ON CARGO HOLD AND BOTTOM ON SINGLE SKIN BULK CARRIER

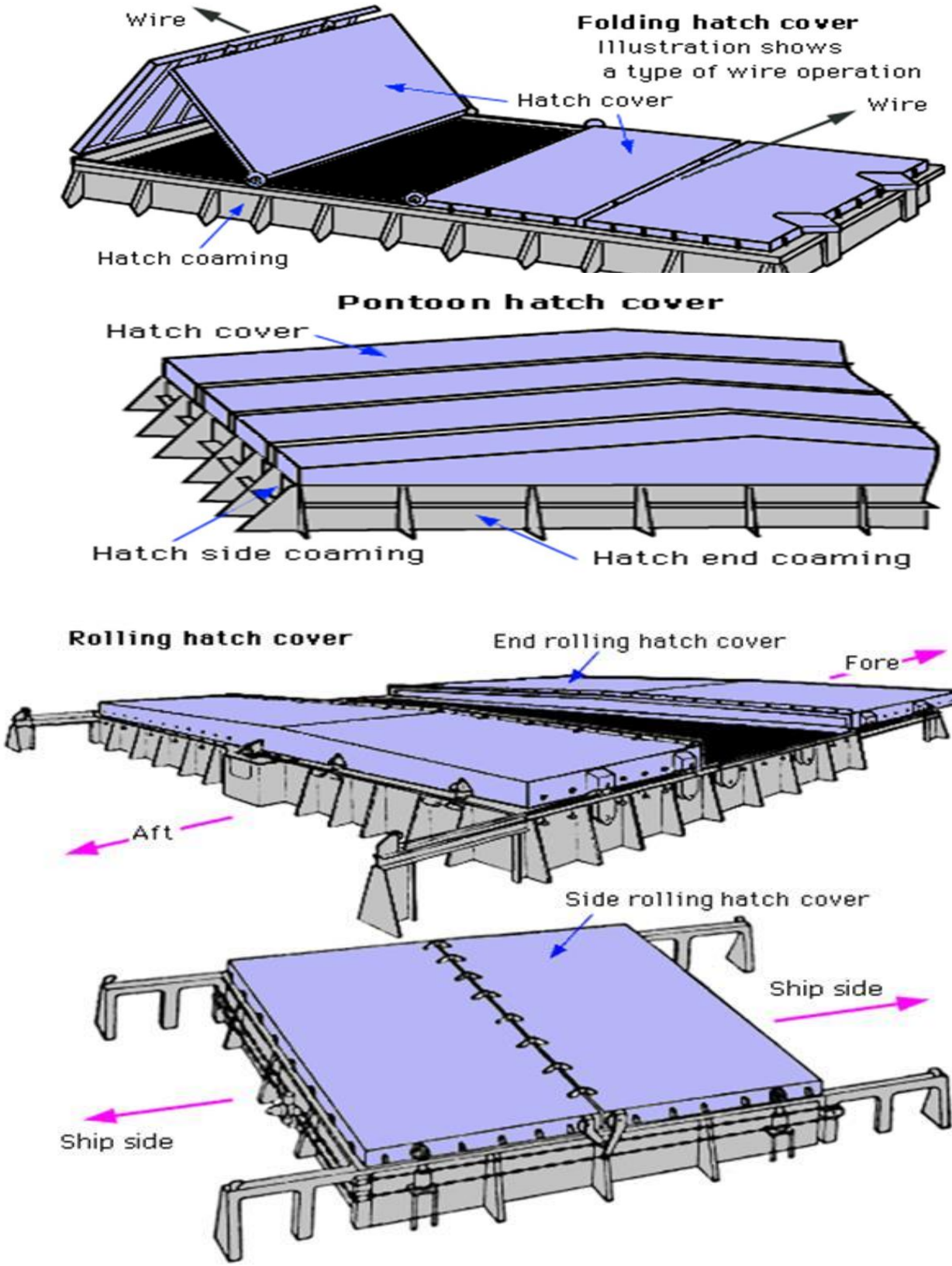
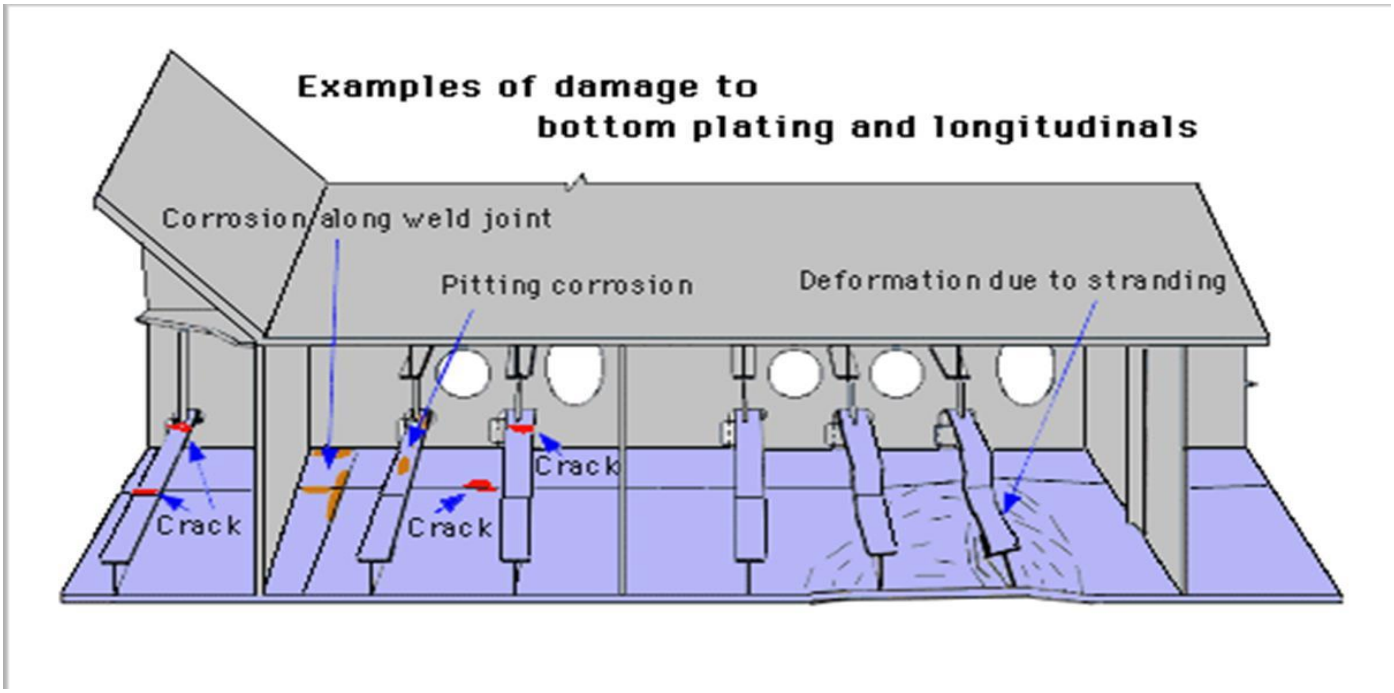


FIGURE N° 8. TYPES HATCHES ON BULK CARRIER



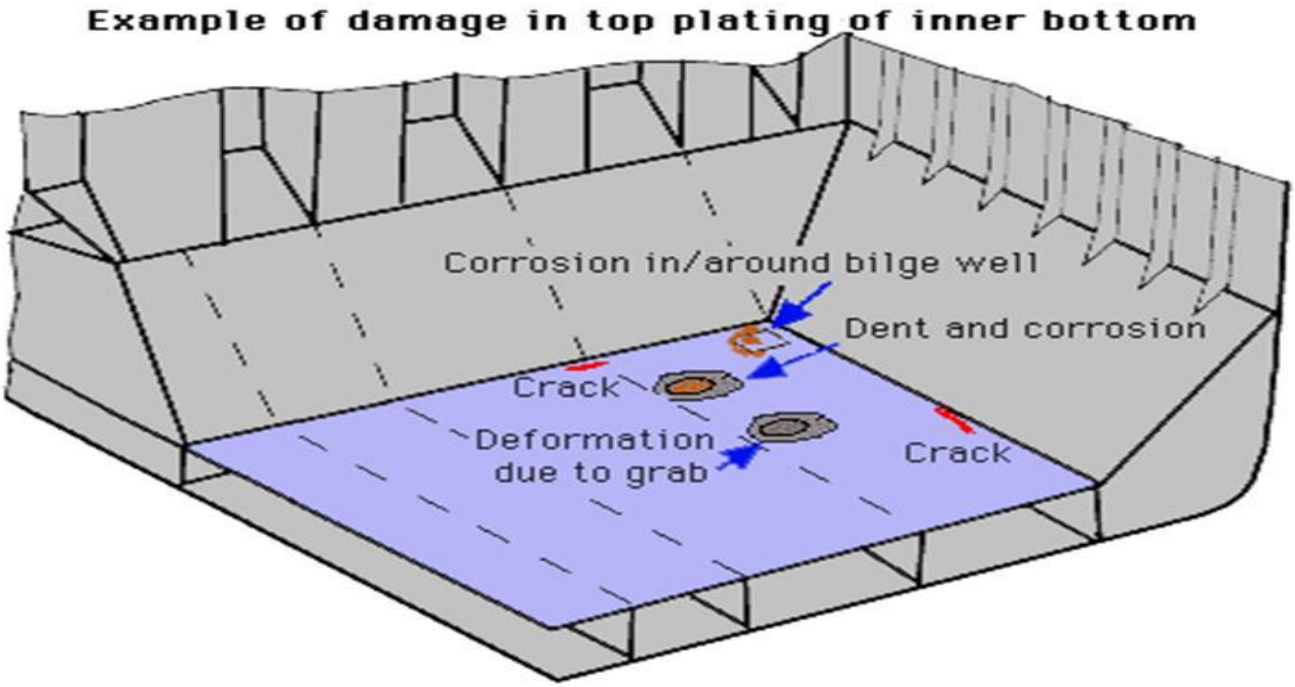
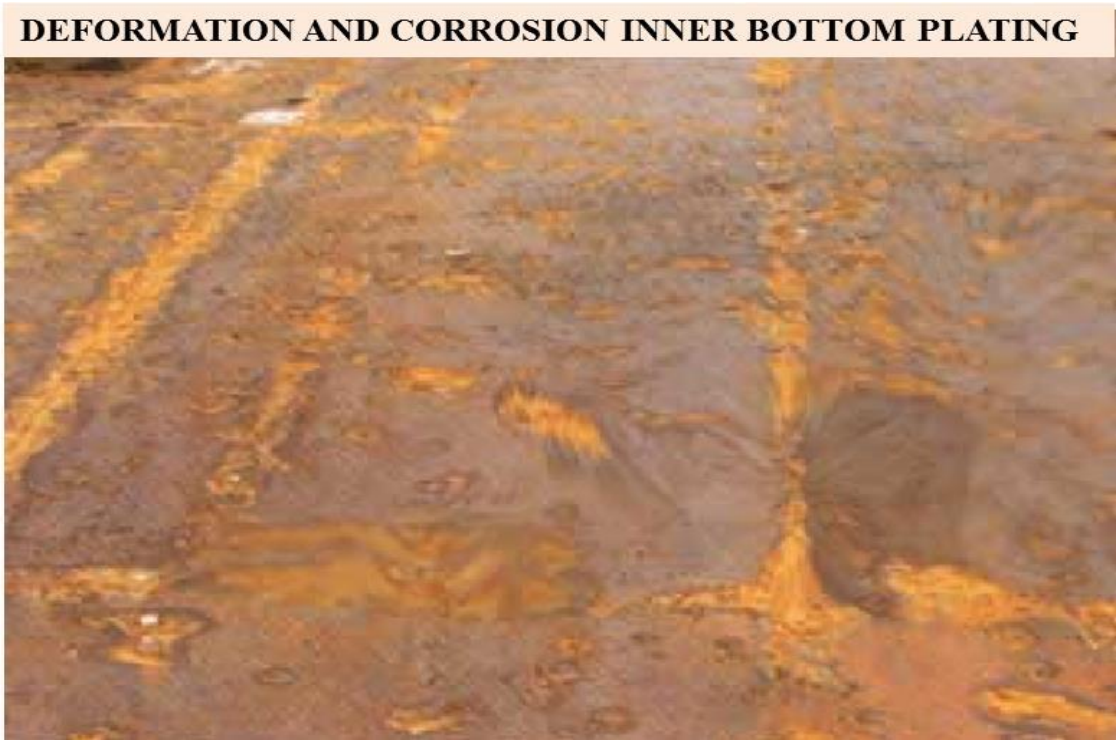


FIGURE N° 9. BOTTOM DAMAGE ON SINGLE SKIN BULK CARRIER



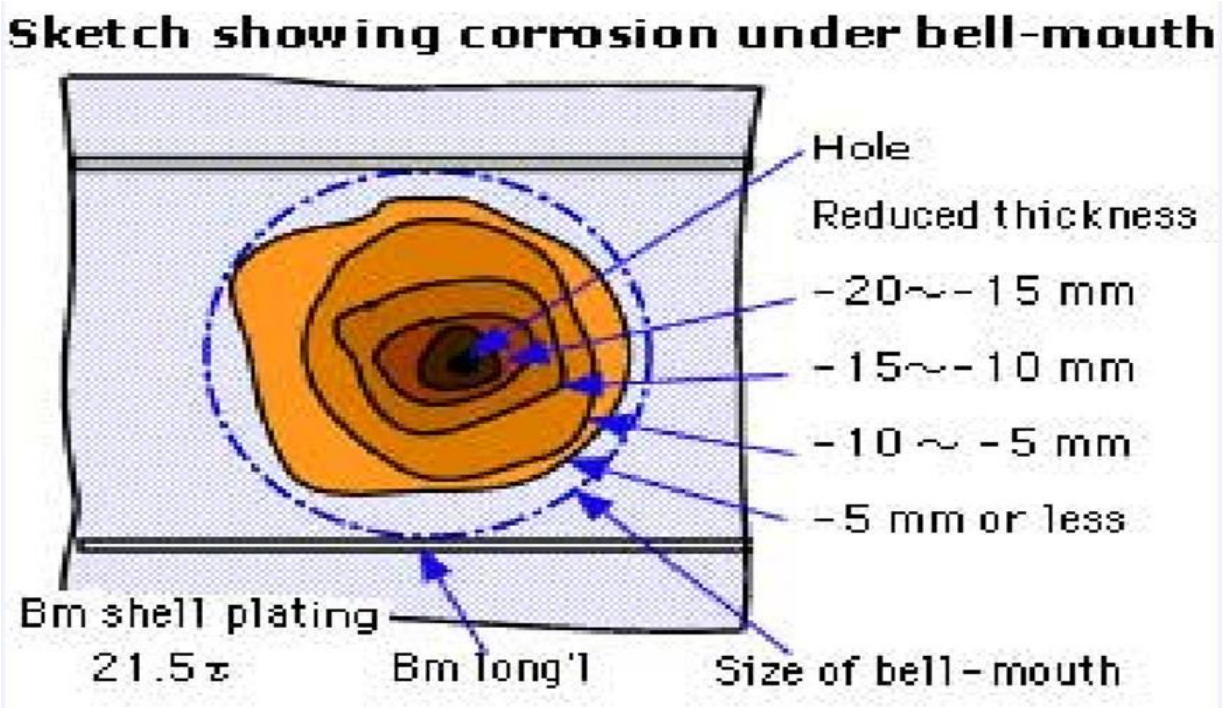
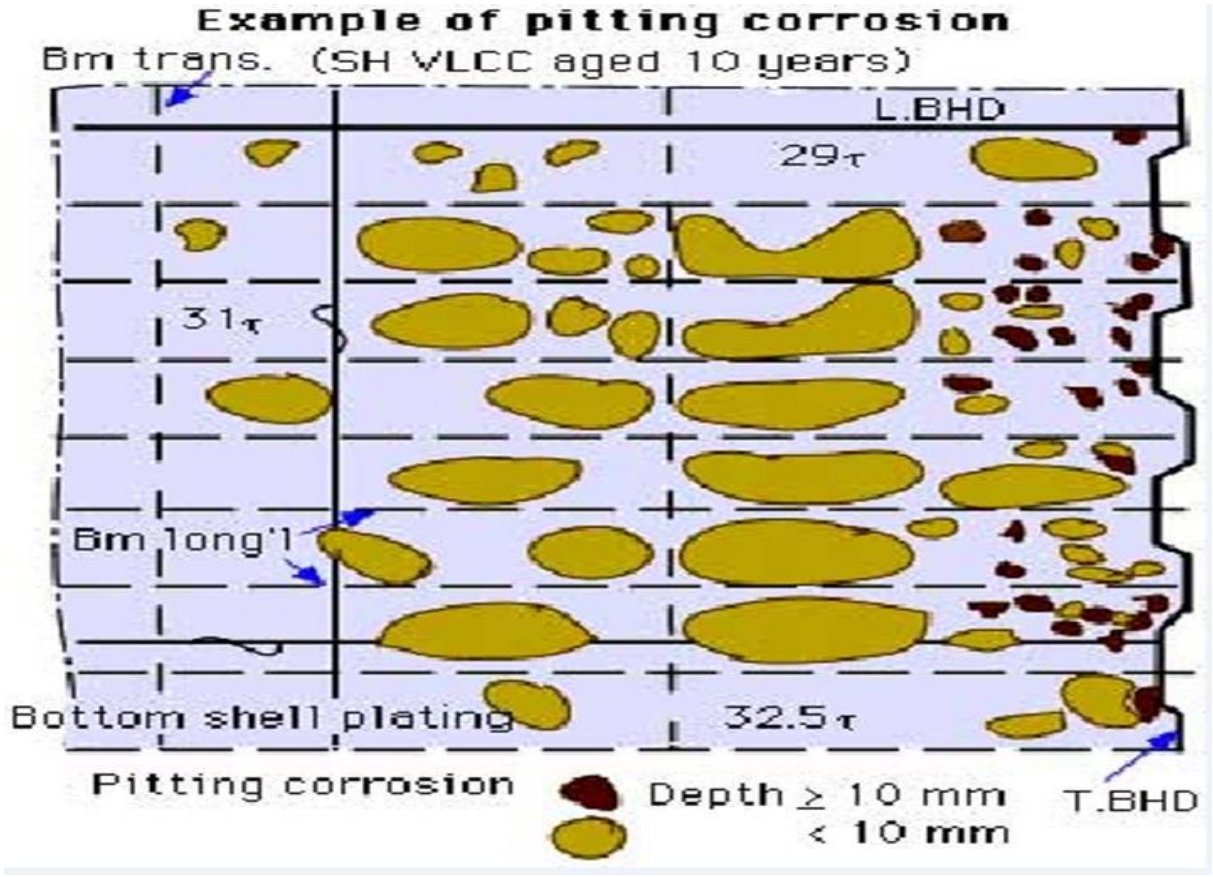
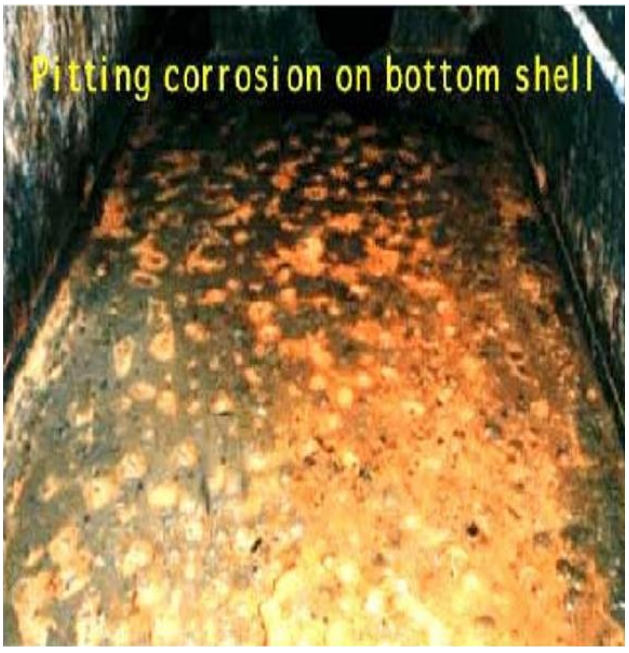


FIGURE N° 10. EXAMPLES ABOUT CORROSION





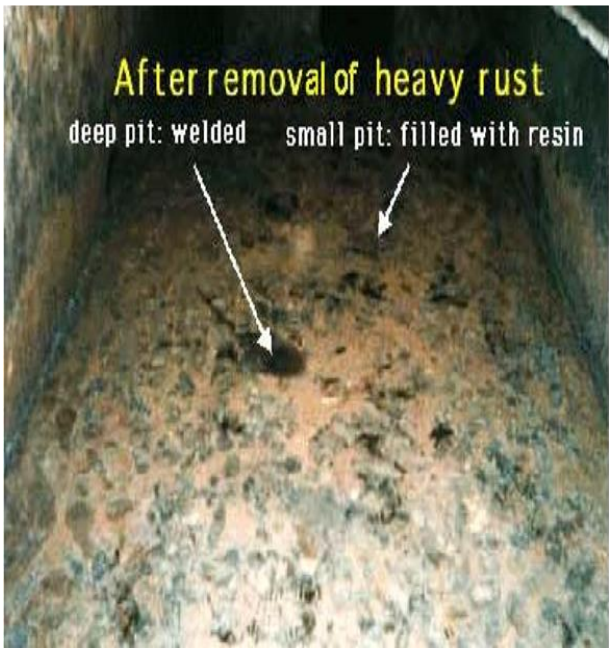
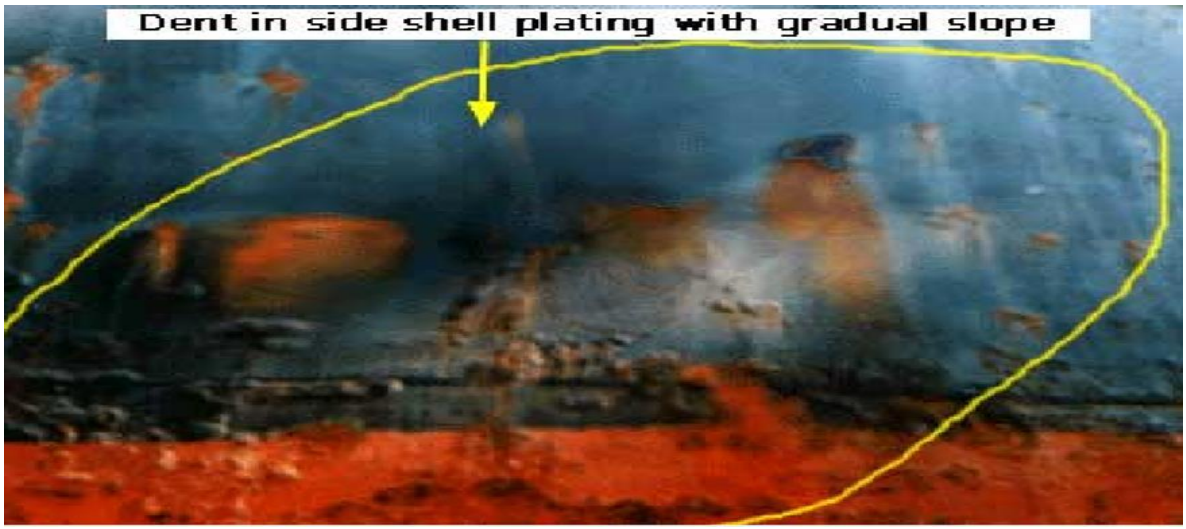


FIGURE N° 11. EXAMPLES ABOUT CORROSION



CORROSION OF UPPER SURFACE OF INNER BOTTOM PLATING

FIGURE N° 12. EXAMPLES ABOUT CORROSION

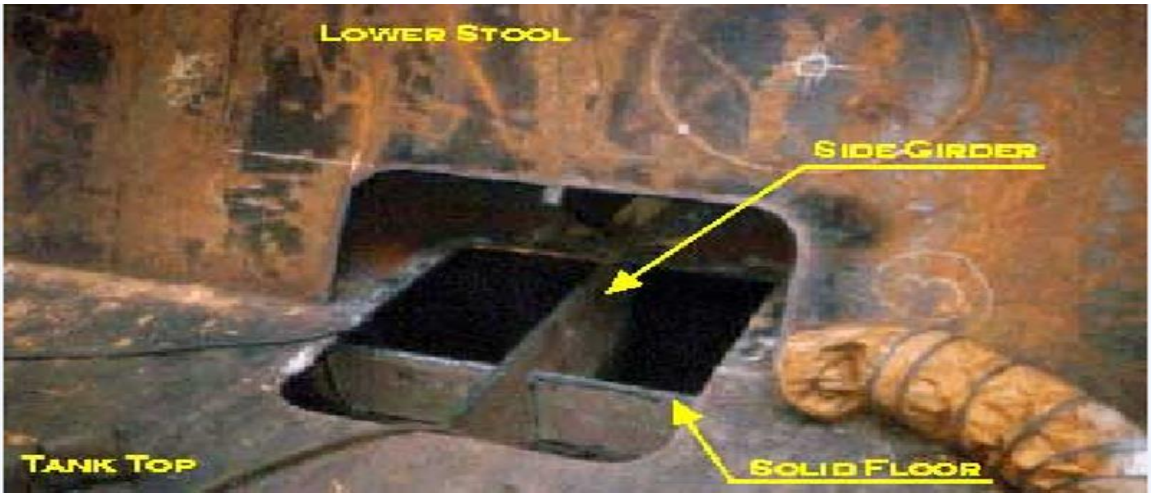
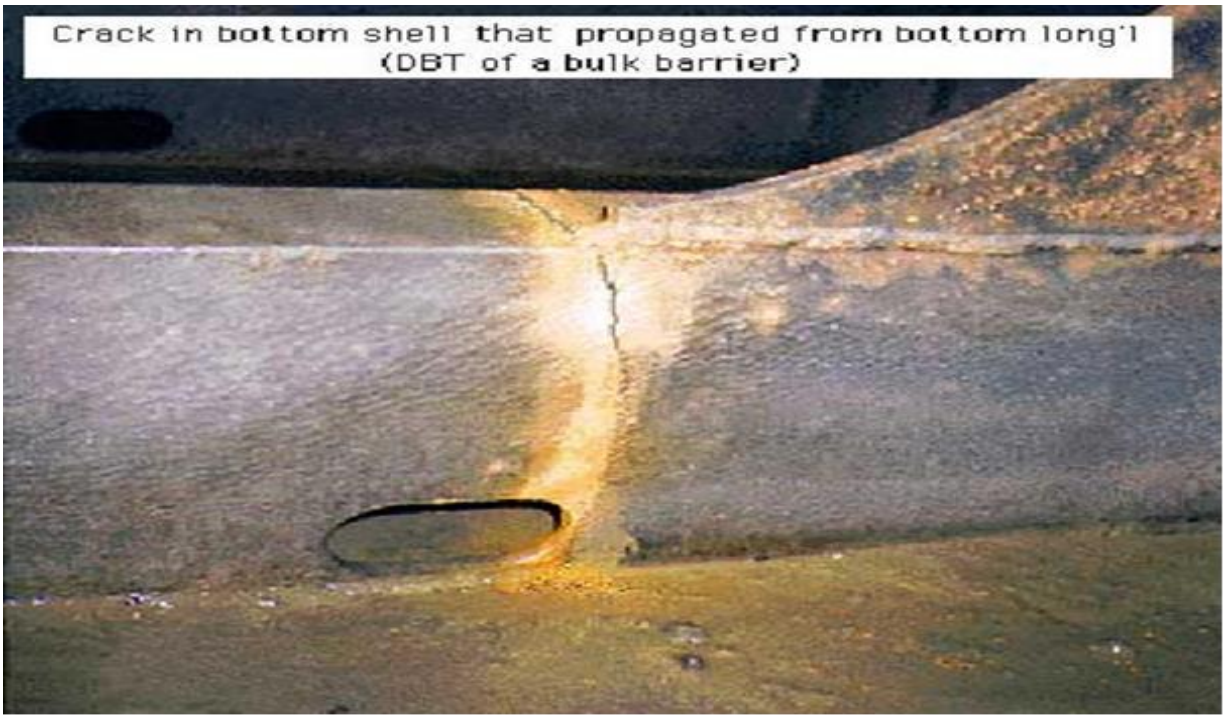


FIGURE N° 13. EXAMPLES ABOUT REPAIRS

Deformation in hold frame and side shell plating due to corrosion/wastage

FIGURE N° 14. EXAMPLES ABOUT DEFORMATIONS ON BOARD THE SHIP´S

FIGURE N° 14. EXAMPLES ABOUT DEFORMATIONS ON BOARD THE SHIP´S



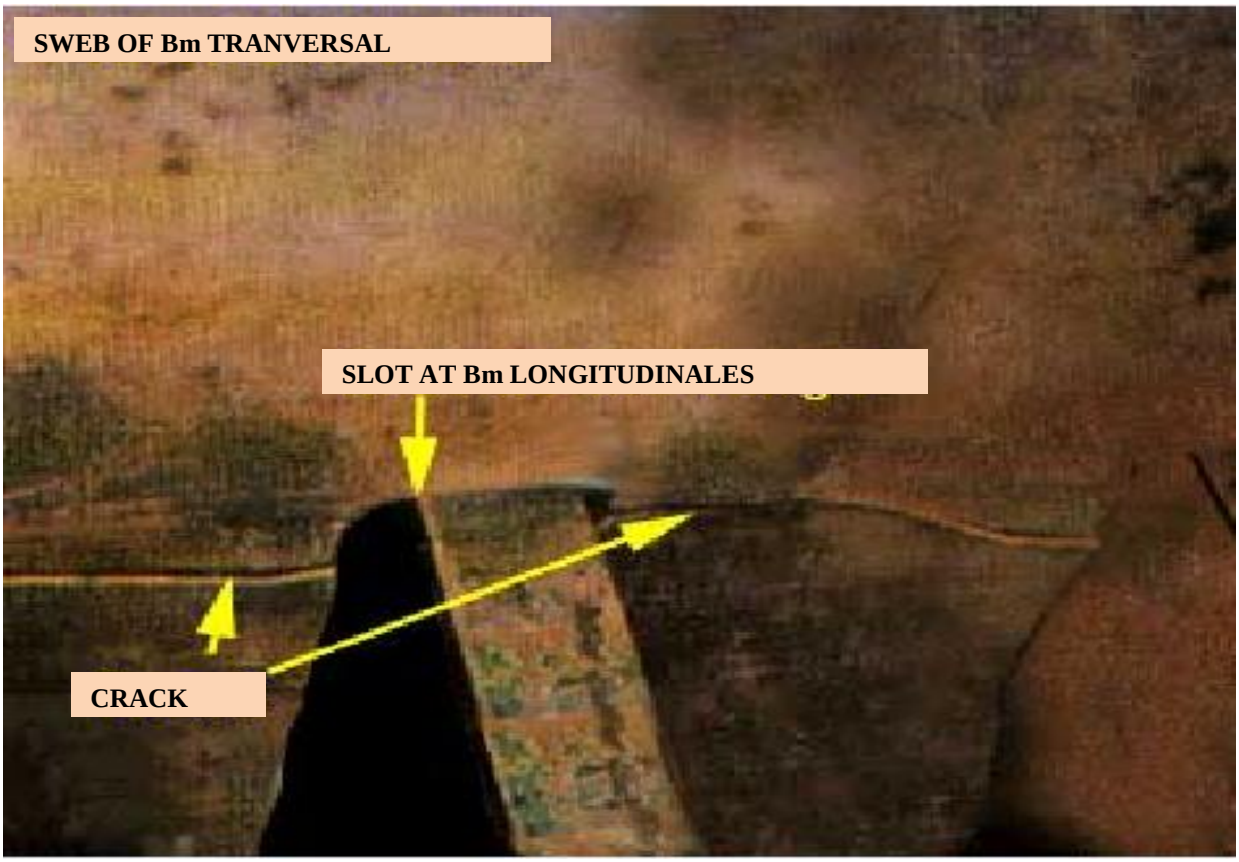


FIGURE N° 15. EXAMPLES ABOUT CRACK

MACHINERY
PART I, CHAPTER 3

MACHINERY
PART I, CHAPTER 3

SECTION 1. PERIODICAL SURVEYS

1.1 GENERAL INSTRUCTIONS

1.1.1 The machinery parts to be examined at Periodical Surveys are detailed in the *Rules and Regulations for the Classification of Steel Ships* (hereinafter referred to as the "Rules for Ships" or *RSTE*).

1.1.2 The present requirements, which are to be carefully studied, are framed to cover only those items used for propulsion of the ship and other essential services.

1.1.3 Except for some non-essential pressure vessels as defined in the Rules for Ships, the requirements of this Chapter exclude equipment such as cargo handling gear, pumps used solely for sanitary or other domestic purposes, and refrigerating machinery.

1.1.4 It is the duty of Surveyors to ensure that the persons responsible for opening up machinery items are made aware as early as possible of the extent of opening up required. The Rules do not state the precise amount of opening up for each survey item, since this will depend to some extent on details of construction, reported faults or obvious signs of defect. It is expected, therefore, that Surveyors will use their experience, judgment and any knowledge of the past history of the installation or similar installations when deciding how extensive the opening up should be.

1.1.5 When machinery installations are fitted with condition monitoring equipment, an acceptable lubricating oil trend analysis programme may be considered as a part of the condition monitoring procedure.

1.1.6 All the procedures contained in this Chapter are intended for general guidance and are not to be interpreted as indicating the full and exact extent of any Survey, which is ultimately left to the Surveyor's discretion.

1.1.7 When it comes to the notice of an Engineer or Electrical Engineer that additions or alterations to the machinery, boilers, electrical, refrigerating or other installations will be or are being, effected and these are likely to involve alterations to the structure of the ship, he is to immediately draw the attention of the Surveyor to the MCO to the matter.

1.2 ANNUAL SURVEYS

1.2.1 All parts of machinery, boilers, electrical installation and associated automation and control equipment which are to be examined at Annual Surveys are covered by *RSTE I Ch 3, Subs 1.3.* Surveys of electrical and automation equipment are considered separately in *MSUR I Chs 4* & *5*.

1.2.2 It is to be noted that the opening up of machinery and boilers is not normally required at Annual Surveys and it is sufficient that items are generally examined under working conditions. If, however, defects, repairs or alterations are found or brought to the Surveyor's attention, they are to be dealt with and reported in the usual manner.

1.3 DOCKING SURVEYS

1.3.1 The propeller is to be examined for erosion, pitting, cracking of blades or possible contact damage.

1.3.2 Any oil leakage from controllable pitch propellers is to be investigated, its cause established and any defect rectified.

1.3.3 In water lubricated stern bearings, the clearance in the sternbush is to be measured and, when considered excessive, recommendations for relining are to be made.

1.3.4 For oil lubricated stern bearings, the requirement to measure the clearance may be waived if an oil gland of an approved type is fitted, in which case it need not be opened up provided the sealing arrangements are satisfactory.

1.3.5 Oil glands are to be tested under the normal oil pressure. Sternbush wear down is to be measured by poker gauge or

other device and compared to any previous readings.

1.3.6 The condition of oil glands is to be reported together with the poker gauge readings.

1.3.7 The fastenings of all suction and discharge valves below the load line and of the sterntube and, where practicable the sternbush, are to be examined. Valves are not to be opened up except as part of the Special Survey. On such occasion all suction and discharge valves including those associated with the refrigerated cargo installation are to be opened out and examined. Care is to be taken to see that the threads on spindles or nuts are in good condition.

1.3.8 Some discharges may be arranged in such a manner that the flow of water tends to return the valve stoppers to their seats. In this case it is to be ensured that the connections between valve stopper and spindles are secure. All fabricated ship's side valve chests are to be specially examined for internal corrosion.

1.3.9 The inability to fully close sea connections has resulted in serious flooding of engine spaces. Therefore, Surveyors are to ensure that these valves are fully reconditioned at Docking Survey and correctly reassembled. In the case with **ICE** notations the de-icing and recirculating arrangements are to be checked.

1.3.10 Where exposed lengths of shafting are protected by wrapping, the Surveyor is to satisfy himself that their condition remains adequate.

1.3.11 The Surveyor is to get informed of the due date of the Propeller Shaft Survey and also with that of the sea connections. Similarly, to establish when anchor, chain and chain lockers are due for survey. Where either of these is immediately or about to become due for survey before the next scheduled Docking Survey, arrangements are to be made to carry out the survey immediately.

1.3.12 When the Owner wishes to have the surveys in *paragraph 1.3.11* above postponed until the next drydocking, details are to be forwarded to HO for consideration.

1.4 ENGINE SURVEY

1.4.1 In *RSTE I, Ch 3* due consideration is given to the extension of survey requirements for main engines which by the nature of the ships' normal service, do not attain the number of running hours recommended by the engine manufacturer for major overhauls during a 5-year survey cycle. Where appropriate, this is to be brought to the attention of Owners.

1.4.2 Any Owner wishing to have a case considered as per *paragraph 1.4.1* should contact HO or the pertinent Regional Office, submitting machinery details, normal annual running hours, and the engine manufacturers' recommendations with regard to overhaul.

1.4.3 For the purposes of *paragraph 1.4.2*, machinery is to be on, or change to, the Engine Survey (ES) cycle, i.e. five years, and main engine running hours recorded and reported at each Annual Survey. At the fifth year all auxiliary machinery is to be surveyed a general examination of the main engine carried out, together with the following:
(a) Full survey of holding bolts and chocks.
(b) Full survey of *c*rankcase doors and explosion relief devices.
(c) Engine trial.

1.4.4 A full Engine Survey will be due at the 10th year. Where two main engines are fitted, it is preferred that at ES one main engine is fully surveyed and the other examined as above. In cases where an extension to survey requirements has been agreed one of the following memoranda items will apply:
(a) Engine Identification. *"Modified ES held on ... Full ES due on ..."*
(b) Engine Identification. "*Full ES held on... Modified ES (subject to reduced running hrs) due on ...*"

1.4.5 In general, for the modified ES to remain applicable, the annual main engine running hours are not to exceed 2000**.**

1.5 CONTINUOUS SURVEY MACHINERY

1.5.1 Surveyors are to enquire from the Owners whether they wish to carry out the Machinery Survey on a continuous basis, HO is to be notified of the Owner's intentions in this respect.

1.5.2 Where machinery is examined on the Continuous Survey basis (CSM), the intention is that, so far as practicable, approximately one fifth of the survey items will be examined each year and that no individual item exceeds five years between subsequent surveys. The completion of the cycle implies that all essential machinery parts have been examined within the previous five years.

1.5.3 The CSM date assigned will normally be the date on which the Hull Survey has been completed, as it is desirable that both dates be concurrent. This will only be possible if all the machinery items have been examined and credited for survey within the previous five-year period. Every endeavour should, therefore, be made to ensure that there are no overdue machinery items at the time of the completion of the Special Survey Hull.

1.5.4 As maintenance of class of a ship is interdependent on machinery Periodical Surveys being carried out, a fresh record of SSH will not normally be assigned if any CSM or other machinery survey items are overdue.

1.5.5 In the case of ships holding a First Special Survey at less than five years from the date of build, a fresh Special Survey record may be assigned, provided the equivalent amount of CSM has been completed (e.g., for a 4-years old ship = 80% of cycle). It is to be noted that until five years from the date of build have elapsed, there cannot be any overdue CSM items. This point is to be borne in mind when examining machinery records for ships under five years old.

1.5.6 Whenever it is known to the Surveyors that a ship will remain in port for some considerable time, for example at prescribed Docking Surveys or in the event of extensive repairs or alterations being effected to the hull or machinery, the records are to be checked so that the opportunity may be taken for bringing the Machinery Survey up to date.

SECTION 2. RECIPROCATING ENGINES

2.1 GENERAL INSTRUCTIONS

2.1.1 The requirements of this Section apply to main and auxiliary engines, their maneuvering starting devices, auxiliary machinery driven by main engine, equipment and spare parts.

2.2 EXAMINATION OF RECIPROCATING ENGINES

2.2.1 For steam engines it is usually not necessary to withdraw the pistons and rods unless special reasons exist for so doing.

2.2.2 For oil engines the pistons are to be removed to facilitate complete examination in view of the more rapid wear usually experienced. The permissible wear will vary with engine type; as a broad guide, however, cylinder liners in oil engines will be recommended to be renewed when worn **1%** of the bore. Reference is always to be made to the manufacturer's recommendations.

2.2.3 Pistons of oil engines may be found cracked in the crowns or at the backs of ring grooves. Piston rods are to be carefully examined in way of crosshead attachments and at the inlet and outlet holes for cooling oil or water. If doubts arise, a suitable crack detection method is to be employed.

2.2.4 Rotary exhaust valves of the type fitted in some older Sulzer (NSD) engines are liable to damage from pieces of broken piston ring passing into the exhaust passages and it is to be verified that these valves are free from significant damage and in good working order.

2.2.5 The crank and thrust shafting of reciprocating engines are to be checked to ensure that the bearing alignment is satisfactory: In the case of machinery surveyed on a CSM basis, this verification is to be carried out, so far as the main engines are concerned, concurrently with the examination of the holding down bolts and chocks. The permissible differential weardown of bearings will vary with engine design and should usually be more restricted in oil engines, particularly with short stiff crankshafts.

2.2.6 Clock gauging between crankwebs is a useful check for alignment but it is important to verify that all journals rest in the lower halves of their bearings during gauging. It has been found that, with a very stiff shaft, removal of the lower half of a main bearing has had no effect on the deflection readings taken from the webs of adjacent cranks. The manufacturer's alignment charts are to be preferably be used.

2.2.7 When main bearings are in good condition but it is thought as a result of wear-down readings that they may need re-metalling, a decision is not to be made solely on the evidence of these readings. Comparison is to be made with any records of previous readings in the possession of the Chief Engineer and considered in association with the crankweb deflections.

2.2.8 When examining crankshafts for possible cracking, particular attention is to be given to the surfaces close to oil holes and where pins and webs are forged or cast in one piece, to the undersides of crankpin fillets.

2.2.9 Where considered necessary, a suitable crack detection method is be used. Some magnetic particle crack detection systems use mains voltage probes, though it is preferable to use coils or permanent magnet systems.

2.2.10 Pin and journal surfaces which have been subjected to overheating and scoring due to wiped bearings are to be carefully examined for surface cracking. Surfaces are also to be checked for hardening, suitable instruments being available for use on these surfaces which leave indentations so small as to have no detrimental effect.

2.2.11 Whenever necessary, due to defects, to grind or machine the pin or journal, the Surveyor should first ascertain whether the crankshaft is of the type manufactured with a surface treatment for enhancing the fatigue strength. Advice is to be sought from HO in these cases. In all cases where an appreciable reduction in diameters (about 1%) is required to correct the faults, permission is to be obtained stating the estimated finished diameter.

2.2.12 The webs of built or semi-built crankshafts are to be examined for movement of the shrink fits and the reference marks are to be checked.

2.2.13 With cast steel webs any area of discolouration on the outer surface in fore and aft directions is be carefully examined and, if necessary, ground and crack detected, since it may indicate the presence of an original casting defect into which oil has seeped. It is important that webs and bolted-on balance weights are always examined at the same time as crankpins.

2.2.14 When carrying out surveys on crankshafts elaborated by an approved welding process (engines fitted with these crankshafts are to bee noted in the Memoranda (Machinery) particular attention is to be given to the weld area. If doubts arise concerning the integrity of the weld, a careful examination by magnetic particle inspection is to be effected and any defect found fully investigated and reported to HO before repairs are carried out.

2.2.15 Bedplates, framing and entablatures of fabricated construction are to be examined for possible cracking in way of welded joints, particularly at the girders under main bearings.

2.2.16 When major cracks are found in a bedplate which has no previous history of such defects HO is to be advised immediately giving full details. Guidance will then be given on the repair procedure to be adopted.

2.2.17 Any major welding repairs to bedplates are to be carefully controlled to ensure that distortion is kept to a minimum.

2.2.18 Alignment of the crankshaft is to be checked in all cases.

2.2.19 The alignment of the crankshaft is also to be checked after any major repairs, additions and/or alterations to adjacent parts of the ship's structure.

2.2.20 When repairs to welded bedplates, columns or entablatures have been effected, the repairs are either be regarded as permanent and recorded in the Memoranda or a Condition of Class is to be imposed for the repairs to be examined again after a service period, depending on the nature and extent of the repairs.

2.2.21 Unless the repairs are of a minor nature, a Condition of Class is to be imposed for a further examination after a service period generally between 6 and
12 months.

2.2.22 Cast iron bedplates are to be examined in way of bearing pockets for distortion after damage due to over- heating of the bearing, specially in the medium and high speed range engines. Cast iron bedplates with serrated locations for the bearing caps are to be examined for cracks emanating from the bottom of the serrations.

2.2.23 Engine seatings and thrust blocks are to be generally examined, together with holding-down bolts, their tightening torque and chocks.

2.2.24 Distortion of bedplates will produce misalignment of crankshafts, which may not be revealed by bridge gauge measurements. Where such conditions are suspected, the condition of the bedplate is to be checked by straight edge, sights, taut wire or any other available means.

2.2.25 Chocking arrangements are to be checked for broken bolts and loose chocks.

2.2.26 Cast iron chocks may be found to have fretted into the tank top plating due to prolonged working, in which case the plating requires to be built up by welding and ground flush.

2.2.27 Resin chocks may be found crushed or distorted and are to be renewed after the bedplate has been realigned.

2.2.28 Additional investigation may be required inside the double bottom tank immediately under the bedplate for structural deformation.

2.2.29 Where torsional vibration dampers and detuners are included in essential machinery installations they are to be examined, as applicable, for broken springs or other defective parts.

2.2.30 In the case of viscous dampers it is to be ascertained that the dampers have not been overheated or suffered mechanical damage and that the dampers remain otherwise efficient, either by arranging for sampling of the silicone fluid to ensure that deterioration has not occurred or by obtaining recent torsiographic records of the system.

2.2.31 A certificate supplied by the manufacturer confirming the continued efficiency of the damper is to be obtained following the analysis of fluid samples and forwarded before the damper is credited for survey. If a damper has been replaced, relevant certification is to be forwarded to HO

2.2.32 In opposed piston oil engines fitted with exhaust pistons connected to the crankshaft via rods and eccentrics, the eccentric

straps are to be opened up for examination. The top end bearings need not be opened provided the Surveyor is satisfied from external examination that they are in good order.

2.2.33 Exhaust manifolds are often fitted with means of preventing foreign bodies such as broken piston rings from entering the turbo-charger casings. Where such protection is fitted, its efficiency is to be ascertained at the time of survey of the turbo-charger.

2.2.34 The design of connecting rods in various makes of main and auxiliary oil engines incorporates serrations in the bottom end bearing housing.

2.2.35 When carrying out surveys on serrated connecting rods, particular attention is to be paid to the roots of the serrations in the rod and cap for signs of cracking

2.2.36 In case doubts arise, a careful examination by magnetic particle inspection is to be carried out and any defect found is to be fully investigated. Reconditioning procedures will have to be agreed with the respective manufacturer and full details are to be submitted to HO before the commencement of any repairs.

2.3 EXAMINATION OF EXPLOSION RELIEF DEVICES

2.3.1 Crankcase explosion relief devices on main and auxiliary engines, if fitted, are to be examined and seen to be capable of working satisfactorily. It is to be verified that flame guards, where required, are in position.

2.3.2 Scavenge spaces in open connection with cylinders are normally provided with explosion relief valves. These are not always readily visible and it is important to ensure that they are opened out for cleaning and inspection at Periodical Surveys and seen to be capable of working satisfactorily.

SECTION 3. STEAM TURBINES

3.1 GENERAL INSTRUCTIONS

3.1.1 The requirements of this Section apply to main and auxiliary steam turbines, their maneuvering gear and spare parts.

3.2 EXAMINATION OF STEAM TURBINES

3.2.1 The weardown of the rotor bearings and the clearance between the thrust collar and pads are to be checked.

3.2.2 Where the thrust collar is not integral with the rotor shaft, it is to be verified that the securing nut is tight and the locking arrangements are efficient.

3.2.3 All nozzles and blading are to be examined together with labyrinth or other packing. Blading is to be sounded for possible slackness or cracking at the roots. Shrouding or binding wire is to be examined.

3.2.4 Blading of steam turbines may be found eroded, particularly in the low pressure stages. This constitutes a defect, but not necessarily one requiring immediate attention, since it will not normally affect the functioning of the machinery. If such a condition is found, it is to be noted in the report, but before making his recommendations to the Owner, the Surveyor is to carefully consider to what extent, if any, the safe working of the turbine is affected.

3.2.5 Vibration of turbines may be traced to a bent rotor. Straightening is to be carried out in accordance with the manufacturer's instructions..

3.2.6 Where heating has been applied it may be necessary to subject the rotor to a stabilizing heat treatment. In all such cases the affected area is to be examined with a magnetic crack detection method

3.3 SURVEY OF TURBINES BY VIBRATION MONITORING METHODS

3.3.1 The complete opening out of main propulsion steam turbines at alternate surveys may be dispensed with provided permanent rotor position indicators are a feature of the installation and readings have been obtained during the period that the ship has been in service by vibration measurement instruments acceptable to MCO.

3.3.2 Comprehensive vibration measurements are to be taken in the presence of the Surveyor during a short sea passage at conditions up to full power and, afterwards, an examination of bearings and flexible couplings is to be held. Full details of MCO requirements in this respect are to be obtained from HO when Owners contemplate such dispensation.

3.4 GUIDANCE NOTES FOR VIBRATION MONITORING SURVEYS FOR MAIN AND AUXILIARY TURBINES

3.4.1 These Notes outline the procedure for carrying out vibration monitoring surveys and explain certain aspects of the survey which may require clarification.

3.4.2 Vibration monitoring of main and auxiliary steam turbines may, under certain circumstances, be accepted as an alternative to opening out during alternate machinery survey cycle.

3.4.3 Notes on Survey format:

(a) Ideally the Owner is to keep vibration records of the turbines from the date of build, but the MCO may accept, in the case of existing ships, a vibration history of at least 12 months prior to the survey. These vibration records are to be available for assessment at the time of the survey.

(b) In addition to any records kept by the Owners, a complete set of vibration readings are to be taken under the supervision of a Surveyor at the time of the MCO survey.

(c) For main propulsion steam turbines, rotor position indicators are to be permanently installed on each turbine. Readings are to be available for comparison with readings taken during the survey.

(d) The Surveyor is to be satisfied from a full power trial that the turbines are in good working order. During this trial sufficient plant performance data are to be recorded in order to make an assessment of operating conditions and for the MCO records.

(e) At a convenient date, either before or upon completion of the vibration monitoring survey, a visual examination of the LP

rotor final stages and astern rotor is to be carried out, as far as practical, through the inspection ports in the turbine casing. The rotor bearings, thrust bearings and flexible couplings are also to be opened out and examined.

3.4.4 Notes on Vibration monitoring equipment:

(a) The equipment used for taking the vibration measurements is to be of a type acceptable to the Surveyor to the MCO and the Owner is to forward details for consideration, prior to agreement for adoption of vibration monitoring.

(b) Documentary evidence is to be available at the time of the survey to verify the equipment calibration and accuracy.

(c) Vibration transducers may be of the acceleration or velocity type. They are to be secured firmly to the bearing housing. Good coupling is important if errors of measurement are to be kept as small as possible.

(d) The vibration pick-up is to be sufficiently direction- sensitive to exclude the possibility that vibrations normal to the direction of measurement will distort the vibration readings in the direction of measurement.

(e) Indication of propeller shaft/rotor speeds will be required.

(f) Measured vibration may be recorded with either mechanically- or electrically-operated instruments e.g. X-Y chart recorder, UV light chart, magnetic tape.

(g) It would be acceptable for the readings to be analysed subsequent to the survey, but it will be more convenient for a suitable analyser to be available during the survey so that the vibration amplitudes over the relevant frequency spectrum can be assessed.

(h) If data are analysed during the survey it would be acceptable to record them in tabular form, but a vibration signature gives a better picture of the condition of the machine.

3.4.5 Notes on Vibration measurement:

(a) Vibration measurements are to be recorded on the forward and aft bearings of the LP and HP rotors in the vertical and horizontal axial directions, i.e. three sets of readings for each bearing at a similar speed. Measurements are to be preferably carried out at points where vibration energy is transmitted to the pick-up mounting, i.e. measurements are to be taken on the bearing housing in the horizontal direction at a height corresponding to the center line, vertically above the center of the shaft center line and axially paragraph to the shaft axis at shaft height.

(b) Readings are to be taken at full power and at least one at reduced power, e.g. 50-60%, over the relevant frequency spectrum of the turbines so that at least the ½, 1st, 2nd and 3rd orders of rotor vibrations may be determined.

$$ORDER = \frac{\text{Frequency of vibration}}{Rotor\ RPM}$$

(c) Readings of vibration amplitude are preferably to be recorded in terms of velocity (mm/s).

(d) Commonly used standards for assessing the severity of vibration on main propulsion and auxiliary steam turbines are the following:

(i) BS 4675, Part 1; 1976 *Basis for specifying evaluation standards for rotating machines with operating speeds from 10 to 200 revolutions per second.* (See also ISO 2372-1974).

(ii) VDI 2056 - 1964, *Criteria for assessing mechanical vibrations of machines.*

3.4.6 Notes on the Determination of machinery condition.

(a) The recorded vibration amplitudes are to be compared with the turbine manufacturer's allowed limits, National or International Standards and previous records.

(b) The vibration levels recorded at the time of the survey are also to be compared with the readings taken previously. There should be no significant change in vibration levels.

(c) For guidance, an increase of 3 - 5 times the original readings will be cause for concern, even if the levels of vibration remain within the limits set by manufacturers or appropriate standards.

3.4.7 Notes on Fault diagnosis:

(a) The vibration records may also be used to indicate the reason for changes in the signature.

(b) The possible causes of vibration and means of recognition by reference to the order of the vibration are covered by *paragraph 14.8.4* (see also *table 14.8.4*).

3.5 MANUFACTURERS OF VIBRATION MONITORING EQUIPMENT

3.5.1 Manufacturers known to produce suitable monitoring equipment are listed below. This does not preclude the use of other suitable sources of equipment.

(a) Bentley Nevada Ltd.
(b) Bruel and Kjaer Ltd.
(c) Endevco Division
(d) Hewlett Packard Ltd.
(e) IRD Mechanalysis Ltd.
(f) Scientific Atlanta Ltd.
(g) Vibro Meter Ltd.

3.6 ASEA STAL AP MACHINERY, APL32 AND 35 LP TURBINES

3.6.1 A number of LP turbine ahead wheel discs have cracked in the fillet to the rotor. At each Periodical Survey of the turbine the entire area of the LP ahead wheel disc is to be magnetic-particle crack detected under the supervision of a Surveyor and full details reported.

3.5.2 If cracks are found in the ahead wheel disc during the above procedure, the Surveyor is to recommend either that the disc be machined off and a suitable entry made in the Memoranda (Machinery) or that the rotor be renewed

SECTION 4. GEARS AND COUPLINGS

4.1 GENERAL INSTRUCTIONS

4.1.1 Requirements of the present Section apply to tooth gears, rigid, elastic, hydraulic and electromagnetic couplings, as well as to other types of gears, coupling boxes, disengaging and couplings.

4.1.2 Gears and couplings are to be examined during the Periodical Surveys to their associated engines and turbines.

4.2 EXAMINATION OF GEAR AND COUPLINGS

4.2.1 Each pinion and wheel is to be checked separately during one complete revolution and the teeth carefully examined for cracks (with the aid of a suitable method of crack detection if necessary), pitting, scuffing or any signs of uneven wear which might indicate that pinions and wheels are out of alignment.

4.2.2 Any available lubricating oil analysis records are to be examined, in particular the results of spectrographic analysis of wear elements.

4.2.3 It is important to examine every tooth. Focused visual scanning under good light of one helix at a time ensures that such defects as broken teeth, cracks or other localized defects are detected.

4.2.4 Side plate welds are to be examined. The teeth are not to be cleaned as this may obliterate evidence of tooth root cracks. On certain occasions cracks may be identified by visual inspections, as they tend to weep along their length due to fretting of the crack surfaces.

4.2.5 If the affected tooth is cleaned in an effort to observe the damage more clearly the evidence is often lost to visual examination. Magnetic particle or dye penetrant is then required to recover the evidence. Marking of teeth which are suspected of containing cracks is therefore recommended prior to cleaning for further investigation.

4.2.6 If excessive pitting, scuffing or uneven wear is found but, at the Surveyor's discretion, the gearing is satisfactory for further service, he may consider recommending that casts be made of the teeth most affected. Means are to be provided for identifying these teeth with the casts which are to be retained on board for the information of Surveyors at subsequent surveys. When this action is undertaken, that fact is to be included into the Survey Report.

4.2.7 Flexible couplings between pinions and rotors and between pinions and wheels of double reduction gears are to be carefully examined. Any sign of unusual wear is to be investigated since this may indicate lack of correct alignment. Gear cases of fabricated construction are to be examined for possible cracks in way of welds.

4.2.8 The vast majority of defects in gearing appear during the early service life. Thus the first survey, usually carried out when the gearing is about five years old, is to be particularly searching.

4.2.9 The top half of the casing is to be lifted and a thorough examination made of the teeth, any bolted connections, the welds of fabricated wheels, the fit of shrunk-on rims and their radial or axial dowels, if fitted, and the fit of wheels on shafts. Main or bull wheels occasionally become slack on shafts, which may be revealed by signs of frettage at the ends of tapers. Where the design permits, the internal structure of wheels is to be examined.

4.2.10 At later surveys, the top half of the casing need not be lifted provided the Surveyor is satisfied that an efficient examination can be made after removal of the inspection doors. This will depend on the design of the gearing and the positions and dimensions of the inspection openings.

4.2.11 For gearing used with low powered oil engines where the construction does not allow the top half of the casing to be lifted, the Surveyor will use his judgment as to the amount of opening out required to enable him to satisfy himself as to the condition of the gearing.

4.2.12 Certain gearing systems incorporate a constant running emergency lubricating oil pump driven through a take-off shaft from the main gears. Cases are on record of failure of this shaft and special attention is therefore to be paid to all such take-off arrangements at the time of survey

SECTION 5. AUXILIARY ENGINES

5.1 GENERAL INSTRUCTIONS

5.1.1 Auxiliary engines are, in general, examined in the same manner as main engines. It is highly desirable to report upon a complete engine at one time.

5.2 EXAMINATION OF AUXILIARY ENGINES

5.2.1 Surveyors need not to adhere rigidly in all cases to the main engine survey requirements when deciding the amount of opening up necessary, particularly with small engines, and provided they are satisfied as to the auxiliary being well maintained.

5.2.2 Recent crankshaft deflection readings are to be made available to the Surveyor, except in the case of very small engines, so that it can be verified that manufacturer's recommended limits have not been exceeded.

5.2.3 When a ship is provided with a tailshaft generator capable solely of supplying the full normal electrical power at sea (including, where applicable, that associated with the refrigerated cargo installation) without the use of self-contained generators, and the ship has at least two independent auxiliary engine driven generators each of which is capable of supplying the full normal sea load, consideration will be given, on application by the Owner, to a Modified Survey to be applied to each of those auxiliary engines at the first due survey after the date of building or commissioning of the ship.

5.2.4 The Modified Survey above is to consist of an examination of the ship's routine maintenance records and log books of the auxiliary engines followed by tests under working conditions of the engines and their essential alarms and controls including circuit breakers, overload and reverse current trips to the satisfaction of the Surveyor.

5.2.5 After the Modified Survey, the auxiliary engines are to be credited towards the ES or CSM cycle and details of the tests included on the continuation sheet to the Report. For the information of the HO the service hours of each of the auxiliary engines since the previous survey is to be reported together with details of any breakdown or failures during that period. At the second and subsequent due dates of survey a Complete Survey of all such auxiliary engines is to be carried out in the normal manner.

5.2.6 Where the "Hansa" quick starter is supplied for the emergency starting of an auxiliary engine from "*Dead ship"* conditions, the starter is to be tested under working conditions at each engine survey or at about five-yearly intervals when the machinery is examined on the Continuous Survey basis in order to demonstrate First start arrangement requirements.

5.2.7 If, for any reason, it is proposed that a ship sails with one or more of the auxiliary engines (prime movers) out of service, Surveyors are to ensure that there is adequate reserve electrical generating capacity as required by the Rules for Ships. In these conditions, provided there are at least two generators in good order, either one of which can carry the essential load, repairs of any additional generator may be postponed. Three remaining generators, of which any two can carry the essential load, would also be acceptable.

5.2.8 When assessing the available electrical capacity any emergency generator which can be connected to the main switchboard is to be included.

5.2.9 It is not necessary that the reserve generating capacity enables the ship to navigate at full speed (in addition to safeguarding any refrigerated cargo which may be on board). Any restriction on the speed of the ship because of this should not, however, constitute a hazard to navigation..

5.2.10 If for any reason a replacement or additional auxiliary oil engine is fitted and the design has not previously been approved, and the power is 110 kW or over, the torsional vibration characteristics are to be checked.

5.2.11 Crankcase explosion relief devices are to be fitted to comply with current accepted standards. If the engine has been built under survey the relevant First Entry Report and crankshaft forging certificate are to accompany the Report. If the engine is not built under the MCO survey the relevant Certificates of any other Classification Society involved are to be obtained and forwarded

SECTION 6. AUXILIARY MACHINERY

6.1 GENERAL INSTRUCTIONS

6.1.1 The auxiliary machinery is considered to include the following:

(a) Pumps (circulating, cargo, stripping, hydraulic, bilge, cooling water, feed, ballast, fire, fuel oil, lubricating oil and condensate pumps).
(b) Compressors.
(c) Centrifugal and oil separagraphtors.
(d) Fans of dangerous spaces and boiler blowers.
(e) Steering gear.
(f) Anchor machinery.
(g) Mooring machinery.
(h) Machinery of rescue craft launching appliances.
(i) Towing winches (on towing vessels).
(j) Cargo and stripping pumps of oil tankers.

6.1.2 Auxiliary machinery driven by main or auxiliary engines (cooling water, fuel oil, lubricating oil and bilge pumps, air compressors, scavenging pumps and blowers) is to be surveyed together with the associated engines.

6.2 EXAMINATION OF PUMPING AND PIPING ARRANGEMENTS

6.2.1 At the Surveyor's discretion essential pumps are to be opened out sufficiently to enable the Surveyor to establish the condition of cylinders, plungers, casings, impellers, valves, etc. Similarly, coolers and pressure heaters are to be tested when considered necessary.

6.2.2 Safety valves or other similar devices fitted on pumps, heaters, etc., are to be examined to ensure that they are in efficient condition.

6.2.3 Bilge suction lines are to be tested by pumping water from the various holds and machinery space bilges and it is to be seen that strums or strainers are fitted in the holds and that sounding pipes are in order. If non-return valves are fitted at or adjacent to the open ends of bilge suction pipes in holds they are to be opened out to see that they are in good working order and do not obstruct the flow of water.

6.2.4 Survey of pumping arrangements will include a general examination of all essential piping, fittings, valves and controls. Emergency bilge suction valves and connections are to be free and not choked. Particular attention is to be given to sea-water piping systems. The extent of survey will depend on various factors, for example the age and service of the ship, the materials of the pipes and valves as well as the onboard maintenance.

6.2.5 Normal inspection methods involve hammer testing, visual examination, and pressure testing, however where considered necessary, ultrasonic thickness measurements may also be taken. Any temporary repairs and the surrounding areas are to be specially examined. The Surveyors must be fully satisfied with replaced pipe sections or permanent repairs completed.

6.2.6 Graphitization of cast iron in sea-water may be a problem often associated with stub or elbow pieces. This process involves the selective removal of the matrix of the material leaving the graphite behind. As a result the strength of the component is dramatically reduced, which in turn may lead to a sudden failure.

6.2.7 Emergency fire pumps are to be tested under working conditions and, provided they operate satisfactorily and deliver the required supply of water, they need not be opened up. The operation of any remote control gear for the sea inlet valve is to be checked.

6.2.8 Where emergency fire pumps are driven by compression ignition engines, either directly or by means of a generator and electric motor, the engines need not be opened up provided they function satisfactorily and it is demonstrated that they can be started when cold.

6.2.9 Hydraulic generators and motors associated with emergency fire pumps need not be opened out provided they are seen to function to the Surveyor's satisfaction.

6.2.10 The requirements of *RSTE I-3* and *RSTE IV-1* & *2* so far as cargo and bunker systems are concerned, are to be complied with. Gas-tight glands fitted to pump shafts which pass through pump-room bulkheads are to be examined to ascertain that they remain

efficient.

6.2.11 The bilge drainage system in pump rooms is to be checked. In ships carrying flammable liquids having a flashpoint < **60°C**, the cargo pumping system is not to have a direct communication with the machinery space, or with the oil fuel bunker lines. The Surveyors are to ensure that any alterations to the piping system made at any time do not infringe this requirement.

6.2.12 Where clean ballast lines pass through cargo oil tanks to forward ballast tanks, pipes are to be hydraulically tested and proved free from leakage.

6.2.13 General arrangements on older ships require special attention and any apparent deviation from the Rules are to be reported at once.

6.3 EXAMINATION OF AIR COMPRESSORS, AIR RECEIVERS AND PIPES

6.3.1 Compressors are to be opened up and the working parts examined. It is important to ensure that the tubes or coils of air coolers are in good condition and when considered necessary, a hydraulic test to **1.25 times** compressed air discharge pressure in the coils/tubes is to be applied. Coils may be found locally thinned due to rubbing against supports or casings or there may be internal erosion at bends which may be detected by light hammering.

6.3.2 Air receivers are to be examined internally, together with mountings. When the dimensions of the openings restrict effective examination, a hydraulic test is to be applied, which need not be more than **150%** of the approved working pressure.

6.3.3 Care is to be taken to ensure that all filters, oil separators, safety devices, bursting discs, fusible plugs and relief valves on compressors, air lines and receivers are in good condition and that drainage arrangements throughout the air system are satisfactory. Several fatal explosions have occurred because relief valves or other safety devices have been rendered inoperative by paint or dirt or by the use of bursting discs made of inappropriate material.

6.3.4 Selected pipes in the starting air system for main and auxiliary engines and at the discharges from air compressors are to be examined not only to establish their condition but to determine that there is no appreciable amount of lubricating oil in the starting air system which, on a number of occasions, has been the cause of serious explosions and loss of life.

6.3.5 In general, it is not considered necessary to examine internally starting air pipes for auxiliary engines or for engines used for emergency or harbor purposes only when their power is less than 110 kW.

SECTION 7. PROPELLER SHAFT SURVEYS

7.1 GENERAL INSTRUCTIONS

7.1.1 The requirements for the periodic survey of screwshafts which vary depending on their configuration are described in the Rules for Ships.

7.1.2 When condition monitoring equipment is fitted an acceptable sterntube lubricating oil trend analysis programme may be considered as part of the condition monitoring procedure.

7.1.3 The dates assigned to Propeller Shaft Surveys (PSS) are to coincide with the last examination of the ship in dry-dock. When it is found necessary to impose a Condition of Class in connection with a screwshaft no fresh record of survey are to be recommended until the Condition of Class has been deleted.

7.1.4 When a screwshaft has been changed for any reason the Surveyor is to indicate in his report whether any amendment to the survey cycle period is necessary as a result of any differing design feature in the replacement and state whether the replacement shaft is new or a reconditioned previously used spare.

7.2 SURVEYS AND DEFECTS

7.2.1 Shafts are to be carefully examined for cracks, particularly at keyways. The forward and aft ends of liners where corrosion may sometimes be found are to be examined. Signs of fretting are occasionally evident on the shaft cone, due possibly to unsatisfactory fit of the propeller or inadequate hardening up of the nut.

7.2.2 Areas of corrosion, sometimes in the form of a circumferential band at the large end of the cone, are to be viewed with extreme caution. In certain cases, circumferential stress corrosion cracking of a branching type has developed from such areas, usually due to the presence of sea-water.

7.2.3 Where screwshafts require examination at the forward part of the cone or the fillet in flanged propeller attachments by an efficient crack detection method, this is to be of the magnetic particle type for shafts of ordinary steel. Facilities for magnetic particle crack detection are available at most dry-docks but where they are not, the shaft can be readily magnetized by encircling it with a few turns of cable with connections to a suitable supply of low voltage, high amperage electric current.

7.2.4 Any cracks found will generally be the result of fatigue. No shaft is to be discarded solely on account of the presence of a small crack. The extent and depth of the crack are to be determined by grinding (not chipping) out the affected material until it is confirmed by magnetic particle crack detection that the crack has been entirely removed. Where defects are found near the end of a liner it must be verified that these do not continue under the liner. The liner is to be machined back if necessary.

7.2.5 When it is decided that the shaft is fit for further service, two courses of action may be undertaken:
(a) The shaft may be accepted without condition and a suitable entry recommended to be put in the Memoranda (Machinery) for the information of Surveyors at future surveys.
(b) The shaft may be accepted subject to the propeller being backed off for examination and crack detection of the affected part after a period in service of, e.g., **12** or **18 months**, in which case it will be recommended that the "PSS" record will be withheld meanwhile.

7.2.6 In deciding which course to adopt as per *paragraph*

7.2.5, Surveyors are to use their experience and judgment. The following general comments are pertinent when considering the case:

(a) If the crack is at the forward end of the keyway it may be beneficial to spoon out the shaft in way if practicable, in which case it may be necessary to make a new key.
(b) Any signs of fretting is to be removed, if necessary by machining, and particular care is to be taken to ensure that the propeller fits well and that the nut is properly tightened.
(c) An accessory cause of a single circumferential crack in way of the forward end of the propeller boss may be the clamping effect of the boss, which may be relieved by beveling the edge of the bore.
(d) Cracks at the edges of keyways may be caused by slackness of the propeller fit on the cone causing excessive pressure of the key on the driving side of the keyway or by the sharp edge of the keyway not having been rounded.
(e) A series of circumferential cracks around the partial portion of the shaft forward of the cone may be removed by machining a groove into the surface of the shaft. The edges of the groove are to be well blended. The diameter of the shaft at the bottom of the groove is not less than that required by the Rules for Ships.

(f) Local corrosion of the after part of a shaft between the sternbush and propeller, is generally caused by a defective rubber ring or oil gland, and can be removed by grinding or machining and leaving the diameter of the shaft not less than that required by the Rules for Ships. Corrosion at the forward end of the shaft owing to a leaking stern gland can be dealt with in the same way.

7.2.7 When it has been proved by magnetic particle crack detection that cracks or corrosion have been entirely removed and the shaft is to be re-fitted, the material around the grooves or depressions must be carefully blended into the adjacent surface of the shaft to avoid stress concentration.

7.2.8 Cracks or corrosion in excess of those described in *paragraph 7.3.5* will generally lead to rejection of the shaft but it is again emphasized that the foregoing remarks are intended to provide some guidance. The ultimate decision is to be made by the Surveyor after carefully considering all the circumstances.

7.2.9 A detailed sketch showing the precise location and extent of the defects is to be forwarded in every case with the Report for record purposes and, where the shaft has been refitted, to enable consideration to be given to any subsequent request from an Owner for a short postponement of a re-examination or a Propeller Shaft Survey to suit his docking programme.

7.2.10 Shaft liners are to be sounded for tightness, more particularly at the ends. When considering the importance of any slackness which may appear present, the Surveyor will decide to what extent the liner's function of protecting the shaft from sea-water is impaired. Liners are also to be examined for possible cracks, particularly in way of the circumferential welds, where the liners are made in more than one length. Dye penetrant or other suitable crack detection method is to be employed whenever necessary.

7.2.11 Bronze liners are sometimes found heavily worn in way of the stern gland packing but otherwise satisfactory. In order to avoid having to renew the whole liner a repair may be effected by welding, provided analyses of the liner material and electrodes or filler rods show not more than
0.5% of lead.

7.2.12 The worn portion of bronze liners is to be machined smooth and during the welding process, the shaft and liner at each end of the repair are to be kept cool, for example, by packing dry ice round the shaft at two places clear of the repair so as not to affect the shrinkage grip of the liner. The welding may be done longitudinally or circumferentially, each run being peened on completion.

7.2.13 When the repair has been machined to the finished size it is to be carefully examined by means of a dye penetrant or other suitable crack detection method, and it is to be verified that the liner is still tight on the shaft in way of the repair.

7.2.14 Repairs to liners, when carried out to the full satisfaction of the Surveyors, need not be made a Condition of Class for re-examination but a suitable note may be recommended for insertion in the Memoranda (Machinery) for information at later surveys. Any other proposals for repairs to bronze liners are to be submitted, in the first instance, to HO for approval.

7.2.15 If a screwshaft is rejected, the identification marks on both the replacing and rejected shafts are to be reported and those on the latter defaced by crossed cuts. Shafts with flanged connections to the propeller boss are to be carefully examined in the flange root radius and all bolts tested for tightness. Sample bolts are to be removed for examination at Propeller Shaft Surveys as considered necessary.

7.3 STERNBUSHES

7.3.1 Sternbush linings are to be renewed when worn.

7.3.2 Permissible clearance in the bush will vary but, depending on the shaft diameter, is not normally to exceed 6 - 10 mm in the case of lignum vitæ, Tufnol, etc.

7.3.3 In general, the maximum permissible wear is less than stated above when the machinery is fitted aft. For oil lubricated shaft bearings re-metalling should, depending on shaft diameter, be considered when the wear approaches 2 mm. When it is considered that the clearance is approaching that at which relining will be necessary, this is to be pointed out to the Owner's representative, since it may better suit the ship's commitments to reline at once rather than risk having to do it at a subsequent docking before the due date of the next Propeller Shaft Survey.

7.3.4 After renewing any bush the Surveyor is to subsequently check the alignment of screw or tube shaft and intermediate shaft.

7.3.5 When a sternbush has been relined the actual clearance prior to and after relining is to be stated, also the designation

of material used for the lining of the sternbush if it is not lignum vitae or white metal. When Tufnol, Railko or other proprietary brand materials are used for sternbush bearings, manufacturer's recommendations for initial clearances are to be complied with.

7.3.6 When existing material is changed for another, the names of both are to be reported.

7.4 PROPELLERS

7.4.1 Propellers are to be removed and examined at each full Propeller Shaft Survey.

7.4.2 Particular attention is to be given to the roots of propeller blades for signs of cracking. Whenever possible it is desirable that repairs to bronze propellers are carried out by propeller manufacturers or repairers.

7.4.3 If a new propeller is installed the accuracy of fit on the shaft cone is to be tested without and with the key in place. Identification marks stamped on the propeller are to be reported for record purposes. If the new propeller is of a different design to the old one, the existing approval of vibration characteristics may no longer be valid. Full particulars of the new propeller are to be reported at an early stage so that vibration characteristics can be determined.

7.4.4 Sealing rings is particularly important to ensure that rubber rings between propeller bosses and aft ends of liners are of the correct size and fitted so that the shaft is protected from sea-water. Failure in this respect will often be found at the ends of keyways because the top part of the key itself is not extended to provide local bedding for the ring in way of the recess in the boss. In such cases it may be practicable to weld an extension to the forward end of the key. It should also be borne in mind that water may enter the propeller boss at the aft end and attention is to be paid to this part of the assembly.

7.4.5 Filling the recess between the aft end of the liner and the forward part of the propeller boss with grease, red lead or similar substance will not be accepted as a method of obtaining water-tightness. Sealing rings used in connection with approved-type oil glands are to be similarly checked.

7.4.6 When oil glands are fitted, the various parts are to be examined at each survey. Particular attention is to be paid to the arrangement for preventing ingress of water to the shaft cone. Repairs or renewals to the oil glands are to be reported for record purposes.

7.4.7 All oil glands, after reassembly, are to be examined under pressure and found to be tight.

7.5 CONTROLLABLE PITCH PROPELLERS

7.5.1 If the ship has a controllable pitch propeller, the working parts and control gear are to be opened up at each Propeller Shaft Survey sufficiently as to enable the Surveyor to satisfy himself of their condition. At least one blade is to be dismantled to allow examination of the internal mechanism and sealing arrangements. The root and flange of the propeller blades and the blade to boss securing arrangements are to be checked for cracks.

7.6 DIRECTIONAL PROPELLERS FOR MAIN PROPULSION

7.6.1 At each drydocking, propeller and fastenings are to be examined as far as practicable and the manoeuvring of the propeller blades is to be tested. At five-yearly intervals, the control gear and working parts of the propeller and associated gearing are to be opened out for examination. Special attention is to be given to the reduction gearing and, in Voith-Schneider propellers, to the attachment of the pinion to its shaft.

7.6.2 Some Owners open out the control gear and working parts as a matter of routine after 5000–6000 hours running and, provided the Surveyors are given the opportunity of examining the propeller on these occasions and the intervals between consecutive examinations do not greatly exceed five years, this would be acceptable for maintenance of class.

7.7 TRANSVERSE PROPULSION UNITS

7.7.1 Connections of the units to the hull and the condition of the propeller are to be examined; control gear and arrangements are to be examined and tested working so far as practicable and insulation of any electrical equipment tested.

7.7.2 Defects in the transverse propelling units will not constitute a Condition of Class unless they pose a hazard to the ship.

7.7.3 Where the ship has a **DYN** (Dynamic Positioning) notation and a defect is found in one of the thrusters which is not repaired at the time of survey, it is to be verified whether the DYN notation may be maintained (see *RSTE VIII -2*).

7.8 CORROSION PROTECTION OF SCREW SHAFTS BY WRAPPING

7.8.1 Where the fitting of a continuous liner is impracticable, all parts of mild steel screw or tubeshafts exposed to sea-water may be wrapped with glass fiber or other approved coatings as a means of protection.

7.9 SEFFLE TYPE CONTROLLABLE PITCH PROPELLER

7.9.1 A considerable number of Seffle type grease lubricated CP propellers installed on ships prior to 1982 have suffered fatigue cracking in the radius between the journal and lower flange of the blades within the hub. The cracks are considered to be serious and liable to affect the safety of the ship if they progress to eventual complete failure and loss of the blade as has occurred.

7.9.2 At each PS Survey the propeller is to be completely dismantled for a thorough examination of all components including crack detection of each blade in way of the journal and flanges within the hub.

7.9.3 At each drydocking of the ship between Propeller Shaft Surveys, Surveyors are to carefully examine the propeller seals, securing devices, wear of journals as far as practicable and remove plugs to ensure that an excessive amount of water has not entered the hub. If any of the above is found to be defective the propeller is to be dismantled for examination and crack detection as described above.

7.9.4 The most common defects found have been cracks in the radius between the journal and lower flange, the slackening and in some instances breakage of the bolts securing the two halves of the hub and excessively worn seals between the blade root and hub. Ingress of sea-water through the joint between the two halves of the hub or the blade root seals has caused heavy corrosion to the internals of the hub.

7.9.5 Blades which are found cracked in the radius between the journal and the lower flange may be repaired using an approved weld procedure. The crack is to be removed completely by grinding and the whole area is to be proved free of cracks by means of dye penetrant examination. Subsequent to welding, the blade is to be stress relieved by heating uniformly in a furnace. After final machining the repaired area is to be re-inspected using the dye penetrant technique.

7.9.6 If a crack is discovered in one blade of a propeller all the other blades are to be examined for similar cracks using dye penetrant inspection.

7.9.7 After re-assembly of the propeller at screwshaft surveys and at each drydocking between PS Surveys, care is to be taken to ensure that the hub is completely filled with grease and all joints and seals found tight. The recommended procedure is the following:

(a) When the plugs in the hub are removed the grease pack is to be probed both top and bottom to break the coating of grease over the plug holes and allow any water to drain out, which is not to be more than approximately half a cupful.

(b) The procedure for checking the fill of grease is to be as follows:
   (i) Move crosshead to the maximum forward position.
   (ii) The most forward of the two grease plugs is to be on the underside.
   (iii) Connect the grease pump to the lower plug hole. (iv) Probe through the upper plug hole to open any voids in the grease aft of the crosshead.
   (v) Pump in grease until full flow issues from the upper plug hole.
   (vi) Replace upper plug and move propeller mechanism several times full ahead to full astern finishing with crosshead fully forward.
   (vii) Remove upper plug and again probe to open any voids in the grease.
   (viii) Use grease pump to check hub is full. If a substantial amount of further grease required before full bore flow from upper plug hole is obtained then repeat steps as per *its (vi), (vii)* and *(viii).*
   (ix) Fit and lock plugs.

(c) During re-assembly of a dismantled propeller the hub is to be packed by hand. Joint faces are to be cleaned before jointing compound is applied. Finally all stages in *subparagraph (b)* are to be complied with.

7.9.8 On completion of surveys full details of the extent of survey carried out are to be reported.

SECTION 8. SURVEYS OF BOILERS, THERMAL OIL HEATERS AND HOT WATER HEATERS

8.1 GENERAL INSTRUCTIONS

8.1.1 A boiler which can supply steam to the main propelling machinery is to be considered as a **main boiler**.

8.1.2 A boiler which can supply steam to auxiliary machinery which is essential to the safe operation of the ship at sea, but cannot supply steam to the main propelling machinery is to be considered as an **auxiliary boiler**. Steam supplied for heating high viscosity oil fuel for use in oil engines is regarded as an **essential service**.

8.1.3 A boiler which can supply steam only for purposes not essential to the safe operation of the ship at sea is recorded as a **domestic boiler**.

8.1.4 Where high pressure steam is generated in the closed primary circuit of an oil fired boiler and used to generate low pressure steam in a secondary pressure vessel, the high and low pressure components are to be considered one boiler and the respective working pressures of both components.

8.1.5 A forced circulated exhaust gas heat exchanger which cannot supply steam direct to the steam range, but is required to use a fired boiler as its steam receiver, is to be considered as an **economizer**.

8.1.6 A forced circulated exhaust gas heat exchanger which cannot supply steam direct to the steam range but is provided with its own unfired steam receiver, is to be considered as a **boiler.**

8.1.7 Forced circulation pumps used in conjunction with exhaust gas heat exchangers are to be examined as part of the engine.

8.1.8 An exhaust gas heat exchanger which can deliver steam directly to the steam range is to be considered as a **boiler.**

8.1.9 Thermal oil heaters and hot water heaters, whether fired or heated by exhaust gas, are to be dealt with as follows:

(a) All units, whether used for essential or domestic purposes, with a working pressure **in excess of 3.4 bar** are to be surveyed at 2½-yearly intervals and examined externally at the Annual Survey of the ship in accordance with of the Rules.
(b) All units used for essential services with a working pressure **less than 3.4 bar** are to be surveyed at the intervals required by the Rules for essential auxiliary machinery. These cases will be found coded in the Master List as ***O-f/Exh.g. Thermal Oil/Hot Water Heater*** and are to be dealt with as part of the ES or CSM cycle.
(c) Units not used for essential services and with a working pressure **less than 3.4 bar** may not be surveyed.

8.1.10 The survey date assigned to any boiler, exhaust gas heated economizer or steam heated steam generator is to be that of the internal examination. In cases where a ship remains in port without the appliance being placed under steam, the date of survey recommended is to be not more than **2 months** after the date on which the internal examination was held. If a later date is required, a further internal survey is to be carried out.

8.1.11 When, at the time of a Boiler Survey, it is found necessary to impose a Condition of Class to be dealt with before the next due date of survey no new record is to be recommended. However, on deletion of the Condition of Class, a fresh record coinciding with the last complete examination of the boiler is to be recommended.

8.1.12 Conditions of Class containing time limits equal to or in excess of the normal cycle time are not to be imposed. However, when a Surveyor considers necessary to record a minor defect which is acceptable until the next due survey he may recommend a suitable entry for the Memoranda (Machinery).

8.2 EXAMINATION OF BOILERS, THERMAL OIL HEATERS AND HOT WATER HEATERS

8.2.1 The survey of thermal oil heaters and hot water heaters (Boiler Survey) is to include ancillary equipment which, together with the controls, is to be examined under working conditions and the correct adjustment of any safety devices verified.

8.2.2 The Surveyor is to carry out himself a thorough examination of each boiler, together with its super heater, superheat control, air heater and economizer, if fitted.

8.2.3 If a boiler has not been sufficiently cleaned to allow a proper examination of pressure parts, the survey cannot be regarded as complete until this has been done.

8.2.4 Where the construction of a boiler does not allow direct visual internal examination of the shell, drums or headers, the Surveyor is to be satisfied that the boiler is in a safe working condition by resorting to remote viewing instruments, ultrasonic examination, or hydraulic testing at
130% the working pressure.

8.2.5 The following precautions are always to be taken by the Surveyor before entering any boiler:
(a) That the boiler has been adequately ventilated.
(b) That some responsible person is aware that the
Surveyor is about to enter the boiler.
(c) That the responsible person is in attendance during the survey.
(d) That measures have been taken to prevent admission of steam or water from another boiler during the time the Surveyor is inside.

8.2.6 The mountings are to be opened up for internal examination and rectification as necessary. The Surveyor is to be sure that all mountings are securely attached and have insulation cut away where this prevents full examination of studs and nuts. Stub piece welds are to be examined in way of attachment to shell.

8.2.7 Shell plating in way of nozzles penetrating the shell and pads attached to the shell are to be carefully examined for cracks originating from the welds.

8.2.8 All water gauges and pressure gauge connections are to be free from obstructions and their shut-off fittings clearly and correctly marked to indicate when they are in the open position. High and low water level alarm fittings and feed water regulators are to be examined.

8.2.9 A thorough external examination of boilers is to be carried out. Boiler supports, chocks, rolling stays, uptakes and the funnel base are to be in satisfactory condition. Supports of both cylindrical and water tube boilers are to be given special attention with lagging removed where necessary.

8.2.10 The supports of water tube boilers have been known to crack, the defect being induced by restricted or seized sliding feet. Rolling stays are to be specially examined in way of attachments to the shell or casings and freedom of pins is to be verified.

8.2.11 Many fatal accidents have occurred due to the failure of joints of manhole, mudhole or handhole doors and it is, therefore, important to ensure that the jointing faces are in good condition and that the clearance at the spigot does not exceed 1.5 mm at any place.

8.2.12 In water tube boilers all integral piping up to and including the main stop valve are to be considered part of the boiler for survey purposes.

8.2.13 The furnace linings and casings of water tube boilers are to be in satisfactory condition. Severe cracks have developed in steam or water drums when exposed to radiant heat due to defective insulation, thus such areas are to be thoroughly examined.

8.2.14 Welded connections of stub pipes to integral steam piping, particularly in way of superheater safety valve branches, are to be specially examined for cracks by magnetic crack detecting methods where considered necessary.

8.2.15 Pressure parts operating at high temperatures, such as superheater outlet headers and manifolds, may be subject to creep damage which can result in failure. In cases of such pressure parts which are not heated by hot gases, the highest metal temperature occurs at the internal surfaces where cracking can commence. These cracks are usually not discovered until the full thickness has been penetrated. No attempt at a welded repair is to be made without reference to HO, and if the internal surfaces cannot be crack detected it will probably be necessary to renew a length of section. Creep damage may also occur to pressure parts which are heated by hot gases, but in these cases the hottest metal temperature occurs on the outer surfaces, and the cracks are therefore more readily detected by visual inspection.

8.2.16 In horizontal smoke tube type boilers, the undersides of the tubes, on the waterside, adjacent to the back tube plate sometimes suffer from intense local corrosion. Therefore, tubes are to be examined in this area as far as practicable. When considered necessary, removal of sample tubes may be requested.

8.2.17 Plugging of smoke tubes by driving home tapered stoppers with or without seal welding to tube ends, will not be acceptable. Stoppers are to be fitted with tie rods. If at the time of the examination, smoke tubes are found fitted with stoppers, and new tubes will not be fitted, the stoppers are to be removed for examination of the tie rods.

8.2.18 Particular attention is to be given to the tubes of air heaters of smoke tube type boilers as they are often subject to rapid wastage. When access to the air side of the heater is difficult, a simple test may be made by running the forced draught fan with the air dampers or valves at the furnace front closed while examining the tubes for leakage. If considered necessary, sample tubes may be removed to determine their condition.

8.2.19 Longitudinal stays attached to end plates by external and internal welds are to be examined at the inner welds for possible cracking. All such stays are to be drilled at the ends with *tell-tale* holes about 5 mm diameter and of sufficient depth to penetrate the centre of the stay beyond the inner weld.

8.2.20 Welded connections of upper tube plate to the shell on certain tank boilers of the Aalborg AQ3 type are to be specially examined for grooving and/or cracking in the boiler shell adjacent to the toe of the weld. In some cases serious cracking has been reported. Repair of this type of defect calls for careful consideration and full details of the extent of defects found and any repair proposals are to be forwarded to HO in the first instance.

8.2.21 Aalborg dual evaporation boiler

8.2.21.1 Surveyors are to take account that an Aalborg dual evaporation boiler suffered an explosion of the secondary stage drum, causing fatalities. Subsequent examination of the drum revealed heavy corrosion on the water side, in the lower part below the heating elements.

8.2.21.2 Large areas were found pitted but specially the areas in way of the circumferential and longitudinal seams which showed heavy corrosion, in some areas so deep that only a few millimetres of shell plating were left prior to the explosion.

8.2.21.3 Special examination of other boilers of this type has since been carried out and there are indications of cracks present in some drums. The manufacturers have advised all Owners of ships where these boilers are fitted as follows:
(a) The drum is to be drained and the two manhole doors item Nos. 2 and 3 (*fig 8.2.21*) to be opened up.
(b) The lower part to be cleaned of sludge.
(c) The welds item Nos. 4 and 5 below the heating elements to be ground smooth.
(d) The area around the welds to be subjected to an M.P.I.
(e) If any indication of cracking is found it is to be removed by grinding and afterwards verified by M.P.I.
(f) Panama HO is to be advised of any indications of faults.
(g) Before the boiler is put back into service the drum has to be repaired according to the MCO requirements.

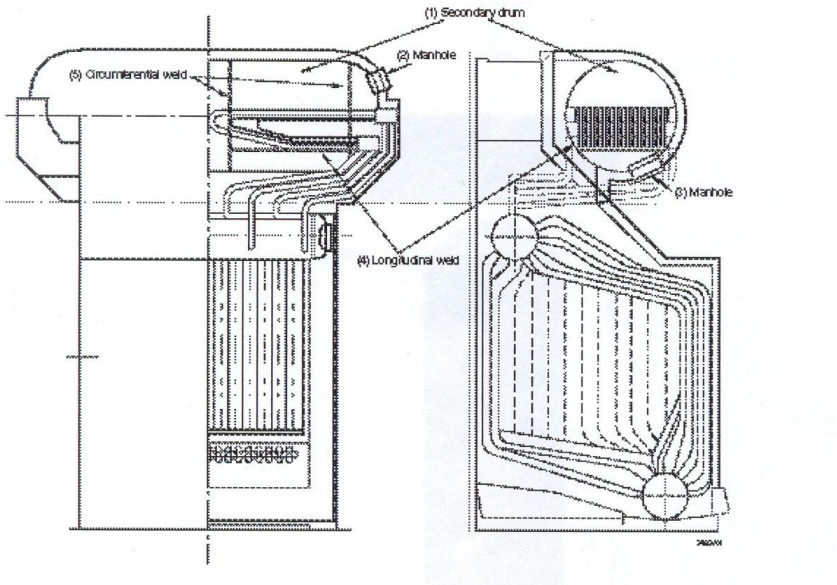


Fig 8.2.21 Secondary stage drum of Aalborg dual evaporation boiler

8.2.21.4 Surveyors are to be guided by the above information when holding surveys of Aalborg dual evaporation boilers and findings are to be reported.

8.2.22 Sunrod Auxiliary Boilers Types CPH and CPDB

8.2.22.1 A number of boilers of these types operating in conjunction with exhaust gas economizers with open feed systems have been found with cracks in regions below the water level where corrosion has occurred.

8.2.22.2 The cracks have been in way of main circumferential and vertical seams and also in way of welded connections to the shell. *Fig 8.2.22* shows typical examples.

8.2.22.3 In the case of the main seam welds the cracks appear to start from the bottom of the corrosion pits. The cracks are mainly transverse to the circumferential seams, and follow the general direction of the seam in way of the heat affected zone in the case of longitudinal seams. Stress corrosion is considered to be the cause of the cracks.

8.2.22.4 For the above application, the a.c. electromagnetic yoke technique using black magnetic ink with white contrast paint is to be used. If any cracks are found, full details are to be reported immediately to HO, with proposals, before any repairs are commenced. When repairs are made, a suitable Machinery Memorandum item is to be inserted.

8.2.23 Horizontal oil fired tank type boilers.

8.2.23.1 Cracks have been found in the shell of this type of boiler in way of inset flat end plates. The cracks generally start from the toe of the internal fillet weld and propagate through the shell.

8.2.23.2 Crack propagation is generally due to corrosion fatigue. The boiler shell in way is therefore to be specially examined during Boiler Surveys. Details of any defects found and the proposed repair procedures are to be submitted to HO before repairs are commenced.

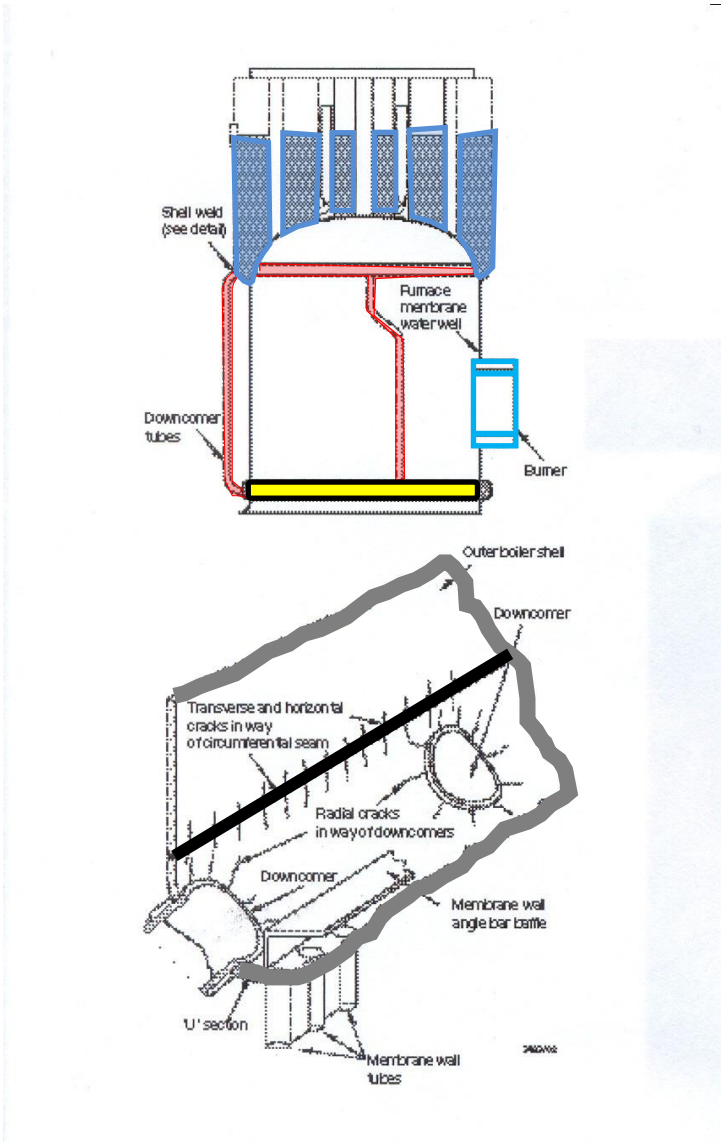


Fig 8.2.22 Typical examples of cracks in way of main circumferential and vertical seams

8.2.24 Cracking in furnaces of horizontal multitubular smoke tube boilers.

8.2.24.1 Circumferential cracking of furnaces at end plate connections has led to serious failures. Cracking starts at the toe of the water side fillet weld and is associated with undercutting or grooving (see *fig 8.2.24).*

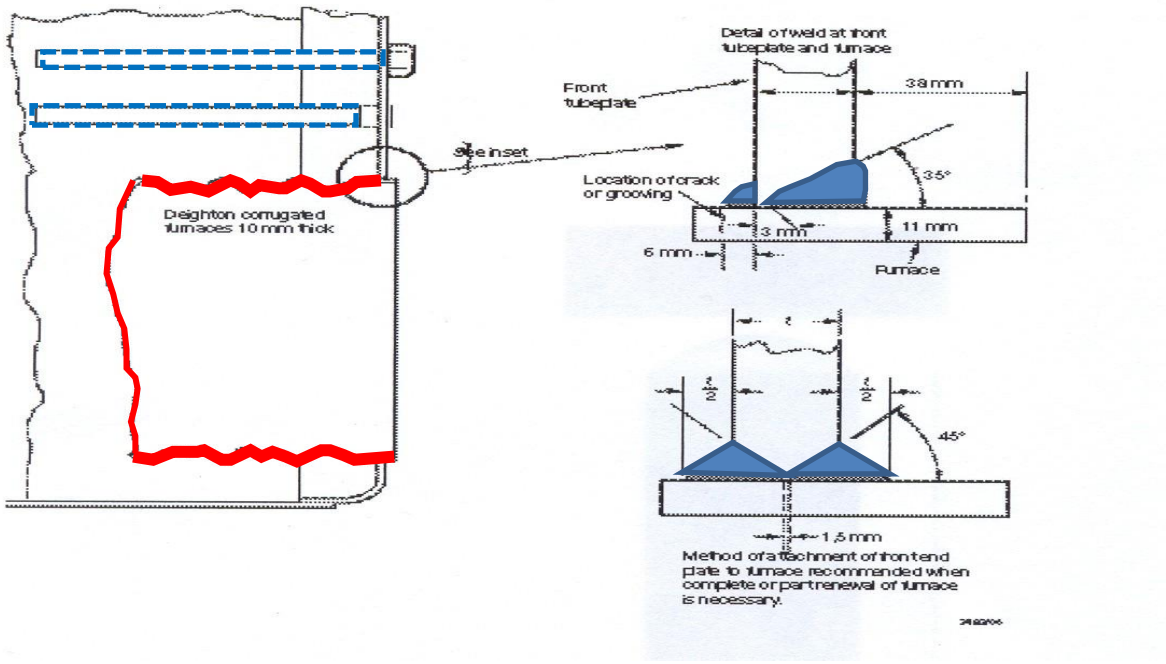


Fig 8.2.24 Example of circumferential cracking of furnaces at end plate connections of horizontal multitubular smoke tube boilers

8.2.24.2 When restricted access prevents examination of the fillet weld from the water side, ultrasonic examination is to be made from inside of the furnace. If cracking is found, repair is to be carried out by renewing a cylindrical section of the furnace.

8.2.24.3 As restricted access usually prevents the execution of a complete sound internal fillet weld, it is preferable to carry out a single side weld from the front, using a GMAW root run giving full penetration with a smooth root bead. Temporary repairs by veeing out and rewelding are not to be undertaken

8.2.25 Cleanliness of exhaust gas economizers

8.2.25.1 When surveying exhaust gas economizers, particular attention is to be paid to cleanliness. Combustion products, particularly those associated with modern long stroke diesel engines, can be such that deposits rapidly build up in economizers and create a fire hazard. A general examination of the cleaning facilities is to be made and the Owner's attention is to be drawn to the economizer manufacturer's recommendations when doubts about cleanliness arise.

8.2.26 Examination of thermal oil heaters

8.2.26.1 Thermal oil heaters and their fittings are generally not prone to internal defects due to the essentially non- corrosive nature of the oil.

8.2.26.2 When surveying these units, external examination, as far as practicable, is to include a thorough examination of tubes,

tube supports and hangers for evidence of chaffing or fretting of tubes.

8.2.26.3 In many installations it is impractical to drain down the entire system to permit a total opening out of mountings and fittings. In such instances the surveyor is to determine the integrity of mountings and fittings by test and operation under working conditions.

8.2.26.4 On completion of the survey, particular attention is to be paid to the burning equipment and operation of safety devices.

8.2.26.5 On pressurized thermal oil heaters where it is not possible to raise the operating pressure, the following procedure is to be adopted for the verification of relief valves:
(a) Following the initial set pressure verification, at the first and subsequent 2½ year survey intervals, the Surveyor is to note the setting of the pressure relief valve adjusting device. The pressure setting is then to be reduced until the valve lifts for the Surveyor to verify that the valve functions with flow occurring. The Surveyor is then to witness that the setting is returned to the original position.
(b) At 10 year intervals the pressure relief valve is to be removed for examination and a bench test where verification of the set pressure is to be carried out.
(c) If the thermal oil is changed at any intermediate date, the set pressure verification is to be done at that time and the 10 year period would be counted therefrom.
(d) All other safety devices are to be verified.

8.3 INTERNAL CORROSION

8.3.1 MAIN WATER TUBE BOILERS

8.3.1.1 If corrosion is found in the steam and water drums of water tube boilers using a closed feed system incorporating a deaerator, it indicates that the limits for the feed and boiler water condition recommended by the boiler maker and water treatment supplier are not being maintained. The Owner's attention is to be drawn to the operating requirements.

8.3.2 AUXILIARY BOILERS ON MOTOR SHIPS

8.3.2.1 Auxiliary boilers on motor ships, using open feed systems and working in conjunction with exhaust gas economizers and atmospheric dump condensers, are often prone to excessive corrosion due to lack of attention to the feed and boiler water condition. In these systems, low feed tank temperatures result in feed water retaining large amounts of oxygen which, if not dealt with, leads to general corrosion pitting.

8.3.2.2 In regions of high stress, for example non-stress relieved welds, this can lead to cracking as a result of stress corrosion or corrosion fatigue mechanism. The Owner's attention is to be drawn to the operating requirements.

8.4 BOILER REPAIRS

8.4.1 Materials for boiler repairs are normally to be supplied with certificates issued by the MCO or any recognized Society. If problems with supply arise, other materials may be considered, but check tests may be required to ensure that the material is satisfactory.

8.4.2 Welded repairs are to be carried out in accordance with a qualified welding procedure. The Surveyor is to ensure that the welders are capable of carrying out the qualified welding procedure.

8.4.3 When plating is found corroded or wasted it is not to be dealt with by fitting doubles.

8.4.4 Isolated and scattered pitting may be dealt with by cleaning out and coating the area with a suitable protective medium.

8.4.5 Corrosion pitting which is localized along a main longitudinal or circumferential seam could be an indication of stress corrosion, with the possibility of cracks starting from the bottom of the pits.

8.4.6 The possibility of cracks is greater when the welds have not been post-weld heat treated. If, after grinding out and proving crack-free by MPI, the remaining wall thickness is not less than the Rule requirements, (see *RSTE VI-2, Sec 2*) no further action need be taken after blending the profile.

8.4.7 If deeper grinding is necessary to remove the corrosion, at the conclusion of which there is no evidence of cracks extending from the weld into the heat affected zone or parent plate, the corroded weld may be built up by welding with the finished weld being ground flush with the surrounding surface. There are to be no repairs by weld build up if there is any cracking extending from

the weld into the heat affected zone or parent plate. This type of defect is to be repaired by cropping and part renewing.

8.4.8 Corroded areas of plating away from welded seams which is considered scattered may, after surface grinding, require no further action provided the following conditions are met:

(a) There is no cracking found by MPI after grinding.
(b) The area of pits does not exceed 15% of the surface area of a 200 mm diameter circle enclosing the pitted area.
(c) The sum of pit lengths in straight lines within the circle does not exceed 50 mm.
(d) The depth of any pit does not exceed 50% of the wall thickness. Areas of corrosion where the paragraphmeters described above are exceeded may be built up by welding provided the following points apply:
(e) The area to be welded does not exceed in size the permissible area of a non-reinforced opening in accordance with the Rules, (see *RSTE VI-2, Subs 3.2*) and the average remaining wall thickness has not diminished by more than 50 %.

(f) Large areas may be built up by welding if the remaining wall thickness is not less than the Rule thickness (see *RSTE VI-2, Sec 2*) and the following conditions are met:
  (i) Plate material specifications are ascertained to enable the suitable selection of a low hydrogen electrode. Post weld heat treatment is to be considered.
  (ii) The weld procedures are qualified using a butt weld test piece.
(g) MPI is to be applied extensively prior to and on completion of welding.

8.4.9 Serious corrosion or wastage will require the working pressure to be reduced, or the plate to be cropped and part renewed. Insert plates are to have well rounded corners.

8.4.10 Welding of insert plates is to be carried out from both sides wherever possible. If access makes this difficult, a single sided weld may be used, the root run is to be gas metal arc welding (GMAW) or gas tungsten arc welding (GTAW) giving full penetration with a smooth root bead. NDE as for Class 1 fusion welded pressure vessels is to be carried out. Particulars of proposed weld repairs are to be submitted to HO.

8.4.11 Where cracks have been found in the shell plating in way of fixing lugs or supports, the doubling plate if fitted is to be removed, the ends of the crack determined and drill stopped.

8.4.12 The crack is to be veed out and welded from both sides and ground flush, X-rayed and crack detected.

8.4.13 The doubling plate is to be extended to cover the repaired area. Where doubling plates were not fitted originally these are now to be fitted, the fillet welds to be crack detected. It is to be noted that doubling plates are to be well rounded at the corners and provided with tell-tale holes.

8.4.14 When boilers are being re-tubed the Surveyor is to carefully examine the tube plates and tube holes (which are to be checked for roundness) before the new tubes are fitted.

8.4.15 An hydraulic test is to be carried out on completion of any welded repair necessary to restore a boiler to a safe and satisfactory operating condition. The hydraulic test is to prove the boiler for the intended working pressure as determined by the set pressure of the safety valves, which may possibly be less than the original approved design pressure.

8.4.16 The minimum design temperature for boilers is 250°C. The hydraulic test will probably be carried out at not more than 50°C. At 250°C the 0.2% proof stress of typical boiler steels is about 85% of the 0.2% proof stress at 50°C. A test carried out at 50°C, with a pressure of 120% the working pressure, will strain the material to the same percentage of the proof stress that will occur at working pressure at 250°C. Therefore, in order to provide a reasonable factor of safety, the test pressure is to be at 140% the intended set pressure of the safety valves. In no case the test pressure is to exceed the original test pressure stamped on the part. The boiler water is to be warmed to 30°C - 50°C for the purpose of the test.

8.5 EXAMINATION UNDER STEAM AND ADJUSTMENT OF SAFETY VALVES

8.5.1 An important part of a Boiler Survey is examination under operating conditions and will include:

(a) Verification of the calibration of the boiler pressure gauges. Where the calibration cannot be readily verified, a written statement is to be obtained from the Master/Chief Engineer confirming that the gauges have been calibrated. Alternatively, consideration may be given to a second gauge for verification of the primary gauge. Detailed records are to be kept in the local file.
(b) Establishing that water level indicators are operating correctly by utilising a methodical blowdown sequence.

(c) Testing all safety and alarm equipment.
(d) Observation of boiler starting sequences and firing.

8.5.2 A general examination of the associated oil fuel system including fuel tank valves, pipes, deck control gear is also to be carried out.

8.5.3 For a solid fuel fired boiler, fuel storage, handling, burning and ash disposal plant are to be examined under working conditions.

8.5.4 Safety valves are to be adjusted under steam to not more than **103%** of the approved design pressure. he Survey Report unless down- rated. In all cases, the pressure to which the safety valves have been set is to be reported and a record left on board.

8.5.5 High pressure boilers with superheaters will usually have two safety valve pressures recorded. The lower pressure relates to the superheater safety valve setting.

8.5.6 The blowdown characteristics of modern high pressure relief valves is adjustable and normally set to re- seat up to 5% below normal working pressure. A non adjustable type valve may have a blowdown of up to 15%.

8.5.7 Consideration may be given to the setting of special safety valve designs on manufacturer's test rigs.

8.5.8 In all cases where a boiler is down-rated, an accumulation test is to be carried out to confirm adequate safety valve performance.

8.5.9 The normal procedure for adjusting safety valves for dual evaporation boilers will be as follows:

(a) The secondary drum water level will be dropped until effectively dry, whilst the primary drum water level is maintained.
(b) Pressure in the primary drum will then be raised to the approved pressure and the primary drum safety valves are adjusted. (If during this operation the secondary drum safety valves lift, these can be provisionally adjusted to their set pressure).
(c) The secondary drum water level will then be raised to the normal working level after which the safety valves will be set as for a normal cylindrical boiler. (Care is to be taken not to fill a hot secondary drum with cold feed water).

8.6 GENERAL PROVISIONS FOR BOILER SURVEY

8.6.1 A Boiler Survey date cannot be assigned until all requirements associated with this section have been complied with. Therefore, every effort is to be made to complete the survey prior to departure from the port of survey. If for any reason the survey is not completed, the Owners definite intentions regarding completion are to be ascertained.

8.6.2 Details including the proposed port and date when the survey is to be completed are to be reported without delay to HO.

8.6.3 Regarding exhaust gas heated units, Chief Engineers are to be advised of the correct working pressure at which safety valves are to be adjusted at the earliest opportunity.

8.6.4 Arrangements are to be made for the Chief Engineer to forward a statement confirming the date of adjustment, the actual pressure and the Engineer's name to the attending Surveyor or Station where the survey was carried out.

8.6.5 If defects are noted which are not dealt with during survey, the Surveyor should state whether or not they affect the safe operation of the boiler.

8.6.6 When the Surveyor considers that repairs are to be carried out before the date when the next Boiler Survey is due a definite date is to be stated, and expressions such as "*For completion during Boiler Survey*", or "*At the next Boiler Survey*", are not to be used.

8.6.7 When repairs other than a few stoppered tubes and similar items of minor importance, are outstanding, the MCO will not normally assign a new record of Boiler Survey until they are completed and this is to be taken into account when issuing Interim Certificates and making recommendations in reports.

8.6.8 When a boiler is found defective and not fit for service a Condition of Class is to be imposed for the boiler not to be used until repaired and surveyed.

8.6.9 If the boiler is to be out of use for a long period (over 1 month) arrangements are to be made to isolate it from the fuel, steam, and water system, and a suitable Memorandum item noted. Care is to be taken to ensure sufficient steam, or alternative arrangements, remain onboard for essential services.

SECTION 9 STEAM PIPE SURVEY

9.1 SELECTION OF PIPES TO BE TESTED

9.1.1 The requirements for a Steam Pipe Survey are given in the Rules for Ships. In selecting pipes for test the number chosen are to be relative to the size of the installation.

9.1.2 The samples selected are to be located in positions where bending stress conditions and/or corrosion are likely to be most severe.

9.1.3 When the selected lengths have been removed they should, together with those adjoining, be examined internally and at the flanges. It is important to examine welded flanges and similar connections for possible cracking.

9.1.4 Where screwed plugs are fitted adjacent to circumferential butt welds in steam pipelines, the plugs are to be removed for internal examination, particularly of the weld, by introscope or other suitable means.

9.1.5 The lengths tested are to be stamped on the peripheries of the flanges with the test pressure, date and Surveyor's initials. The lengths are to be selected so that, in the course of surveys, all pipes which require examining and testing will be dealt with. To facilitate this, the number of lengths tested and their positions are to be stated in the report. All saturated steam pipes for super heaters fitted in the smoke boxes of cylindrical boilers are to be tested at each survey.

9.1.6 In installations where access for internal examination of steam pipes is restricted and effective examination is prevented, or pipes have welded joints between lengths, consideration is to be given to using ultrasonic non-destructive inspection techniques. Special attention is to be paid to areas of stress, corrosion, and welding.

9.2 STEAM LINES

9.2.1 As part of the Steam Pipe Survey the steam lines are to be generally examined and the Surveyor is to satisfy himself that the drainage and supporting arrangements are in order.

9.3 HEATING COILS IN TANKER CARGO TANKS

9.3.1 In the case of oil tankers, when heating coils in cargo tanks are removed for any reason or are found to be defective, blank flanges are to be fitted to the main steam and exhaust pipelines for the cargo heating system at a suitable position forward of the machinery space bulkhead to eliminate the possibility of oil vapor gaining access to the machinery space via these pipelines if valves in the system should be inadvertently left open.

SECTION 10 MACHINERY SURVEYS OF NON SELF-PROPELLED VESSELS

10.1 GENERAL PROVISIONS

10.1.1 The requirements of this Section do not apply to the auxiliary machinery and electrical installations of floating dry-docks, converted tankers used as oil storage barges, mobile offshore units or drilling rigs, etc., for which the appropriate Rules or International Codes will be applied.

10.1.2 Surveys of boilers fitted in this type of vessels are to be carried out as for self-propelled ships and at each Special Survey of the hull the pumping and piping arrangements are to be generally examined and tested under working conditions.

10.1.3 The sea connections are to be opened up and examined.

10.1.4 In general, pumps or prime movers need not be opened up for survey unless considered necessary on the basis of the foregoing examination and testing.

10.1.5 Where non-propelled vessels are classed for the carriage of oil with a flash point **<60°C** and are fitted with auxiliary electrical equipment, this equipment is to be examined and tested as required for self-propelled oil tankers.

SECTION 11 MACHINERY REPAIRS

11.1 RECOMMENDATIONS

11.1.1 When it is considered that machinery parts are to be rectified, repaired or renewed, the Owner's representative is to be advised without delay. If it is found impracticable to deal with any such item before the ship sails and the Surveyor considers that deferment is permissible, he will decide the maximum period machinery may remain in service without impairing the safety of the ship. Normally the maximum period is not to exceed 3 months, but a shorter period may be necessary. In any case the period is not to be greater than one year. When deciding periods for postponement of repairs or for re-examination, it is essential to fix a precise date.

11.1.2 The use of terms such as "*The next survey"*", "*Upon arrival at*", or "*The next drydocking*" are to be avoided unless accompanied by a date. Any recommendation for deferred repairs is to appear in the Survey Report and an identical statement is to be included in the Interim Certificate.

11.1.3 When the Surveyor is aware that the ship is proceeding to a particular port to continue the survey or carry out repairs, he is to ensure that the Surveyors at that port are fully advised of the position and of his recommendations.

11.1.4 Whenever necessary for multiple screw ships to operate with one shaft line out of operation the idle shafting is to be securely locked to ensure that no damage may be caused to the engines or gearing as a result of propeller rotation.

11.2 CONDITIONS OF CLASS

11.2.1 Items recommended to be dealt with in the foregoing manner are termed Conditions of Class, since class maintenance becomes conditional on or subject to something being done.

11.2.2 All recommended Conditions of Class are to be quoted in Interim Certificates and in the appropriate Condition of Class, machinery section of the Survey Report. Conditions of Class are shown in the Survey Report and included in the Quarterly Notice to Owners. Surveyors are not to recommend the imposition or continuance of Conditions of Class without giving the matter the fullest consideration.

11.2.3 After a satisfactory period of service, Conditions of Class may sometimes be recommended for deletion or, if considered appropriate, the record in question may be transferred to the Memoranda (see *Subs 11.4*). For recommendations regarding repairs effected to welded bedplates, columns or entablatures (see *paragraphs 2.2.15 - 2.2.18*).

11.3 EXTENSION OF TIME LIMIT FOR CONDITIONS OF CLASS

11.3.1 Owners often apply, through the local Surveyors, for an extension of the time limit imposed for dealing with a Condition of Class. In some instances the condition was originally recommended by, or the item in question was last examined by, the local Surveyors themselves and in such cases it is essential that, when transmitting the Owner's request to HO, the Surveyors state their own views as to whether or not the request may reasonably be granted.

11.3.2 There have been many occasions where a Surveyor has visited a ship which has a Condition of Class requiring action by a certain date which is already overdue at the time of his visit but, for various reasons, the matter has not been dealt with. In such cases, if the Condition of Class cannot be dealt with, the Surveyor is to discuss the matter with the Chief Engineer, ascertain from him that the item in question has been functioning satisfactorily and consider whether, on the basis of information obtained, he can reasonably recommend an extension of the time limit for the required survey. At the same time he is to impress upon the Chief Engineer the necessity of dealing with the matter within the period he will recommend.

11.4 MEMORANDA - MACHINERY

11.4.1 Sometimes examination of machinery may reveal blemishes of a minor character which do not affect its safe and efficient operation and may, therefore, properly be left to the initiative or discretion of the Owner.

11.4.2 A broken part may be repaired in such an efficient manner that the Surveyor does not consider re- examination

or renewal necessary. Nevertheless, the attending Surveyor may place such blemishes on record in case they arouse comment at future surveys. In these circumstances an appropriate entry in the Memoranda - Machinery is to be made.

11.4.3 In addition to conveying information regarding blemishes, during surveys the barred speed ranges and other general matters, such as Master List changes, may also be recorded by Surveyors when they wish to draw the attention to items which must receive more than normal attention at subsequent surveys, but which are nevertheless not sufficiently serious to warrant the recording of a Condition of Class.

11.5 RESPONSIBILITY FOR RECORDING DEFECTS OR BLEMISHES

11.5.1 From *Subs 11.1-3* it is clear that a Surveyor has a choice of methods for recording defects, blemishes or informative notes. Irrespective of which method is used, it must be clearly understood that neither a Condition of Class or a Memoranda entry can be used as a means of escaping responsibility for making a decision, and the Survey Report must clearly indicate that in the Surveyor's opinion the part in question is considered to be efficient and will not effect adversely the safe working of machinery during the recommended period of postponement.

11.6 DAMAGE SURVEYS

11.6.1 When the machinery is damaged as a result of a casualty, fire, fracture of some part, negligence, latent defect or similar cause, the Surveyor is to recommend repairs or further examination at a later date which he considers necessary in order to maintain the class. He is to ascertain if the Owner or Underwriters wish him to make a Special Damage Report.

11.7 REPAIRS

11.7.1 The Surveyor is to ensure that all essential repairs are efficiently carried out and, whenever advisable, is to witness a working test on completion.

11.7.2 When important forgings or castings are renewed, the test marks are to be included in the report, and a copy of the certificate attached.

11.7.3 If it is found necessary to replace any important part with one not manufactured under survey by the MCO or a recognized Society, the Surveyor is to carry out a careful examination of the replacement, effect any possible check tests, obtain works or other test certificates and report the full facts to HO.

11.7.4 Special consideration is to be given to rectification or repairs to iron castings, particularly as grey and spheroidal graphite irons have inferior welding characteristics.

11.7.5 When repair procedures are being proposed which have not been approved previously, full particulars of the proposal are to be forwarded to HO for approval.

11.8 REPAIRS AT SEA

11.8.1 When an Owner wishes to carry out repairs at sea to boilers, pressure vessels and important machinery items which affect classification, the MCO will require that a satisfactory measure of control is exercised. In all cases where it is proposed to effect such repairs, the following procedures are to be adopted:

(a) Repair methods are to be discussed with the Owner and his repair contractors and approved by the Surveyors to the MCO. No repairs may be undertaken until such approval has been obtained.

(b) The Surveyors are to satisfy themselves regarding the suitability of materials to be used in the repair of pressure parts.

(c) Arrangements are to be made for important welded connections to be prepared and examined by the Surveyors before welding is commenced.

(d) The welding sequence is to be stated and agreed to by the Surveyors, who are to satisfy themselves regarding the experience of the welders.

(e) Wherever necessary, facilities for pre-heating and stress relieving are to be placed on board the vessel. Welding electrodes are to be of an approved type with adequate arrangements for proper storage.

(f) The vessel's itinerary is to be obtained from the Owner and Surveyors at intermediate and terminal ports of call fully advised of the case. Arrangements are to be made for examination of work in progress and on completion with suitable non-destructive testing methods, appropriate hydraulic tests and subsequent examination under working conditions.

(g) All Surveyors concerned in such repairs are to ensure that, in addition to preparing reports for HO, full documentation of

their involvement is placed on board the vessel for the guidance of Surveyors at the following port of call.

11.9 DAMAGED MACHINERY

11.9.1 Machinery that is no longer suitable for use is to have all MCO marks expunged (e.g. condemned crankshafts, hard stampings on web are to be defaced).

SECTION 12. SECOND-HAND PARTS AND UNAUTHORIZED SPARES

12.1 REQUEST FOR EXAMINATION

12.1.1 Surveyors are sometimes requested to examine second-hand parts. If the part is intended for disposal or sale and was not originally made under MCO survey, the request is to be refused, unless authorization has been given by HO, since any certificate or other statement issued might give the impression that the part was constructed under MCO survey.

12.2 FITTING ON CLASSED SHIPS

12.2.1 Where it is proposed to fit on board a classed ship a second-hand part intended for essential service and which was not made under MCO survey, it is to be examined throughout, the scantlings checked and any necessary hydraulic, electrical or running tests applied.

12.2.2 When the part in question is fitted in place of one which has been removed on account of damage or for some other reason, the Surveyor is to verify that its power or capacity is adequate for the purpose intended. Whenever possible the certificate of origin is to be obtained.

12.2.3 If the part is of major importance, the circumstances should first be referred to HO for consideration. After applying appropriate tests the Surveyor may stamp and date the part accordingly, but the stamps *tested* are not to be used, since this would imply that the construction complied in all respects with the MCO requirements.

12.2.4 For small pumps and similar items a test under working conditions may usually be sufficient but the Surveyor may have the item opened out if he considers this necessary.

12.3 NON-APPROVED SPARES

12.3.1 Original equipment manufacturers (OEMs) are strongly recommending that only original or authorized spare parts are fitted when replacements become necessary, The main technical case for this recommendation is that the latest developments/modifications can only be obtained with parts supplied by OEMs or their licensees (authorized manufacturers).

12.3.2 If unauthorized parts are supplied with a MCO certificate there is an implication taken by purchasers that the parts are acceptable regardless of any comments from the OEM or the extent of the MCO inspection. Therefore, Surveyors are always to satisfy themselves, before attending for hydraulic tests and finish machined examinations that the manufacturer has the required detailed drawings and specifications and the necessary expertise to produce an acceptable quality and finish for the parts.

12.3.3 Whenever a Surveyor has concerns regarding the proper authorization of the manufacturer, whilst being fully satisfied with the overall quality of the product, particular care is to be taken with the wording of the certificate. For example an OEM's type reference is not to be quoted and a recommendation included of the parts being examined prior to installation by the original equipment manufacturer or authorized service agency to confirm compliance with their latest specifications or instructions.

SECTION 13. APPROVED CHIEF ENGINEER SCHEME

13.1 GENERAL PROVISIONS

13.1.1 Under the Approved Chief Engineer Scheme, (ACES) certain parts of the machinery may be surveyed and overhauled by the Chief Engineer while the ship is at sea or in a port where Surveyors to the Society are not available.

13.1.2 This scheme applies only to ships whose machinery is under a CSM basis. It does not apply to Owners' Superintendents.

13.1.3 Requirements of *Subs 13.2* and *13.3* are to be complied with.

13.2 ADMINISTRATIVE ARRANGEMENTS

13.2.1 The prescribed form of application for approval is to be completed, giving the principal particulars of the Chief Engineer including name, age, qualifications and experience:

(a) He is to hold a First Class Certificate of Competency or equivalent and, in general, have been in the Owner's service for at least 3 years since obtaining this Certificate.
(b) If the Chief Engineer has recently joined the company and therefore does not have the three-year qualifying period, his previous record, i.e. companies with which he has served and periods with each, is to be attached for consideration.
(c) If these particulars are found to be satisfactory MCO will issue a letter to the Owner approving the Chief Engineer to carry out surveys under the terms of the Scheme.
(d) A Certificate or Letter of Approval will be issued for the Chief Engineer and will be valid while he remains in the employment of the Company named thereon.

13.2.2 When approval has been granted, the Owner is to arrange for copies of the Certificate/Letter to be kept on board the ship for information of the Master, Chief Engineer and Surveyors to the Society.

13.2.3 In the event of a Chief Engineer leaving his employment, the Owner is to inform the Society's HO in writing in order that the Certificate may be cancelled.

13.3 PRACTICAL APPLICATION

13.3.1 With regard to stand-by units, for example auxiliary engines and main lubricating oil pumps, it will be the responsibility of the Chief Engineer, in consultation with the Master, to ensure that such items are only opened up for examination under favorable conditions so that no hazard to the ship or cargo would result from breakdown of a working unit. For example:
(a) The number of auxiliary generator sets is to be such that all services essential to the propulsion and safety of the ship, together with preservation of the cargo, can be supplied when any two of the sets are not working.
(b) One of these two sets could then be overhauled while the other remained available as the standby set.

13.3.2 After survey by the Chief Engineer, at the first port where Surveyors to the MCO are available, these are to be shown the relevant entry in the log book and given two copies of a statement in English by the Chief Engineer describing the item he has surveyed, its condition as found and any repairs effected:

13.3.3 Parts which have been replaced by spares are to be retained and shown to the Surveyor.

13.3.4 Items such as auxiliary engines, independently driven pumps and compressors are to be examined under working conditions by the Surveyor who, if not satisfied, will have the right to require any item to be opened out for his inspection.

13.3.5 The Surveyor will issue an Interim Certificate to the Owner and forward his report to HO in the usual manner.

13.3.6 Surveyors are not entitled to accept statements by Chief Engineers who are unable to produce valid certificates.

13.3.7 It is understood that the Owner will carry out as much of the machinery surveys as practicable at ports where Surveyors to the MCO are available.

13.3.8 Any item which constitutes a Condition of Class will be excluded from this Scheme.

13.3.9 The following parts of machinery may be surveyed by an approved Chief Engineer:

(a) Main engine cylinder covers.
(b) Main engine valves and valve gear.
(c) Main engine cylinder liners.
(d) Main engine pistons and piston rods.
(e) Main engine connecting rods, crossheads, top end bearings and guides.
(f) Main engine fuel injection pumps and fuel booster pumps.
(g) Main engine scavenge pumps and turbo-chargers except where only one unit is fitted.
(h) Main engine detuners, vibration dampers and moment compensators.
(i) Main engine driven pumps, e.g. bilge, lubricating oil, cooling water.
(j) Independently driven pumps, e.g. bilge, ballast, fire, fresh water cooling, sea-water cooling, lubricating oil, oil fuel transfer.
(k) Main engine fresh water and lubricating oil coolers except where there is only one cooler for each service.
(l) Low pressure heaters used in H.V.F. fuel systems of diesel engines.
(m) Air compressors.
(n) Windlass.
(o) Forced or induced draught fans and engines.
(p) Auxiliary oil and steam engines including their coolers and pumps (providing the number of generator sets is such that all services essential to the propulsion and safety of the ship, also the preservation of refrigerated cargo, can be supplied when any two sets are not working. One of these sets can then be overhauled while the other remains as 'stand-by').
(q) Refrigerated cargo installations:
    (i) Reciprocating refrigerant compressors. (ii) Brine pumps.
    (iii) Condenser cooling pumps.
    (iv) Liquid refrigerant circulating pumps. (r) Liquefied gas carriers:
    (i) Reciprocating refrigerant compressors. (ii) Reciprocating cargo gas compressors. (iii) Condenser cooling pumps.
    (iv) Circulating pumps (where fitted).
(s) Ships with **IGS** notation:
    (i) Independent gas generators.
    (ii) Scrubber units.
    (iii) Blowers.

13.3.10 The Owner is to instruct his Chief Engineer that the survey of auxiliary engines is to proceed as follows:

(a) The engine is to be completely opened up and a careful examination made of all cylinders, liners, covers, valves, valve gear, pistons, piston rings, top and bottom end bearings, gudgeon pins, crankcase door fastenings and explosion relief devices.
(b) The top halves of all main bearings are to be removed and at least two bottom halves turned out for inspection. If these are found in good condition the remaining bottom halves need not be disturbed.
(c) A very careful examination is to be made of all crankpins and journals for cracks specially at the fillets and in the vicinity of oil holes.
(d) The crankweb deflections are to be measured and recorded. Care is to be taken to ensure that the journals are resting on the main bearings when the readings are taken.
(e) The cylinder liners are to be gauged and the wear recorded.
(f) The lubricating oil cooler is to be opened, examined and tested.
(g) Any direct driven lubricating oil pumps, cooling pumps, air compressors, etc., are to be opened up and examined. (h) It is to be verified that all safety devices are in efficient working condition.

13.3.11 A confirmation survey to auxiliary engines is to be carried out by the Surveyor to the MCO as follows:

(a) At least one main bearing and one bottom end bearing are to be selected, opened up and inspected together with the journal and crankpin.
(b) In engines having more than five journals, at least two main journals, crankpins and their bearings are to be examined.
(c) The deflections of the crankwebs are to be measured and compared with those recorded by the Chief Engineer.
    (d) The engine is to be examined running under load and the governor and circuit breaker tested.
(e) All safety devices, remote controls and automatic alarms are to be tested.

SECTION 14. APPROVED PLANNED MAINTENANCE SCHEME AS AN ALTERNATIVE TO CSM

14.1 GENERAL PROVISIONS

14.1.1 The survey of machinery by Chief Engineers under the terms of an Approved Planned Maintenance Scheme (APMS) may be regarded as an extension to the Approved Chief Engineer's Scheme described in *Sec 13*, with certain additional conditions and advantages for both the Owner and MCO.

14.1.2 Only approved Chief Engineers may carry out surveys on a planned maintenance basis and accordingly the approval procedure specified in *Subs 13.2* remains applicable.

14.1.3 The MCO has no intention of dictating to Owners the form that a Planned Maintenance Scheme should take, so widely varying approaches may be taken, provided the general principles outlined in *Subs 14.2* are met.

14.2 PLANNED MAINTENANCE SCHEME

14.2.1 Planned Maintenance Schemes normally contain four basic maintenance categories:

(a) **Preventive maintenance**. This category calls for items to be opened out for inspection and overhaul at specified time periods or after a specified number of running hours. Maintenance is carried out irrespective of machinery condition in order to retain the machine in satisfactory operational conditions.
(b) **Conditional maintenance**. This is dictated by the performance or physical state of the machine, determined by regular or continuous checks of applicable paragraphmeters, and is only undertaken when operating conditions have deteriorated below a satisfactory standard, but before breakdown or failure occurs.
(c) **Corrective maintenance**. This is sometimes referred to as "*Breakdown maintenance*" and is only carried out in order to restore a machine or component back to operational condition after a failure or malfunction.
(d) **Replacement maintenance**. The component or machine is run until destruction and then replaced. While this cannot be considered as maintenance of that component, it is maintenance to the overall system.

Of the maintenance categories detailed above, only preventive and conditional maintenance would be acceptable to the MCO.

14.2.2 Many schemes are made up with a combination of preventive and conditional maintenance. However, breakdown or corrective maintenance will be necessary to deal with unforeseen circumstances. Therefore, any Planned Maintenance Scheme is to have sufficient flexibility to take account of unscheduled maintenance.

14.3 BASIC REQUIREMENTS FOR THE APPROVAL OF PLANNED MAINTENANCE SCHEMES

14.3.1 In order to obtain approval the following conditions are to be met:
(a) A numbered index of the items is to be included in the Scheme. This index is to include at least all CSM items which appear on the Master List of Survey Items. The Scheme may also cover many items which are not required for classification.
(b) The indexing system is to be such that ready cross references to the MCO machinery Master List numbers can be made. It is to indicate also those items to be dealt with on preventive maintenance and those on conditional maintenance.
(c) The maintenance and monitoring methods to be used, the time scales for maintenance and monitoring of each item and the limits of acceptable conditions, where applicable, are to be included.
(d) Maintenance descriptions are to cover, at least, the minimum opening out necessary to demonstrate that a satisfactory examination of the item will be carried out. The extent of work to be undertaken is to be indicated but it is not necessary for approval purposes to include very detailed job descriptions.
(e) A system for reporting to Owners, and recording on board the ship and at the Owner's Head Office, details of the maintenance carried out, the condition as found and any repairs carried out, together with a list of parts used.
(f) The reporting and recording procedures are to be sufficiently comprehensive to demonstrate that the correct operation of the Planned Maintenance Scheme can be verified by both the Owner and the Surveyor at the time of the survey.
(g) A description of the scheme regarding the application on board the ship and the proposed flow of maintenance documents and the method of filing same.

14.3.2 Where machinery items are maintained on a conditional basis the applicable monitoring techniques are to be described and details of the monitoring equipment submitted.

14.3.3 The acceptable limits of deteriorated conditions are to be stated and these are to be derived from manufacturers' recommendations, applicable severity criteria as defined in Standards, or the Owner's required limits when these are more severe.

14.3.4 Machinery on preventive maintenance is to be examined completely for survey purposes at intervals not exceeding five years, although in practice many items will have maintenance carried out on them much more frequently.

14.3.5 Rotating machines on conditional maintenance may be accepted for survey on the basis of the monitored readings without opening up if the condition is shown to be good

14.3.6 The application of the Scheme on board the ship may take the form of simple planning charts or the more complex interactive computer based systems.

14.3.7 Interactive systems can be arranged so that as various functions impinge on each other, the system can recalculate and adjust its recommendations in the light of new data.

14.3.8 As stated previously no matter which type of Scheme is devised it is to have flexibility. Projected dates for the work to be carried out in a given period may not always be achievable, either by lack of opportunity or because the needed spares are not available. The Scheme is to cater for outstanding maintenance and clearly indicate overdue items and the proposed new schedule.

14.4 APPROVAL OF THE MAINTENANCE SCHEME

14.4.1 If the Scheme is considered to be acceptable to the MCO a *Certificate for Operation of an Approved Maintenance Scheme* will be issued by HO. This certificate is to be retained on board the vessel for the information of the Master, Chief Engineer and Surveyors.

14.4.2 All Chief Engineers operating the Scheme on a vessel must hold a Certificate of Authorization issued by the MCO or a recognized class Society.

14.4.3 Ships accepted in the Scheme will have an entry in the Memoranda (Machinery): "*CSM replaced by APMS*".

14.5 OPERATING CONDITIONS

14.5.1 It is a condition of the Scheme that the Owner arranges for the Surveyors to carry out an Annual Survey of the machinery, together with an audit of the maintenance and monitoring records.

14.5.2 Annual Surveys to the machinery are to be held within three months before or after the due date.

14.5.3 Authorized Chief Engineers may carry out surveys of all machinery items for which they are authorized, at sea or in port, whichever is most convenient. They are no longer restricted to ports or places where Surveyors to the MCO are not available, as is the case with the ACES. It will not be necessary to have confirmatory surveys carried out at the next port after each examination by the Chief Engineer and the reports may be filed and dealt with at the annual audit.

14.5.4 At the time of the Annual Audit, confirmatory surveys are to be carried out on those items to be credited which have been examined by the Chief Engineer during the preceding year.

14.6 ANNUAL AUDIT AND CONFIRMATORY SURVEY

14.6.1 At the Annual Audit the Chief Engineer is to make available the maintenance records which are to be examined to a sufficient extent as to satisfy the Surveyors that the Scheme is being correctly operated and that the machinery has functioned satisfactorily since the previous survey.

14.6.2 Maintenance records are to indicate that all scheduled maintenance has been carried out. Any items not dealt with as per the schedule are to be discussed with the Chief Engineer and a satisfactory explanation obtained

14.6.3 Where condition monitoring of main or auxiliary machinery is incorporated in the Scheme, the records are to be examined to verify that vibration levels, performance criteria, etc., are within the approved specified limits.

14.6.4 At the Surveyor's discretion, confirmatory readings on available running machinery may be taken for comparison with the ship's records. (For the interpretation of condition monitoring records, see *Subs 14.8*).

14.6.5 A General Examination of the machinery is to be carried out and, so far as practical, machinery to be credited for survey is to be examined under working conditions by the Surveyor. If the Surveyor is not satisfied with the condition as found he may have any items opened for his inspection.

14.6.5 For installations with a single main engine where torsional vibration characteristics indicate that there is no susceptibility to damage as a result of uneven firing, an Owner who has installed equipment to monitor the paragraphmeters defined in *Subs 14.11*, may be granted a special arrangement whereby the Chief Engineer will be permitted to survey the main engine crankshaft and bearings. In this case it is conditional that a Modified Survey is carried out whenever a request is made by the Owner to credit any part of the crankshaft or crankshaft bearings.

14.6.6 The confirmatory Modified Survey for main engine crankshafts and bearings is to include the following:
(a) Checking the condition monitoring records (see *Subs 14.8*).
(b) Checking bearing clearances where possible.
(c) Checking for signs of wiped or broken white metal in the crankcase.
(d) Checking the witness marks of shrink fits.
(e) Checking the bedplate structure inside and out.
(f) Obtaining the Chief Engineer's statements regarding crankpins, journals and bearings.

14.6.7 When carrying out the Modified Survey the crankcase is to be generally examined.

14.6.8 The bedplate structure is to be examined generally in accordance with the guidance given in *paragraphs 2.2.15 - 2.2.17* and *2.2.22* in way of the bearings to be credited for survey.

14.6.9 The Chief Engineer's records of main bearing weardown readings and crankweb deflections are to be examined and compared with the engine manufacturer's alignment charts. At the discretion of the Surveyor, crankweb deflections may be requested to be taken in his presence.

14.6.10 The Chief Engineer's statements regarding the condition of crankpins, journals and bearings are to be carefully examined.

14.6.11 Where the condition monitoring defined in *paragraph 14.11.2* is provided, main propulsion steam turbines may be credited for survey without lifting the top casing. This type of survey is to be carried out only after referring the Owner's request to HO, when additional guidance will be provided, (see also *Subs 3.3*).

14.7 DOCUMENTS

14.7.1 Statements signed by the Chief Engineer are to be submitted for each item that the Owner requires to be credited for class. Statements are to give details of repairs carried out and spare parts used.

14.7.2 When only routine maintenance has been carried out the statements need not be forwarded to HO but are to be retained by the Local Surveyor.

14.7.3 Under the terms of the APMS the Chief Engineer is to provide written details of any breakdown or malfunction of the essential machinery which are to include the main cause of failure.

14.7.4 The Surveyor is to verify that the Chief Engineer who has signed the statements has Certificates of Authorization.

14.7.5 After carrying out the survey as outlined above, the Surveyor is to issue an Interim Certificate to the Owner indicating the items which have been credited for class.

14.7.6 The dates of items to be credited for class are to be aligned to the date of the confirmatory survey regardless of when the Chief Engineer carried out his survey.

14.7.7 When a satisfactory Annual Audit has been carried out it is to be reported and the Memoranda updated accordingly. This date is to be one year from the previously assigned due date.

14.7.8 Any survey items of machinery not covered by the APMS are to be surveyed by the Surveyor and credited in the usual way and are to include any due or overdue items.

14.7.9 In the event of the Surveyor not being satisfied that the APMS is being correctly carried out, either from the maintenance records or the general condition of the machinery, a report is to be forwarded to HO via the Regional Office – if same has been established - recommending that special arrangements for dealing with machinery surveys be suspended.

14.8 INTERPRETATION OF CONDITION MONITORING RECORDS

14.8.1 Condition monitoring may be described as the use of instrumentation to make regular or continuous measurements of certain parameters, in order to indicate the physical state of the machine, without disturbing its normal operation. This information may be used for determining the actual condition of a machine at any given time or, based on the trend characteristics of the condition, may be used for predicting the remaining useful life before component deterioration or loss of performance terminates its ability to carry out its required function.

14.8.2 The extent of conditional maintenance and associated monitoring equipment provided in the Planned Maintenance Scheme is at the Owner's discretion and will normally be determined by the cost effectiveness of using condition monitoring as opposed to preventive maintenance.

14.8.3 No matter which monitoring techniques have been incorporated in the Scheme it is important to appreciate that the rate of change of condition is as important as the actual levels, so the use of trending the readings cannot be overemphasized.

14.8.4 One of the most effective techniques for determining the condition of rotating machinery is vibration monitoring. The equipment used for vibration measurement is to be capable of determining vibration amplitudes over the frequency spectrum of the machine. *Table 14.8.4* gives typical interpretations of the causes of vibration at specific frequencies.

14.8.5 After establishing the vibration signature of the machine it will be acceptable to record only the single values of overall vibration or the all-pass readings. These are used as the indication to determine when an analyzed signature should again be taken for diagnostic purposes. The all-pass readings, taken at regular periods, are to be plotted so that rates in change and comparison with limits can be made.

14.8.6 Another approach to determining the condition of a machine is to use performance monitoring. For simple items such as pumps it would be normal to record discharge pressure and power at the same time as the vibration readings are taken. For reciprocating machinery more elaborated monitoring may be necessary.

14.8.7 Of the techniques given in *paragraph 14.11.1* for reciprocating oil engines it will be noted that the monitoring required is generally what would be found on any well automated ship, except for combustion pressure-time curves and injection pressure-time curves.

14.8.8 Combustion pressure-time curves give information regarding the overall condition of piston rings and liners, the balance of the engine and condition of fuel pumps and valves. That this type of monitoring will not indicate material defects such as cracks in way of piston ring grooves, etc., but it does give the ship's staff guidance as to when the overhaul of a unit is to be undertaken.

14.8.9 Regular analysis of the engine lubricating oil at predetermined intervals can provide information of operational malfunctions. *Table 14.8.9* lists typical lubricating oil analytical tests, the causes of abnormal results and recommended action to be taken. It is not a requirement that metallic debris analysis be carried out, but some Owners regard this as a useful technique in a predictive maintenance programme.

14.8.10 The simplified data in *table 14.8.10* show a list of elements against the typical engine parts.

Table 14.8.9 Typical lubricating oil analytical tests

Analysis test	Condition	Cause	Action
1	2	3	4
Viscosity	Increase	Oil oxidation	Check for blow-by, fuel injectors, piston over- heating, bearing hot spots, oil storage tanks
		Contamination by residual fuel	
		Admixture with heavier grade of oil	
		Emulsified water contamination	
Viscosity	Decrease	Distillate fuel dilution	Check fuel injectors, oil storage tanks
		Admixture with lighter grade of oil	
Flashpoint	Decrease	Distillate fuel dilution if viscosity is also decreased	Check fuel injector
Water	Fresh	FW Jacket cooling leakage	Check items for leaks and eliminate water still present
		Purifier malfunction	Test purifier by samples taken immediately before and after
		Tank top rivet or joint leak	
		Condensation in faulty venting system L.O. cooler leaking (FW circulated)	
Water	Salt	L.O. cooler leaking	Check items as listed
		(SW circulated) tank top rivet or joint leak	May involve pressure test on tanks in
		Ships' hull bottom or cofferdam leak	Check one or more bearings
		Deck vents and filling connections to oil tanks leaking	
Alkalinity TBN	Decrease	Poor combustion, cold running, exhaust valve failure, high water contamination, increase in fuel sulphur level	Check and improve combustion
		Too low a lubricating oil consumption	Increase water cooling temps
			Check valves
			Remove water
			Check fuel analysis for sulphur content
			Consider higher TBN oil
Strong acid SAN	Any	Can only be present if all TBN is exhausted	Change oil using higher TBN oil
		Oil of too low initial TBN	Check engine for crankshaft or bearing corrosion
Insolubles	Increase	Increased blow-by	Check for blow-by, breathers, air filters, purification treatment, combustion, fuel quality
		Airborne dirt	Note engine internal cleanliness
		Excessive wear	
		Poor combustion	
		Poorer quality fuel	
		Lubricating oil breakdown	

Analysis test	Condition	Cause	Action
1	2	3	4
		Filter or centrifuge malfunction	
		Inadequate dispersancy	
Oxidation	Increase	Cylinder blow-by	Check for cause on items listed
		Bearing hot-spots	If these are in order change to more thermally stable lubricating oil
		Filter or centrifuge malfunction	
		Carbonized piston cooling spaces	
Element		Wear of moving parts as per established check list	Check combustion
		Rust from tanks or pipes	Lubricating oil purifiers and filters
		Residual fuel contamination	Adjust or replace defective parts as necessary
Microbial (Test kit) jacket water and oil	10^4 or higher	Microbial infestation	Submit sample to microbiologist
			Eliminate water ingress
			Use biocide
			Further action as advised by microbiologist

Table 14.8.4 Typical interpretations of the causes of vibration at specific frequencies

Frequency or vibration	Order	Most likely cause	Amplitude	Other possible causes and remarks
1 × Rotor RPM	1^{st}	Unbalance	Proportional to unbalance; largest in radial direction	Most common cause of vibration; Eccentric journals, bent shafts
1 × Rotor RPM (2 & 3 × RPM sometimes)	1^{st}	Misalignment couplings or bearings	Large in axial direction	
2 × Rotor RPM	2^{nd}	Mechanical looseness	Radial direction	Usually accompanied by unbalance and/or misalignment Could also be rubbing effects.
3 × Rotor RPM	3^{rd}			Rare. Could be a combination of misalignment and looseness.
½ × Rotor RPM less	1/2	Oil whip or whirl		Occurs on high or medium speed pressure lubricated machines with plain bearings.
Many times RPM	n^{th}	Gear noise aerodynamic forces blade defects	Low	Gear teeth × RPM of gear wheel blades × RPM of rotor

Table 14.8.10 Elements and typical engine parts

Element	Symbol	Engine parts	PPM max.
Iron	Fe	Liners, crankshaft, timing gears, camshaft, piston heads	40
Chrome	Cr	Piston rings	10
Copper	Cu	Top end bushes, crankpin and main bearings	25
Lead	Pb	Top end bushes, crankpin and main bearings	30
Aluminium	Al	Piston skirts, camshaft bearings, timing gear bushes	15
Tin	Sn	Camshaft bearings, timing gear bushes, main and crankpin bearing overlay	10
Vanadium	V	Residual fuel contamination	15
Sodium	Na	Sea-water ingress, residual fuel	10
Silicon	Si	Airborne or other dirt ingress	25

14.9 ITEMS ACCEPTABLE FOR SURVEY BY CHIEF ENGINEERS UNDER APMS

14.9.1 Machinery items listed below may be accepted for Chief Engineer's survey under the APMS.

(a) **Main and auxiliary machinery**:
- (i) Main engine cylinder covers and liners.
- (ii) Main engine valves and valve gears.
- (iii) Main engine pistons and piston rods.
- (iv) Main engine connecting rods, crossheads, top end bearings, guides, gudgeon pins and bushes.
- (v) Main engine crankshafts and bearings (multiple engine installations only). For single installations see *paragraph 14.6.6.*
- (vi) Main engine fuel injection pumps and fuel booster pumps.
- (vii) Main engine scavenge pumps, blowers and air coolers.
- (viii) Main engine detuners, dampers and balancer units.
- (ix) Main engine camshaft and camshaft drive.
- (x) Main propulsion steam turbines (casing, rotor and blading) at alternate surveys provided the parameters defined in *paragraph 14.11.2* are monitored and vibration measurements during full power trials are taken in the presence of a Surveyor.
- (xi) Main engine driven pumps, e.g. bilge, L.O. and cooling water.
- (xii) Independently driven pumps, associated motors and cables where insulation resistance readings are supplied (bilge, ballast, fresh & sea water cooling, lubricating oil and oil fuel transfer.)
- (xiii) Main engine fresh water and L.O. coolers.
- (xiv) Low pressure heaters used in HVF systems of oil engines.
- (xv) Windlass and windlass machinery
- (xvi) Main and auxiliary condensers/drain coolers. (xvii) Air compressors and their safety devices. (xviii) Forced or induced draught fans.
- (xix) Auxiliary oil and steam engines including their coolers and pumps (IF the number of generating sets is such that all services essential to the propulsion and safety of the ship, also the preservation of refrigerated cargo, can be supplied when any two sets are not working. One of these sets can then be overhauled while the other remains as stand-by).
- (xx) Intermediate shafts. (xxi) Main engine thrust.

(b) **Refrigerated cargo installations:**
- (i) Reciprocating refrigerant compressors. (ii) Brine pumps.
- (iii) Condenser cooling pumps.
- (iv) Liquid refrigerant circulating pumps.

(c) **Liquefied gas carriers:**
- (i) Condenser cooling pumps.
- (ii) Circulating pumps (where fitted).
- (iii) Reciprocating refrigerant compressors.
- (iv) Reciprocating cargo gas compressors.

(d) **Ships with IGS notation:**
   (i) Blowers.
   (ii) Scrubber units
   (iii) Independent gas generators.

14.10 ITEMS NOT ACCEPTABLE FOR SURVEY BY CHIEF ENGINEERS UNDER APMS

14.10.1 Items listed below will not be accepted for Chief Engineer survey under the APMS.

(a) Main engine crankshaft and bearings in single engine installations where the special requirements in *paragraph 14.6.6* are not complied with.
(b) Reduction/increase gearing, flexible couplings and clutches.
(c) Holding down bolts and chocks.
d) Crankcase doors, crankcase and scavenge relief devices.
(e) Boilers and all other surveyable pressure vessels.
(f) Boiler fuel oil heaters.
(g) Steam pipes and starting air pipes.
(h) Maneuvering valves and bulkhead stop valves.
(i) Steering machinery.
(j) Pumping arrangements.
(k) Electrical equipment other than that listed under *Subs 14.9.*
(l) Propellers. (m) Screwshafts.
(n) Sea connections.
(o) Main engine controls, bridge, centralized or automatic.
(p) UMS/CCS requirements.
(q) Engine trial.
(r) First start arrangements trial.
(s) All components of inert gas systems not listed under *Subs 14.9.*

14.11 MACHINERY PARAMETERS TO BE MONITORED FOR CONDITION BASED SURVEYS

14.11.1 Main propulsion diesel engine:

(a) Shaft horsepower.
(b) Engine and shaft rev/min.
(c) Cylinder pressures – time curves.
(d) Oil fuel injection pressure – time curves.
(e) Charge air pressure.
(f) Exhaust gas temperatures.
(g) Engine cooling systems temperatures and pressures.
(h) Engine lubricating oil system temperatures and pressures.
(i) Turbo-charged rev/min and vibration.
(j) Lubricating oil analysis data.
(k) Crankshaft deflections.
(l) Main bearing temperatures.

14.11.2 Main propulsion steam turbines (casing, rotor and blading) at alternate surveys:

(a) Turbine rotor vibration. (b) Shaft horsepower.
(c) Shaft and turbine rotor rev/min.
(d) Plant performance data, e.g. steam conditions at the inlet and outlet of each turbine, boiler performance data, condenser vacuum, sea temperature and steam conditions of other major steam consuming auxiliaries.

14.11.3 Auxiliary machinery:

(a) Cooler efficiencies, inlet and outlet temperatures.
(b) Heater temperatures.
(c) Pumps and fans vibration and performance.
(d) Differential pressure across filters.

(e) Diesel engines are to be fitted with the monitoring specified in *14.11.1 subparagraphs (e)-(j)*
(f) Auxiliary turbo alternators to be monitored generally as in *paragraph 14.11.2*

SECTION 15. LUBRICATING OIL TREND ANALYSIS PROGRAMME

15.1 GENERAL PROVISIONS

15.1.1 When condition monitoring equipment is fitted an acceptable lubricating oil trend analysis programme (LOTAP) may be considered as part of the condition monitoring procedures.

15.1.2 Oil samples are to be taken at regular intervals as shown in *Subs 15.2* and the tests listed therein are to be carried out. The resultant laboratory reports of which there should preferably be at least three, are to be retained on board for examination by the Surveyor.

15.1.3 Samples are to be taken when the machinery or shafting is at service temperature and rotating, always from the same position with care being taken to ensure that the test sample is representative of the oil within the system.

15.1.4 The test position is to be flushed through to ensure removal of any trapped oil or debris before taking the sample.

15.1.5 *Tables 15.1.5-1* and *15.1.5-2* show the changes in oil condition, the probable cause of the change, the problems that may result from it, a list of alert levels, and preferred tests. The alert levels shown are for guidance only, it is more important to have a number of sequential results to enable any trends to be identified. These tables used in combination with the three most recent analysis results should assist in making a reasoned estimate of the condition of the oil and the health of the machinery.

15.1.6 Spectrographic analysis will be essential for detection of the wear and contaminant elements.

15.1.7 When doubts arise regarding the results in general, full details are to be forwarded to HO.

15.2 STERNTUBE LUBRICATION SYSTEMS MONITORING

15.2.1 Samples are to be taken at regular intervals of approximately four months, but not exceeding six months. Minimum tests to be carried out are:

(a) Wear
(b) Water
(c) Chloride content
(d) Oxidation
(e) Contaminant elements

15.2.2 **Viscosity**. Most oil lubricated sterntubes use the same grade of oil as the main engine system, often an SAE 30 product with viscosity of approximately 110 cSt at 40°C. Occasionally an SAE 40 or 50 oil might be selected thus it is essential to establish the viscosity of the new oil when looking for increases or decreases.

15.2.3 **Water**. The most common hazard with oil lubricated sterntubes is water leakage through the after gland seal, which may create a variety of problems. Fortunately most of the oils in use today are of the additive type and usually when water is co-mingled, form an emulsion, which in the short term at least, is better for lubrication than having the water in a free state. Certain oils have been specially formulated to form an emulsion in the presence of water and are able to continue satisfactory lubrication for a longer period with water contents greatly in excess of the alert level.

15.2.4 **Elements**. Experience suggests that a high copper content alone usually indicates wear or damage of the bronze after face seal and subsequent analyses often confirms this by an increase in water content. Wear of viton rubber after shaft seals may not be detected by spectrographic analysis but may be identified in the laboratory by visual inspection and an increase in insolubles. Saline water will be confirmed by the presence of sodium and magnesium. Iron content may be shaft wear or rust. Tin, copper and lead suggest wear of the sterntube bearing except in the case of reinforced resin bearings which contain no metals and like Viton can only be detected by observation and increase in insolubles.

15.2.5 **Other analysis**. Microscopic analysis of the particles may be recommended to identify the failure process and, where applicable, non-metallic bearing or seal material.

Table 15.1.5-1 Sterntube lubrication system monitoring

Oil test condition	Probable cause	Possible problems	Alert levels	
Viscosity cSt	Oxidation	Inferior lubrication	>25%	
Increase	Insolubles	Deposits		
	Water			
	Admixture with heavier			
	Grade			
Viscosity cSt	Admixture with Lighter	Reduced film strength	< 10%	
Decrease	Grade	Oil leakages		
Water % volume increase	Leaking after gland seal	Emulsification	> 1.00%	
		Sludging		
		Rusting		
		Bacteria		
		Inferior lubrication		
Oxidation mgKOH/g	Overheating	Viscosity increase	> 1.0%	
Increase	Containment and wear	Inferior lubrication		
	Elements	Deposits		
Insolubles % wt increase	Oxidation	Viscosity increase	> 0.15%	
	Wear debris	Abrasive wear		
	Dirt, sand			
Element ppm increase	Containment and wear metals	**Likely source**		
		Bearing	Tin	> 10
		Shaft/rust	Iron	> 30
		Bearing	Lead	> 10
		Aft seal	Nickel	> 10
		Sand/dust	Silicon	> 10
		Salt water	Sodium	> 80
		Salt water/lub. additive	Magnesium	> 30
		Aft seal/bearing	Copper	> 30

Table 15.1.5-2 Sterntube lubrication system monitoring

Test	Unit	Method
Appearance	—	Visual
Colour	—	Visual
Viscosity @ 40°C	cST	IP 71
Water	% (V/V)	IP 74
Water, Nature	—	Qualitative
Pentane insolubles	% wt	ASTM D893*
Oxidation	mgKOH/g	IP 177
Strong acid number	mgKOH/g	IP 177
Elements		
Aluminium	mg/kg	P.E.S
Chromium	mg/kg	P.E.S
Copper	mg/kg	P.E.S
Iron	mg/kg	P.E.S
Lead	mg/kg	P.E.S
Nickel	mg/kg	P.E.S
Tin	mg/kg	P.E.S
Sodium	mg/kg	P.E.S
Silicon	mg/kg	P.E.S
Magnesium	mg/kg	P.E.S
NOTE: * Procedure A or B depending on oil grade .		

ELECTRICAL EQUIPMENT
PART I, CHAPTER 4

SECTION

ELECTRICAL EQUIPMENT
PART I, CHAPTER 4

SECTION 1 PERIODICAL SURVEYS

1.1 GENERAL PROVISIONS

1.1.1 The electrical installations of existing ships will be subject to the following surveys:
(a) Annual Surveys.
(b) Intermediate Surveys carried out in lieu of the second or third Annual Survey.
(c) Special Surveys at five-yearly intervals.

1.1.2 Results of surveys to electrical equipment will be considered for the Machinery class notations.

1.2 ANNUAL SURVEY

1.2.1 The Annual Survey will comprise the following:
(a) A general examination visually and in operation, as feasible, of electrical machinery and emergency source of electrical power. If they are automatic, also in the automatic mode.
(b) A general examination of switchgear, switchboards and other electrical equipment and megger testing of selected parts of the installation, when deemed necessary.
(c) The main source of electrical power is to be tested under load.
(d) A general examination of main and auxiliary steering arrangements, including their associated equipment and control systems and maneuvering gear.

1.2.2 The satisfactory operation of all emergency sources of power is to be verified and where these are automatically controlled they are to be tested in the automatic mode. Earth bonding straps, where fitted, are to be examined.

1.3 INTERMEDIATE SURVEY

1.3.1 The Intermediate Survey will include those aspects covered by the Annual Survey and, additionally, the following:

(a) The generating sets are to be examined under operating conditions to confirm that the largest motor on board can be started with one generating set out of action.
(b) Ships with a UMS notation where the electrical power requirements are normally met by one generating set, are to be examined to confirm that on loss of power the stand-by generator is automatically started and connected to the main switchboard, and the essential services are automatically restarted.

1.3.2 **Oil and chemical tankers** and **LGC** ships are to be subjected to the following additional surveys:
(a) A general examination of the electrical equipment and cables in dangerous zones such as cargo pump rooms, and areas in way of cargo tanks for defective certified safe type equipment, improperly installed wiring, non- approved lighting fixtures or equipment and dead end wiring.
(b) A test of insulation resistance of the electric circuits except where a proper record of the testing is maintained. Consideration is to be given to accepting recent readings by the crew. If any of these readings are marginal or if the condition of the cables, fixtures or equipment appears defective in any way, verification measurements may be required. These measurements are not to be undertaken until the ship is in a gas free condition.

1.4 SPECIAL SURVEY

1.4.1 The Special Survey will encompass an extensive examination and test of the electrical installation as required by *paragraphs 1.4.2- 1.4.15*. (See also *RSTE I Ch 3 Subs 9.4*).

1.4.2 The insulation resistance of generators, switchboards, motors, cables and other electrical equipment is to be tested and adjusted if it is found not to comply with the requirements given below. . The installation may be sub- divided or equipment, which may be damaged, disconnected for the purpose of this test.

(a) For main and emergency switchboard, feeder circuit breakers being open, busbar circuit closed, measuring and monitoring instruments disconnected, the insulation resistance measured across each insulated busbar and hull, and across insulated busbars is not to be less than **1M**

(b) 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 1000 times the rated voltage, in volts. When appropriate, the Surveyor will check also that the insulation resistance of generator independent exciters is not less than **0.25 MΩ**.
(c) 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 is not to be less than **0.1MΩ**.
(d) The variation of the resistance with time is to be checked, comparing the current figure with previous readings. If the insulation resistance has dropped suddenly or is not sufficient, the defective circuits are to be traced, disconnecting as much circuits as necessary. However, this test may be dispensed with if it is found that the measured records remain efficient and they comply with the above requirements.

1.4.3 Main and emergency switchboards, section panels, and distribution fuse panels are to be examined and overcurrent protective devices and fuses inspected to verify that they provide suitable protection for their respective circuits.

1.4.4 Generators are to be tested under load conditions, either separately or in paragraphllel and the performance of speed governors, switches and circuit breakers is to be checked to verify that protective devices including preference tripping relays, if fitted, operate satisfactorily.

1.4.5 Emergency sources of electrical power are to be tested, including:
(a) Operation test of emergency generating set.
(b) Test of emergency accumulator batteries.
(c) The transitional source of electrical power is to be tested, as far as practicable.

1.4.6 Battery chargers are to be tested.

1.4.7 Mechanical ventilation of battery rooms / lockers is to be examined.

1.4.8 The lighting fittings, internal communication and signalling systems, mechanical ventilation systems, and other electrical equipment are to be tested for effectiveness.

1.4.9 The electrical power supply of navigation lights and associated alarm and signal devices is to be tested. Navigation light indicators are to be tried under working conditions, and correct operation on the failure of supply or failure of navigation lights verified

1.4.10 The electric cables are to be examined, so far as is practicable, without undue disturbance of fixtures or casings unless opening up is considered necessary as a result of observation or of the tests required by *paragraph 1.4.2.*

1.4.11 The generator prime movers are to be surveyed as required by *RSTE I Ch 3/ 9.2.6.* and the governing of the engines tested.

1.4.12 All generators and steering gear motors are to be examined and are to be operated under working conditions, though not necessarily under full load or simultaneously.

1.4.13 Where transformers associated with supplies to essential services are liquid-immersed, the Owner is to arrange for samples of the liquid to be taken and tested for breakdown voltage, acidity and moisture by a competent testing authority, and a certificate giving the test results is to be furnished to the Surveyor.

1.4.14 Emergency lighting, transitional emergency lighting, supplementary emergency lighting, low location emergency lighting, general emergency alarm and public address systems are to be tested or checked as far as is practicable.

1.4.15 Where the ship is electrically propelled, 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 is to be tested. Special attention is to be given to windings, commutators and slip-rings. Operation of protective gear and alarm devices is to be checked, so far as is practicable. Insulating oil, if used, is to be tested in accordance with *paragraph 1.4.13*. Interlocks intended to prevent unsafe operations or unauthorized access are to be checked to verify that they are functioning correctly. Emergency overspeed governors are to be tested.

1.5 ADDITIONAL SURVEY OF ELECTRICAL EQUIPMENT IN HAZARDOUS AREAS AND SPACES

1.5.1 A general examination of the electrical equipment in areas which may contain flammable gas or vapour and/or combustible dust is to be carried out to ensure that the integrity of the safe type electrical equipment has not been impaired owing to corrosion, missing bolts, etc., and that there is not an excessive accumulation of dust in dust protected electrical equipment.

1.5.2 Electrical cable runs are to be examined for defects on sheaths and armours, where practicable, and to ensure that the means of supporting the cables are in good order.

1.5.3 Tests are to be performed to verify the effectiveness of bonding straps for the control of static electricity.

1.5.4 Alarms and interlocks associated with pressurised equipment or spaces are to be tested for their correct operation.

1.6 ADDITIONAL SURVEY OF ELECTRICAL EQUIPMENT IN TANKERS 5 YEARS OLD

1.6.1 For tankers five years old and over, the requirements of *Subs 1.5* are to be complied with. In addition, an electrical insulation resistance test of the circuits terminating in, or passing through the hazardous areas is to be carried out.

1.6.2 The Additional Survey required by *paragraph 1.6.1* is recommended to be carried out during Docking Survey

SECTION 2. SURVEYS AFTER REPAIRS AND MODIFICATIONS

2.1 GENERAL PROVISIONS

2.1.1 Surveys to electrical equipment of existing ships after repairs or modifications will be considered as surveys to new constructions, except that the examinations will be limited to the equipment which has undergone repairs or modification or has been replaced.

2.1.2 Survey to modified, replaced or repaired equipment other than covered by this Section will be carried out as required for new constructions in *Pt II*. Alternatively, it may be performed in accordance with accepted standards.

2.2 SWITCHGEAR

2.2.1 The insulation resistance of completed installations is to be measured to ensure that the switchgear can be energized without danger to personnel or equipment and to verify that the insulation has not deteriorated below an acceptable level.

2.2.2 Insulation resistance measurement is to be carried out with a direct reading ohmmeter of the generator type such as a megger or similar instrument. The minimum values of insulation resistance and test voltage are given in *table 2.2.2*.

Table 2.2.2 INSULATION RESISTANCE MINIMUM VALUES

Rated voltage U_n (V)	**Minimum test voltage** U_t (V)	**Minimum insulation resistance** (MΩ)
≤250	2 U_n	1
>250-1000	500	1
>1000-7200	1000	$(U_n/1000) + 1$
>7200	To be agreed	To be agreed

2.2.3 Before switchboards, section boards and distribution boards are put into service, their insulation resistance is to be not less than the values given in *table 2.2.2* when measured between each busbar and earth and between each insulated busbar and the busbar connected to the other pole or poles. The test is to be carried out with all circuit breakers and switches open and all fuse links for indicating lamps, voltmeters, etc., removed. Semi-conducting devices such as diodes or thyristors are to be shorted out or disconnected.

2.2.4 Test voltage U_t is to be applied during not less than **1 minute**. If it is impractical to test as specified above the test may be carried out at a reduced voltage for a longer period as required by *table 2.2.4*.

Table 2.2.4 Insulation resistance test at reduced voltage

Reduced test voltage U_r	**Duration of test** (Minutes)
0.85 U_t	2
0.75 U_t	3
0.70 U_t	4
0.65 U_t	5
0.60 U_t	10
0.55 U_t	15

2.3 ROTATING MACHINES

2.3.1 A machine which has experienced a failure of its windings due, for example, to ingress of seawater or mechanical damage, is to be repaired.

2.3.2 After complete or partial repair of the windings, the fully assembled machine is to be subjected to a high voltage test and insulation resistance test.

2,3,3 The repaired machine is to be run at full speed and if practicable be run on load.

2.3.4 The insulation resistance of generators is to be measured immediately after a period of running while the machine is still hot.

2.3.5 The insulation resistance between windings and between each winding and earth is to be measured. During the measurement any temperature sensors embedded in the windings are to be earthed.

2.4 CABLES

2.4.1 For low voltage cables, a test of insulation resistance between each conductor and earth, and between conductors is to be carried out.

2.4.2 For high voltage cables, in addition to the test provided for in paragraph 2.4.1, the cable is to be subjected to a high voltage test in accordance with IEC 502: Extruded Solid Dielectric Insulated Power Cables for Rated Voltages from 1 kV to 30 kV, or according to the Manufacturer's recommendations. Results of the test will be considered satisfactory if no breakdown of the insulation occurs.

2.5 REPAIRED EQUIPMENT IN HAZARDOUS SPACES OR AREAS

2.5.1 The insulation resistance of electrical equipment and cables in hazardous areas is to be measured in accordance with the requirements of *Subs 2.2-2.4*.

2.5.2 In ships which are not free of flammable liquids or vapors, insulation may only be tested using an intrinsically safe insulation tester with the following maximum values of parameters:

(a) Voltage: 1.2 V.
(b) Current: 0.1 A.
(c) Energy storage: 20 µJ.

SECTION 3. ELECTRICAL EQUIPMENT IN HAZARDOUS AREAS

3.1 GENERAL PROVISIONS

3.1.1 In oil and chemical tankers, the Intermediate and Special Surveys require the condition of each item of certified safe-type equipment to be determined and defective equipment identified.

3.2 INTERMEDIATE SURVEY

3.2.1 The Intermediate Survey will comprise a close inspection of all safe-type equipment for the identification of those defects which are apparent only by the use of tools.

3.2.2 The Intermediate Survey will not normally require enclosures to be opened.

3.2.3 The alarms and interlocks associated with pressurized equipment or spaces are to be checked.

3.2.4 Insulation resistance measurements are to be carried out or, alternatively, recent measurements (1 month) carried out by the crew may be reviewed. These measurements are not to be attempted until the ship is in a gas free condition unless an intrinsically safe insulation tester is available.

3.2.5 Aspects to be checked during Intermediate Survey are detailed in *table 3.2.5*.

3.3 SPECIAL SURVEY

3.3.1 The Special Survey will include those items covered by the Intermediate Survey and, in addition, identifying defects such as. loose terminations, which are only apparent by opening up enclosures and using tools or test equipment.

3.3.2 Equipment requiring internal examination is to be isolated and is not to be opened until sufficient time has elapsed as to permit any surface temperature or stored electrical energy to decay to a level below which it is incapable of causing ignition.

3.3.3 An internal examination is to be carried out on a representative group of each type of equipment, provided that all equipment is subjected, at least, to visual inspection.

Table 3.3.4 Intermediate Surveys to electical equipment in hazardous areas

No.	Aspect
1	Corrosion of cable entries and cable penetrations.
2	Corrosion of electrical fittings.
3	Corrosion of equipment enclosures.
4	Loose fixings, glands, conduit, stoppers.
5	Loose electrical connectors.
6	Excessive accumulation of dust and dirt.
7	Condition of gaskets and fastenings.
8	Condition of bearings
9	Loose fixings, glands, conduits and stoppers.
10	Oil or compound leakage.
11	Unadequate types or voltage levels of lamps.
12	Equipment subjected to excessive vibration.
13	Maintenance not carried out or in accordance with the Manufacturer's recommendations
14	Undue installation of additional apparatus or cables.
15	Malfunction of protective devices.
16	Unauthorized modifications of equipment.

3.4 REPAIRS, MODIFICATION AND RE-CERTIFICATION OF SAFE-TYPE EQUIPMENT

3.4.1 No modification is to be made to certified equipment unless permitted in the Certification documentation or if it is approved by the Manufacturer.

3.4.2 Repairs of safe-type equipment are to be carried out using new parts obtained from the Manufacturer

AUTOMATION & CONTROL
PART I, CHAPTER 5

AUTOMATION & CONTROL
PART I, CHAPTER 5

SECTION 1. GENERAL REQUIREMENTS

1.1 GENERAL INFORMATION

1.1.1 In ships having an attended machinery space, the controls, alarms and safety systems required for the **M100** notation are to be surveyed in conjunction with the applicable machinery item at the due date, and credit for the item will include the relevant control equipment.

1.1.2 A non-compliance with the requirements of the Rules for control or automation equipment will, if warranted, constitute a Condition of Class which will be imposed in accordance with current procedures.

1.1.3 Alternatively to imposing a Condition of Class as per *paragraph 1.1.2* above, the ship´s machinery class may be considered **M90** at the discretion of HO, upon recommendation by the Surveyor and agreement with the Owner.

SECTION 2. SPECIFIC REQUIREMENTS FOR VESSELS WITH AUTOMATION NOTATIONS

2.1 ANNUAL SURVEY

2.1.1 For ships having a UMS, CCS notation, a general examination of the control equipment is to be carried out.

2.1.2 Satisfactory operation of safety devices and control systems is to be verified.

2.1.3 An Annual Survey of the control engineering installation on UMS, CCS vessels is required not only for classification purposes but also on behalf of various National Authorities who require Intermediate Surveys for the purpose of permitting continued operation with manning dispensations.

2.1.4 Where the Administration has issued a certificate for manning dispensations the same may require an endorsement at 12 month intervals to confirm that the UMS notation remains valid.

2.1.5 Where test schedules are performed and records kept on board and the Chief Engineer can show that routine testing has been carried out at regular intervals, the results of these tests are to be taken into account when determining the scope of survey.

2.1.6 Reports from firms having maintenance contracts may be used for determining the extent of the Annual Survey.

2.2 PERIODICAL SURVEYS

2.2.1 The statements of *paragraphs 2.1.3-2.1.6* on the use of test schedules will also apply when carrying out Periodical Surveys.

2.2.2 Periodical Surveys of automation and control equipment for the UMS notation are to be divided into individual systems.

2.2.3 The individual systems to be surveyed are to be, as far as possible, the following:

(a) Bridge control system.
(b) Alarms and safeguards.
(c) Control and communication systems.
(d) Fire detection and prevention.
(e) Fire pumps.
(f) Automation of electric power supply.
(g) Automatic start of standby pumps.
(h) Bilge level detection.
(i) Operation of bilge valves.

2.2.4 **Bridge control**: Where it can be shown that maneuvering is normally carried out from the bridge this is to be taken into account.

2.2.5 Since Port regulations may prevent maneuvering the engine through the full speed ranges, it may be acceptable to witness a demonstration of maneuvering ahead and astern over a limited speed range.

2.2.6 **Alarms**: A number of alarms may be selected as representative of the alarm system and these are to be seen to operate at the various alarm locations, including bridge and accommodation areas.

2.2.7 **Safeguards**: Systems incorporating safeguards such as automatic shutdowns and slowdowns, are to be tested as realistically as possible.

2.2.8 **Control and communications systems** are to be tested between control stations by transferring functions between them.

2.2.9 **Fire detection and fire prevention**. The general operation condition of the fire detection system is to be examined. Random detector heads are to be tested. A General Examination of the protection arrangements for oil fuel injector pipes on main and auxiliary engines is to be carried out.

2.2.10 **Fire pump**. The remote starting of the fire pump is to be tested.

2.2.11 **Electric power supply**: Arrangements for automatic start and connection of standby generators and automatic load shedding of non-essential load are to be tested.

2.2.12 When it is impractical to carry out the tests of automation of the electric power supply under full working conditions, functional tests under simulated conditions may be substituted at the Surveyor's discretion.

2.2.13 **Automatic start of standby pumps:** A satisfactory check is to be carried out by stopping the running pump.

2.2.14 The **bilge level detection system** is to be tested having due regard to the possible overboard discharge of oil.

2.2.15 **Operation of side and bilge valves**: Ship's side and bilge valves are to be tested by actual operation for freedom of movement. Attention is to be paid to the operation of the valve position indicators. Tests may be limited to inlets and discharges below the load waterline..

2.2.16 If the control equipment required by the Rules for the UMS, CCS or ICC notations is found to be deficient, a Condition of Class will not beimposed, but a recommendation is to be made in the Memoranda (Machinery) that the respective notations be suspended until the defect (detailed) has been dealt with. Alternatively, a notation UMS-h/24 may be recommended.

2.2.18 When carrying out surveys of control and automation equipment for compliance with automation notations Surveyors are advised to make use of the Chief Engineer's records, test schedules or any other relevant documentation kept on board the vessel.

2.3 SURVEYS FOR UMS, CCS NOTATIONS

2.3.1 For guidance on survey and testing in accordance with **UMS, CCS** and **ICC** notations requirements see *Sec 4.*

2.4 Surveys for dynamic positioning notations

2.4.1 On vessels having the notations **DYN(CM), DYN(AM), DYN(AA) or DYN(FA)** the control system and associated machinery items are to be generally examined at the Annual Survey under operating conditions, so far as is practicable.

2.4.2 During the Annual Survey the operational and maintenance records, as well as test schedules for the dynamic positioning system are to be checked to verify that the installation has performed satisfactorily since las survey.

2.4.3 During the Special Survey the control system and associated machinery items are to be examined and tested to demonstrate that they are in good working order.

2.4.4 For guidance on Special Survey testing in accordance with any DYN notation requirements see *Sec 5*.

2.4.5 A non-compliance in the dynamic positioning control equipment or associated machinery items will, if warranted, constitute a Condition of Class.

2.5 BRIDGE NOTATIONS

2.5.1 On vessels having the notations SBL, 1-W and IBS the navigating bridge equipment is to be generally examined at the Annual Survey.

2.5.2 For each magnetic compass the following documents are to be available:
(a) Compass Accuracy Compliance Certificate.
(b) Deviation card. (updated during the previous yearly period).
(c) Certificate of Compass Adjuster.

2.5.3 During Special Survey the bridge and navigational equipment is to be examined and tested to demonstrate that it is in good working order. For testing and survey of bridge systems related to notations SBL, 1-W and IBS see *Sec*

SECTION 3. SPECIAL PURPOSE SHIPS

3.1 APPLICATION

3.1.1 The requirements of the present Section apply to ships engaged on transportation of liquid chemicals in bulk and ships for liquefied gases (LGC).

3.2 DETECTION OF TOXIC VAPOURS

3.2.1 Vapour detection will be required to be fitted for toxic and flammable gases in accordance with the requirements of *table 3.2.1*.

3.2.2 Survey and testing of the vapour detection system is to be carried out at annual intervals. A valid certificate from a specialist firm will be acceptable.

3.2.3 For guidance on testing of the vapour detection system see *Sec 7*.

Table 3.2.1 Vapour detection requirements

Product (UN number)	Vapour detection
Acetaldehide (1089)	F+T
Ammonia (1005)	T
Butadiene (1010)	F+T
Butane (1011)	F
Butane-propane mixtures (1011/1978)	F
Butylene (1012)	F
Chlorine (1017)	T
Diethyl ether (1155)	F+T
Dimethylamine (1032)	F+T
Ethane (1961)	F
Ethyl chloride (1037)	F+T
Ethylene (1038)	F
Ethylene oxide (1040)	F+T
Ethylene oxide-propylene oxide mixtures (2983)	F+T
Isoprene (1218)	F
Isopropylamine (1221)	F+T
Methane (1972)	F
Methylacetylene-propadiene mixtures (1060)	F
Methyl bromide (1062)	F+T
Methyl chloride (1063)	F+T
Monoethylamide (1036)	F+T
Nitrogen (2040)	O
Pentane (1255)	F
Pennene (1255)	F
Propane (1978)	F
Propylene (1077)	F
Propylene oxides (1280)	F+T
Sulphur dioxide (1079)	T
Vinyl chloride (1086)	F+T
Vinyl ethyl ether (1302)	F+T
Vinylidene chloride (1303)	F+T

NOTES:
F – Flammable vapour detection
T – Toxic vapour detection
O – Oxygen analysis

SECTION 4. SPECIAL SURVEY - NOTATIONS UMS, CCS

4.1 GENERAL INFORMATION

4.1.1 Extent of Special Survey of automation and control equipment for the notations UMS, CCS is to be as per *tables 4.1.1-1* to 4*.1.1-21*

Table 4.1.1-1 Testing of alarm systems

Test	Requirements
Simulated failure of power supply to alarm system.	Power failure alarm. Automatic changeover to emergency or reserve power supply.
Lamp test of bridge and other alarm panels.	Confirm proper alarm indications.
Machinery, control and safety alarms.	Clearly distinguishable form other alarms.
Acknowledgement of machinery alarm from bridge.	Sound and light alarms remain active in machinery space .
Silencing of sound alarm, if feasible.	Light alarm is to remain on.
Running second alarm after first has been silenced.	Sound alarm to activate once more.
All alarms not dealt with.	Clear indication at all times.
Overrides	Light indication at control station and means to prevent inadvertent operation.

Table 4.1.1-2 Testing of safety systems

Test	Requirements
Test failure of control system alarm.	Safety system operates independently of other systems.
Test failure of safety system on one part of machinery.	Safety sytem so arranged that operation on other parts of machinery not affected.
Activation of safety system	Sound and light alarms indicating action and its cause.
Override of safety system	Light indication at control station. Arrangements to prevent inadvertent operation.
Manual reset of safety system	Operational
Simulated power failure	Light and sound alarms. Automatic power supply changeover.

Table 4.1.1-3 Testing of remotely controlled valves

Test	Requirements
Simulated failure of actuator power	Valves are not to open inadvertently.
Secondary means of valve operation	Secondary means is to be fitted.
Remote control station	Indication of each valve's position.

Table 4.1.1-4Testing of fire detection and prevention system

Test	Requirements
Tone of fire alarm	Distinct from other alarms. Audible in accommodation, bridge, control stations and machinery spaces.
Detector heads in machinery space	Individual heads are to be testable and properly indicated on fire alarm panel.
Smoke tests in potential outbreak points	Air currents are not ot render system ineffective.
Test of manual fire alarms	In ways of entrances to engine and boiler rooms, bridge, CCS, fore control station.
Simulated power failure	Light and sound alarm. Automatic power changeover.
Simulated faults in systems	Light and sound alarms (self-monitoring capabilty).
Temporary switch off of loops or detector heads	Indicated locally and at fire control panel. Automatic reactivation after preset time.
Main and auxiliary engines high pressure fuel pipe	Safeguards for containment of leaks are sufficient to prevent fuel reaching ignition surfaces.
Collector tank, if fitted.	High level alarm.

Table 4.1.1-5 Testing of machinery controls Central and secondary control stations

Test	Requirements
Machinery failure alarm	Failure is to be indicated at CCS. Light and sound alarms distinct form others.
Communication with bridge	Operational.
Engineers' alarm	Clearly audible in engineers´ accomodation.
Secondary control stations	Indication in Central station as to subsidiary in control
Control changes between stations	Control to be possible only from one station at a time. Control switching only on acceptance from receiving station.
Simulated power failure to control system	Alarm on bridge and central (main) control station
Other simulated failures to control system	System is always to fail to the safe condition.
Restricted speed range	Indication at any control station and prevention of prolonged running in restricted range.
Disabling of remote control	Ability to control essential machinery manually.
Automatic start of standby pumps	To operate when discharge pressure for working pump falls below preset value.

Table 4.1.1-6 Testing of machinery alarms –Oil engines for propulsion purposes

Test	Requirements
Speed reduction and alarm for: Oil mist in crankcase	Fitted
Low piston coolant outlet flow	Indication at control station that speed reduction necessary.
Low piston coolant pressure	Ditto
Low cylinder coolant pressure	Ditto
High cylinder coolant pressure	Ditto
High cylinder coolant temperature	Ditto
High scavenge air temperature	Fitted
High exhaust gas temp.	Fitted

Table 4.1.1-6 (Cont.)

Test	Requirements
Automatic temp. control of: - Lubricating oil	High temperature alarm.
- Oil fuel	Viscosity control.
- Piston coolant	High temperature alarm.
- Cylinder coolant	High temperature alarm.
- Fuel valve coolant	Low pressurte alarm.
Starting air pressure	Low pressure alarm.
Lub oil sump	Low level alarm.
Lub oil inlet for engine, turbo blower and gearing	High temperature alarm.
Lub oil filters	High pressure alarm.
Cylinder lubrication flow	Low flow alarm.
Cooling media	Standby pump automatic start pressure.
Cylinder outlet	Two stage alarm. Automatic shutdown if temperature exceeds preset value.
Thrust bearing	High temperature alarm.
Engine overspeed	Alarm
Starting of main engines from remote stations	Air pressure/electric charge level to be indicated at all stations.
Automatic start of engines	Number of consecutive failed starts limited to 3. Interlocks to prevent starts when necessary.
Crankcase protection (Engines >2500 kW or Piston bore >300mm)	Oil mist monitoring. Engine bearings temperature monitoring.

Table 4.1.1-7 Gas turbines for propulsion purposes

Test	Requirements
Overspeed	Automatic stop and alarm.
High exhaust gas temperature	Ditto
Flame failure	Ditto
Excessive vibration	Ditto
Failure of lubricating oil pressure	Ditto
Lubricating oil temperature	Automatic temperature control.
Oil fuel supply	Automatic temperature or viscosity control.
Exhaust gas	Automatic temperature control.

Table 4.1.1-8 Steam turbines for propulsion purposes

Test	Requirements
Excessive vibration	Speed reduction and alarm.
Axial movement of rotor	Ditto
Low vacuum in condenser	Ditto
High condensate level in condenser	Ditto
Lubricating oil supply	Automatic control.
Condensate level in condenser	Ditto
Gland steam pressure	Ditto
Turbine and gearing lubricating oil	High temperature alarm. Low pressure alarm. Automatic stop if drops below a preset value.
Lubricating oil slump	Low level alarm.
Lubricating oil filters differential pressure	High pressure alarm.
Electric pump for lubricating oil	Protection of turbine from water torque upon pump failure.
Condensate extraction	Standby pump automatic start.
Thrust bearing	High temperature alarm /Lubricating oil outlet high temperature alarm.
Astern turbine	High temperature alarm.
Gland steam	High and low pressure alarms.
Sea water	Low pressure alarm. Low flow alarm. Stand.by pump automatic start.
Overspeed	Alarm

Table 4.1.1-9 Main and auxiliary boilers

Test	Requirements
Automatic control of parameters	- Combustion system - Oil fuel supply temperature. - Boiler drum water level. - De-aerator water level. - Superheated steam pressure and temperature. - De-superheated steam press. and temperature.
Feed water	High salinity alarm.
Water level	- High level alarm. - Low level alarm with independent sensors or actuators.

Table 4.1.1-9 (cont.)

Test	Requirements
Superheater alarms:	- High/low outlet pressure. - High temperature. - High de-superheated steam temperature.
Feed empe forced circulation	- Low flow alarm+ oil fuel automatic shutoff. - Standby pump automatic start readiness.
Oil fuel	- Low pressure alarm. - High viscosity/low temp. alarm. - Low atomizing air pressure alarm. - Standby pump automatic start
Burner flame	- Ignition failure alarm for each burner. - Automatic fuel shutoff .
Combustion air	- Low pressure alarm. - Automatic oil fuel shutoff.
Uptake (for boilers with economizer or gas air heaters)	- High emperatura alarm.

Table 4.1.1-10 Thermal fluid heaters

Test	Requirements
Automatic control of parameters	- Combustion system. - Heavy oil fuel supply temperature. - Thermal fluid temperature.
Expansion tank	Low level alarm + oil fuel automatic shutoff.
Thermal fluid	- Two stage high outlet .temperature alarm. Oil fuel automatic shutoff at 2nd stage. - Flow failure/low pressure alarm+ oil fuel automatic shutoff . - Standby pump automatic start readiness
Combustion air	Low flow pressure alarm + oil fuel automatic shutoff.
Oil fuel	- Low pressure alarm. - High temp. alarm (heavy oil). - Atomizing air low pressure alarm. - Standby pump automatic start
Burner flame	Failure alarm for each burner. Oil fuel automatic shutoff.

Table 4.1.1-11 Inert gas generators

Test	Requirements
Automatic combustion control	Maintain steady state throughout entire operating range.
Cooling water	High temperature alarm.
Inert gas	- Low pressure alarm. - High outlet temp. alarm + automatic oil fuel shutoff.
Combustion air	Low pressure alarm + automatic oil fuel shutoff.
Oil fuel	- Low pressure alarm - High temperature alarm (for heavy oil)
Burner flame	Ignition failure alarm + automatic oil fuel shutoff.
Inert gas oxygen content	Two-stage high percent alarm + interruption of cargo operations on high percent.

Table 4.1.1-12 Incinerators

Test	Requirements
Oil fuel	- High temperature alarm (for heavy oil only). - Low pressure alarm.
Combustion air	Low pressure alarm + oil fuel/sludge automatic shutoff.
Burner flame	Ignition failure alarm + oil fuel/sludge automatic shutoff.
Furnace temperature	- Low temperature alarm - High temperature alarm + oil fuel/sludge automatic shutoff - Control device is to ensure waste being completely burned.
Exhaust temperature	High temperature alarm.

Table 4.1.1-13 Auxiliary oil engines

Test	Requirements
Lubricating oil	- High temperature alarm. - Low pressure alarm.
Coolant outlet (engines >220 kW)	Two-stage high temperature alarm + automatic shutdown at 2^{nd} stage.
Overspeed	Alarm
Starting air	Low pressure alarm.

Table 4.1.1-14 Auxiliary steam turbines

Test	Requirements
Lubricating oil inlet	- High temperature alarm - Two-stage low pressure alarm + automatic shutdown at 2^{nd} stage.
Condenser vaccum	- Low vacuum alarm + automatic shutdown of turbine.
Axial displacement of rotor	Excess displacement alarm + automatic shutdown.
Overspeed	Alarm

Table 4.1.1-15 Auxiliary gas turbines

Test	Requirements
Lubricating oil inlet	Low pressure alarm + automatic shutdown of turbine.
Burner flame	Failure alarm + automatic shutdown of turbine.
Vibration	Excessive vibration alarm + automatic shutdown.
Exhaust gas	High temperature alarm + automatic shutdown.
Overspeed	Alarm

Table 4.1.1-16 CP propellers for propulsion purposes

Test	Requirements
Main power source for actuating medium	To be indicated.
Reserve power source for actuating medium	To be indicated.
Simulated failure of main pump to hydraulics	Automatic start of reserve (standby) pump + failure alarm of main pump.
Test of stations from which proulsion may be controlled	Indication of pitch and shaft speed at each station.
Simulated failure of power supply of control sysem between bridge and hydraulic actuator	Alarm
Hydraulic system	Low pressure alarm.
Hydraulic tank	Low level alarm.
Hydraulic oil	High temperature alarm. (If oil cooker fitted.)

Table 4.1.1-17 Turbine-driven cargo/ballast pumps in dangerous spaces or zones

Test	Requirements
Bearing temperature	High temperature alarm.
Casing	High temperature alarm.
Bulkhead gland	High temperature alarm.

Table 4.1.1-18 Electrical power supply system

Test	Requirements
Generators overload	Alarm for load shedding.
Busbar voltage	Low/high alarm.
Busbar frequency	Low frequency alarm.
Generator cooling air	High temperature alarm.
Simulated failure of main power supply	Automatic switch on to emergency source or temporary emergency source for essential emergency lighting.
Load shedding (ships with 2 or more main generators	Arrangements to ensure steering and propulsion (as essential services).
Automatic connection of reserve main generator	Connection in 45 seconds or less.

Table 4.1.1-19 Miscellaneous tests/surveys

Test	Requirements
Sterntube lubricating oil tanks	Low level alarm.
Oil lubricated sterntube bearing	High temperature alarm.
Service oil fuel tanks	High/low level alarms.
Oil fuel settling tanks	High temperature alarm.
Coolant tanks	Low level alarm.
Sludge tanks	High level alarm.
Service feed water tanks	Low level alarm.
Water purifier	− Broken seal alarm. − Oil inlet high temperature alarm.
Air compressors	− Low lubricating oil pressure alarm + automatic shutdown. − High discharge air temperature alarm.
Hydraulic controls	Low pressure alarm.
Pneumatic controls	Low pressure alarms.
Dual fuel systems	Indication on which fuel is being used.
Oil heaters	Two-stage high temperature alarm + automatic shutoff of heating supply on 2nd stage.
Manual controls	Sufficient instruments to ensure an effective operation of machinery.
Automatic bilge pump (if fitted)	Automatic start.

Table 4.1.1-20 Tests/surveys for UMS notation – Bridge and accommodation

Test	Requirements
Relay of machinery alarms to engineers' accommodation	Capable of alerting engineers that a fault has occurred.
Relay of machinery alarms to bridge	Watch officer is made aware that a machinery fault has occurred, is acknowledged and has been dealt with.
Unacknowledged machinery fault alarms	Activation of engineers' alarm after a preset time.
Alarms requiring speed or power reduction or automatic shutdown	Must be separately identified on bridge.

Table 4.1.1-21 Tests/surveys for CCS notation

Test	Requirements
CCS Alarm system	Ensures identification of faults and adequate supervision of equipment.
CCS Alam+control systems	To comply with requirements of previous tables.
Communication means between bridge and CCS	− At least two means are to be operational. − One means is to be provided for communication with engineers' accommodation and machinery space. − At least one means is to operate during main power supply failures.
Main electrical power supply failure (simulated)	Alternative electrical power supply available.
Control positions for main machinery, cargo, ballast systems and navigation	At least two operator terminals available, with necessary pinting devices.
Indicators	All essential parameters for safe operation and operational status of machinery to be indicated.
Tests of alarms through controlled systems	− Alarms are to be immediately displayed. − Alarms to be displayed in order of occurrence. − Unacknowledged alarms to be displayed in flashing manner. − Shutdown and slowdown alarms to have a distinctive display.
Displays	− Standartized sysmbols. − Easily read from operator position. − Manual means for adjustment of brightness.
Keyboard	Grouped for rapid access to functions. Same grouping at all terminals.
Miscellaneous requirements	− Terminals to be protected from liquid spills − System clock with a restricted access and backup power supply.
NOTE: Tests are additional to those required by previous tables for UMS notation.	

SECTION 5. SPECIAL SURVEYS - DYN NOTATIONS

5.1 GENERAL INFORMATION

5.1.1 The dynamic positioning control system and associated machinery are to be generally examined under operating conditions.

5.1.2 During performance of tests the Surveyor will not carry out any operations of the system, its controls or alarms, including lamp tests. All operations are to be carried out by designated crew members on Surveyor´s request.

5.2 TESTS DURING SPECIAL SURVEY

5.2.1 The following tests are to be carried out during Special Survey:

(a) Lamp test at operator's console to verify all alarm and indication lamps.

(b) Operation of control station transfer switch to transfer control to secondary/auxiliary control stations, to verify smoothness of transfer and the operation of relevant interlocks.

(c) Operation of manual control in ahead, astern, port and starboard directions, to verify that thrust is in accordance with selected direction. Repeat from all secondary stations.

(d) Operation of turning moment control to verify that vessel turns in accordance with the selected direction. Repeat from all secondary stations.

(e) Operation of ABANDON DIVE switch, whenever applicable, to check that alarm is initiated at the Dive Control stations.

(f) Performance of a combined test with the joystick for manual control and turning moment on automatic control. Perform once more selecting position keeping on automatic mode and turning moment on manual mode. Verify that manual control has no effect on selected automatic functions

(g) Select automatic mode, deploy and put on line at least 2 position reference systems. Command offsets in both direction and heading. Deviation is to be within limits specified by Owner. Allow the system to stabilize after each command.

(h) Redundancy tests on automatic control, for notations DYN(AM), DYN(AA) and DYN(FA):

  (i) With all thrusters selected and operational, stop the most effective one and check that the ship maintains predetermined operation area and heading.

  (ii) Switching off online controller and verifying that there is automatic changeover to standby controller. The ship is to maintain the station capabilities. Perform test for all stations.

  (iii) Simulating an electrical power failure. Verify emergency/reserve electrical power supply to station. Verify paragraphmeters of voltage and current, which are to be in accordance with specified values for equipment. Check that upon restoration of main power supply, emergency/reserve source returns to normal condition.

  (iv) Switching off one position reference system, gyrocompass, wind sensor and vertical reference unit. Verify that the relevant alarms are triggered. Verify the unit's changeover to standby unit and continuity of the station keeping capability.

(i) Stopping of one thruster with the emergency stop, which is to override the dynamic positioning control of the thruster. Perform for each thruster.

(j) Power tests:

  (i) Trip one running generator set and check that full positioning thrust capability is maintained and that the ship maintains station operational.

  (ii) If overload condition occurs pitch limitation is to be carried out and the relevant alarms triggered.

  (iii) Restart one generator set and check that pitch limitation is reduced and load rebalanced.

  (iv) Simulate a single failure on a switchboard section and verify that the ship maintains station operational.

  (v) Simulate total failure of dynamic positioning system and note the ship's deviation from given position while the operator switches to manual control.

(k) Deploying diving complex, if applicable, and operation on automatic control with not less than 2 position reference systems deployed for a 30 minute period and check the station keeping capability.

(l) Additional tests for DYN(FA) notation:

  (i) Control of dynamic positioning system is to be verified from emergency control position with main control station isolated.

  (ii) Perform position and heading changes.

  (iii) Check manual transfer of control.

  (iv) When in TEST mode, care is to be taken when transfering control from the emergency control station back to the main console. The main control station is to be in STANDBY mode.

SECTION 6. SPECIAL SURVEY - BRIDGE NOTATIONS

6.1 GENERAL INFORMATION

6.1.1 On vessels having the notations SBL, 1-W and IBS the navigating bridge equipment is to be generally examined as required by *paragraph 2.5.1* for the Annual Survey and, additionally, the tests required by this Section are to be carried out as applicable.

6.2 WATCH AND CALL ALARMS

6.2.1 Initiate the navigation officer's call alarm and verify its audibility in all the navigation officers' accommodation and public spaces.

6.2.2 For the watch alarm the following is to be carried out:

(a) Setting the time delay to its maximum value (which is to be ≤12 min) and switching on of the system.
(b) Check the time to prewarning on the bridge.
(c) Acknowledge prewarning on the bridge.
(d) Check that the acknowledgement resets the time interval and repeat the test for each acknowledgement button.
(e) Wait until prewarning starts again but this time do not acknowledge.
(f) Check the time interval between prewarning and start of watch alarm. (Max. 1 minute.)
(g) Check that the watch alarm is clearly audible in all the navigations' officers' accommodation and public spaces.
(h) Cancel watch alarm.

6.2.3 An interruption of main electrical power supply to the bridge alarms is to be performed and the following is to be checked:

(a) Automatic changeover to the emergency or reserve electrical power supply.
(b) Automatic start of light and sound power failure alarms.

6.2.4 Verify that the alarms below, when not acknowledged on the bridge within one minute, cause either the navigation officer alarm to be initiated or the individual alarm to be transferred to the navigation officers' accommodation and public spaces:

(a) Shallow depth warning.
(b) CPA (Closest point of approach) warning.
(c) TCPA (Time to closest point of approach) warning.
(d) Autopilot failure.
(e) Gyrocompass malfunction

(f) Navigation light failure.
(g) Watch safety system failure. (h) UMS alarms
(i) Off-course warning.
(j) Off-course alarm system failure.

6.3 TRANSVERSE THRUSTERS CONTROLS

6.3.1 Start the thrusters and apply pitch to port and starboard from centre console, verifying the satisfactory operation of motor and pitch indicators.

6.3.2 Test the control changeover to bridge wing consoles and apply pitch to port and starboard from each wing, verifying the satisfactory operation of pitch indicators.

6.4 MANUAL STEERING CONTROLS

6.4.1 Check the steering motor satisfactory start/stop operation and indication.

6.4.2 Check the control changeover between centre console and bridge wing consoles.

6.4.3 Operate manual steering to give 5-15º rudder movements to port and starboard in all the control consoles.

6.4.4 Test changeover to local emergency steering.

6.4.5 Observe operation of rudder angle indicators throughout the full range of movement Accuracy of rudder angle indicator is to be ±1º. Record the indicator values as shown in *table 6.4.5*.

Table 6.4.5 Rudder angle indicator values

Position of rudder stock (degrees)	**35**	**30**	**20**	**10**	**0**	**10**	**20**	**30**	**35**
Centre indicator									
Port wing indicator									
Stb. wing indicator									
Panorama indicator									

6.5 MAGNETIC COMPASS

6.5.1 The checks provided for in *paragraph 2.5.2* are to be carried out.

6.6 GYROCOMPASS

6.6.1 The procedure for gyrocompass test will be as follows:

(a) Start gyrocompass with heading set approximately 90º off the true heading.
(b) After a 3-hour interval check that the compass has settled, by means of taking five bearings to a distant object.
(c) Determine the true north bearing by a sun azimuth bearing or other suitable means.
(d) Determine the settled north bearing by the mean of the 5 observations. The root mean square error in the readings, compared to the mean values is not to exceed 0.75º.
(e) Register the difference between the settled north heading and the true north heading.
(f) Perform operations in *subparagraphs (a)-(e)* for each additional gyrocompass.

6.7 RADAR AND ARPA

6.7.1 The following tests are to be carried out:

(a) Take visual bearings of 4 appropriate features and comparing to the bearings from the radar. Accuracy of he radar bearings is to be within **1º** of the visual bearing.
(b) Measure the range of 2 appropriate features using each range on the radar and comparing to the actual ranges. Accuracy of the radar range measurement is to be within **1.5%** or ±**70 m** of the range used, whichever is the greatest.
(c) Perform tests in *subparagraphs (a)* and *(b)* for each radar and ARPA unit.

6.8 DOPPLER LOG

6.8.1 Observe that all the log displays are indicating zero speed.

6,8.2 Associated outputs to ARPA/radar units are also to indicate zero speed.

6.8.3 Check satellite position fixing sysem for indication of zero speed.

6.9 ECHOSOUNDER

6.9.1 Operate echosounder on shallow range and compare the sounding readings with the actual depth. Accuracy is to be within **±1 m**.

6.10 SATELLITE NAVIGATION SYSTEM

6.10.1 The following is to be peformed:
(a) Observe initializing of equipment.
(b) After completion of initializing, compare indicated position of vessel with actual position determined or known otherwise. Accuracy is to be within 0.25 miles.

6.11 RADIO NAVIGATION SYSTEM

6.11.1 The following is to be peformed:

(a) Observe initializing of equipment.
(b After completion of initializing, compare indicated position of vessel with actual position determined or known otherwise. Accuracy is to be within 0.25 miles.

6.12 NAVTEX RECEIVER

6.12.1 The following is to be carried out:
(a) Observe/check record of satisfactory operation of receiver during Safety Radio Survey.
(b) Observe satisfactory operation of printer.

6.13 WHISTLE CONTROLS

6.13.1 The following tests are to be performed:
(a) Check the manual operation buttons.
(b) Verify the operation of the whistle timer.

6.14 WIND PARAGRAPHMETERS INDICATION SYSTEM

6.14.1 Display is to indicate correct speed and direction of wind. Check by other available means.

6.15 NAVIGATION LIGHTS

6.15.1 The following tests are to be performed:
(a) Verify operation on main and emergency sources of electrical power.
(b) Verify indicator panel operation (pilot lamps, dimmer).
(c) Test of navigation lights failure

6.15.2 Verify the proper operation of Morse/manoeuvering light(s).

6.16 TELEPHONE COMMUNICATIONS

6.16.1 Test telephone communications to and from the bridge for all extensions on main and emergency source of electrical power.

6.16.2 Verify that the bridge takes priority over all other ongoing telephone calls.

6.17 WHEELHOUSE LIGHTING

6.17.1 Verify the operation of two independent lighting circuits on the bridge by interrupting one of them and checking that the other is still functional.

6.17.2 Verify satisfactory operation of emergency lighting for navigating bridge, chartroom, radio room (if applicable) stairways and exits.

6.17.3 Verify that all the controls, indicators and instruments on the navigating bridge are visible in the dark from internal lighting within the equipment.

6.17.4 Verify operation of all dimmer switches.

6.18 NAVIGATIONAL EQUIPMENT POWER SUPPLY

6.18.1 Verify satisfactory operation of changeover between main and emergency/reserve power supplies to the following equipment:
(a) Gyrocompass and repeaters.
(b) Radar and ARPA units.
(c) Magnetic compass illumination.
(d) Echosounder.
(e) Doppler log.
(f) Satellite navigation system.
(g) Radio navigation system.
(h) Manual steering system.
(i) Rudder angle indicator.
(j) Propulsion controls.
(k) Engine rpm indicators.
(l) Rate of turn indicators.
(m) Autopilot

6.18.2 Verify that the failure of the final circuit to each navigation equipment item does not impair the power supply to anyother item. Failures are to be simulated for the following items:
(a) Gyrocompass and repeaters.
(b) Radars.
(c) ARPA units.
(d) Echosounder.
(e) Doppler log.
(f) Satellite navigation system.
(g) Radio navigation system.
(h) Manual steering system.
(i) Rudder angle indicator.
(j) Propulsion controls.
(k) Engine rpm indicators.
(l) Rate of turn indicators
(m) Autopilot.

6.18.3 Verify operation of indicators for each power supply for all the equipment covered by this Subsection.

6.19 TESTS OF MISCELLANEOUS EQUIPMENT AND SYSTEMS

6.19.1 The following tests are to be carried out:
(a) The **public address system** is to be checked for proper functioning. It is to be clearly audible in all public spaces, open decks, bow and stern areas.

(b) The **fire detection system** is to be checked in accordance with *table 4.1.1-4*.
(c) **Watertight doors** operation indicators are to be checked for satisfactory operation.
(d) **Clearview screen** or bridge wipers are to be checked in operation. Simulated failure in each clearview is not to affect adversely the power supply to the remaining clearview screens or wipers.

SECTION 7. PERIODICAL SURVEY OF VAPOUR DETECTION SYSTEMS

7.1 CATALYTIC SYSTEMS

7.1.1 Each detector is to be tested by exposure to the span gas. Check the availability of test tubes through which span gas may be injected to the detector without dissipation into the compartment´s atmosphere.

7.2 AIR SAMPLING SYSTEMS

7.2.1 System is to be checked to ascertain if each sample tube is drawing an air sample.

7.2.2 Verify the NO FLOW alarm, if applicable.

7.2.3 The sensor is to be checked by means of an injection of span gas and the correct alarm setting is to be verified at 30% of lower explosion limit.

7.2.4 When testing of each individual sensor line is unpractical, a representative selection of sensors is to be made.

REFRIGERATED INSTALLATIONS
PART I, CHAPTER 6

SECTION

REFRIGERATED INSTALLATIONS
PART I, CHAPTER 6

SECTION 1. GENERAL

1.1 APPLICATION

1.1.1 To maintain its class notation, any classed refrigerated cargo installation is to undergo satisfactory surveys in accordance with the scheme outlined in this Section.

1.1.2 Annual Survey. This survey is to be carried out at nominal intervals of 12 months after the date assigned to the preceding Annual Survey. It may be carried out within the period extending three months before and three months after the due date.

1.1.3 Special Survey. The Special Survey may be undertaken under one of the following schemes:
(a) Regular scheme: The Special Survey is to be carried out approximately five years after the date of the Initial Survey and at five-yearly intervals thereafter.
(b) Continuous Survey: Upon request, the MCO may agree to the Special Survey being conducted progressively over a five year period. In principle, approximately 20% of the survey requirements are to be completed annually and preferably at the time of the Annual Survey.

1.1.4 Loading Port Surveys. Upon request by the Owner, a Loading Port Survey may be carried out at any time on one or more chambers to certify their condition prior to loading a refrigerated cargo. Such surveys may only be carried out if the installation is classed with the MCO and the survey records are up to date.

1.1.5 Loading Port Surveys are not mandatory and do not imply that the temperatures noted are necessarily suitable for the cargo which is to be carried.

SECTION 2. SURVEY REQUIREMENTS

2.1 ANNUAL SURVEY

2.1.1 The purpose of the Annual Survey is to establish that the condition of the refrigerated cargo installation as a whole is satisfactory and that the machinery is operating reliably and may be expected to continue to do so for the ensuing 12 months.

2.1.2 With a view to minimizing interference with operational commitments, Annual Survey requirements have been framed to avoid any opening up or dismantling unless the ship's records or external examination indicate the presence of some fault requiring attention. This is to be made known to Owners and their representatives to avoid the unnecessary dismantling which is sometimes put in hand prior to the Surveyor's attendance being requested.

2.1.3 **CARGO CHAMBERS**

2.1.3.1 Modern installations generally incorporate materials which are not susceptible to rot, corrosion, ageing or the depredations of vermin; do not settle, and maintain their insulation properties over long periods of time without serious deterioration. However, there are still installations in service incorporating materials which are subject to decay such as plywood not of marine quality, and settling - loose cork and mineral wool. Ships with installations incorporating these materials will probably be nearing the end of their service lives and they require more stringent examination than do installations using more modern materials.

2.1.3.2 Defects most likely to be encountered are mechanical damage to linings, decay (dry rot) of timber linings, grounds and fittings and the corrosion and failure of fastenings resulting from the frequent presence of condensed moisture.

2.1.1.3 The seals on the closing arrangements, e.g. hatches, doors, bilge limbers, etc., are also vulnerable and minor damages are to receive early attention since, apart from the loss of efficiency resulting from leakage, ice is likely to form in damaged seals and exacerbate the damage. The cleanliness of scuppers, their brine traps and if fitted, their non-return valve is to receive particular attention. It is only infrequently that significant quantities of water drain through such scuppers and in consequence, they frequently become choked with debris and may be ineffectual when really needed.

2.1.2 AIR COOLERS

2.1.2.1 These may be either within the cargo chambers or in adjacent compartments. The latter tend to be visited only infrequently by ship's staff and sometimes become the repositories of rubbish. This is to be deprecated, and both the coolers and the spaces in which they are housed are to be seen to be in clean condition, with cooler drip trays imperforated by corrosion; their drains clear; seals, where fitted, primed and the drain heating arrangements in good order. Direct expansion coolers with light aluminium fins are susceptible to mechanical damage and their condition is to be checked.

2.1.3 MACHINERY

2.1.3.1 All rotating units of the plant, i.e. compressors, condenser cooling pumps, primary and secondary refrigerant circulating pumps, fans, etc., are to be examined under working conditions.

2.1.3.2 Frequently the chambers will be at ambient temperature at the time of the survey and it will not be feasible to confirm, solely by inspection, that the installation continues capable of maintaining the notation temperatures. However, the refrigerant evaporation and condensation temperatures can be checked and provided that there is no evidence of mechanical defects, these are a fair indication that the plant is in good order. This will be substantiated by satisfactory log book entries over the preceding period.

2.1.4 GRIDS

2.1.4.1 Although not used in modern reefer ships, serpentine grids on vertical and overhead surfaces of chambers are still specified for fishing vessels and there are reefer ships in service using this system. Grids are susceptible to mechanical damage.

2.1.4.2 The condition of securing clips is to be checked to ensure that the pipes are properly supported; joints are to be checked for evidence of leakage, and any indication of severe rusting is to be investigated. Due to the temperature differentials,

condensation frequently forms on the pipe surfaces producing conditions which are conducive to corrosion.

2.1.4.3 Normally, good galvanizing provides sufficient protection but if the galvanizing is damaged, rust will quickly form and in addition to the possibility of the ultimate perforation of the pipe, cargo may suffer damage from staining as a result of rusty condensate dripping from overhead pipes. In some ships, portable sections of brine piping are provided for fitting in way of hatch openings. The connections of such pipes are particularly susceptible to damage when being fitted or stored, and are to be checked to confirm that they are in a usable condition and provided with some form of protection when stowed.

2.1.5 INSULATION OF PRESSURE SYSTEMS

2.1.5.1 The external insulation of low temperature piping and components is to be inspected for any obvious evidence of breakdown due to failure of the vapour barrier on the outside of the insulation. This is important since, in addition to the obvious thermal losses, the resulting conditions are conducive to the corrosion of pipes and the shells of brine coolers, liquid refrigerant receivers, etc.

2.1.6 THERMOMETERS

2.1.6.1 Most modern installations incorporate electronic data logging equipment which includes facilities for recording the temperatures of chambers and the air leaving air coolers, etc. The maintenance of these units is essentially specialist's work and a certificate in respect of professional servicing within the preceding 12 months is to be sighted.

2.1.6.2 The operation of all distant reading thermocouples and electrical resistance thermometers is to be tested and a specialist's recent calibration sighted. In the event that this is not available, calibration is to be verified by comparing the readings obtained with those of standard mercury thermometers placed adjacent to sensing elements selected at random.

2.1.7 ELECTRICAL SYSTEM

2.1.7.1 The driving motors of all rotating machines forming part of the refrigerating plant are to be sighted running, with particular attention to any fan motors which are in positions which preclude their being under frequent observation by ship's staff.

2.1.7.2 Electrical insulation resistance of motors, switchgear and cables is to be measured and is to be not less than 0.1 MΩ for any component or circuit. Megger readings taken by ship's personnel or a responsible contractor will be accepted.

2.1.7.3 The ship's electrical generating installation is to be examined. It is to be confirmed that there are sufficient generator sets in working order to enable the refrigerating load, together with the ship's essential electrical load, to be maintained in the event of the failure of any one of the available generator sets. Random tests are to be made to establish that automatic controls, alarms, etc., are in working order.

2.2 SPECIAL SURVEY

2.2.1 The Special Survey serves to confirm the findings of the examinations carried out during the Annual Surveys, by opening up plant and machinery at intervals of five years for the purpose of establishing that no concealed defects have developed. It can be said as a generalization that refrigeration compressors operate under favorable conditions and are inherently reliable.

2.2.2 The most detrimental influences are dirt and water within the closed primary refrigerant circuit. Whatever precautions are taken it is likely that both will gain access during the course of dismantling on board ship, and there is a considerable body of informed opinion which holds that harm resulting from the dismantling of compressors under adverse conditions is likely to outweigh any advantages resulting from such dismantling at purely arbitrary intervals. This view is not to be lightly dismissed, but at the same time, compressors cannot be allowed to run until they break down. Unfortunately, there is no way in which the condition of a compressor can be established with certainty without some opening up, and the Rules require that each reciprocating compressor be dismantled at the time of the Special Survey to an extent sufficient for the crankshafts, cylinder bores, pistons, piston rods, connecting rods, valves and seats, glands, relief devices, suction filters and lubricating arrangements to be examined.

2.2.3 The condition of one component will be a guide to the condition of other similar components and likewise, the condition of one compressor will be, generally, indicative of the conditions of others. Much may be learned from the comments of the responsible ship's staff on the performance of the installation and the history of defects, if any, which have developed and

required attention during the preceding five years.

2.2.4 Account is to be taken of running hours if the compressor has been little used. In the final analysis, the Surveyor must be satisfied that the machinery in question is in a satisfactory condition and must be prepared to sign a report to that effect, but it is the intelligent assessment of parts which are opened up which is required rather than opening up as an end in itself. In the light of the foregoing, the interval between the opening up for examination of screw compressors has already been extended to six years or 30 000 running hours, whichever is earlier.

2.2.5 The whole issue of survey intervals for compressors of all types will be kept under review and they may be further extended in due course. The foregoing applies specifically to compressors. Other components in refrigerating systems which are less sensitive to damage resulting from opening up, generally suffer wear and tear similar to that sustained by other items of auxiliary machinery. The following comments are made for guidance:

(a) **Low temperature pressure vessels**. These are particularly susceptible to external corrosion of the shell plating in the event of the thermal insulation or vapour barrier being faulty. Small sections of insulation are to be removed to ascertain the condition, and obviously, these are to be selected to include any areas, the appearance of which may indicate some breakdown. Insulation and the vapour seal must be effectively restored on completion.

(b) **Sea connections**. Surveyor is to note that in some installations the cooling water is taken from a ring main system and that there is no independent refrigeration sea connection. In the case of ships not classed with MCO, a certificate of the Classification Society with which it is classed, or other documentary evidence, is normally acceptable and a copy is to be attached to the survey report.

(c) **Ventilation and ducting**. Air ducts are to be examined for damage by cargo handling, cleanliness and corrosion. The valves on air refreshing systems are particularly susceptible to corrosion and seizure, and are to be checked.

(d) **Insulation and linings**. With modern materials, the deterioration of insulation is minimal and discretion is to be exercised as to the extent to which linings are to be removed for inspection purposes. Foamed *in situ* insulating materials and insulated panel systems can normally be expected to be in good condition which can be confirmed by small bore holes made in the lining. Insulation in pre-formed blocks maintains its characteristics well and only sufficient lining is to be removed to establish that there is no general deterioration. Loose cork fill, glass wool and mineral wool do have a tendency to settle in service and evidence of this is to be sought by the opening of small apertures at the top of vertical linings. Openings in the linings are to be made in positions selected to facilitate their removal with minimum damage, and it is vital that any insulation removed for inspection purposes be fully restored, and the joints in the replacement lining made air and vapour tight. Vapour seals on the internal linings of the chambers are to be examined as far as practicable.

2.3 LOADING PORT SURVEY

2.3.1 When a Loading Port Certificate is required by the Owner or his representative, a survey is to be carried out at the loading port. The certificate is not in respect of the cargo to be loaded or the manner in which it is to be stowed.

2.3.2 The refrigerating installation is to be examined under working conditions, and the temperatures in the cargo chambers are to be noted.

2.3.3 The refrigerated cargo spaces and chambers are to be examined in an empty state to ascertain that they are clean and free from odour which may adversely affect the cargo to be loaded, that the air cooler coils and cooling grids and their connections are free from leakage, that cargo battens, where fixed to the vertical surfaces, are in good order, that cargo gratings or dunnage battens are available as necessary for the floors or decks, and that no damage has been sustained to the insulation or its lining prior to the loading of the refrigerated cargo. Any indications of defective insulation not considered to warrant immediate attention are to be noted and specially reported.

2.3.4 All scuppers and bilge suctions draining insulated spaces are to be examined to ensure that they are in good working order, and that any liquid seals are primed.

2.3.5 If the ship loads at more than one port, one survey only at the first loading port will be required, provided that it includes the examination of all spaces or chambers which are to be used for refrigerated cargo during the voyage, and that general cargo is not subsequently carried in any of the spaces or chambers prior to loading the refrigerated cargo.

2.3.6 In the case of ships engaged on voyages of less than two months, a Loading Port Certificate will be considered as valid for two months, provided that the cargoes carried are of such a nature as not to damage the insulation or appliances in the insulated chambers, nor to affect, by taint or mould, the refrigerated cargoes loaded during that period. For longer voyages the certificate will be valid for only one cargo from the loading port(s) to the discharge port(s).

2.3.7 If there is no Surveyor to the MCO available at the loading port(s), or at a port within a reasonable distance, the MCO will accept the report of a survey held at the loading port by two engineers of the ship.

2.4 REPORTING

2.4.1 A log book is to be kept on board in which entries in respect of all surveys of refrigerated cargo installations be initialled by the Surveyor concerned. It is the Surveyor's responsibility to see that this is done and that the records are kept in a proper manner. This procedure is likely to be dispensed with if arrangements are introduced for maintaining refrigeration survey records by computer.

2.4.2 All Annual and Special Surveys are to be reported through a Survey Report.

2.4.3 Conditions of Class are to be recommended when defects are found which cannot receive immediate attention but which do not jeopardise the operation of the installation for the required duty, for the period for which postponement is contemplated.

2.4.4 The Surveyor's requirements with regard to Conditions of Class are to be made known to the representatives of the Owner at the time of the survey, and their intentions with regard to compliance are to be ascertained and included in the Report.

SECTION 3. SYSTEMS FOR THE CARRIAGE OF INSULATED CARGO CONTAINERS

3.1 CONTAINERS

3.1.1 Insulated containers for the carriage of refrigerated cargoes are of two common basic types, both of which are covered by MCO Certification Scheme.

3.1.2 The **porthole** container is provided with two circular openings at the front end through which cooled air from an external source may be circulated. When detached from the supply of cooled air, the apertures are closed by means of simple disc type valves which are operated externally.

3.1.3 The **integral** container incorporates its own refrigerating machinery. Such units are built into the front end of the container and comprise: electric motor, compressor, air cooled condenser with fan, evaporator/cooler with circulating fan, and control and temperature recording equipment. A water cooled condenser, intended for use when the container is carried below deck on board ship, may also be included.

3.1.4 There are other types of insulated containers in use to a lesser extent which are not currently certified by MCO. These include:

(a) Containers fitted with a refrigerating appliance which uses a solid expendable refrigerant such as water ice or dry ice (solid carbon dioxide), or a liquid expendable refrigerant such as liquid nitrogen or liquid carbon dioxide. They are usually carried above deck.

(b) Insulated tank containers designed to carry chemicals and liquefied gases at a controlled temperature between – 30°C and 50°C. They are built in accordance with IMO requirements but, as the nature of cargo is hazardous, the containers must be carried above deck only.

3.1.5 The sizes of insulated containers in most general use are ISO Types 1C (8'×8'×20'), 1CC (8'×8'6"×20'), 1A (8'×8'×40') and 1AA (8'×8'6"×40') but 10 ft and 30 ft containers are also in use.

3.2 CONTAINER CERTIFICATION SCHEME

3.2.1 The Container Certification Scheme is applicable to containers for all purposes and is designed to ensure compliance with ISO standards for dimensions, strength and weather-tightness. It also meets the requirements for certification under the provisions of the *International Convention for Safe Containers* (CSC-72). Certification is carried out on the basis of approved manufacturers producing container types which have been satisfactorily prototype- tested under survey.

3.2.2 For thermally insulated containers, the **Type Approval Certificate** will be endorsed in respect of heat leakage characteristics and airtightness, as established by tests on representative containers carried out under survey at an approved test station. There are no limiting values imposed on thermal conductance.

3.2.3 Provision is also made for the certification of refrigeration units for incorporation into integral type containers, and for clip-on units which are essentially similar, and designed to be attached temporarily to the front ends of porthole type containers while they are detached from a fixed supply of cooled air. Both types of units may incorporate their own prime mover (normally a diesel engine) and generator which makes them independent of electric power supplies.

3.2.4 Type approval follows the usual procedure of plan appraisal, followed by testing of a prototype unit. Certification is on the basis of batch and line production by approved manufacturers. It is to be noted, however, that certification of the refrigerating machinery is not a prerequisite for the certification of an integral type container.

3.2.5 Periodical Surveys will not be carried out on certified containers.

3.3 PARTICULARS OF CONTAINER SHIPS FOR PORTHOLE CONTAINERS

3.3.1 General

3.3.1.1 The widespread adoption of refrigerated cargo containers has required a paragraphllel evolution of specialized ships designed to transport them. As with the containers themselves, there are two distinct types, i.e. porthole type and integral type.

3.3.2 Guides

3.3.2.1 Vessels for porthole containers type are provided with guides below deck for carrying containers. Refrigerated containers normally constitute only part of the total number of containers carried.

3.3.2.2 The vertical cell guides are arranged in athwartships rows, generally referred to as bays, and each bay is provided with a system of fixed air ducts extending across the transverse bulkhead adjacent to the front (i.e. porthole) ends of the containers, as stowed. The ducts are partitioned to provide passages for the delivery and return of refrigerated air, and connection with the containers is effected by extending couplings which are so located that they align with the porthole openings in the containers when stacked in the guides.

3.3.3 Ducting

3.3.3.1 There are a number of different approaches to ducting design but the common basic features are the following:
(a) Air passages for the supply and return of refrigerated air. These must be airtight to minimize the loss of air into the hold space, and insulated to minimize the ingress of heat from the hold space.
(b) An air cooler.
(c) A circulating fan and motor.
(d) Couplings for connecting the ducts to the containers.
(e) Sensors for monitoring temperature, CO_2 content, fire, etc.

3.3.3.2 Current practice generally favors a vertical configuration in which a single self-contained duct incorporating all the above features is provided for each vertical stack of containers. Such ducts can be factory assembled under favorable conditions and lowered into the ship as completed units.

3.3.3.3 Ducts designed for a stack of as many as nine containers will be approximately 25 m in length and present considerable transport and handling problems. For this reason they may be manufactured in two or three sections, the final joints being made on board.

3.3.3.4 The partitioning in the ducts may be quite complex and incorporate variations in cross sectional area, shutters, guide vanes, air freshening ports, etc., with a view to achieving a uniform supply of air to all insulated containers in the stack both when it is filled with insulated containers and when it is partly filled; or filled with a mixture of both insulated and non-insulated containers.

3.3.3.5 Air coolers are of conventional design, with the usual defrosting arrangements, and are normally supplied with a secondary refrigerant (calcium chloride brine), but there are a few ships equipped with direct expansion coolers.

3.3.3.6 Coolers are, generally, arranged in two sections so that in the event of blockage or other failure, some cooling may be maintained pending cleaning or repair of the defective section. However, the Rules allow for up to ten 20 ft or five 40 ft standard containers being supplied by a single unit.

3.3.3.7 Fans are normally of the propeller type and to achieve the required air flow without resorting to large diameters, they are usually mounted in pairs. Centrifugal and mixed flow fans are also used, usually as single units. The drive may be either direct or via Vee belts, with the motors located outside the air streams and accessible for repair or replacement.

3.3.4 Couplings

3.3.4.1 Couplings bridge the gap between ducting and the containers and take the form of a short extending tube operated by compressed air.

3.3.4.2 There are two basic types of couplings: one which extends the tube by pneumatic pressure, a weak spring such as elastic cords being provided for retraction; and a fail safe approach in which the coupling is extended by means of a spring and retracted by compressed air. In both types the seal between the coupling and the container is obtained by an inflatable rubber ring or soft rubber lips incorporated in the moving part of the coupling.

3.3.4.3 Into the couplings a valve is normally built which closes when retracted; however, some older types close against moveable shutter plates which are provided adjacent to each pair of couplings. They remain in this position if anon-insulated container is occupying the corresponding position in the stack or if the cell is only partly filled with porthole type containers.

3.3.4.4 The concurrent use of both the ISO Type 1C (8'×8'×20') and Type 1CC (8'×8'6"×20') containers introduces coupling alignment problems. Although the spacing of the ports in both types is the same, the positioning of the ports in relation to the top plane of the container differs.

3.3.4.5 When containers of one type are stacked in a cell with couplings positioned for the other type, there will be a misalignment which will increase with the height of the stack. For this reason, containers of only one type can be carried in any one set of cell guides, except for a very few ships which have adaptable couplings. In these, misalignment is minimized by placing stools of about 0.6 m height at the bottom of the stack when 8 ft high containers are loaded. This limits misalignment to a maximum of about ±0.6 m which can be accommodated by offset rotating couplings. However, this arrangement is suitable only for stacks of similar containers and cannot accommodate mixing of the two types.

3.3.5 Refrigerating machinery

3.3.5.1 The refrigerating machinery to be found in container ships is of conventional conception.

3.3.5.2 Cellular container ships differ from conventional cargo ships in that they normally have underdeck passages running the full length port and starboard, outboard of the cell guides. These form a convenient route for brine piping which may be installed in a light gauge steel plate trough which is filled with foamed *in situ* polyurethane which provides convenient thermal insulation, protection against corrosion and a vapour barrier.

3.3.5.3 A small number of ships have **module coolers**, each of which cools one single container. The module is an insulated box-duct, enclosing a cooler and air circulating fan, both sized to cool one container, and with two couplings to connect with that single container.

3.3.5.4 A series of modules mounted above each other can cool a stack of containers, every container being totally independent of the others as regards temperature, fresh air, cargo cross-contamination.

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3.3.6 Cell air conditioning

3.3.6.1 As the containers are insulated, there is no fundamental reason, as far as the cargo is concerned, for controlling the temperature of the hold space in which the cell guides are installed. However, if the containers are being carried at low temperatures and if the ship is operating in cold ambient conditions, there is a tendency for parts of the ship's structure to fall to temperatures below those for which the steel grades are suitable.

3.3.6.2 The hold temperature in way of the topmost containers in the stacks may reach quite high values in warm climates due to the sun's radiation on deck and hatch covers. Under these conditions, temperature gradients in the hold space may be severe, making it difficult to control the temperatures within the containers to close limits. Thus, it may be necessary to install cell air conditioners which include a heat exchanger through which both heating and cooling media can be circulated, and a fan providing from four to six changes per hour within the cell space.

3.3.6.3 Temperature control can be further improved by insulating the hold space itself, either wholly or in part. As space is at a premium, the thickness of such insulation is usually limited to about 60 mm, except underdeck, where it may be as much as 250 mm. It is normally in the form of plastic foam or glass fibre slabs with light gauge metal cladding on the cell side. Such slabs are secured either by gluing or pinning, the joints between the panels being sealed with mastic or tape.

3.3.6.4 Hold insulation is optional, but the heat ingress into an insulated space is only about 12% of the ingress into the same space without insulation.

3.3.7 Class notation

3.3.7.1 As with conventional refrigerated cargo installations, an **RMC** class notation may be assigned, but in lieu of a minimum carrying temperature, a temperature of the air supply to the containers is given for a specified maximum sea-water temperature.

3.3.7.2 The MCO has no direct control over the thermal characteristics of the containers to be carried, but the class notation states the maximum number of certified containers of a specified average thermal conductance for which it is valid.

3.4 PARTICULARS OF SHIPS FOR INTEGRAL CONTAINERS

3.4.1 Vessels for integral containers have cell guides but may also be fitted for the carriage of integral containers on deck. Within the cells, electric power points are arranged adjacent to each container position, and also a supply of cooling water is provided for the condensers which are connected by short lengths of detachable flexible hose incorporating self-closing valves. The cooling medium is fresh water cooled in turn in a fresh water/sea-water heat exchanger.

3.4.2 Above deck, cooling water is not required and air cooled condensers are utilized. Remote indicating sensors may be provided at each container position so that the satisfactory functioning of the individual refrigeration units can be monitored.

3.4.3 The holds are not insulated, but the temperature within them is maintained a few degrees above ambient by ventilation. Circulation is usually by extraction fan, with natural supply ducting led to the bottom of the holds. However, recent developments suggest that the use of water cooled condensers under deck may not be essential.

3.4.4 A substantial part of the latent heat of condensation of the refrigerant is in any case dissipated into the hold space via the air cooled condensers, and it appears that, at least for certain trades, sufficient cooling can be achieved by air circulation alone. This necessitates the installation of carefully designed air ducting and increased fan capacity, but reports are encouraging and it is expected that there will be further developments in this direction.

3.4.5 Class notations in respect of refrigeration are not assigned to ships of this type as the MCO has no control over either the machinery or the insulation of the containers which may be carried. However, at the Owner's request, an entry will be included in the particulars recorded against the ship's name to the effect that the ship is equipped to carry a given number of self-refrigerated containers. No mention is made of temperature.

3.5 SURVEY REQUIREMENTS

3.5.1 The requirements of Annual and Special Surveys are similar to the requirements of Annual and Special Surveys for conventional refrigerated vessels, and are to be carried out in the manner detailed in S*ubs 2.1* and *2.2*.

3.5.2 Loading Port Surveys are, however, not carried out on container ships.

3.5.3 Requirements of *Subs 3.6* & *3.7* deal with items of the refrigerated installation which are applicable to container ships only.

3.6 SURVEY OF SHIPS FOR PORTHOLE CONTAINERS

3.6.1 Brine pipes.

3.6.1.1 The total length may run into hundreds of metres and some installations may have expansion pieces fitted between pipe sections. The pipes are normally fitted outside the cells along passageways or in a pipe compartment situated under the passageway.

3.6.1.2 Brine pipes may be insulated individually using prefabricated sections of insulation; in groups by an *in situ* foaming technique, or by spraying polyurethane on top of the pipe. Where insulation is protected by a metallic lining, it is to be examined for any damage or frost build up. Flange joints, valves and expansion pieces are to be examined for brine leakage.

3.6.2 Ducts

3.6.2.1 All ducts together with their cooler houses are to be examined internally and externally and any signs of condensation or frost build up are to be investigated.

3.6.2.2 When fruit cargo is carried, large amounts of water may collect at the bottom of vertical delivery and suction ducts and if this water is not adequately drained it may damage the insulation in these areas.

3.6.3 Couplings

3.6.3.1 A good connection is to be maintained between the ducts and containers while in service, but they are to also be airtight when

retracted, (i.e. when they are in the closed position). The temperature difference between the refrigerated air supplied to the containers and the cell, may in some cases exceed 30°C, therefore any air leakage will lead to considerable thermal losses.

3.6.3.2 The Surveyor is to satisfy himself that the couplings have not suffered any mechanical damage; that they function properly and are airtight. The latter can be checked in the closed position with fans in operation. It is important, however, that the air flow through a duct is maintained by leaving at least one pair of couplings opened, otherwise the air temperature inside the cooler house would rapidly increase which may cause damage to the insulation and/or fan.

3.6.3.3 All couplings are normally to be easily accessible for repair or replacement but as some prefabricated vertical ducts serving nine container stacks are over 20 m high, precautions and great care is to be taken during examination of the couplings when cells are empty.

3.6.3.4 Where dry air is required for correct operation of couplings, the Surveyor is to also examine the condition of the driers and air compressors.

3.6.4 Temperature sensors

3.5.4.1 These are fitted in the cooler house or delivery duct to measure the supply air temperature and also in the connection pieces between the duct and couplings to measure the return air temperature from the container.

3.6.4.2 There are also a number of sensors fitted inside the cell, usually at the forward and after bulkheads at three different levels to measure the cell temperature. On ships equipped with cell conditioners, the sensors are often fitted inside the delivery and suction ducts.

3.6.4.3 The temperature of the brine entering an air cooler may also be measured by a sensor. All temperature sensors are to be examined and tested at 0°C at three-yearly intervals or alternatively 25% each year.

3.6.5 Cell insulation

3.6.5.1 All surfaces including hatch covers are to be carefully examined for any damage to the lining and insulation and repairs recommended as necessary.

3.6.5.2 At the time of loading of the containers into the ship, the insulation and lining at the hatch coaming and ship side areas may be damaged. In installations where condensation from ducts is discharged into the cells, tank top insulation is in constant danger of being soaked with water.

3.6.5.3 On ships where the insulation is not glued, but pinned to a surface, there is a possibility of failure of a securing pin. This may lead to a breakage of a seal between sheets of lining, and moisture ingress.

3.6.6 Cell conditioners

3.6.6.1 Cell conditioners are to be seen in operation on heating and cooling duty and the functioning of the fan checked. If a system is designed for supplying fresh air into a cell using cell conditioners, this is to be seen during survey.

3.7 SHIPS FOR INTEGRAL CONTAINERS

3.7.1 If an endorsement to the effect that the ship is equipped to carry self-refrigerated containers , the Owner may request that the relevant parts of the system be examined. Surveyors, bearing in mind that there are no specific Rules for this type of installation at present, are to be guided by the following procedure.

3.7.2 **Cell ventilation**. The following conditions are to be complied with:

(a) The complete ventilation system is to be examined for damage and efficiency of operation. Extraction, and supply fans (if fitted), is to be run to ascertain that they remain in good working order.

(b) Ducts do not need to be completely airtight, but any considerable mechanical damage or obstruction of the inlets may upset good air distribution and adversely affect the temperature of the cell. For the same reason any deflection plates fitted are to remain in place.

3.7.3 Water cooling systems. On ships which are fitted with water cooling system, the condition of sea and fresh water pumps, heat exchangers, pipes, valves and flexible hoses are to be examined.

3.7.4 **Power points**. All power points and any remote temperature recording arrangement are to be in good working order. Any such examinations are to be reported on as a non- classification survey.

SECTION 4. LIQUEFIED GAS CARRIERS

4.1 SURVEY OF INSTALLATIONS

4.1.1 The basic requirements for Annual Survey and Special/Continuous Survey are outlined in the guidance on the refrigeration aspects of such surveys as given in *Secs 1* and *2*.

4.1.2 It is of utmost importance to take the fullest precautions to ensure safety during any inspection, particularly relating to the clearance of gas in spaces.

4.1.3 Inspection of insulation, which is fitted externally to cargo tanks is called for to be carried out (when the space is gas freed). The inspection is to include checking for cracks and deformation, and local icing or condensation in the form of *cold spots* when the tanks are cold, on the visible surface.

4.1.4 A few small cold spots do not reveal much existing deterioration of the overall insulation. However, they are to be carefully noted because these are the likely areas of further deterioration, likely to need repair in the future.

4.1.5 Special attention is to be paid to all discontinuities, such as joints in the lining material, chocks and supports, domes, sumps, pipe entries, cable and thermometer connections, etc.

4.1.6 Insulation fitted to the inside surface of the ship's inner hull is liable to be very wet at the inner bottom, where ice has melted off the tank surface and poured down. This moisture will cause damage if it gets into the insulation.

4.1.7 With internal insulation inside the cargo tanks, check for damage to the insulation and lining due to sloshing of the liquid cargo.

4.1.8 At the base of the tanks there can be damage due to movement of the pumps and their support structure, as well as falling objects. There are to be no penetration of the visible skin, and deformation is to be minimal.

4.1.9 With chocks and tank supports, check for damage and misalignment. Many chocks are designed to allow sliding motion and the wear is to be checked. Check also for crushing or cracking of the timber support blocks

4.1.10 Any necessary removal of insulation to carry out inspection of chocks and tank supports is to be made good, i.e. followed by replacement with good insulation material and careful sealing to prevent water/water vapour ingress. It is normal for there to be some moisture and ice (when tanks cold) visible at chocks and supports, but inspection may reveal some worse than others.

4.1.11 Insulation of cargo piping and the water-tightness of its protective covering is important, to prevent corrosion, to reduce boil-off of cargo in the liquid lines, to improve compressor performance, and to prevent formation and dripping of condensed water. Again, special attention is to be paid to discontinuities such as valves, pipe supports, bends, pumps, expansion bellows areas, etc.

4.1.12 Reliquefaction/refrigeration equipment fitted to LPG/NH_3/Ethylene carriers requires to be inspected, and its treatment is similar to that for the refrigeration equipment of classed reefers.

LIFTING APPLIANCES
PART I, CHAPTER 7

SECTIONS

LIFTING APPLIANCES
PART I, CHAPTER 7

SECTION 1. GENERAL

1.1 APPLICATIONS

1.1.1 Examinations, inspections and testing are to be carried out in order to ascertain that the lifting appliances meet the requirements of the *Rules for Lifting Appliances in a Marine Environment* (*RLIF*) and are fit for safe use.

1.1.2 The shipowner is to submit the lifting appliances for examinations and testing in the case and intervals specified herein and to carry out all necessary preparations and test.

1.1.3 Examination of the lifting appliances on board may be requested by the shipowner in the following circumstances:
(a) For new appliances without certification or classification.
(b) To replace existing classification/certification issued by other organizations in order to comply with Port or National Authorities for a ship changing flag or for a ship transferring class to MCO
(c) For an uprating or revision in design conditions or criteria for existing appliances.

1.1.4 Examinations and supervision of test of the lifting appliances, their machinery and gear after they have been built, re-rigged or repaired are to be carried out by a Surveyor to the MCO upon submission of documents certifying the readiness for use and final acceptance by the Manufacturer.

1.1.5 When a lifting appliance is examined by a Surveyor to the MCO, the ship's Administration is to inform him about all the defects found and also of alterations made or repairs and replacements of parts and ropes that have been done since the previous examination.

1.1.6 In case of an accident with the lifting appliances in survive, the ship's Administration or the shipowner is to provide for a timely examination of the appliance by a Surveyor to the MCO.

1.1.7 If examinations, inspections or testing reveal that the lifting appliances, their metal structures, machinery and gear do not meet the requirements of the Rules (*RLIF*), the MCO document will not be issued for the appliances or their elements. Certificates for the lifting appliances which are in service will become invalid until the appliances are brought into conformity with the Rules or until the defects are eliminated.

1.1.8 Certificates issued by the MCO for the lifting appliances will become invalid in any of the following cases:
(a) If the Certificate on Testing or Thorough Examination is not available.
(b) If an entry on timely performance of periodical examinations has not been made.
(c) If the lifting appliance does not comply with its certificate.
(d) After an accident.

1.1.9 Proof loads used in tests are to be specially intended for this purpose and have a mass confirmed by an appropriate document. The mass of cast ingots and, as far as practicable, of the other loads, is to be determined using a scale. If this is not possible, the mass is to be calculated.

1.2 PLANS AND INFORMATION'S

1.2.1 For the Initial Survey of a new lifting appliance, the shipowner is to submit the following documentation:
(a) Specification.
(b) General arrangement plans of the cargo handling gear with indications of the main characteristics (safe working load, operation areas, outreach, cargo lifting and lowering speed, maximum and minimum outreach, etc.
(c) Drawings of derrick and crane rigging.
(d) Drawings of metal structures.
(e) Technical documentation of machinery and drives,
(f) Technical documentation of electrical equipment.
(g) Drawings of components of the cargo handling gear together with the strength calculation or with particulars roving their strength as equivalent to that of the standard components approved by the MCO.

(h) Drawings of safety devices.
(i) Drawings of securing of the cargo handling gear in the stowed position.
(j) Diagrams of forces acting on stressed items of the cargo handling gear.
(k) Instruction for derricks operating in union purchase rig with indications of the working range, safe working load, types and scheme of rigging.
(l) Testing programme of the cargo handling gear in assembly at the Manufacturer's.

1.2.2 In case of structural alterations in lifting appliances as a result or re-rigging or repairs, the scope of the technical documentation to be submitted is to be in accordance with the structural alterations made.

1.2.3 For the testing and inspection of lifting appliances in service that have not been re-rigged or repaired, the scope of documentation to be submitted will be the following:
(a) Register of Ship's Cargo Handling Machinery and Gear.
(b) Certificate of Testing and Thorough Examination of Lifting Appliances
(c) Certificate of Testing and Thorough Examination of Derricks in Union Purchase Rig.
(d) Certificate of Testing and Thorough Examination of Interchangeable Components and Loose Gear.
(e) Certificate of Testing and Thorough Examination of Wire Rope.
(f) Certificate of Testing and Thorough Examination of Lifts.
(g) Manufacturer's Certificates for Natural Fibre and Synthetic Ropes.
(h) Instruction on Operations of Ship's Derricks and Cranes in Union Purchase Rig.

SECTION 2. TESTING AND EXAMINATION OF EXISTING CARGO HANDLING MACHINERY AND GEAR

2.1 GENERAL

2.1.1 Cranes, winches and reels are to be tested according with a testing program approved by the MCO, using the proof load given in *table 2.1.1*.

Table 2.1.1 Proof load for cargo handling machinery and gear

Safe working load (tonnes)	**Proof load**
Under 20	1.25 × SWL
20 - 50	SWL + 5 t
Over 50	1.1 × SWL

2.1.2 The test and examination will be proved by the Certificate issued by the MCO or by the Manufacturers. Certificate is to be signed by a competent person.

2.1.3 Marking and stamping of the tested cranes, winches and reels is to be done in accordance with *Sec 6*.

2.1.4 Lifting appliances are to be submitted for test in the fixed-up state. Prior to testing, they are to be thoroughly examined and may be submitted for testing only when no defects have being found during the examination that may affect the safety of the test.

2.2 LOAD TEST

2.2.1 Load tests during the Initial and Periodical Surveys are to be carried out with a proof load only.

2.2.2 Load test between the periodic tests carried out after re-rigging or repairs of any load bearing or in case where a need in additional test arise , the use of securely fixed spring or hydraulic dynamometers, in lieu of a proof load, may be allowed during Periodical Survey, if previously agreed upon with the MCO .

2.2.3 Dynamometers may be used provided that the rigging allows to subject the particular item to the same stresses as if the lifting appliance had been tested by a proof load and the SWL of the lifting appliance is not greater than 15 tonnes.

2.2.4 Dynamometers used in the cargo load appliance test are to be calibrated with an accuracy within **± 2%**. During the load test their readings are to remain constant for at least **5 minutes**.

2.2.5 Where, due to pressure limitations, an hydraulically operated lifting appliance fails to hoist the proof load, determined as per *table 2.1.1*, it will be sufficient to hoist the greatest possible load at the maximum permissible hydraulic pressure if the testing of the lifting appliance with a proof load at the Manufacturer's is proved by the certificate. In this case, assembled cranes may be tested at the Manufacturer's with a proof load on the hoisted hook by means of another cargo handling gear.

2.2.6 If the winch pull is not sufficient to hoist the proof load, the latter is allowed to be hoisted by another winch; however, braking and keeping the proof load in suspension is to be done by the winch to be tested.

2.2.7 If the rigging of the heavy lift derrick includes the detachable stays and shrouds, these are not to be fitted when the derrick is tested.

2.2.8 Collapsible derricks are to be tested with a proof load on a very prop with which they are normally used.

2.2.9 Where stationary derricks are intended for operation in two hatches, they are to be tested in the operating position at each hatch separately. The derricks with two eyreplates are to be tested with a proof load on each plate.

2.2.10 The proof load is to be hoisted with the derrick boom inclined at an angle of **15°** to the horizontal for the light-lift derricks and **25°** for the heavy lift derricks. When the angles in service exceed the above values, the actual angles are to be used in test.

2.2.11 Derrick cranes are to be tested with a proof load at the maximum angles allowable in service.

2.2.12 Inclination angles of derrick booms are to be indicated in the Certificate.

2.2.13 For derrick cranes and cranes with a variable jib radius and constant safe working load, the proof load is to be hoisted at the maximum and minimum radio of the jib

2.2.14 Where the safe working load of the crane varies with the jib radius, the proof load is to be hoisted at the maximum and minimum radio for each particular safe working load.

2.2.16 The crane jib radius is to be stated in the Certificate. In case of a variable jib radius, it is to be also marked in the crane.

2.2.17 After the proof load has been hoisted, it is to be swung to the extreme positions in both directions by slewing the derrick or the crane or by moving the crane.

2.2.18 Operation of the brakes of the derricks and crane cargo winches is to be tested by a quick lowering of the proof load for about 3 m and its sharp braking. The test is to be performed at two or more positions of the derricks.

2.2.19 Keeping the proof load in suspension with the winch drive disconnected as well as manual release of the brakes is also to be tested.

2.2.20 For heavy lift derricks the derrick boom radius is to be varied under the proof load. The functioning of the span winch brake is to be checked.

2.2.21 The load test is also to include a functional check of the emergency switches and interlocking of the cargo winches and span rope and preventer guys reels with an independent drive.

2.2.22 After testing with a proof load, the cranes are to be tested with the safe working load, with the hoisting, slewing, luffing and travelling motion machinery operating in the maximum speed duty; the slewing, luffing and travelling motion brakes are to be tested by sharp braking.

2.2.23 If hosting, slewing, luffing and travelling motions of the cranes are combined, then the operation of the crane is to be tested for each allowable combination.

2.2.24 The limit switches and the radius indicators are to be tested during the load test. If cranes are provided with limit-load switches, their functioning is to be also tested during the load test.

2.3 LOAD TEST OF CRANES IN ENCLOSED SPACES

2.3.1 Where a hoist is located in an enclosed space – such as a machinery space, workshop, shaft alley or other– due to structural or technological reasons and upon agreement with the MCO, it may be tested on a specially equipped bench outside the said space.

2.3.2 Monorails are to be tested on board ships by means of dynamometers by application of a proof load determined as per *table 2.1.1*, in different points along the monorail length.

2.3.3 Eyes for cargo handling operations in enclosed spaces are to be tested by a proof load equal to twice the allowable working load for each eyreplate

2.4 Load test of derricks working in union purchase rig

2.4.1 Derricks working in union purchase are to be tested with a proof load in accordance with *table 2.1.1*, each derrick separately.

2.4.2 In addition, derricks working in union purchase are to be tested with a load equal to 1.25 SWL in union purchase.

2.4.3 During the test the proof load is to be transferred from one derrick head to the head of another derrick in the position giving the biggest angle between the cargo runners.

2.4.4 If the derricks are rigged in different manners, those positions are to be subjected to the testing that is likely to exert the greatest stress in the preventer guys.

2.4.5 If the stressing one of the components of the union purchase ring exceeds the stress occurring in case of the single derrick rig, an additional test is to be carried out with the boom in such position that the component in question is tested in conditions similar to thus assumed in calculations.

2.4.6 Results of the load test and examinations of lifting appliances, their winches and accessories are to be entered in the Certificate of Test shown in *figure 2.4.6*.

2.5 LOAD TEST OF LIFTS

2.5.1 The static load test of the ship's lifts will be carried out to check the strength of the lift machinery, wire ropes and their attachments, as well as the operation of the brakes.

2.5.2 The following proof loads are to be applied during the load test:

$P_{st} = 1.5\ P$ For cargo lifts with a drum winch.
$P_{st} = 2.0\ P$ For all types of passenger lifts and for cargo lifts with a traction winch.

Where:

P = Safe working load of the lift.

SECTION 3. PERIODICAL SURVEYS, INSPECTIONS AND TESTS

3.1 GENERAL INSTRUCTION

3.1.1 The Cargo Gear Survey is carried out by request of the ship's Owner or other interests, with the purpose of checking the technical condition of the cargo gear appliances when deficiencies in his work have been detected.

3.1.2 The Survey is to be carried out to give faith of the technical state of parts, elements and mechanisms of the cargo handling appliances that have been object of verifications, to check that the detected deficiencies have been dealt with, or to establish operational limitations to the existent means. The Survey is to be carried out keeping in mind the provisions of the International Labour Organisation's Convention No. 152 in accordance with *Ch 7*.

3.1.3 Between Surveys and examinations carried out by the Surveyors, the ship's Administration will be responsible for the continuous supervision of keeping the lifting appliances in conformity with the Certificate and in accordance with the Rules; the maintenance of established limitation of the permissible safe working load, jib radii of cranes and inclination angles of the derricks boom; control adjustment of derricks and preventer guys and also the angle between the cargo runners in union purchase, and for keeping the lifting appliances fit for safe use.

3.1.4 Periodical Overall Survey and Annual Inspections are to be carried out to ascertain that Certificates of Tests of lifting appliances, interchangeable and loose gear and ropes, appropriate marking and stamp, and entries about periodical heat treatment of interchangeable gear are availed, as well as to assess the condition of metal structures and their parts and assemblies, machinery and gear of the lifting appliances.

3.1.5 When defects are found during the Periodical Survey that may endanger safe use of the lifting appliances or wear is found exceeding the allowable values, the defective and worn out parts are to be replaced and the defects made good.

3.1.6 Periodical Survey of cargo handling gear of ships not engaged on international voyages may be combined with the Annual Surveys of the ship, having regard to the submissions before the assigned date and the extension permitted.

3.2 ANNUAL TEST

3.2.1 All derricks and gear permanently attached to derricks, mast and decks are to be inspected by a Surveyor to the MCO at least once every 12 months.

3.2.2 Ship cranes, hoist and derrick winches and derrick cranes are to be thoroughly inspected by a Surveyor to the MCO at least once every 12 months.

3.2.3 All interchangeable and loose gear is to be thoroughly inspected at least once every 12 months.

3.2.4 An Occasional Test, carried out in accordance with *Sec 4* will be regarded as an Annual Test.

3.2.5 The Occasional Test and associated examinations are to be confirmed by a Certificate.

3.3 FIVE-YEAR SURVEY

3.3.1 All derricks and gear (including span chain stoppers) permanently attached to derrick masts and decks are to be thoroughly surveyed at least once every 5 years.

3.3.2 Thickness measurement of the metal structure of the lifting appliances is to be carried out at least once every 5 years, as deemed necessary.

3.3.3 Periodical Tests of the lifting appliances mounted on board a ship are to be carried out at least once every 5 years, in accordance with the requirements of *Sec 2*.

3.4 CERTIFICATION

3.4.1 The Cargo Gear Survey Certificate states the technical condition of the interchangeable components, loose gear, wire or structural elements that have been inspected during the Survey, as well as the observations deemed necessary.

3.4.2 Upon completion of the Survey, a Cargo Gear Survey Certificate will be issued.

SECTION 4. OCCASIONAL EXAMINATIONS AND TESTS

4.1 GENERAL INSTRUCTION

4.1.1 Occasional Examinations and Tests are to be carried out in the following occasions:
(a) After the replacement of lifting appliances as a whole or installing them in another place.
(b) After the re-rigging of the lifting appliances, major overhaul or repair after an accident.
(c) After major overhaul, alterations or replacement of metal structures, machinery and fixed gear of the lifting appliances.
(d) When the height of the span rope fastening has been changed or fastening shrouds or stays have been shifted. (e) After a replacement or major repair of a winch or a brake, after replacement of the car, counterweight, electric motor, and suspension ropes, winch drum. (f) After repair or replacement of the traction sheave.
(g) After removal of lifting appliances due to operational or technical reasons and their repositioning in the original place.
(h) After replacement of interchangeable and loose gear and ropes.

4.1.2 After accidents involving the lifting appliances which have been taken place during service, an Occasional Examination is to be carried out to find out the technical reasons for the accident. The extent of the examination required in this case is to be to the satisfaction of the Surveyor.

4.2 SURVEYS FOR TEMPORARY INCREASE IN SWL

4.2.1 Under certain conditions, a request may be filed for a temporary increase in the SWL of a lifting appliance to cover one or two special lifts.

4.2.2 The conditions and procedure for a temporary inclreas of SWL are as follows:
(a) Approval may only be given in cases where the MCO or a recognized Society has certified the cargo gear.
(b) The permit, in general, will apply for SWLs greater than 50 tonnes.
(c) The permitted overload is not to exceed the proof load.
(d) The Register is to be valid and up to date.
(e) A general visual examination of the gear is to be carried out by the Surveyors prior to the first load being lifted. At the Surveyors discretion, a more thorough survey may be required.
(f) Owners are to give their written consent and record each lift.
(g) The loads to be lifted are to be verified by the Owner.
(h) The lifting operations are to be closely supervised by the Owner's representative.
(i) Whenever possible, the outreach, heel and trim are to be reduced.

4.2.3 Whilst the above procedure is generally acceptable, adherence to it does not guarantee acceptance by National Authorities.

4.2.4 The stringency of the MCO procedure is intended to provide a basis, on technical grounds, for the SWL to be exceeded in particular, occasional circumstances.

4.3 CHANGE OF FLAG (PORT OF REGISTRY)

4.3.1 The Cargo Gear Survey requirements are to be in accordance with those of the applicable National Authority for a ship changing flag.

4.3.2 It is to be verified that the existing Cargo Gear Certification is valid and issued by a competent authority, and the Register of Ship's Cargo Handling Machinery and Gear.is to be updated with the new port of registry.

4.4 CHANGE OF OWNERSHIP

4.4.1 It is to be verified that the Cargo Gear Certification is valid, updated and issued by a competent authority.

4.4.2 The Register of Ship's Cargo Handling Machinery and Gear is to be endorsed with particulars of the current Owner.

SECTION 5. LIMITS OF WEAR

5.1 GENERAL INSTRUCTION

5.1.1 The requirements of this Section are tentative and may be altered depending of the specific operating conditions of a component and the type of wear .

5.1.2 In order to determine more exactly the effect of wear on the strength and reliability of the item, calculation methods may be used.

5.2 LIMITS OF WEAR

5.2.1 The components with 10% of wear and more, regarding thickness or diameter as well as the components with cracks, fractures, or permanent deformations are to be renewed.

5.2.2 When determining the wear of the articulated joints of derrick heel goosenecks and lugs, derrick span eyreplate swivels, they are to be treated as plain bearing. The greatest diametral clearance is to comply with manufacturer standards.

5.2.3 A wire rope is not to be used if:

(a) Five percent or more of the total number of wires in the rope are broken in any length equal to 10 times the rope diameter.
(b) There is any tendency towards birdcage (i.e. separation of the strands of wires).
(c) A strand is broken.
(d) Excessive wear is present which manifests itself by a flat wire surface.
(e) It shows sign of corrosion, particularly of the internal corrosion.
(f) The wire is broken only in one strand, or in the length of 10 times the rope diameter, or in the wire hinge with the metal clips.
(g) More than one of the wires close to metal clips are broken.

5.2.4 Natural and synthetic fibre ropes are not to be allowed for use in case of broken or rotten yarns, considerable wear or deformation.

5.2.5 Metal mast derricks, winch foundations, metal structures of cranes and loose gear having a thickness equal to 80% or less than their initial thickness are to be renewed.

5.2.6 Wear of lift parts and assemblies is not to exceed the limits established by the Manufacturer or by those given below:

(a) Wear of collars and seals is to be determinated by the amount of oil leakage.
(b) The clearance between the armature and the brake electromagnet and the yoke is not to exceed **4 mm**.
(c) The clearance between the rope and the grove bottom is to be not less than **2 mm**.
(d) The limits of uneven wear the grooves relative to each other are to be such as to allow the balancing suspension to compensate for the rope running without disconnection of the contact used to control shifting of the balance-beam lever.
(e) When wear of the grooves exceeds the above limits the sheave is to be grooved or renewed. Grooving of the sheaves is permitted only once.
(f) Wire ropes are considered to be defective depending of the number of the wire breaks within the length of one step of a lay specified in Table 5.2.6. The number of breaks in one step of a lay, at which the rope of the construction specified in the above mentioned Table is considered to be defective, is to be determined on the basis of the data given in the Table for the rope with the nearest number of the strands and number of wires in the cross section.

Table 5.2.6 Number of wire breaks within the length of one step of the lay at which the rope is to be rejected

Initial safety factor according to *RLIF Ch 5*	**Rope construction**			
	6×19 = 114 and one natural fibre core		6×37 = 222 and one natural fibre core	
	Number of wire breaks within the length of one step of lay			
	Cross	One-side	Cross	One-side
Less than 9	14	7	23	12
9-10	16	8	26	13
11-12	18	9	29	14
13-14	20	10	32	16
15-16	22	11	35	18
Over 16	24	12	38	19

NOTE:
In calculating wire breaks the factors are to be assumed as follows:
1.0 - For break of a thin wire.
1.7 - For break of a thick wire.

5.2.7 In case of wear of external strands of the rope or corrosion of wires, the number of wire breaks for rejection is to be reduced in accordance with *table 5.2.7*.

Table 5.2.7 Requirements for rope rejection relating to wear of external strands or corrosion of wires

Wear of external strands or corrosion of wires according to the rope diameter (%)	**Number of wire breaks within the length of one step of a lay, in percent of values given in *table 5.2.6***
10	85
15	75
20	70
25	60
≥30	50

5.2.8 If wear or corrosion of wires is 40% or more of the initial diameter of wire, the rope is to be rejected.

5.2.9 Where the car is suspended in two ropes, each rope is to be rejected separately. Substitution of more worn- out rope will be permitted.

5.2.10 In case of wire breaks within the length of one step of a lay the number of which does not lead to rejection and in case of permissible wear of external strands, the rope will be allowed for use subject to a close supervision of its condition.

5.2.11 In case a broken strand is found in the rope, further use of the rope will not be allowed.

5.2.12 The number of wire breaks within the length of one step of a lay of the overspeed governor, is not to exceed **20**.

5.2.13 Where the car is suspended in three or more ropes, their rejection will be based proceeding from the maximum number of wire breaks within the length of one step of a lay. In this case the allowable number of wire breaks in one of the ropes may be exceeded but not more than by 50% compared to the values given in *table 5.2.6*.

5.2.14 Wear of shells of the car and counterweight shoes may be allowed provided the total side clearance between the wear surfaces of the guide and the shell is to be not greater than 4 mm and the total face clearance measured by the rod gauge is to be not greater than 8 mm.

5.2.15 The brake block coatings may be used as long as their thickness in the mid-portion and the edges will not be reduced to ½ and ⅓

of their original thickness respectively.

SECTION 6. REPAIRS AND REPLACEMENT PROCEDURE

6.1 MATERIALS

6.1.1 The repair material grade is to be identical to that of the parent or original material as indicated on the plans.

6.1.2 Alternatively, material with equal or superior properties, i.e. mechanical, chemical and assurance against brittle fracture may be used, taking into account the thickness and the environment in which the appliance is designed to operate.

6.1.3 In circumstances where it is not possible to readily ascertain the material grade of the parent structure, e.g. as a result of plans being unavailable, the mechanical and chemical properties are to be determined by suitable tests.

6.1.4 Welding is to be carried out by qualified welders to a nationally/internationally recognized procedure which is to include the selection of suitable welding consumables, pre- heating and post-weld heat treatment where necessary.

6.1.5 On completion of welding and heat treatment the repair is to be examined by suitable non-destructive techniques.

6.2 TESTING

6.2.1 All tests are to be carried out in accordance with the procedure detailed in *Sec 2*.

6.2.2 Except where there is a specific requirement by a National Authority, re-testing of union purchase rigs will not be essential, provided that the derrick has been re-tested in single working.

6.2.3 In addition to the normal conditions, derricks and cranes having a safe working load not exceeding 15 tonnes may be re-tested using a hydraulic or spring weighing machine (dynamometer) provided the tests are carried out at appliance operating configurations which represent those which would have been achieved using test weights.

SECTION 7. SURVEY ITEMS OF MAIN STRUCTURES, MACHINERY AND GEAR OF LIFTING APPLIANCES

7.1 DERRICKS

.1 Cargo winches.
.2 Span winches
.3 Guy winches
.4 Span reels
.5 Preventer guy reels

7.2 METAL STRUCTURES

.1 Cargo masts.
.2 Short post for mounting derricks heel fitting.
.3 Cross trees.
.4 Cross members.
.5 Derrick booms.
.6 Derrick boom supports.
.7 Stiffening of ship's structure in way of masts, winches and eyeplates.

7.3 ROPES AND GEAR

7.3.1 Interchangeable components:

(a) Blocks.
(b) Hooks.
(c) Chains.
(d) Shackles.
(e) Swivels.
(f) Rigging screw.
(g) Thimbles, rope sockets, pressed clips, of the ropes.
(h) Triangular and polygonal plates.
(i) Derrick head eye fittings.
(j) Cross head forks of blocks.
(k) Accessories of the cross members type, which are regular items of heavy lift-derricks (subject to special consideration by the MCO in each case).
(l) Stops for fastening preventer guys with pressed-on bushes.

7.3.2 Fixed gear:

(a) Derrick head eyeplates, span ropes, slewing and preventer guys.
(b) Eyeplates secured on ship's hull, deck or metal structure.
(c) Derrick heel fittings.
(d) Span eyeplates with bearings.
(e) Derrick heel goosenecks with bearings.
(f) Built-in sheaves of the boom with collars.

7.3.3 Loose gear:

(a) Lifting beams.
(b) Frames.
(c) Container spreaders.
(d) Other similar gear.

7.3.4 Ropes:

(a) Shrouds and stays.
(b) Cargo runners, span ropes, tackles and slewing guy pendants.
(c) Preventer guys and boom head guys in union purchase.

7.4 CRANES AND HOISTS

7.4.1 Machinery:

(a) Hoisting machinery.
(b) Luffing machinery.
(c) Slewing machinery.
(d) Travelling motion machinery.
(e) Brakes.

7.4.2 Metal structures:

(a) Bridges.
(b) Gantries.
(c) Jibs.
(d) Frames.
(e) Foundations.
(f) Stiffening of ship's hull, pontoons and docks in way of cranes.
(g) Fixed and turning columns.
(h) Balance beams and rods aft movable counterweight.
(i) Supports for derricks when stowed for sea.

7.4.3 Ropes and gear:

(a) Loose gear
    (i) Blocks.
    (ii) Hooks.
    (iii) Chains.
    (iv) Shackles.
    (v) Swivels.
    (vi) Thimbles, rope sockets and pressed clips of ropes.
    (vii) Accessories of the cross member's type, which are regular items of heavy cranes (subject to special consideration by the MCO in each case).
(b) Fixed gear:
    (i) Eyreplates.
    (ii) Trunions, axles with bearings.
    (iii) Lead screws.
    (iv) Rollers.

(c) Loose gear being part of the ship:
    (i) Slings.
    (ii) Lifting beams.
    (iii) Frames.
    (iv) Container spreaders.
    (v) Other similar gear.

(d) Ropes:
    (i) Cargo runners.
    (ii) Derrick ropes.
    (iii) Grab ropes.

(e) Safety devices:
    (i) Limit switches.
    (ii) Jib radius automatic indicators.
    (iii) Limit load switches.
    (iv) Signalling devices.
    (v) Anti-stealing devices.
    (vi) Safety buttons or switches.

7.5 LIFTS

7.5.1 Metal structures:

(a) Trunks.
(b) Guides.

(c) Cabins.
(d) Ceiling.
(e) Foundations.

7.5.2 Lift equipment:
(a) Trunk door.
(b) Counterweight.
(c) Stops and buffers.

7.5.3 Lift winches (drum and traction types):
(a) Cargo shaft.
(b) Couplings.
(c) Base plates.
(d) Brakes.
(e) Drums.

7.5.4 Safety devices:
(a) Gripping devices.
(b) Overspeed governors.
(c) Lowering and lifting limits switches.

7.5.5 Ropes and items of cable runs and fastening of ropes (sheaves, cleat casings, cleats, couplings, clips, hold- down straps, etc.

7.6 ELEVATING PLATFORMS

7.6.1 Platform:

(a) Platform equipment:
  (i) Guides.
  (ii) Shoes.
  (iii) Blocking devices.
  (iv) Buffers.
  (v) Locking devices.
  (vi) Guard railings.
  (vii) Drives (mechanical or hydraulic).
(b) Supporting appliances:
  (i) Ropes with guides.
  (ii) Chains with guides.
  (iii) Fastenings.
  (iv) Lever-pull system.
  (v) Hydraulic structural elements.
  (vi) Gear racks.
  (vii) Spindles.
(c) Safety devices.

7.7 ELECTRICAL EQUIPMENT OF LIFTING APPLIANCES
.1 Electric motors
.2 Electric Brakes
.3 Control Stands
.4 Limit switches
.5 Safety winches or buttons
.6 Control device of load mass
.7 Cabling
.8 Other electrical equipment required for the operation of the lifting appliance

TRANSFER OF CLASS
PART I, CHAPTER 8

Section

SECTION 1

GENERAL

1.1 DEFINITIONS

1.1.1 For the purpose of this Chapter, the following definitions apply:

Acceptance to class (ATC): The process of classification of a ship without a class or with a valid class from a nonrecognized Society.

ATC Surveys: Initial Survey to an existing ship without a class from a recognized Society.

Losing Society: The Society whose class the ship undergoing transfer or acceptance to class is currrently holding.

Society of a recognized performance: A Classification Society which is either:
(a) A Member of IACS.
(b) An Associate to IACS.
(c) A Society with which the Bureau has an Agreement for mutual substitution or recognition.
(d) A Society that will be deemed necessary by the classification committee of the society.

Transfer of class (TOC): The process of classification of existing ships that are transferring class from a recognized Society to MCO CLASS

TOC Surveys: All surveys required for the transfer of class, generally considered.

1.2 GENERAL PROVISIONS

1.2.1 Where a ship has previously held MCO Class the process for transfer of class is to be followed, but the requirements for plan submission and approval may be waived.

1.2.2 Where Class is being reinstated, reference is to be made to *Ch 1 Sec 6*.

1.2.3 Where a Surveyor is co-ordinating the TOC or ATC and involving another Surveyor or Office they are to ensure that the responsibility for submission of information is understood

1.3 CORRESPONDENCE AND DOCUMENTATION

1.3.1 For a ship undergoing TOC, ATC or reclassification, all communications including correspondence, plans and other technical documentation, reports and certificates, whether of a class or statutory nature, are to be directed to the HO or a Regional Surveyor or Office for further transfer to HO.

1.4 INITIAL REQUEST

1.4.1 As soon as a Client indicates his intention to enter a ship into MCO Class, a preliminary review is to be carried out to consider the commercial aspects of the case.

1.4.2 A Request will be allowed to proceed to HO or Regional Surveyor after a review has been carried out to clarify all commercial aspects of the case. For ships 15 years of age and above, the review is to be followed by a preliminary inspection.

1.4.3 Notification of the Request together with a summary of the same are to be submitted to HO or the Regional Surveyor. The request will be considered by HO in all cases, and classification may be declined if the condition of the ship, its technical record or commercial suitability of classification is not found satisfactory.

1.4.4 The Client is to be made aware of the minimum survey requirements for transfer or acceptance to class. All surveys held and credited during this process are chargeable, including the preliminary inspection.

1.4.5 It is of utmost importance that the Client’s interest in the ship is clearly defined, i.e. whether as an Owner, Operator, bareboat charterer, buyer, etc.
1.4.6 The Client is to be advised not to relinquish any existing class until the MCO has issued an Interim Certificate of Class.

1.5 INITIAL REVIEW

1.5.1 The Initial Request for Survey will be reviewed by the Local Surveyor using all available information with a view to clarify if the ship presents a higher than normal risk.

1.5.2 The following aspects are to be considered during the Initial Review:

(a) Ship´s type, age and tonnage.
(b) Flag State.
(c) Service history, including Port State Control detentions and casualty records.
(d) Previous Owners, fleet details, credit worthiness.
(e) Previous transfers of class.
(f) Dual class arrangements.
(g) Survey status.
(h) Outstanding Conditions of Class and Recommendations or Memoranda.
(i) Any relevant commercial aspects.

All the above information is to be submitted by the prospective client desiring TOC or ATC.

1.5.3 Reference may be made to the following web sites for Port State Control records:
(a) Paris MOU: www.parismou.org
(b) Tokyo MOU: www.tokyo-mou.org.
(c) General Port State information: www.equasis.org
(d) US Coast Guard: www.uscg.mil/hq/g-m/pscweb/index
(e) Viña del Mar Agreement: www.acuerdolatino.int.ar
(f) Mediterranean MOU: www.medmou.org

1.6 PRELIMINARY INSPECTION

1.6.1 A Preliminary Inspection (hereinafter "*Preinspection*") is to be performed after completion of the Initial Review and is to be carried out to the extent of a general examination of hull, machinery and statutory items, sufficient to ascertain the overall condition of the ship and her level of maintenance.

1.6.2 The extent of hull examination will depend on the ship type and available safe access means.

1.6.3 Whenever the Initial Review or Pre-inspection results in the conclusion that the ship presents a higher than normal risk, the Client is to be advised –after consultations with HO- that the Bureau declines the request for classification.

1.7 WRITTEN REQUEST FOR PRE-INSPECTION

1.7.1 A signed request for the Pre-inspection is to be obtained before Surveyors to the Society attend the ship.

1.7.2 The Client is to complete and sign a Request Letter which is to be forwarded without delay to HO Piraeus, or the appropriate Regional Surveyor or Office, prior to commencement of any works relating to the transfer or acceptance.

1.7.3 An appropriate place and time for the Preinspection are to be agreed, noting that the ship has to be prepared for survey (i.e. holds and tanks made available for inspection, co-operation of the crew ensured, etc.) It is also necessary to agree fees for any work in excess of standard transfer of class requirements (e.g. dangerous goods list compilation).

1.7.4 It is to be made clear to the Owner/Operator that if the required information or plans are not submitted, MCO will not be able to provide full post-classification services.

1.8 TECHNICAL DOCUMENTATION OF THE SHIP

1.8.1 Prior to the commencement of the TOC procedure, with the exception of Initial Request and Pre-inspection, all plans and documents required by *Sec 4* are to be submitted to the attending Surveyor.

1.8.2 Unless instructed otherwise, all plans are to be forwarded to HO Panama or the appropriate Regional Surveyor/Office for further submission to HO.

1.8.3 If there is an identical sister ship classed with MCO CLASS, submission of plans may be waived, provided the necessary plans and information are available at the Society´s records system. Confirmation that the arrangements are the same as the sister ship will be required and plans of any alterations are to be approved.

1.8.4 All information pertaining to a ship is to be identified with at least the ship´s IMO Number or ship´s name and accompanied by an Advice of Plans or correspondence. All plan legends, titles, or main features are to be in English or Spanish language.

1.8.5 Where the attending Surveyor, appointed Regional Surveyor or HO evidence that a design feature could be detrimental to the ship or its machinery, MCO CLASS will advise the Client accordingly and, if necessary, request that modifications be carried out as a condition for class.

1.8.6 If a major modification or conversion is to take place, the plans of such alteration together with those of the unaltered ship are to be forwarded well in advance of the work.

1.8.7 Approvals of modifications or conversions are chargeable.

1.9 INFORMATION FOR CLIENTS

1.9.1 Considering a good policy that the Surveyor be able to advice Clients on frequently asked questions concerning the TOC procedure, the information in this Subsection is to be taken into account.

1.9.2 **Best time to transfer class.** The best time to transfer class is within the regular classification and statutory survey range dates. For ships over 15 years of age, it is best to transfer within the range date of the Special or Intermediate Survey. The regular class surveys can then be used to assess the condition of the ship for transfer.

1.9.3 **How to speed up the TOC process.** Compile plans and information into a package for transmission to HO or a designated Regional Office or Surveyor before the TOC surveys. Submit reports and outstanding information promptly following the survey.

1.9.4 **New notations.** Equivalent Bureau notations to those assigned by the current Class Society will be assigned on the basis of the available evidence and results of surveys. In some cases, it may be necessary to include an additional notation.

1.9.5 **Plans and information.** Plans are required to maintain a comprehensive record of design configuration. In this manner, MCO CLASS can assist Owners with future advice on modifications, repairs, etc.

1.10 STATUTORY CERTIFICATION

1.10.1 Instructions to Surveyors concerning all matter of statutory certification and surveys will be sent to by HO to the acting Local Surveyor directly or via a Regional Office or Surveyor, if applicable.

1.10.2 Instructions to Surveyors will be issued on the basis of information provided by the client (see *para 1.5.2*).

SECTION 2

SURVEYS FOR THE TRANSFER OF CLASS

2.1 GENERAL PROVISIONS

2.1.1 The requirements of this Section apply to ships that are currently in class with a recognized Classification Society.

2.1.2 Requirements of this Section are in compliance with the requirements of *RSTE I Ch 2 Sec 3* and are to be considered a further elaboration of the above requirements. In case any differences arise, the former are to be considered as primary.

2.1.3 Contacts with TSCI and IACS Members and Associates for transfers of class, whenever necessary, are to be maintained by HO Panama.

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2.2 PERFORMANCE OF TOC SURVEYS

2.2.1 A Survey Programme is to be set forth, including at least surveys overdue and due within 3 months, according to the losing Society's survey programme. An additional survey to the scope of an Annual Survey and a general examination of machinery and control systems are to be scheduled. (See also *para 2.2.6*.)

2.2.2 An In-water Survey may be required depending on the time elapsed from the last Docking Survey, at the discretion of trhe Bureau. All due and overdue recommendations imposed by the losing Classification Society are to be dealt with as appropriate.

2.2.3 A sea trial may be held, to the Surveyor's discretion, if the ship has been laid up for a long period.

2.2.4 The next Special Survey will become due five years from the Special Survey held by the losing Society and not 5 years from the Initial Class Surveys. The ship will follow the survey programme determined by the losing Society.

2.2.5 Any due surveys or conditions of class are to be dealt with during the TOC.

2.2.6 Additional survey requirements for certain ships depending on their age will include the following:

(a) For all ships **5-10 years** of age a representative number of ballast spaces are to be examined.
(b) For all ships **11-20 years** of age a representative number of cargo spaces are to be examined.
(c) For ships subject to **ESP** which are **15 years** of age and above, MCO CLASS may carry out a full Special Survey or Intermediate Survey, including Docking Survey, whichever comes first.
(d) For all ships **20 years** of age and above, a full Special Survey, including Docking Survey, will be carried out, to the discretion of the Bureau. When applying the *subparas (c)* or *(d)* above and the Docking Survey is not due, an In-water Survey may be carried out.

2.3 INSTRUCTIONS TO SURVEYORS

2.3.1 HO Piraeus will prepare and forward to the Local Surveyors the appropriate Instructions, issued on the basis of information provided by the client and relevant flag requirements. All matters of statutory certification will be included in the Instructions.

2.3.2 For ships less than 2 years of age, of unusual design, or not built in accordance with the requirements of MCO CLASS or a recognized Society, an examination of plans will be required. Advice will be provided in the Instructions to Surveyors.

2.3.3 Plans will be required for appraisal when the Owner requests MCO CLASS notations which are not equivalent to those of the losing Society.

2.3.4 If alterations to the ship are to take place at the TOC Survey, the relevant plans are to be submitted for approval.

2.3.5 If there are serious safety issues such as damage from collision, grounding or fire, which are being dealt with at the time of TOC Survey, HO is to be informed immediately.

2.3.6 TOC Surveys are very important and complex surveys that are to be carried out in very limited time in one port. Surveyors should make every effort to achieve this.

2.3.7 TOC Surveys are to be carried out by at least two experienced Surveyors simultaneously. In order to complete the TOC Surveys in one port, more than two Surveyors may be required. At least one of the Surveyors is to be capable of taking ultrasonic thickness measurements and determining the diminution

2.4 SURVEY RECORDS FROM THE LOSING SOCIETY

2.4.1 HO will request from the losing Society the ship's current survey status and a copy will be forwarded to theattending Surveyor with the Instructions. However, it is important that survey records on board are examined and any recent certificates not accounted for in the survey status informed to HO or the Regional Office.

2.4.2 Particular attention is to be paid to recently issued certificates for the imposition or deletion of Conditions of Class and other conditions, such as barred speed ranges and service restrictions.

2.5 CONDITIONS OF CLASS

2.5.1 All Conditions of Class and Recommendations imposed by the losing class society are to be examined and dealt with as found necessary.
2.5.2 Due and overdue Conditions of Class are to be dealt with at the time of the TOC Survey. Where possible all remaining COCs are to be dealt with at the time of Survey, at the Surveyor´s consideration.

2.5.3 The Interim Certificate of Class issued is to report the status of each COC or recommendation including those which are not dealt with. Due dates for COCs imposed by the losing class society cannot be changed.

2.5.4 If during the TOC Survey serious deficiencies are revealed that question the ship's suitability for class, an Interim Certificate of Class is not to be issued. HO and the Regional Office or Surveyor (where applicable) are to be advised immediately as it may be necessary to advise the Owner not to relinquish their existing classification.

2.6 HULL SURVEY

2.6.1 The Hull Survey is to have the scope of an Annual Survey and to be in accordance with *PART I Ch 3 Subs 1.2* and any relevant instructions to Surveyors issued by HO.

2.6.2 The general arrangement of the ship is to be verified against the available plans and technical information, and compliance reported.

2.6.3 Any surveys or items that are due or overdue are to be dealt with.

2.7 MACHINERY SURVEY

2.7.1 If a ship is transferred to MCO CLASS when the due date of the Complete Survey of machinery is imminent or overdue, a Machinery Survey is to be held in accordance with the current Rules for Ships (*PART I Ch 3 /1.3.1, 1.3.3*)

2.7.2 The minimum Machinery Survey to be held is to comprise a General Examination of all essential machinery in accordance with the scope of an Annual Survey (*PART I Ch 3 Subs 1.3*) and the instructions to Surveyors issued by HO for each TOC case.

2.7.3 Any surveys or items that are due or overdue are to be dealt with.

2.8 ISSUE OF CERTIFICATES

2.8.1 Upon completion of the TOC Surveys, an Interim Certificate of Class (see also *PART I Ch 2 / 1.2.4*) will be issued and a copy faxed immediately to HO **and** the Regional Office, if applicable. Copies of Statutory certificates (as applicable) issued during the survey are to be faxed at the same time as the Interim Certificate of Class to HO **and** the Regional Office.

2.8.2 The Interim Certificate of Class is to be endorsed with the following remark:
"*If additional Recommendations or Conditions of Class are received from the previous Class Society after the issue of this Certificate, they are to be dealt with at the first port of call. If these new recommendations or conditions are not dealt with this Certificate will cease to be valid unless the vessel agrees to proceed directly, without further trading, to a suitable port where they can be dealt with.*"

2.8.3 Classed ships will be granted a **Certificate of Class** with the corresponding class notations, valid for 5 years and subject to endorsements for Annual and Intermediate Surveys. The assignment of class, classification characters and notations, which denote the degree of confidence that the ship has, will be assigned by HO following the satisfactory completion of Surveys, and the verification of compliance with the Rules.

2.8.4 Class notations for the ship will be assigned on the recommendations of the attending Surveyors or the Regional Office, based on the information available.

2.8.5 It is the responsibility of the Surveyor to ensure that the correct notations are included into the Interim Certificate of Class based on the losing Society´s class certificate or other evidence available. HO may be contacted for advice and reference is to be made to *PART I Ch 2 Sec* 7.

2.8.6 Upon completion of the TOC and issue of the Interim Certificate of Class, the Owner or Operator is to be notified by a standard letter.

2.8.7 HO Panama may at its discretion modify the proposed class notation inserted in the Interim Certificate of Class.

2.8.8 In exceptional cases, when the TOC Survey is not completed in one port, an interim certificate should not be issued. A Survey Report is to be submitted to HO or the Regional Office and the port at which the ship is due. The Report is to list all surveys completed or partly held and is to contain the Surveyor's recommendation for classing the ship on completion of the TOC Survey. All valid Statutory certificates issued by the losing Society are to be left on board until TOC Surveys are completed.

2.8.9 Certificates of Class issued by LR, BV, Korean Register and NKK will be valid until the day before the fifth anniversary of the assigned date. All other Class Society certificates will be valid until the fifth anniversary date. Care is to be taken to ensure that Special Surveys are assigned the proper anniversary date and MCO CLASS Certificates of Class remain valid until the proper date.

2.9 INFORMATION ON TOC SURVEY

2.9.1 On completion of the TOC Survey, the following documents are to be sent immediately by fax or electronic format to HO and the appropriate Regional Office:

(a) A copy of the Interim Certificate of Class
(b) Copies of all Statutory Certificates endorsed/renewed during the TOC Survey.
(c) Copies of all valid Statutory Certificates issued by the losing Society which were not reissued during TOC Survey.
(d) Copies of last Certificates of Class issued by the losing Society.

2.9.2 Within **four weeks** after completion of the TOC Survey, the Surveyors are to prepare and forward the following documents to HO Panama:

(a) Survey reports.
(b) Ship´s plans, as required by *Sec 4*.
(c) Records of CSH and CSM cycles kept on board. Since the description and numbering of machinery items varies between classification societies, copies of CSM records are to be amended to show the location and numbering in accordance with MCOCLASS practice before being submitted to HO or the pertinent Regional Office.

NOTE: MCO CLASS practice is to notate CSM items from forward (e.g.: fore lubricating oil pump, aft lubricating oil pump); port , midship and starboard, upper and lower, etc.

2.9.3 When Master Lists cannot be compiled locally, Surveyors are to submit, as early as possible, General Arrangement and capacity plans and a Report on machinery installation. When the ship has undergone alterations, the plans forwarded are to reflect such changes.
2.9.4 If a Special Survey takes place at the time of the transfer of class, Thickness Measurements Reports TM1 - TM8, including Report TM (General Particulars) are to be submitted to HO or the appropriate Regional Office.

2.9.5 Where the scope of TOC surveys allows insufficient time to complete the datasheet, arrangements should be made for the Owner to complete the data.

2.9.6 All information and checklists not specified in the above paragraphs of this Section are to be vetted and retained in the Local Office.

SECTION 3

ACCEPTANCE TO CLASS

3.1 GENERAL PROVISIONS

3.1.1 The requirements of this Section apply to ships not currently in class with a Society of a recognized performance. In this case, the ATC procedure will be generally governed by *PART I Ch 2 Sec 2* (see particularly *Subs 2.1* and *2.5*) .

3.1.2 As soon as a Client indicates by written an intention to enter a ship into MCO CLASS , a Review is to be carried out to consider the commercial aspects. A request for classification will only be allowed to proceed further if a Review has been carried out by the local Surveyor or Regional Office, subject to approval by HO.

3.1.3 For ships 15 years of age and above, in addition to the Review, a Pre-inspection will be required. Notification of the request together with a summary of the Review is to be submitted to HO or the Regional Office. The request will be considered by the Head Office at Piraeus and classification may be declined if the condition of the ship or its history is not satisfactory.

3.1.4 If the ship was built under the survey of, or at any time was classed by, an IACS Member or Associate, HO is to be advised and special consideration may be given to the extent of plan approval required.

3.1.5 For ships without a valid Certificates of Class the plans, drawings and other particulars relevant to classification are to be appraised for compliance with the MCO CLASS Rules.

3.1.6 An estimate of Plan appraisal and Survey fees will be submitted to the applicant.

3.1.7 A written request is to be completed and signed by the Owner covering design appraisal aspects only.

3.1.8 Following acceptance by the Owner of the recommendations from design appraisal, a Request for ATC is to be completed and signed by the Owner. If necessary, an updated fee for survey will be issued on confirmation of the port of survey. The Request for ATC is to be forwarded to HO with a copy of all approved documents and relevant recommendations issued.

3.2 SUBMISSION OF TECHNICAL INFORMATION

3.2.1 Required plans and other technical documents are to be submitted in triplicate to HO or the Regional Office authorized to carry out the Plan appraisal. The plan requirements for ships are detailed in *Sec 4*.

3.2.2 Submitted plans and docuiments are to reflect the arrangement of the ship on completion of acceptance to class.

3.2.3 All plan approval is to be completed before the commencement of the ATC Survey.

3.2.4 Where applicable, copies of intact and damage stability manuals may be requested.

3.2.5 All the issues raised during the plan appraisal are to be dealt with to the satisfaction of HO and the Local Surveyor.

3.3 PERFORMANCE OF ATC SURVEYS – CERTIFICATE

3.3.1 In general, a full Special Survey is to be carried out in accordance with the age and type of ship, together with Complete Surveys of machinery, boilers, electrical equipment, screwshafts and, where applicable, surveys for additional service notations as desired by the applicant.

3.3.2 For ships not built under a recognized Society, longitudinal strength calculations, local strength calculations, equipment number computation and load line calculation are to be carried out.

3.3.3 Recognition of surveys held by other Class Societies or Administrations may be given by HO on a caseby- case basis.

3.3.4 When the required reports on completion of the survey of ships submitted for classification have been received and duly approved, a **Interim Certificate of Classification** will be issued to Client. The Certificate will be subject to replacement by the full term Certificate of Class issued by HO.

3.4 INFORMATION OF ATC SURVEYS

3.4.1 On completion of all surveys, the pertinent First Entry Report, Master Lists, plans and datasheets, are to be submitted to HO. The Interim Certificate of Classification will be issued after authorisation by HO.

3.4.2 The First Entry Report will contain the following:

(a) General arrangement and Capacity plan used to identify compartments for the Master List.
(b) The Hull Datasheets generated by HO and used to create the ship's memoranda items.
(c) The Surveyor's statements concerning the proposed Class Notation.
(d) The Hull and Machinery Checklists.
(e) The Machinery Sea Trials Data, if considered necessary by HO or the attending Surveyors.

3.4.3 Reports are to be completed for all Surveys carried out to confirm that all design appraisal has been completed in accordance with the Rules and that all recommendations raised during design appraisal have been dealt with.

3.5 RECLASSIFICATION OF SHIPS

3.5.1 For the reclassification of ships which previously held MCO CLASS, plans and information are to be available in MCO CLASS HO and appropriate information is to be requested from the Owner and/or the Local Surveyor attending the prospective port os survey for verification that the arrangements are as approved. Any available Master List is to be checked for accuracy.

3.5.2 Where alterations to the ship are to take place at the reclassification surveys, plans are to be submitted for approval.

3.5.3 When plans and information of the ship to be reclassed are not available, or when more than 10 years have elapsed since their approval, a resubmission of plans as stated in Sec 4 may be required, at the discretion of HO.

3.5.4 A new submission of plans and information will be required when:

(a) Major alterations have been carried out during the period that the ship was without a class.
(b) A change in freeboard has been assigned to the ship during the period it was disclassed. Plans are to be submitted unless it can be confirmed that the maximum draught at which the ship operates is within the range of scantling draughts for which the ship was previously approved by the Bureau and that the capacity plan remains correct with respect to tank configuration and use. Minimum ice class draft and minimum draft for bow slamming may apply.
(c) Control equipment has been retrofitted during the period that the ship was disclassed and the Client requests a UMS notation. Machinery plans and documentation detailed in Sec 4, subpara 4.7.4(c), are to be submitted for approval.
(d) An inert gas installation has been retrofitted during the period that the ship was disclassed. The assignment of IGS notation is mandatory and the requirements of paras 4.7.5 and 4.7.6 are to be met.
(e) The ship has been re-engined during the last 2 years, either with a new main or auxiliary engine. Torsional vibration calculations are to be submitted as required by the Rules. For machinery that was installed prior to the last 2 years, torsional vibration calculations will not be required for conventional machinery arrangements subject to satisfactory service experience. Details of service experience are to be reported.

SECTION 4

PLANS AND INFORMATION

4.1 GENERAL PROVISIONS

4.1.1 The plans and information listed in this Section are to be submitted to HO prior to the commencement of the ATC Surveys. In case of TOC, the documents are to be submitted to HO, as far as practicable, within 4 weeks from the completion of TOC Surveys.

4.1.2 The list of technical documentation contained in this Section is in accordance with the requirements of the Rules (*RSTE I Ch 2 Secs 3.4 – 3.7*) and is to be considered as a further elaboration of the above requirements.

4.2 HULL

4.2.1 The following information is to be submitted for approval:

(a) General arrangement plan.
(b) Midship section.
(c) Profile and deck view plans.
(d) Watertight bulkheads.
(e) Rudder span and rudderstock.
(f) Shell expansion plan.
(g) Hatch covers plan.
(h) Hull openings plan.
(i) Cargo capacity plan.
(j) Loading conditions, calculations of still water bending moments and relevant documents; particulars of loading calculations and Instructions Booklets, as applicable.
(k) Stability documents.

4.3 MACHINERY

4.3.1 The following information is to be submitted:

(a) Engine room general arrangement.
(b) Diagrams of fuel (transfer and service) pipes; bilge, ballast, lubricating oil, cooling, steam and feed general service and starting compressed air piping.
(c) Diagrams of fire-fighting systems.
(d) Drawings of boilers and air receivers.
(e) Drawings of shaft line, reduction gear and propellers.
(f) Drawings of steering gear.
(g) Torsional vibration calculations as required per conditions (Required only for ships less than 2 years old or for older ships whose propelling system has been modified during the 2 years preceding classification).
(h) Safety plan.

4.4 ELECTRICAL EQUIPMENT

4.4.1 The following information is to be submitted:

(a) Master plan of power distribution, lighting and emergency power circuits.
(b) Single line diagram of networks and switchboards.
(c) Location and arrangement of electrical equipment in hazardous areas.

4.5 MISCELLANEOUS INFORMATION AND REQUIREMENTS

4.5.1 The following documentation is also considered necessary and is to be submitted to the HO:

(a) Trim and Stability Booklet (for ships of length 24 metres and above).
(b) Loading Manual, if applicable (see *paras 4.6.3, 4.6.4*).
(c) Damage Stability calculation, for ships which are required by IMO Conventions to comply with a subdivision and damage standard (e.g. passenger ships).
(d) Grain Loading Manual, for ships intended for the carriage of grain.
(e) Other booklets, depending on the ship's type and as required by IMO Conventions.

4.5.2 For installations, arrangements or equipment covered by an additional or special notation, not specified in this Chapter, MCO CLASS will determine the documentation to be submitted.

4.5.3 The fire requirements for passenger ships will be subject to a special consideration.

4.6 ADDITIONAL INFORMATION

4.6.1 In addition to the plans required in *Subs 4.2 - 4.5*, the following hull plans and documentation are to be submitted:

(a) For **Oil tankers, chemical tankers and ore/oil ships,** as applicable:
  (i) General arrangement of cargo piping in tanks and on decks.
  (ii) Pumping arrangements at the forward and after ends and drainage of cofferdams and pump rooms.
(b) For **Chemical tankers** only:
  (i) Copy of existing Certificate of Fitness.
  (ii) Full particulars of intended cargoes.
(c) For **Gas carriers/tankers** only, the submitted plans are to include details of:
  (i) Cargo tank supports, anti-rolling/pitching/flotation chocks.
  (ii) Deck tanks and their supports.
  (iii) Distribution of hull steel by quality and grade.
  (iv) Full particulars of intended cargoes including maximum vapour pressure, minimum and, where applicable, maximum liquid temperature.
  (v) Means of protection for ship steelwork (e.g. drip trays, cladding, etc.) at loading manifolds.
  (vi) Scantlings, arrangements and materials of the cargo containment system including primary and, where fitted, secondary barriers.
  (vii) Tank dome plans.
(d) **Ferries and ro-ro ships:**
  (i) Outer and inner bow door or ramp.
  (ii) Stern door or ramp.
  (iii) Side doors.

4.6.2 Any restrictions on loading imposed by the losing Society are to be advised.

4.6.3 A Loading Manual is to be forwarded for every ship for which longitudinal strength calculations are required (i.e. for ships of length greater than 65 m). This Manual is to have been approved and endorsed by a recognized Society with respect to the longitudinal strength.

4.6.4 If an approved Loading Manual cannot be provided, evidence is to be submitted to demonstrate that the longitudinal strength and loading of the ship have been examined and found satisfactory. If this evidence is not available, HO may decide to carry out a longitudinal strength analysis, which will be chargeable.

4.7 LOADING INSTRUMENT

4.7.1 If a ship would have required a loading instrument at the time of build for compliance with the Rules then, upon transfer to MCO CLASS, an approved loading instrument will be required.

4.7.2 Where the loading instrument is approved by a recognized Society, the User Manual and test loading conditions are to be forwarded to HO for record.

4.7.3 Performance is to be carried out. If results are satisfactory, the test conditions are to be endorsed by the Surveyor/Office stamp with the statement: "*The data contained in these test conditions has been introduced into the program and the results produced checked and found to be acceptable*".

4.7.4 In addition to the plans required by *Subs 4.3*, the following machinery plans and documentation are to be submitted for appraisal, where applicable:

(a) For ships **less than 2 years** old, torsional vibration calculations.
(b) For ships with **ICE** notations:
  (i) Main propulsion line shafting.
  (ii) Reduction gear.
  (iii) Details of clutch system or torque limiting devices.
(c) For **UMS** notation:
  (i) Fire-alarm system.
  (ii) List of instruments.

(iii) Test schedule.
(iv) Maintenance and function testing plans.

4.7.5 For ships fitted with an inert gas installation, the assignment of an **IGS** notation will be mandatory and the IGS piping arrangement plans and data are to be submitted for appraisal.

4.7.6 Irrespective of the Rules´ requirements, the inert gas installation is to comply with SOLAS-74 Chapter II-2 Reg 62 (1981 Amendments) as applicable to its date of installation. Copies of any Certificates on board issued by a recognized Society and indicating compliance with the above are to be submitted to HO.

4.8 STATUTORY INFORMATION

4.8.1 For ships less than 500 GRT the following Fire Safety Plans are to be submitted. Structural fire protection.

(a) Fire-fighting arrangements.
(b) Fixed fire-fighting systems.

4.8.2 For ships of 500 GRT and above plans required by *para 4.8.1* are to be submitted if available;

4.8.3 Where a change of flag occurs copies of impact and damage stability manuals may be requested, where no requested copies of the endorsement page are to be submitted.

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SECTIONS

OTHER SURVEYS
PART I, CHAPTER 9

SECTION 1. DAMAGE SURVEY

1.1 GENERAL INSTRUCTION

1.1.1. The Damage Survey is a service that the entities or recognized persons hire with the objective of certifying the damages undergone by the ship in her hull and machinery as a result of a collision, grounding or any another cause. This objective is achieved by means of the following procedures:

(a) Information of the probable causes of the damage.
(b) Nature of the damage.
(c) Damaged zones, equipment and structures.
(d) Extent of damage.
(e) Determination of repairs to be undertaken.
(f) Dry-docking the ship for repairs (if necessary).
(g) Necessity to move the load of the spaces if the ship is loaded and these spaces were affected.

1.1.2 Where possible, it is desirable that the Owner be present or represented when Damage Surveys are held. If this is not feasible, the Surveyor is to advise the Master that a Survey is to be carried out, so that he may take the necessary steps on behalf of the Owner.

1.1.3 In all cases of damage to classed ships, whether or not the Surveyor has been called upon to make a Damage Report, the facts must be given in the usual Survey Reports, in which it is only necessary to state the alleged cause of the damage, the location, nature, and extent of the damage found, the repairs (if any) effected, and which of these are considered permanent or temporary.

1.1.4 In the event of more than one damage, the information in *paragraph 1.1.3* above is to be stated separately for each one.

1.1.5 Only damage repairs to items subject to classification need be included in Survey Reports, and damage repairs are to be clearly separated from those due to wear and tear.

1.1.6 When a Damage Survey is also being held by another party, e.g. an Officer of a Salvage Company, the Surveyor is to cooperate with him to ensure that all repairs required for classification purposes are included in the Damage Report.

1.1.7 Damage Surveys for classification purposes are to be carried out and reported in accordance with the present Chapter.

1.1.8 In addition to Damage Surveys, Surveyors are entitled to act on behalf of Owners or, with the Owner's consent, on behalf of Underwriters with regard to damage sustained to hull and machinery of both classed and unclassed ships.

1.1.9 No survey may be held without the consent of the Owners or their representatives, and, where Owners are mentioned in this Section, the term includes their representatives such as Agents, Masters and Superintendents.

1.1.9 Damage Surveys are to be restricted to the hull, machinery, equipment and permanent fittings of the ship. Surveyors are not to survey goods or cargo, make up or sign any statement of average, or undertake any other business whatever in connection with the damage without the prior consent of Head Office.

1.1.10 When a request for a Damage Survey of the hull, machinery, equipment or permanent fittings of a classed ship has properly been made, the Surveyor will bear in mind that his recommendations are to include all repairs, necessary for maintenance of class.

1.1.11 Surveyors may hold Damage Surveys and issue reports on ships classed with other Societies provided the request is properly made and the survey is within the scope defined in *paragraph 1.1.9*.

1.1.12 When a Damage Survey is requested for floating docks, dredges or other floating devices of unusual design, the Surveyor is to contact HO to specify or to clarify the details that are considered necessary

1.1.13 If the Surveyor has doubts in connection with the works to be undertaken according to this Manual, he is to get advice from Head Office (HO).

1.2 DOCUMENTATION

1.2.1 The Owner or his representative will be requested to produce the following documentation:
(a) Log books
(b) Related statement(s) of facts
(c) Additional information as may be required

1.3 SURVEYS AND REPORTS

1.3.1 When a Damage Survey has been held on ships classed with the MCO, a Damage & Ocassional Survey Report (will be issued, in accordance with current forms and procedures.

1.3.2 In the cases when the Survey is required by an insurance company or is related to the applicant's reclamation, the Surveyor is to be informed of the requirements for his practical application, specifying the required guarantee details. Owner and HO are to be informed about all these particulars.

1.3.3 The Damage Report is to state the relevant dates and the period of time covered by the examined log books. Inspection of log books or certified extracts will be necessary to enable the Surveyor to satisfy himself that the damage is either authenticated or can reasonably be associated with the date or dates when it is alleged to have been sustained.

1.3.4 Where the survey covers more than one damage the log books or extracts are to be examined and the above information relating to dates and period of time are to be reported for each damage.

1.3.5 If log books or extracts are not available covering the incident which is alleged to have been the cause of damage, the report is to state "*Neither log books nor extracts submitted*". It is to be reported whether the ship was loaded, partly loaded or in ballast at the time the damage was sustained and, if available, the draughts forward and aft are to be included, as these may have some bearing on the extent of damage, particularly in cases of collision.

1.3.6 The Report will always state at whose request the survey was held and whether it was on behalf of insurance interests or the Owner. In the former case, that it was held with the consent of the Owner or his representatives.

1.3.7 When representatives of various interests are present at the survey, their names and the names of the respective interests they represent are to be included in the report.

1.3.8 It sometimes happens that a request for a survey is made by two different parties, by Agents on behalf of insurance interests and by the Owner. The Surveyor will then issue two separate reports, each of which is to clearly state who requested the survey. The part dealing with the damage and recommendations is to be identical in both reports

1.3.9 Damage Reports are to be issued only to the party requesting the survey and no copy is to be issued to any other party without the written consent of the former.

1.4 TESTS AND EXAMINATIONS

1.4.1 A properly authenticated request having been received and the Owner's consent obtained, the Surveyor is to ascertain the alleged cause and nature of the damage. The ship's official log books, or certified extracts in English, wherein particulars of the occurrence of the damage are recorded, must be examined.

1.4.2 The Surveyor is to carry out the inspection of the areas, equipment and machinery affected during or after the damage with the objective of determining the nature and magnitude of the same ones.

1.4.3 In case of damage from collision or grounding, whenever it proceeds for the assessed extent of same and to the Surveyor's discretion, the Owner may be requested to submit the realization of underwater videos.

1.4.4 As a result of the examinations it will be determined if it is necessary to dock the ship to carry out the necessary repairs.

1.4.5 In case the ship is with load, the Surveyor is to determine the necessity of transferring the load, fuel or other supplies to other

spaces

1.5 CAUSES OF DAMAGE

1.5.1 The Surveyor is to state whether or not, in his opinion, the damage found is reasonably attributable to the alleged cause or causes **on the available information**. The wording **in bold** is important because it sometimes happens that further particulars bearing on the cause of damage come to light at a later date. If no cause of damage is alleged the report is to state "*No cause stated*".

1.5.2 If the Surveyor is firmly of the opinion that the damage is not consistent with the alleged cause he is to report consequently and to state the possible cause.

1.5.3 In every instance where the Surveyor does not agree that the damage is wholly consistent with the alleged cause, after carefully considering all the information available, he should state why he disagrees and give his own reasoned opinion as to the cause, citing the evidence leading him to his conclusions. The Surveyor is to be sure of his facts and bear in mind that he might be called upon to substantiate his views in a court of law at some future date. If the evidence is doubtful or indefinite an opinion is not to be expressed.

1.5.4 Where any portion of the damage found is of such a nature that it is obviously due to other than the alleged cause, the particulars of such portion of the damage are to be dealt with separately in the Report. This is necessary considering that damages sustained on different occasions or by different causes may be recoverable from different Underwriters.

1.5.5 It is not of any great significance whether damaged hull or machinery parts are numbered from forward or aft but it must always be made quite clear in the Report which method has been adopted

1.5.6 When permanent repairs are partly or wholly postponed, the approximate dimensions and scantlings of the damaged structural items should be reported because, before the repairs are effected, further damage might be sustained in the vicinity from a different cause which could concern a different Underwriter.

1.5.7 The time taken in carrying out the permanent repairs recommended is to be included in the report. If more than one damage is surveyed the time for repairing each should be shown as if it were the sole damage, indicating the time both in dry-dock and afloat. The date of arrival of the ship at the repair port and the actual dates of commencement and completion of repairs, also of dry-docking and undocking, should be stated.

1.6 REPAIRS

1.6.1 If a damaged hull plate could be properly repaired by cropping and partial renewal but the Owner decides to renew the whole plate. The report should then state the approximate dimensions of the part of the plate which would have been cropped and that the whole plate was renewed at the Owner's request.

1.6.2 New material is to be of the same quality and scantlings as the original. Where items such as propellers require to be renewed, it should be made clear in the report that the new ones are to be of the same type and materials as. those they are to replace which should be accurately described.

1.6.3 If it is found that the steelwork is badly wasted in addition to having sustained damage, mention should be made of the wastage and the Surveyor should amplify his remarks by thickness comparisons, photographs, etc.

1.6.4 In the case of surveys held without prejudice on damage to a quay or pier caused by a ship striking same, the reports should include a note regarding the depreciation of the structure and the Surveyor's opinion whether the depreciation factor is reasonably applicable and if so, the percentage.

1.6.5 If the Owner requests that:

(a) All repairs should be postponed; or
(b) Only temporary repairs should be recommended; or
(c) Partly temporary and partly permanent repairs should be recommended, and the Surveyor is satisfied that the desired course may safely be adopted, he should make it quite clear in his report that the action taken was at the request of the Owner, may not be responsible for the cost of temporary repairs. In the report, temporary and permanent repairs must be dealt with separately.

1.7 CERTIFICATION

1.7.1 Upon completion of Damage Survey, a Damage Survey Report will be issued.

SECTION 2. TOWAGE SURVEYS

2.1 GENERAL INSTRUCTIONS

2.1.1 The objective of a Towage Survey is certifying the security of the towage of ships, barges, pontoons, docks and other floating devices being with or without load.

2.1.2. The Towage Survey is to include, in general:

(a) General assessment of the structural capacity of the towed object, its trim and stability, condition of fire fighting and bilge systems, steering gear system and signal means.
(b) Assessment of the conditions of the tug to carry out the tow, valuation of the tug towing device, and the components of the mooring and anchoring systems.

2.1.3 This type of service is provided at the specific request of the Client, and an appropriate fee charged.

2.1.4 It is important to establish that this service does not cover ship handling during ocean towage, which remains the responsibility of the tug master or towing company involved.

2.1.5 Towage certification should, in general, cover the assessment and survey for 'Fitness to be towed'. In addition assessment and surveyfor 'Suitability oftowing arrangements' may be undertaken if requested.

2.1.6 When the survey is related with ships without class, ships classified by other societies, floating dikes, dredge or other floating devices of unusual design the Surveyor will consult with the HO to specify or to clarify the details that are considered necessary.

2.1.7 If the Surveyor has doubts in connection with the works to execute according to the orientations of this Manual, he is to refer to HO.

2.1.8 In the cases when the Administration of the Flag State of the towed vessel requires an effective Certificate of Lines of Load and/or of Safety for the realization of the voyage and the towed vessel is not in order, the Surveyor is to get advice from HO.

2.2 DEFINITIONS AND EXPLANATIONS

2.2.1 For the purposes of the present Section, the following definitions apply:

Bollard pull: Amount of force able to exercise a tug during traction works (trail tow, manoeuvres with ships, etc.).
Tow: Action or effect of towage.
Towage: To take a ship or other floating device on the water throwing of him by means of an end or cable.
Towing equipment: All equipment on the towing and towed objects used to affect towage
Trim: Difference between the draft in the forward and aft perpendicular, in meters.
Tug: Sipe specially intended to tow ships and other towed objects

2.3 DOCUMENTATION

2.3.1 Normally, the tug will be required to be in possession of the following International Certificates, (as applicable):
(a) Certificate of Registry.
(b) Certificate of Class.
(c) Safety Construction Certificate.
(d) International Load Line Certificate.
(e) Certificate of Tonnage Measurement.
(f) Certificates of Navigation Lights and Shapes.
(g) Safety Radio Certificate.
(h) Safety Equipment Certificate.
(i) Certificates for Navigation Equipment.

2.3.2 Any additional certification requirements of the National Authorities are to be complied with.

2.3.3 To the Surveyor's discretion the following additional information may also be requested:

(a) Information on Stability.
(b) General Arrangement plan.
(c) Towing System Arrangement.
(d) Towing means distribution scheme.

2.4 FITNESS TO BE TOWED

2.4.1 A "*Fitness to be towed*" examination is to confirm the structural adequacy of the hull for the foreseen voyage and its integrity against the intake of water. If the vessel is in a damaged condition, the structural strength is to be specially investigated.

2.4.2 All hatchways, ventilating and air pipes on the towed vessel are to be secured with closing appliances in accordance with Rule requirements.

2.4.3 All windows, sidescuttles and skylights are to be closed, and their respective deadlights fitted and secured in position, except where these windows and sidescuttles are to be used in the riding crew's accommodation. In this case the deadlights are to be stowed near their respective windows and sidescuttles.

2.4.4 Outside doors giving access to accommodation spaces and companionways, other than the minimum required for the riding crew, are to be securely closed.

2.4.5 All tank top manhole covers are to be in place and securely bolted down. Watertight doors in hold, 'tweendeck and engine room bulkheads are to be securely closed.

2.4.6 All inlets and overboard discharges not in use by the riding crew, and all inlets and overboard discharges in an unmanned tow, are to be secured in the closed position and tested for watertightness.

2.4.7 Automatic non-return valves are to be checked to ensure their effective operation. Pipelines leading overboard without any closing appliances are to be blanked off at the shell.

2.4.8 An external examination is to be made of the oil fuel tanks, pipes and fittings, and of the fire-extinguishing arrangements to ensure their integrity.

2.4.9 Electrical circuits which will be in service are to be megger-tested.

2.4.10 Particular attention is to be paid to the structure in way of the bollards and fairleads to be used for the tow. If this is found to be inadequate, additional stiffening is to be fitted either under or on the deck in way of these fittings. If the bollards, cleats, or fairleads are considered to be inadequate for the proposed voyage and estimated loadings, fittings of asuitable size are to be provided and securely fitted in positions agreed with the tug's Master

2.4.11 Where the towed vessel is to be manned, the bilge and ballast pumps, or pumps placed on board for the purpose, suction manifolds and valves, are to be in a satisfactory working condition with provision made to operate all the necessary suctions.

2.4.12 Any other pumping arrangements required by the riding crew during the voyage, e.g. oil fuel transfer pumps for auxiliary machinery, are to be examined and tested under working conditions.

2.4.13 If the towed vessel is unmanned there should be sufficient pumping capacity on board to deal with any likely emergency.

2.4.14 If the ship's own pumps are to be employed and are electrically driven, the Surveyor is to satisfy himself that at least one of the ship's existing generators, prime movers and its starting arrangements, is of sufficient capacity for the intended load and is in good working order.

2.4.15 If temporary/portable pumps are placed on the towed ship, their installation and connections are to be done to the Surveyor's satisfaction.

2.4.16 Sounding facilities to all holds and tanks are to be provided.

2.4.17 Due regard is to be given to the arrangements for freeing water from deck. Any water breaking on deck is not to be trapped.

2.4.18 When the main engines are not going to be used during the tow, the shafting is to be securely locked to ensure that no damage may be caused to the engines or gearing as a result of rotation of the propellers.

2.4.19 The Surveyor is to draw attention to the need for sufficient reserves with a generous margin, for the intended voyage.

2.4.20 The towage company is to advise the Surveyor on the duration of the tow – distance to be covered divided by speed of tow, plus a margin of 100% for a tow lasting one week, or 50% for a tow lasting six weeks.

2.4.21 In addition to the above requirements the following items are to be examined:
(a) Strength of securing arrangements for cargo and loose gear.
(b) Standby anchoring arrangements, where provided
(c) In case of towage of floating docks it is essential to examine the method of securing of working platforms and cranes, etc., to the dock working deck

2.4.22 Towed vessels are to exhibit the lights, shapes - and, if manned, be able to emit the sound signals- required by the International Regulations for Preventing Collisions at Sea, 1972. Due consideration is to be given to the reliability of the lights and sound signal means and their ability to function for the duration of the voyage.

2.5 SUITABILITY OF TOWING ARRANGEMENTS

2.5.1 To verify that the tug has the technical conditions required for the towage, the following details are to be taken into account:
(a) Name
(b) Type
(c) Place and date of built. (d) Owner or operator
(e) Main characteristics
(f) Quantity of main engines and power
(g) Bollard pull
(h) Speed

2.5.2 In order to assess the suitability of towing arrangements the following aspects are to be considered:

(a) The adequacy of the tug or towing vessel: In principle the power of the tug or towing vessel is to be such as to ensure a speed of tow of at least 5 knots in moderate weather (Beaufort 4). For deep sea towages only tugs fitted with towing winches are to be used.
(b) The minimum breaking strength of the tug's tow rope should in principle be not less than twice the maximum bollard pull of the tug. However, consideration may be given to the route and likely weather conditions, etc.
(c) All elements of the towing gear are to be consistent in terms of their towing capability with the strength of the towline.
(d) The towed vessel is to be supplied with a spare towline safely secured on board and fitted with recovery equipment, installed and connected for immediate use.
(e) If a trailing line is used as part of the recovery equipment, a buoy is to be fitted at the end of the line and the distance from the aft end of the tow is to be at least 50 metres.
(f) At least one extra set of fibre towing spring and chains, if used, as well as wire towing pennants, flounder plate, shackles and thimbles, is to be carried on board the tug.

2.5.3 The towing connection is to be agreed with the tug Master. Generally, but depending on the tug Master's requirements, for a deep sea tow two lengths of chain cable or equivalent, one on each side, are to be provided, either by the tug or from the towed vessel's own equipment, to form a bridle with a fishplate connection at the fore end.

2.5.4 When the towed vessel has her own crew, the Surveyor is to ensure himself of the existence on board of the required Certificates, and also of any other documentation that may be considered in connection with the towage in each particular case.

2.5.5 Where a towed vessel's own equipment is to be used, it is to be subjected to a detailed examination to ensure that it is in good order.

2.5.6 An additional length of chain cable or a stretch rope may be attached between the fishplate and the towing hawser to act as an intermediate "spring". The legs of the bridle are to be of equal length and a tripping rope/wire is to be connected to the fishplate to facilitate heaving in and recovery of bridle aboard the tow.

2.5.7 For coastal towing, similar arrangements are to be made, except that the chain bridle may not be required on a small tow and the chain intermediate spring may be dispensed with.

2.5.8 Where more than one vessel is to be towed by one tug, each towed vessel is to be on a separate wire direct to the tug. Only in cases of very short tows in sheltered waters will a departure from this procedure be considered.

2.5.9 To estimate the necessary traction the following empiric formula may be used:

$$BP = \left[\frac{\Delta^{2/3} \bullet v^{3}}{7200} + (0.06B \bullet D_1) \right] \bullet K$$

(2.4.9) Where:

BP = Required traction, in tonnes.
Δ = Displacement of towed vessel, in tonnes.
B = Moulded breadth of towed vessels
v = Speed, in knots
D_1 = Height in metres of the exposed transverse cross section of the towed vessel including height of the cross section of the load on deck, where applicable
K = 2 - **5**
Factor that takes into account the probable conditions during the towage and gives a margin for adverse conditions of time (surf, wind, etc).

2.5.10 Where the Bollard Pull of the tug is not certified it is to be calculated by the following formula:

$$BP = \frac{N}{9V}$$

(2.4.10) Where:

N = Effective power in the tug , in BHP.
V = Maximum speed, in knots
$9V$ = Not less than 75

2.5.11 Where the tow is intended to be by the stern it is suggested that the required bollard pull of the tug be increased by 20%. The draught and trim are to be similar to the ahead condition with the tow trimming aft with regard to the direction of tow. The strength of bollards and fairleads may require to be upgraded.

2.5.12 For shipshape vessels it is recommended that the draught forward and trim for ocean voyages be not less than given in *table 2.5.12*.

Table 2.5.12 Draught forward and trim

Length (m)	**Draught forward** (m)	**Trim** (m)
30.0	0.90	0.30
60.0	1.80	0.50
90.0	2.40	0.75
120.0	3.00	0.90

2.5.13 Pontoon type vessels are normally towed on level keel or a small trim by the stern.

2.5.14 The Surveyor will be able to accept recommendations from the Master of the tug as for the seat of the towed object, but whenever the values don't depart excessively of those previously recommended ones.

2.5.15 If the towed object is manned during the voyage, the following requirements will apply:

(a) A minimum of two portable VHF and one daylight signalling lamp are to be carried on board for communication between the towing vessel and the towed object.

(b) Adequate life-saving appliances are to be provided in addition to suitable accommodation, provisions and cooking facilities.

(c) If the foreseen voyage extends beyond 30°N or 30ºS latitude, an immersion suit for each person on board is to be provided.

(d) Six **paragraphchute rocket signals** and 6 **hand flares** are to be provided.

2.5.16 At least one suitable lifeboat or workboat with propulsion engine will be required for transferring personnel and equipment from the towing vessel to the towed object. Suitable launching and recovery arrangements are to be provided. Where the tow is unmanned, boarding ladders are to be securely fixed to both port and starboard sides of the vessel.

2.5.17 The resistance of the towline is to be determined by the following formula:

$$T_{rot} = K \cdot BP \qquad (2.4.17)$$

Where:

T_{rot} = Towing line resistance, in t.

K = **5** if BP $\leq$ 10 t

3 if BP $\geq$ 30 t

Intermediate values will be determined by lineal interpolation.

2.5.18 All the wire rope in use is to have the same lay (i.e. left hand, right hand, etc).

2.5.19 The values of the resistance of the other components of the tow device (insertion shackles, etc) are to be in correspondence with the resistance of the towline.

2.5.20 All the connecting items like shackles, ring, etc are to have an ultimate load bearing capacity of minimum 50% in excess of the documented minimum breaking load of the towing arrangement to be used.

2.5.21 If fibre rope pennants are used, the pennants are to be in a sound condition and the minimum breaking load of any fibre rope pennant is to be not less than:

(a) **2.0** times the towline minimum breaking load for tugs with bollard pull less than 50 tonnes.

(b) **1.5** times the towline minimum breaking load for tugs with bollard pulls greater than 100 tonnes.

(c) Linearly interpolated between 1.5 and 2.0 times the towline minimum breaking load for tugs with bollard pull between 50 and 100 tonnes.

2.5.22 Fibre rope pennants are to be terminated with hard eyes, and are not normally to be connected to the apex of the towing bridle.

2.5.23 In cases of towages performed with two towing lines in paragraphllel, the resistance of each one is not to be lesser than **0.55** T_{rot}.

2.5.24 The length of the towline will be assumed in dependence of the prospective sea force, according to *table 2.5.24*.

Table 2.5.24 Length of the towline depending on the sea force

Sea force (Beaufort)	**Length of the towing line** (m)
3	350
4	500
5	700
6	900
7	1100
8	1250

2.5.25 Where the towed object is not manned appropriate means are to be prepared so that the personnel of the tug can go on board in any moment.

2.5.26 Operation of the navigation lights is to be checked to ensure that they meet the provisions of COLREG-72, as well as to ensure that the towing/riding crew has taken the cautions to deploy the lights of "Not under command".

2.5.27 All the cranes, derricks, crane derricks or other equipment on the deck of the towed object is to be meekly assured for the towage.

2.5.28 No part of any towline arrangement is to be used in the towing operation if:

(a) The reduction in the cross sectional area due to wear abrasion, corrosion and broken wires exceed the 10% or there is severe kinking, crushing or other damage resulting in distortion of the rope structure

(b) End sockets or other towline termination such as thimbles, etc., are damaged, deformed or significally corroded.

2.5.29 In cases when the tow presents a direct danger to navigation, offshore structures or coastlines through breaking adrift or for some other causes, the Master of the towing vessel is bound by SOLAS RegulationV/2 to communicate the information by all the means at his disposal to ships in the vicinity and also to the competent authorities at the first point on the coast with which he can communicate.

2.5.30 In all cases the arrangement for recovering the tow, shall it break adrift, is to be made in accordance with good seamanship, bearing in mind the seasonal weather conditions and area of operation.

2.5.31 If relevant, gog ropes or alternative arrangement are to be provided to prevent athwartship pull, and to facilitate retrieving of the towline. The arrangement is to be remotely operated.

2.6 STABILITY

2.6.1 Intact stability of the towed object in all possible load and ballast conditions foreseen for the trip is to be checked. When doubts arise in this respect, the Surveyor will be able to require the realization of an inclination test in the "*Ready to sail*" condition, assuming in principle that the obtained GM is not lesser than **+0.3 m**.

2.6.2 The Surveyor is to ensure himself of the state of the ballasts so that the reduction is guaranteed to the minimum possible of its effect due to free surfaces.

2.6.3 All the appropriate measures are to be taken to avoid water stagnating in upper decks.

2.6.4 The stability of the towed vessel during ocean towage is to comply with the requirements of the Flag State involved and it is the Owner's responsibility to ensure that this aspect is given consideration.

2.6.5 Compliance with any applicable damage stability is to be verified, if not unreasonable due to special conditions. Such damage stability is to be demonstrated to the extent the towed object may have been previously documented to.

2.6.6 If after having carried out all the suitable confirmations still persist doubts concerning stability, the Surveyor is to seek advice from HO.

2.6.7 The established draught will be stood out in the sides of the towed vessel, mainly if she is not manned, so that could be a probable indication of the intake of water to the inside of her.

2.6.8 The Surveyor will be able to admit the total or partial load of the towed vessel when he considers that the vessel´s flooding conditions, stability and security are satisfactory. Nevertheless the Surveyor is to make known to the Owner that the ultimate responsibility for the security of the load is his.

2.6.9 The cargo securing arrangement and the weather protection for loading cargo, equipment and stores on the towed vessel are to be carefully examined to ensure that they are adequate for the voyage. Where applicable, reference is to be made to the towed object's cargo securing manual.

2.6.10 In the particular cases of non-propelled barges intended for the carriage of loads on deck, the Surveyor is to ensure himself that they have been well fixed according to the provisions of *RSTE VII-8* or *VII-10*,. depending on the cargo nature. This is to be included in the Towage Certificate.

2.7 CERTIFICATION

2.7.1 A Towage Certificate will be issued if the Surveyor considers that the towed object meets the conditions required to be towed on the intended voyage and that the designated tug is in conditions of towing the object with the required margin of security.

2.7.2 If the Owner requires class to be maintained during the tow, the Surveyor is to get advice from HO before issuing any Interim Certificate.

2.7.3 In the case of a classed ship which is being towed because of defective propelling machinery, and all essential auxiliary machinery is in a satisfactory working condition the class could be maintained if a suitable condition of class is imposed on the propelling machinery.

2.7.4 In all cases where the Flag State requires the ship to carry a valid Load Line and/or Safety Construction Certificate, Panama Office is to be advised.

2.8 BOLLARD PULL TESTING PROCEDURE

2.8.1 During bollard pull (BP) testing the main engines are to be run at the manufacturer's recommended maximum torque according to maximum continuous rating.

2.8.2 Verification of the actual output should be requested during the test.

2.8.3 Propellers fitted when performing the test are to be used when the vessel is in normal operation.

2.8.4 All auxiliary equipment such as pumps, generators and other equipment which are driven from the main engines or propeller shafts in normal operation of the vessel should be connected during the test.

2.8.5 The length of the towline is to be not less than 300 metres, measured from the stern of the vessel and the test bollard. A minimum length of twice the vessel length may be accepted.

2.8.6 The water depth at the test location is to be not less than 20 metres within a radius of 100 metres form the vessel.

2.8.7 The minimum water depth which may be accepted has to be twice the maximum draft of the vessel. It is to be noted that reduced water depth may adversely affect the test results.

2.8.8 The test is to be carried out with the vessel's displacement corresponding to full ballast and half fuel capacity.

2.8.9 The vessel is to be trimmed at even keel or at a trim by stern not exceeding 2% of the vessel's length.

2.8.10 The vessel is to be able to maintain a fixed course for not less than 10 minutes. The certified continuous BP will be the average reading of the 10 minutes period.

2.8.11 The test is to be performed with a wind speed not exceeding 5 m/sec.

2.8.12 The current at the test location is not to exceed **0.5 m/sec** or **1knot** in any direction.

2.8.13 The load cell used for the test is to be approved by a competent body or recognized Society and be accurate within +/- 2% within the range of loads to be measured and for the environmental conditions existing during the test.

2.8.14 An instrument giving a continuous reading and a second instrument recording the bollard pull graphically as a function of time are both to be connected to the load cell.

2.8.15 The load cell is to be fitted between the eye of the towline and the bollard.

2.8.16 The figure certified as the vessel's continuous BP is to be the towing force recorded as being maintained without any tendency to decline for a duration of not less than 10 minutes.

2.8.17 A communication system is to be established between the vessel and the person(s) monitoring the load cell and the recording instrument ashore, by means of VHF, HF or telephone connection, for the duration of the test.

CHARACTER OF CLASSIFICATION AND CLASS NOTATIONS
PART I, CHAPTER 10

SECTIONS

CHARACTER OF CLASSIFICATION AND CLASS NOTATIONS
PART I, CHAPTER 10

SECTION 1: CHARACTER OF CLASSIFICATION AND CLASS NOTATIONS

1.1 DEFINITIONS

NOTE

For the purpose of class notations, the definitions given in 1.1.1 to 1.1.2 will apply.

1.1.1 **Clear water**. Water having sufficient depth to permit the normal development of wind generated waves.

1.1.2 **Fetch**. The extent of clear water across which a wind has blown before reaching the ship.

1.1.3 **Sheltered water**. Water where the fetch is six nautical miles or less.

1.1.4 **Reasonable weather**. Wind strengths of force six or less in the Beaufort scale, associated with sea states sufficiently moderate to ensure that green water is taken on board the ship's deck at infrequent intervals only or not at all.

1.1.5 **Type notation**. A notation indicating that the ship has been arranged and constructed in compliance with particular Rules intended to apply to that type of ship. Type notations that may be assigned are listed in Table 1.1.2.

Table 1.1.2 Type notations

DRY CARGO		LIQUID CARGO		PASSENGER	
Symbols	**Types**	**Symbols**	**Types**	**Symbols**	**Types**
AH	Anchor handler	**CHTNK**	Chemical tanker	**CRU**	Cruise Vessel
AHTS	Anchor Handler Tug Ship/ Anchor Handler Towing Supply	**CNG**	Compress Natural Gas	**CRW**	Crew Boat
BARG	Barge	**DRV**	Drill vessel	**FER**	Passenger ferry
BACO	Barge Container Carrier	**DHOT**	Double hull oil tanker	**HOT**	Hotel and Rest Vessel
BLK	Bulk carrier	**FPSO**	Floating Production Storage & offloading Ship	**LFE**	Local Ferry
CAB	Cable Vessel	**FSO**	Floating Storage & offloading Ship	**PAS**	Passenger Vessel / Ship
CONS	Container ship	**FSRU**	Floating Storage regasification Unit	**PASF**	Passenger Ferry
CONBLK	Container Bulk	**GASC**	Gas Carrier	**PASVF**	Passenger/Vehicle Ferry
CONRORO	Container Roll On/Roll Off	**LGC**	Liquefied gas carrier	**ROPAX**	Roll on-Roll off & Passenger Ship
CONDC	Container Dry Cargo	**LGT**	Liquefied gas tanker	**ROPAXFF**	Roll on-Roll off & Passenger Fast Ferry
CV	Crane Vessel	**LNG**	Liquefied Natural Gas	**SPS**	Sailing Passenger Ship
DSS	Diving support ship	**LPG**	Liquefied Petroleum Gas	**TNK**	Tanker
DRG	Dredger	**MODU**	Mobile Offshore Drilling Unit		
ET	Escort tug	**MOU**	Mobile Offshore Unit		
FIFI	Firefighting Vessel	**OB**	Oil Barge		
FIS	Fishing vessel	**OBA**	Offshore Barge		
FDK	Floating Dock	**OBC**	Oil Bulk Carrier		
FLO/FLO	Float-On / Float -Off	**OBO**	Ore, Bulk & Oil vessel/carrier		
FLIP	Floating Instrument Platform	**O/O**	Ore & Oil vessel/carrier		
GCA	General Cargo Vessel	**OOC**	Ore Oil Carrier		
HLV / HLS	Heavy Lift Vessel / Heavy Lift Ship	**ORS**	Oil Recovery Ship		
HB	Hopper Barge	**OTV**	Oil Tanker Vessel		
HD	Hopper Dredger	**POC**	Product Oil Carrier		
HVC	Hovercraft	**PROBO**	Product Oil Bulk Ore		
HSC	High Speed Craft				
ICE	Icebreaker				
LAU	Launch				
LC	Landing Craft				
LASH	Lighter Aboard ship				
LIV	Livestock Carrier				

LO-LO	Lift On/Lift Off				
OBCV	Ore, Bulk & Container Vessel				
OC	Ore carrier				
OSV	Offshore Supply Vessel				
OT	Offshore Tug				
OV	Oceanographic Vessel				
OWS	Offshore Well Stimulation				
PON	Pontoon				
PVS	Platforrm Supply Vessel				
RARA	Rail On-Rail Off				
RCS	Reclamation ship				
REF	Refrigerated cargo ship				
RES	Research Vessel				
RORO	Roll on-Roll off cargo ship				
PPL	Pipe laying				
SAL	Salvage Vessel				
SLV	Sea launch Vessel				
SEABEE	Barge Container Carrier				
SBB	Shipborne Barge				
ST	Stern Trawler				
STS	Standby ship				
SHB	Split Hopper Barge				
SHD	Split Hopper Dredger				
TRW	Trawler				
TUG	Tug				
VHC	Vehicle Carrier				
VLCC	Very Large Crude Carrier				
VLGC	Very Large Gas Carrier				
ULCC	Ultra Large Crude Carrier				
WDS	Waste Disposal Ship				
YAC	Yacht				

1.1.6 **Cargo notation.** A notation indicating that the ship has been designed modified or arranged to carry one or more particular cargoes, e.g. sulphuric acid. Ships with one or more particular cargo notations are not thereby prevented from carrying other cargoes for which they are suitable.

1.1.7 **Special duties notation**. A notation indicating that the ship has been designed, modified or arranged for special duties other than those implied by the type and cargo notations, e.g. research. Ships with special duties notations are not thereby prevented from performing any other duties for which they may be suitable.

1.1.8 **Special features notation**. A notation indicating that the ship incorporates special features which significantly affect the design, *see* Table 1.2.2

1.1.9 **Service restriction notation**. A notation indicating that a ship has been classed on the understanding that it will be operated only in suitable areas or conditions which have been agreed by the Classification, e.g. protected waters service.

1.1.10 **Linked** means connected, while in operation, to an attendant ship (which may be on shore, submerged or afloat) by a restraining line, suspension cable or umbilical cord.

1.1.11 **Laid-up notation**. A ship not under repair or not actively employed may be assigned the laid-up notation in order to maintain the ship in class subject to agreement by the Classification. A general examination of the hull and machinery is to be carried out in lieu of the Annual Survey. An Underwater Examination (UWE) is to be carried out in lieu of the Special Survey.

1.2 CHARACTER SYMBOLS

1.2.1 All ships, when classed, will be assigned one or more character symbols as applicable. For the majority of ships, the character assigned will be **100A1**, ✠ **100A1**

1.2.2 A full list of character symbols for which ships may be eligible is as follows:

✠ This distinguishing mark, will be assigned to ships built under supervision of another IACS member society and later assigned class with MCO. For such ships the class notations will be reviewed separately and equivalent notations will be assigned.

100 This character figure will be assigned to all ships considered suitable for sea-going service.

A This character letter will be assigned to all ships which have been accepted into class in accordance with MCO‘s Rules and Regulations, and which are maintained in good and efficient condition.

1 This character figure will be assigned to:

(a) Ships having on board, in good and efficient condition, anchoring and/or mooring equipment in accordance with the Rules.

(b) Ships classed for a special service, having on board, in good and efficient condition, anchoring and/or mooring equipment approved by the Classification as suitable and sufficient for the particular service.

N This character letter will be assigned to ships on which the Classification has agreed that anchoring and mooring equipment need not be fitted in view of their particular service.

T This character letter will be assigned to ships which are intended to perform their primary designed service function only while they are anchored, moored, towed or linked, and which have, in good and efficient condition, adequately attached anchoring, mooring, towing or linking equipment which has been approved by the Classification Committee as suitable and sufficient for the intended service.

1.2.3 For classification purposes, the character figure **1**, or either of the character letters **N** or **T**, is to be assigned.

1.2.4 In cases where the anchoring and/or mooring equipment is found to be seriously deficient in quality or quantity, the class of the ship will be liable to be withheld.

1.2.2 TABLE : SPECIAL FEATURES NOTATION

SYMBOLS	CHARACTER SYMBOLS
✠	This distinguishing mark will be assigned, at the time of classing, to new ships constructed under MCO’s Special Survey, in compliance with the Rules, and to the satisfaction of the Classification Committee.
• ✠	This distinguishing mark, will be assigned to ships built under supervision of another IACS member society and later assigned class with MCO. For such ships the class notations will be reviewed separately and equivalent notations will be assigned.
100	This character figure will be assigned to all ships considered suitable for sea-going service.
A	This character letter will be assigned to all ships which have been built or accepted into class in accordance with MCO’s Rules and Regulations, and which are maintained in good and efficient condition
1	This character figure will be assigned to:
(a)	Ships having on board, in good and efficient condition, anchoring and/or mooring equipment in accordance with the Rules.
(b)	Ships classed for a special service, having on board, in good and efficient condition, anchoring and/or mooring equipment approved by the Classification Committee as suitable and sufficient for the particular service
N	This character letter will be assigned to ships on which the Classification Committee has agreed that anchoring and mooring equipment need not be fitted in view of their particular service.
T	This character letter will be assigned to ships which are intended to perform their primary designed service function only while they are anchored, moored, towed or linked, and which have, in good and efficient condition, adequately attached

	anchoring, mooring, towing or linking equipment which has been approved by the Classification Committee as suitable and sufficient for the intended service.

SPECIAL FEATURES NOTATION	DESCRIPTION
BC	Assigned to bulk carriers of length 150 m or above
Bottom Strengthened for (Operating Aground) (Loading and Unloading Aground)	Assigned where the bottom structure has been additionally strengthened for loading and unloading aground
BLS	Bow Loading System. Assigned to tankers equipped with bow loading arrangements to facilitate the transfer of cargo oil from offshore loading terminals
Cargo Loading on (Tank Top/ Tween/ Deck (s) Plating/ Hatch cover(s)) limited to tonnes/m2	Assigned where cargo loading on tank tops, decks and/or hatch covers are limited to a specified maximum value which is less than the normal Rule loading
Carriage of Oils with a F.P. not exceeding 60°C	Assigned to non-oil tankers where the ship is suitably constructed and arranged for the carriage of oils with a flash point not exceeding 60°C(closed cup test)
Carriage of Oils with a F.P. exceeding 60°C	Assigned where only the carriage of oils having a flash point exceeding 60°C (closed cup test) is contemplated
(Specified Cargo(es)) only	Assigned where arrangements have been approved for the carriage of a specific product(s)
c.c.	Assigned where structures are fitted with an approved corrosion control system
CCSA	Certified Container Securing Arrangements. Assigned where freight container securing arrangements are fitted, and the design and construction of the system is in accordance with MCO Rules and loose fittings are supplied
CG	Cargo Gear. Assigned where cargo gear is included in class at the Owner's request
CL	Cargo Lift(s). Assigned where cargo lift(s) are included in class at the Owner's request
CR	Cargo Ramp(s). Assigned where cargo ramp(s) are included in class at the Owner's request
CRC –/– –kW –%/–%	Carriage of refrigerated containers. The **CRC** notation may be applied to any ship which has the ability to carry refrigerated containers operating at their design condition with a 24-hour average external ambient air temperature of 35°C The following descriptive notations may be appended, giving details of electrical power and type of cargo: –/– No. of hold-stowed refrigerated containers/No. of deck-stowed refrigerated containers e.g. 230/140 –kW Power generating capacity dedicated to supplying the container plug-in points, e.g. 2,800 kW –%/–% Stowage ratio of deep frozen and chilled cargoes, e.g. 60%/40%
Container Cargoes in (((all) Hold(No(s)))(and on Upper Deck)((and on (all) Hatch Cover(s) (No(s))...)	Assigned where general cargo ships carry container cargoes.
Deck No(s) ... Strengthened for Carriage of Roll on-Roll off Cargoes	Assigned where it is proposed either to stow wheeled vehicles on the deck or to use wheeled vehicles for cargo handling and the deck and supporting structure has been specially considered

SPECIAL FEATURES NOTATION	DESCRIPTION
DSPM4	Dual Single Point Mooring. Assigned to a ship provided with a dual mooring line arrangement at a single-point mooring
Fire-Fighting Ship 1, 2, 3 (with water spray)	Designed where fire protection and fire-fighting equipment is provided. Type 1, 2 or 3 signifies the capacity of the fire-fighting equipment. The total discharge capacity of the monitors in m3/h is shown in brackets. 'With water spray' signifies that a ship is provided with a water spray system which will provide an effective cooling spray of water
Hatch Covers omitted in Hold (No(s)) ...	Assigned where the omission of hatch covers have been specially considered based upon the model tests or alternative means to determine the quantity of water likely to ingress the cargo holds and the means by which it is effectively and safely discharged
Heavy Deck Loads	Assigned where decks are strengthened for loading in excess of Rule basic minimum, e.g. 'Upper deck aft of Fr. 50 strengthened for load of 10 tonnes/m2'
Helicopter Landing Area	Assigned where a helicopter landing area is provided
Hold (No(s)) ... may be empty at draughts not (less than) (exceeding) ...m	Assigned where particular loading arrangements have been specially considered
Ice Class	Assigned where a ship is strengthened to navigate in specific ice conditions. Supplementary Ice Class notations are given in Table 2.2.3
Icebreaker	Assigned designed for icebreaking duties
LA	Mandatory Lifting Appliance(s). Assigned where the lifting appliance is considered to be an essential feature, e.g., cranes on crane barges, lifting arrangements for diving on diving support ships, and is mandatory
LFPL	Low Flashpoint liquids. Assigned to offshore supply ships intended for the carriage of liquids with flashpoint below 60°C (closed cup test) in bulk
For Liquefaction and Storage of (Methane, etc.) in Independent Gas Tanks (Type B, etc.), Maximum Vapour Pressure ( ) bar, Minimum Temperature Minus ( ) °C	Assigned where ships of Category 1B or 2 which have process plants installed solely for the purposes of the physical liquefaction of impure feedstock gases at low temperature and the storage of the purified liquefied gases (where the chemical treatment of the impurities is an incidental process)
MARPOL 20.1.3	Assigned to double hull oil tankers not meeting the Rule minimum double side width requirements but which comply with MARPOL Annex 1, Regulation 20.1.3
MARPOL 21.1.2	Assigned to double hull oil tankers of less than 5000 tonnes deadweight which have a complete double hull in accordance with MARPOL Annex I, Regulation 21.1.2
Movable Decks	Assigned where all movable decks comply with MCO requirements. Movable decks other than those specifically indicated in MCO Rule requirements are not a classification item
Oil Recovery	Assigned when a ship is equipped for oil recovery operations
Petrol in Hold (No(s))...	Assigned to ships that can carry motor vehicles with fuel in their tanks for self-propulsion, in specified locations. It does not apply to ships that are designed primarily for the carriage of motor vehicles Specific requirements will be advised upon request
PL	Passenger Lift(s). Assigned where the passenger lift(s) are included in class at the Owner's request
PM T1 [or T2 or T3] encircled	For ships fitted with a positional mooring system (PM). The supplementary notation T1 [or T2 or T3] encircled may be applied if the system is thruster-assisted. The encircled numeral defines the thruster allowance
PMC T1 [or T2 or T3] encircled	For ships fitted with a positional mooring system for mooring in close proximity to other ships or installations (PMC). The supplementary notation T1 [or T2 or T3] encircled may be applied if the system is thruster-assisted. The encircled numeral defines the thruster allowance

SPECIAL FEATURES NOTATION	DESCRIPTION
RD	Relative Density. Assigned where a ship has tanks appraised for a maximum permissible relative density greater than 1,025
Self-Discharging (Unloading)	Assigned where a ship fitted with self-unloading equipment whose structural aspect has been specially approved
SLS	Stern Loading System. Assigned to tankers equipped with stern loading arrangements to facilitate the transfer of cargo oil from offshore loading terminals
Specialised for the Carriage of ...	Assigned to a vessel which has been designed for the carriage of specified cargo other than that applied by the type notation
SPM4	Single Point Mooring. Assigned to a ship provided with a single mooring line arrangement at a single point mooring
Strengthened for Heavy Cargoes ((any) Hold (No(s)) ..... may be empty)	Assigned to a bulk carrier of less than 150 m in length or a ship designed for the carriage of heavy cargoes. If only certain holds are strengthened for heavy cargoes, they will be specified
HNLS	Hazardous and noxious liquids system. Assigned to ships complying with the requirements for the transport and handling of limited amounts of hazardous and noxious liquid substances in bulk
Hold No(s) ... Strengthened for Regular Discharge by Heavy Grabs	Assigned to bulk carriers where cargoes are regularly discharged by heavy grabs and the thickness of the plating of the hold inner bottom, hopper and transverse bulkhead bottom stool is increased
Submersible to a depth of ...m below Upper Deck in Harbour only	Assigned to a ship that is designed so that it can be submersed to a specified depth in harbour only
Timber Deck Cargoes	Assigned where a cargo of timber is carried on an uncovered part of the freeboard or superstructure deck (does not include wood pulp or similar cargo) and the requirements of the 1966 Load Line Convention concerning timber deck cargoes or other National Regulations are complied with
TLS	Submerged Turret Loading System. Assigned to tankers equipped with submerged turret loading systems to facilitate the transfer of cargo oil from offshore loading to terminals
Winterisation	Assigned to a ship that is intended to navigate in cold climates and may be exposed to low temperatures that may cause equipment to freeze due to ice accretion from atmospheric icing or sea spray or due to freezing of liquid within a system. Protection measures are provided and operational procedures are specified to ensure that equipment is suitably protected to enable operation in low temperatures.
WDL(+)	Weather Deck Load. Assigned where the weather deck load scantlings have been approved for a loading greater than a design head of 3,5 m

1.3 CLASS NOTATIONS (HULL)

1.3.1 When considered necessary by the Classification or when requested by an Owner and agreed by the Classification Committee, a class notation will be appended to the character of classification assigned to the ship. This class notation will consist of one of, or a combination of: a type notation, a cargo notation, a special duties notation, a special features notation and/or a service restriction notation, e.g. ' ✠ **100A1** Oil Tanker F.P. exceeding 60°C in No. 4 tanks ESP

1.3.2 Details of the ship types and particular cargoes for which special Rules apply are given in Chapters 2, 3, 4, 5 and 6 which apply to such ships and cargoes.

1.3.3 Details of the more common special features and the conditions relevant to the assignment of special features notations, together with the form of such notations, are incorporated in Chapters 2, 3, 4, 5 and 6 as applicable.

1.3.4 Service restriction notations will generally be assigned in one of the forms shown in 1.3.6 to 1.3.10, but this does not preclude Owners or Shipbuilders requesting special consideration for other forms in unusual cases.

1.3.5 Where a service notation is applicable, certain exemptions may be granted. Where these affect statutory requirements, such as Load Lines, the Owner or shipbuilder is to obtain the authorization of the Flag State. Such exemptions are to be recorded on the Class certificate and any applicable statutory certificate.

1.3.6 **Protected waters service**. Service in sheltered waters adjacent to sand banks, reefs, breakwaters or other coastal features, and in sheltered waters between islands, e.g. 'Protected Waters Service at Storebaelt Bridge'.

1.3.7 **Extended protected waters service**. Service in protected waters and also for short distances (generally less than 15 nautical miles) beyond protected waters in 'reasonable weather', e.g. 'Extended Protected Waters Service from the Port of Lagos'.

1.3.8 **Specified coastal service**. Service along a coast, the geographical limits, and for a distance out to sea generally not exceeding 21 nautical miles, unless some other distance is specified for 'coastal service' by the Administration with which the ship is registered, or by the Administration of the coast off which it is operating, as applicable, e.g. 'Indonesian coastal service'.

1.3.9 **Specified route service**. Service between two or more ports or other geographical features e.g. 'London to Rotterdam service' 'London, Rotterdam and Hamburg service'.

1.3.10 **Specified operating area service**. Service within one or more geographical area(s), e.g. 'Pacific Tropical Zone service'. 'Great Lakes and St.Lawrence to Pt. du Monts service' 'Red Sea, Eastern Mediterranean and Black Sea service'.

1.3.11 ***IWS**. This notation (In-water Survey) may be assigned to a ship where the applicable requirements of MCO's Rules and Regulations. This notation will be withdrawn for **ESP** ships upon reaching 15 years of age.

1.3.12 **ESP**. This notation (Enhanced Survey Programme) will be assigned to oil tankers, combination carriers, chemical tankers, bulk carriers and ore carriers which are subject to an enhanced survey programme

1.3.13 **CSR**. This notation will be assigned to bulk carriers and double hull oil tankers. Additional mandatory and non-mandatory class notations for CSR bulk carriers are given in 1.3.14

1.3.14 **Class notations for CSR bulk carriers**. In general, CSR bulk carriers less than 150 m in length are to comply with the requirements (CSR) and will be eligible for one of the following mandatory class notations:

{any holds may This class notation is normally assigned to **be empty}**	A ship designed to carry dry bulk cargoes of cargo density 1,0 tonne/m3 and above, with an approved arrangement of loaded holds such that any hold may be empty at the maximum draught.
{holds a, b, ... This class notation is normally assigned to **may be empty}**	A ship designed to carry dry bulk cargoes of cargo density 1,0 tonne/m3 and above with specified holds empty at maximum draught.

CSR bulk carriers equal to or greater than 150 m in length will be eligible for one of the following mandatory class notations:

BC-A, {holds a, This class will be assigned for bulk carriers **b, … may be**	Designed to carry dry bulk cargoes of cargo **empty}** density 1,0 tonne/m3 and above with specified holds empty at maximum draught.
BC-B	This class will be assigned for bulk carriers designed to carry dry bulk cargoes of cargo density 1,0 tonne/m3 and above with all cargo holds loaded.
BC-C	This class will be assigned for bulk carriers designed to carry dry bulk cargoes of cargo density less than 1,0 tonne/m3 with all cargo holds loaded.

1.3.15 **ESN**. This notation (Enhanced Survivability Notation) will be assigned to non-**CSR** bulk carriers which are designed to withstand the individual flooding of all cargo holds.

1.3.16 **LI**. This notation will be assigned where an approved loading instrument has been installed as a classification requirement.

1.4 Class notations (machinery)

1.4.1 The following class notations are associated with the machinery construction and arrangement, and may be assigned as considered appropriate by the Classification,:

✠ LMC This notation will be assigned when the propelling and essential auxiliary machinery, have been constructed, installed and tested under MCO's Special Survey and in accordance with MCO's Rules and Regulations for the classification of Ships,
This notation will be assigned when;
The existing machinery installation and arrangement have been tested and found to be acceptable to MCO

MCH .This notation will be assigned when the:

- System arrangements of propelling and essential auxiliary machinery, , are appraised and found to be acceptable to MCO.

IGS This notation will be assigned when a ship intended for the carriage of oil in bulk, or for the carriage of liquid chemicals in bulk, is fitted with an approved system for producing gas for inerting the cargo tanks.

1.4.2 The following class notations are associated with the machinery control and automation, and may be assigned as considered appropriate by the Classification:

UMS This notation may be assigned when the arrangements are such that the ship can be operated with the machinery spaces unattended. It denotes that the control engineering equipment has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto.

CCS This notation may be assigned when the arrangements are such that the machinery may be operated with continuous supervision from a centralised control station. It denotes that the control engineering equipment has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto

ICC This notation may be assigned when the arrangements are such that the control and supervision of ship operational functions are computer based. It denotes that the control engineering equipment has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto.

IP This notation may be assigned to a ship classed with MCO when the arrangements of the machinery are such that the propulsion equipment and all the essential auxiliary machinery is integrated with the power unit for operation under all normal sea-going and manoeuvring conditions. The system is to be bridge controlled and the propulsion equipment is to incorporate an emergency means of propulsion in the event of failure in the prime mover. It also denotes that the machinery and control equipment have been arranged, installed and tested in accordance with MCO's Rules.

IFP This additional notation may be assigned where an integrated fire protection system is fitted to provide control and monitoring of all active fire protection and fixed fire extinguishing systems from a centralised fire-control station. It denotes that the integrated fire protection system has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto.

PORT Assigned when equipment is installed for the automation of in-port operations involving manoeuvring, berthing and laying alongside. For the assignment of this notation, the ship is also to be assigned **UMS**

1.4.3 The following class notations are associated with dynamic positioning arrangements, and may be assigned as considered appropriate by the Classification:

DP(CM) This notation may be assigned when a ship is fitted with centralised remote manual controls for position keeping and with position reference system(s) and environmental sensor(s). It denotes that the machinery and control engineering equipment has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto.

DP(AM) This notation may be assigned when a ship is fitted with automatic main and manual standby controls for position keeping and with position reference system(s) and environmental sensor(s). It denotes that the machinery and control engineering equipment has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto.

DP(AA) This notation may be assigned when a ship is fitted with automatic main and automatic standby controls for position keeping and with position reference system(s) and environmental sensor(s). It denotes that the machinery and control engineering equipment has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto.

DP(AAA) This notation may be assigned when a ship is fitted with automatic main and automatic standby controls for position keeping, together with an additional/emergency automatic control unit located in a separate compartment and with

position reference systems and environmental sensors. It denotes that the machinery and control engineering equipment has been arranged, installed and tested in accordance with MCO's Rules, or is equivalent thereto.

PCR()() This rating supplements the DP () notation. This rating indicates the calculated percentage of time that a unit is capable of holding heading and position under a standard set of environmental conditions (North Sea).
Two rating numerals are calculated:

- The first numeral represents the percentage of time that the ship can remain on station when subjected to a set of standard environmental conditions (North Sea fully developed) with all thrusters operating.

- The second numeral represents the percentage of time that the ship can remain on station when subjected to a set of standard environmental conditions (North Sea fully developed) with the most effective thruster being inoperative.

- A typical rating might be (95),(70). The foregoing dynamic positioning notations may be supplemented with a Performance Capability Rating (PCR). This rating indicates the calculated percentage of time that a ship is capable of holding heading and position under a standard set of environmental conditions (North Sea).

1.4.4 The following class notations are associated with navigation safety, and may be assigned as considered appropriate by the Classification:

NAV1 This notation will be assigned when the bridge layout and level of equipment are such that the ship is considered suitable for safe periodic operation under the supervision of a single watchkeeper on the bridge. It denotes that the navigational installation has been arranged, installed and tested in accordance with MCO's
Rules, or is equivalent thereto.

IBS This additional notation will be assigned where an integrated bridge system is fitted to provide electronic chart display, track planning and automatic track following, centralised navigation information display, and bridge alarm management. It denotes that the integrated bridge system has been arranged, installed and tested satisfactory by MCO's Rules, or is equivalent thereto.

For assignment of this notation, in addition to satisfying MCO Rules, or equivalent thereto, for navigational function integration:

(a) The layout of the bridge and the equipment located on the bridge is to satisfy the requirements of a relevant international or national ergonomic or human-centred design standard, or an acceptable equivalent, to the satisfaction of MCO; or

(b) The notation **NAV1** is also to be assigned; or

(c) Where the bridge is not intended to operate a periodic one man watch, the layout of the bridge and the equipment on the bridge are to satisfy the requirements for the assignment of the notation **NAV1** to the satisfaction of MCO with the exception of requirements identified by MCO Rules that may be relaxed in such cases.

1.4.5 Machinery class notations will not be assigned to ships the hulls of which are not classed or intended to be classed with MCO.

1.4.6 The notations ✠ **LMC** and **MCH** will in general not be assigned to non-propelled craft, but individual cases will be considered on their merits.

1.5 CLASS NOTATIONS (MACHINERY SPECIAL FEATURES)

1.5.1 The following class notation is associated with onshore power supply arrangements and may be assigned as considered appropriate by the Classification upon application from the Owners:

OPS Assigned when the machinery, electrical and control engineering arrangements installed on board to permit continued operation of services by connection to an external electrical power supply have been assessed.

1.5.2 The following class notations are associated with positional mooring systems, or thruster-assisted positional mooring systems, and may be assigned as considered appropriate by the Classification Committee:

PM Assigned when a positional mooring system is fitted. It is not intended to apply to vessels which have station-keeping capabilities, but which are not required to remain on station in adverse weather conditions. This notation can be supplemented by a Thrust-Assisted notation **T1** [or **T2** or **T3**].

PMC Assigned when a positional mooring system for mooring in close proximity to other vessels or installations is fitted. It is not intended to apply to vessels which have station-keeping capabilities, but which are not required to remain on station in adverse weather conditions. This notation can be supplemented by a Thrust-Assisted notation **T1** [or **T2** or **T3**].

GF Assigned to ships other than LNG carriers, where the main propelling and/or auxiliary machinery is designed to operate on natural gas as fuel, or a combination of natural gas and oil fuel. The notation also indicates that the gas-fuelled machinery has been installed and tested in accordance with MCO's Rules and Regulations.

1.5.3 The following class notations are associated with machinery redundancy and may be assigned as considered appropriate by the Classification:

PMR This notation will be assigned where the main propulsion systems are arranged such that, in the event of a single failure in equipment, the ship will retain not less than 50 per cent of the installed prime mover capacity and not less than 50 per cent of the installed propulsion systems. It also denotes that the installation has been arranged, installed and tested in accordance with MCO Rules.

PMR* This notation will be assigned where the main propulsion systems are arranged such that, in the event of a single failure in equipment, the ship will retain not less than 50 per cent of the installed prime mover capacity and not less than 50 per cent of the installed propulsion systems and where the machinery is installed in separate compartments such that, in the event of the loss of one compartment, the ship will retain availability of propulsion power. It also denotes that the installation has been arranged, installed and tested in accordance with MCO Rules.

SMR This notation will be assigned where the steering systems for manoeuvring are arranged so that steering capability will continue to be available in the event of a single failure in the steering gear equipment or loss of power supply or control system for any steering system. It also denotes that the installation has been arranged, installed and tested in accordance with MCO's Rules.

1.6 CLASS NOTATIONS (REFRIGERATED CARGO INSTALLATIONS (RMC), CONTROLLED ATMOSPHERE (CA) SYSTEMS AND CARRIAGE OF REFRIGERATED CONTAINERS (CRC))

1.6.1 The following class notations may be assigned as considered appropriate by the Classification, on application from the Owners:

RMC This notation will be assigned when the arrangements of the refrigerated cargo installation have been found to be equivalent to Rule requirements, and the installation has been tested in accordance with the relevant requirements of the Rules.

‡ This symbol will be assigned to installations considered suitable for the carriage of fruit. It indicates that the following parameters have been assessed and found satisfactory:

(a) The rate of air circulation and the air refreshing arrangements through the refrigerated spaces or chambers, or to containers.
(b) The temperature controls and monitoring arrangements.
(c) The installation's capability to cool down a complete cargo of fruit to its carrying temperature within a specified time.
The symbol will also be assigned to fishing vessels that have the refrigerating capacity to freeze down their catch.

RMC (LG) This notation will be assigned to a classed liquefied gas carrier or tanker, in which reliquefaction or refrigeration equipment is fitted for cargo temperature and pressure control, where the equipment has been found equivalent to Rule requirements and tested in accordance with the relevant requirements of the Rules.

RMC (BC) Assigned to a classed chemical tanker where the equipment has been found equivalent to Rule requirements and tested in accordance with the relevant requirements of the Rules

TC Assigned to a classed chemical tanker where the temperature control systems have been found equivalent to Rule requirements and tested in accordance with the relevant requirements of the Rules

1.6.2 The following class notations are associated with controlled atmospheres and may be assigned as considered appropriate by the Classification, on application from Owners,

(CA) This notation may be assigned when a ship is fitted with arrangements for maintaining airtightness in CA zones and for the ready connection to a gas system in accordance with the relevant requirements of the Rules.

CA (%O2, This notation may be assigned when a ship is **%CO2)** provided with a CA system which will achieve and maintain specified ranges of oxygen and carbon dioxide levels in accordance with the relevant requirements of the Rules.

RH This notation may be assigned when a ship can maintain a specified relative humidity in the CA zones.

RPA Assigned to ships where the Refrigeration Machinery for Provision Stores and Air-conditioning

Before assignment of any of the above notations it is a prerequisite that the refrigeration installation is assigned an **RMC** class notation.

1.6.3 The following class notation is associated with the carriage of refrigerated cargo containers and may be assigned as considered appropriate by the Classification, on application from Owners:

✠ **CRC** This notation may be assigned when a ship is provided with a ventilation system which is approved, installed and tested in accordance with the relevant requirements of the Rules.

1.6.4 The class notation assigned will additionally specify the temperature conditions and other relevant characteristics for which the equipment has been approve.

1.6.5 The class notation assigned will be maintained as long as the installation is found, at the prescribed Periodical Surveys, to be in a fit and efficient condition, and in accordance with the requirements of the Rules.

1.6.6 The Classification Committee will give consideration to ships engaged on voyages of short duration, to installations of small capacity, or to other special circumstances. In such cases the class may include a service limitation or other restriction.

1.6.7 Refrigerating installations designed to supply refrigerated air to insulated containers in ships' holds board container ships, are eligible for classification. The installation is to include the refrigerating machinery, supply and return air ducting and the flexible couplings between containers and the duct system. Where the arrangements are such that cell air conditioning is essential to the carriage of the containers, the air Conditioning equipment and/or insulation of the hold, deckheads, sides and tank tops are to be included in the classification.

1.6.8 Other methods of carrying refrigerated cargoes in containers aboard container ships will be considered for classification on application.

1.7 CLASS NOTATIONS (MATERIALS)

1.7.1 The following materials notations are associated with material properties and may be assigned by MCO:

Z25 Steel grade with through thickness properties for normal ship applications,
Z35 Steel grade with through thickness properties for more severe applications,