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CR Classification Society

FOUNDED 1951

# RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2019

## AMENDMENT No.1

*February 2020*

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| The following Parts have been amended and the effective dates are: | |
|---|---|
| **Part** | **Effective date** |
| I | July, 2020 |
| II | July, 2020 |
| III | July, 2020 |
| IV | July, 2020 |
| VI | July, 2020 |
| VII | July, 2020 |
| XI | July, 2020 |
| XIV | July, 2020 |

The Rules for the Construction and Classification of Steel Ships 2019 thereof are to be read in conjunction with this Amendment.

AMENDMENT TO "THE RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2019"

# PART I CLASSIFICATION AND SURVEY

# List of major changes in Part I from 2019 edition

| | | | |
|---|---|---|---|
| 1.1.4 | Revised | 2.3.1~2.3.2 | Deleted |
| 1.2 | Revised | 2.3.3 | Revised |
| 1.4.3 | Revised | 2.3.4~2.3.6 | Revised |
| 1.5 | Revised | 2.3.7 | Deleted |
| 1.6.2 | Revised | 2.4.1 | Revised |
| 1.6.3 | Revised | 2.5.1 | Revised |
| 1.6.4 | Revised | 2.5.1(r) | Renumbered and Revised |
| 1.6.5 | Revised | 2.5.2(f) | Revised |
| 1.6.6 | Revised | 2.5.5~2.5.12 | Deleted |
| 1.6.7 | Revised | 2.6.1~2.6.2 | New |
| 1.6.8 | Revised | 2.6.1~2.6.2 | Revised |
| 1.6.9 | Revised | 2.6.3~2.6.4 | Deleted |
| 1.13 | Revised | 2.6.7~2.6.14 | Deleted |
| 1.14 | Revised | 2.6.13 | Renumbered and Revised |
| 1.17.1(a)(iii) | Revised | 2.7 | Revised |
| Table I 1-3 | Revised and New | 2.7.2~2.7.5 | Deleted |
| Table I 1-4 | Revised | 2.7.6~2.7.9 | Renumbered |
| Table I 1-6 | Revised | 2.7.10~2.7.18 | Deleted |
| 2.1.1(f) | Revised | 2.8 | Renumbered |
| 2.1.2 | Revised | 2.9 | Renumbered |
| 2.1.3 | New | 2.10 | Revised |
| 2.1.3 | Revised | 2.11~2.12 | New |
| 2.1.4 | Revised | 2.11 | Renumbered and Revised |
| 2.1.5 | Revised | 2.12 | Renumbered and Revised |
| 2.2.1 | Revised | 2.13 | Renumbered and Revised |
| 2.2.2 | Revised | 2.14 | Renumbered and Revised |
| 2.3 | Revised | 2.15 | Revised |

| | |
|---|---|
| 2.16 | New |
| 2.16 | Renumbered and Revised |
| 2.18.3 | New |
| Chapter 3 | New |
| 3.1 | New |
| 3.4 | New |
| Table I 2-1A | Revised |
| Table I 2-1B | Deleted |
| Table I 2-1C | Deleted |
| Table I 2-2A | Deleted |
| Table I 2-2B | Renumbered and Revised |
| Table I 2-2C | Deleted |
| Table I 2-3A | Revised |
| Table I 2-3B | Revised |
| Table I 2-3C | Revised |
| Table I 2-4A | Revised |
| Table I 2-4B | Revised |
| Table I 2-4C | Revised |
| Table I 2-5A | Revised |
| Table I 2-5B | Revised |
| Table I 2-6A | Revised |
| Table I 2-6B | Revised |
| Table I 2-7 | Revised |
| Table I 2-8 | Revised |
| Table I 2-9 | Revised |
| Table I 2-10 | Deleted |
| Table I 2-11 | Deleted |
| Table I 2-12 | Deleted |
| Table I 2-13 | Deleted |
| Table I 2-14 | Renumbered and Revised |
| Table I 2-15 | Renumbered and Revised |
| Table I 2-16 | Deleted |
| Table I 2-17 | Renumbered and Revised |
| Table I 2-18 | Renumbered and Revised |
| Table I 2-19 | Renumbered and Revised |
| Table I 2-20 | Renumbered and Revised |
| Table I 2-21 | Renumbered and Revised |
| Table I 2-22 | Renumbered and Revised |
| Table I 2-23 | Renumbered and Revised |
| Table I 2-24 | Renumbered and Revised |
| Table I 2-25 | Renumbered and Revised |
| Table I 2-26 | Renumbered and Revised |
| Table I 2-27A | Renumbered and Revised |
| Table I 2-27B | Renumbered and Revised |
| Table I 2-27C | Renumbered and Revised |
| Table I 2-27D | Deleted |
| Table I 2-28 | Renumbered and Revised |
| Table I 2-29A | Renumbered and Revised |
| Table I 2-29B | Renumbered and Revised |
| Table I 2-29C | Renumbered and Revised |
| Table I 2-28 | New |
| Table I 2-29 | New |
| Table I 2-30 | New |
| Table I 2-31 | New |
| Table I 2-32 | New |
| A2.2.2(c) | Revised |
| Appendix 3 | Deleted |
| Appendix 4 | Renumbered |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

## Chapter 1 Classification of Steel Ship

*Paragraph 1.1.4 has been amended as follows:*

### 1.1 General

1.1.4 The stability of the ship is to be sufficient and in compliance with the requirements of governmental authority ~~or~~, International Conventions and Codes and Chapter 30 and 30A of Part II of the Rules, as applicable.

*Section 1.2 has been amended as follows:*

### 1.2 Application

The Society has the right to adopt, and publish as deemed necessary, Rules relating to classification and has (in relation thereto) provided the following:

1.2.1 Except in the case of a special directive by the Society, no new Regulation or alteration to any existing Regulation relating to classification character or to class notation is to be applied to existing ships.

1.2.2 Except in the case of a special directive by the Society, or where changes necessitated by mandatory implementation of International Conventions and Codes are concerned, no new Rule or alteration ~~to~~ in any existing Rule ~~materially affecting classification~~ is to be applied compulsorily after the date on which the contract between the ship builder and shipowner for construction of the ship has been signed, nor within six months of its adoption, nor after the approval of the original midship section or equivalent structural plans. ~~Where it is desired to use existing previously approved plans for a new contract, written application is to be made to the Society.~~ The date of "contract for construction" of a ship is the date on which the contract to build the ship is signed between the prospective shipowner and the ship builder. This date and the construction number (i.e. hull numbers) of all the vessels included in the contract are to be declared by the party applying for the assignment of class to a newbuilding. The date of "contract for construction" of a series of sister ships, including specified optional ships for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective shipowner and the ship builder. In this section a "series of sister ships" is a series of ships built to the same approved plans for classification purposes, under a single contract for construction. The optional ships will be considered part of the same series of sister ships if the option is exercised not later than 1 year after the contract to build the series was signed. If a contract for construction is later amended to include additional ships or additional options, the date of "contract for construction" for such ships is the date on which the amendment to the contract is signed between the prospective shipowner and the ship builder. The amendment to the contract is to be considered as a "new contract". If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which the revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Where it is desired to use existing approved ship or machinery plans for a new contract, written application is to be made to the Society. Sister ships may have minor design alterations provided that such alterations do not affect matters related to classification, or if the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on

the date on which the alterations are contracted between the prospective owner and the ship builder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval. Recognising the long time period that may occur between the initial design contract and the contract for construction for offshore units for fixed locations, the date determining effective classification requirements will be specially considered by the Society in such cases.

1.2.3 Information contained in the reports of classification and statutory surveys will be made available to the relevant owner, National Administration, Port State Administration and, if authorised in writing by that owner, to any other person or organisation.

1.2.4 Information relating to the status of classification and statutory surveys and suspensions/withdrawals of class together with any associated conditions of class will be made available as required by applicable legislation or court order.

1.2.~~3~~5 The Rules may be used in High Speed Crafts, Aluminum Vessels and FRP ships, if applicable.

*Paragraph 1.4.3 has been amended as follows:*

1.4.3 Ship type notation, special duty or purpose notation, additional service notation and hull construction notation

(a) Ship type notation

A notation indicating that the ship has been arranged and constructed in compliance with particular usage intended to apply to that type of ship. See Table I 1-2 of this Chapter.

(b) Special duties or purpose notation

(i) A notation indicating that the ship has been designed, modified or arranged for special duties other than those implied by the type and cargo notation, e.g. **Research Vessel**. Ships with special duties notations are not thereby prevented from performing any other duties for which they may be suitable.

(ii) A notation indicating that the ship has been designed, modified or arranged for special services other than those implied by the type and cargo notation, e.g. **Special Government Services**, **Patrol Vessel**, **Patrol Boat** etc. Ships with special purpose notations are not thereby prevented from performing any other duties for which they may be suitable.

(c) Additional service notation

A type notation and/or a special duty or purpose notation may be completed by one or more additional service notations. The specific rule requirements applicable to each service notation are to be complied with. See Table I 1-3 of this Chapter.

(d) Hull construction notation

For ships with hull construction other than monohull, such as catamaran, trimaran, small waterplane area twin hull (SWATH) and etc., the hull construction of ship is in compliance with relevant requirements of the Rules or the requirements agreed by the Society, the hull construction notation of **Catamaran**, **Trimaran**, or **SWATH** will be affixed after the ship type notation.

*Section 1.5 has been amended as follows:*

## 1.5 Application for Classification and Surveys

1.5.1 An application for the classification of ships is to be submitted in writing or by e-mail or fax by the builder for a ship to be built under the Society's survey or by the owner for a ship not built under the Society's survey.

1.5.2 An application for surveys for maintenance of class is to be submitted in writing or ~~typing~~ by e-mail or fax by the owner or owner's representative.

*Paragraph 1.6.2(f)(ii)(5) has been amended as follows:*

## 1.6 Surveys of Steel Ships

1.6.2 Classification initial survey during construction

(f) Hull Survey for New Construction

(ii) Survey of the hull structure

IACS UR Z23 Table 1 provides a list of surveyable items for the hull structure and coating and is applicable to the Society including:

(1) Description of the shipbuilding functions;

(2) Classification and statutory survey requirements;

(3) Survey method required for classification;

(4) Relevant IACS and statutory requirement references;

(5) Documentation to be available for the ~~classification~~ Surveyor during construction.

a) The shipbuilder is to provide the ~~classification~~ Surveyors access to documentation required by classification, this includes documentation retained by the shipbuilder or other third parties.

b) The list of documents approved or reviewed by the Society for the specific new construction are as follows:

- plans and supporting documents
- examination and testing plans
- NDE plans
- welding consumable details
- welding procedure specifications
- welding plan or details
- welder's qualification records
- NDE operator's qualification records

*Paragraph 1.6.3 has been amended as follows:*

1.6.3 Classification survey of ships not built under survey

Ships which have not been built under survey to the Society, but which are submitted for classification, are to be subjected to a classification survey of ships not built under survey (See 2.~~16~~8 of this Part). Survey planning meeting (kick-off meeting) is to be held prior to the commencement of the survey.

*Paragraph 1.6.4 has been amended as follows:*

1.6.4 Special Survey

(a) Survey intervals

The Special Survey is to be subjected to surveys at the fixed intervals not exceeding five years. Special Surveys are normally to be effected in the sequences of :

No.1 - for ships up to 5 years old.

No.2 - for ships between 5-10 years old.

No.3 - for ships between 10-15 years old.

No.4 & subsequent - for ships age > 15 years old.

(b) Commencement of Special Survey

(i) The Special Survey may be commenced at the 4th Annual Survey and be progressed with a view to completion by the 5th anniversary date.

(ii) As part of the preparation for the Special Survey, the thickness measurement held and survey programme (see 2.1.~~5~~6(a) of this Part) are to be dealt with in advance of the Special Survey. However, the thickness measurement held before the 4th Annual Survey cannot be credited as a part of Special Survey.

(d) Extension of Special Surveys

(i) If a ship at the time when the Special Survey is due but not in a port in which it is to be surveyed, the Society may upon the Owner's written request in advance in each case extend a period not exceeding 3 months. Such extension is, however, only to be granted for allowing the ship to complete its voyage to the port in which it is to be surveyed, and only in cases where it is considered proper and reasonable to do so.

(ii) If a Special Survey is completed after the due date, the due date of the next Special Survey is based upon a date not exceeding 5 years from the due date of the existing Special Survey.

(iii) A maximum three months extension of Special Survey beyond the due date may be granted provided an occasional survey has been carried out satisfactorily based on a scope of Annual Survey and the additional items considered by the Head Office of the Society.

(f) Continuous survey

(i) At the request of the owner, and upon approval of the proposed arrangement, a system of continuous surveys for hull, machinery and cargo refrigerating machinery appliances, may be undertaken, except for hull surveys of tankers, bulk carriers and similar types of ships, where-by the Special Survey requirements are carried out in regular cycle to complete all the requirements of the particular Special Survey within a 5-year period. If the continuous survey is completed beyond the 5-year period, the completion date is to be recorded to agree with the original due date of the cycle. If the continuous survey is completed prematurely but within three months prior to the due date, the Special Survey is to be credited to agree with the effective due date. The continuous survey can, also be adopted respectively for the hull, the machinery including the electrical equipment and the refrigerated cargo installations.

(ii) Where some items of the machinery are opened up and examined by the recognized chief engineer as normal routine for maintenance at ports where the Surveyor is not available or at sea, the open-up inspection of the items, at the request of Owner, under certain conditions, may be dispensed with at the discretion of the Surveyor subject to a confirmatory survey at the convenient port of call where the Surveyor is available. The confirmatory survey is to be carried out within five months from the date of the item of the machinery which was opened up and inspected by the recognized chief engineer. If deemed necessary by the Surveyor, the individual item may be inspected again.

(iii) All items stipulated in 2.7.1~~, 2.7.2 and 2.7.3~~ except thickness measurement are covered by a system of continuous survey for hull. The thickness measurement for the ship which adopts a system of

continuous survey for hull conducted before the 4th Annual Survey cannot be credited for the Special Survey.

(g) Planned ~~Machinery~~ Maintenance Scheme(PMS) for machinery

~~An approved PMS is considered as an alternative to continuous survey for machinery specified in (f).~~

(i) Application

(1) These requirements apply to an approved Planned Maintenance Scheme for Machinery (PMS) as an alternative to the Machinery Continuous Survey (MCS). (see 1.6.4(f) above)

(2) It considers surveys to be carried out on the basis of intervals between overhauls recommended by manufacturers, documented operator's experience and a condition monitoring system, where fitted.

(3) This scheme is limited to components and systems covered by MCS.

(4) Any items not covered by PMS shall be surveyed and credited in the usual way.

~~The PMS, in principle, apply to those items of machinery and equipment installed on the following ships which are to comply with *International Safety Management Code* adopted by IMO.~~

~~(1) The ships are to be less than 15 years old.~~

~~(2) The ships operated by Owners/ship management companies have the maintenance system fixed satisfactorily.~~

~~(ii) Survey for PMS~~

~~(1) Initial survey for PMS~~

~~The initial survey is to be carried out by the Surveyor within one year from the date of approval of PMS, and it is to be verified that the planned machinery maintenance is carried out in accordance with the approved scheme.~~

~~(2) Annual Survey for PMS~~

~~The Annual Survey is to be carried out at each class periodical survey and it is to be verified that the planned machinery maintenance is carried out by the recognized chief engineer in accordance with the approved machinery maintenance scheme and survey schedule table and recorded correctly and that the machinery is in good order.~~

(ii) Maintenance intervals

In general, the intervals for PMS shall not exceed those specified for MCS. However, for components where the maintenance is based on running hours, longer intervals may be accepted as long as the intervals are based on the manufacturer's recommendations.

(iii) Onboard responsibility

(1) The chief engineer shall be the responsible person on board in charge of the PMS.

(2) Documentation on overhauls of items covered by the PMS shall be reported and signed by the chief engineer.

(3) Access to computerized systems for updating of the maintenance documentation and maintenance program shall only be permitted by the chief engineer or other authorized person.

(iv) Procedures and conditions for approval of a PMS

(1) System Requirements

a) The PMS shall be programmed and maintained by a computerized system. However, this may not be applied to the current already approved schemes.

b) The system shall be approved in accordance with a procedure of the Society.

c) Computerized systems shall include back-up devices, such as disks, tapes, or CDs, which are to be updated at regular intervals.

(2) Documentation and information

The following documentation shall be submitted for the approval of the scheme:

a) organization chart identifying areas of responsibility.

b) documentation filling procedures.

c) listing of equipment to be considered by classification in PMS.

d) machinery identification procedure.

e) preventive maintenance sheet(s) for each machine to be considered.

f) listing and schedule of preventive maintenance procedures.

(3) In addition to the above documentation the following information shall be available on board:

a) all clauses in 1.6.4(g)(iv)(2) above, in an up-to-date fashion.

b) maintenance instructions (manufacturer's and shipyard's).

c) reference documentation (trend investigation procedures etc.).

d) records of maintenance including repairs and renewals carried out.

(v) Approval validity

(1) When the PMS is approved, the notation **PMS** will be assigned to the ship.

(2) An implementation survey shall be carried out to confirm the validity of the notation **PMS** (see 1.6.4(g)(vi)).

(3) An annual report covering the year's service, including the information as required under the clauses 1.6.4(g)(iv)(2)c) and e) as well as the information on changes to other clauses in 1.6.4(g)(iv)(2), shall be reviewed by the Society.

(4) An Annual Audit shall be carried out to maintain the validity of the PMS (see 1.6.4(g)(vii))

(5) The survey arrangement for machinery under PMS can be cancelled by the Society if PMS is not being satisfactorily carried out either from the maintenance records or the general condition of the machinery, or when the agreed intervals between overhauls are exceeded.

(6) The case of sale or change of management of the ship or transfer of class shall cause the approval to be reconsidered.

(7) The ship owner may, at any time, cancel the survey arrangement for machinery under PMS by informing the Society in writing or by e-mail or fax and for this case the items which have been inspected under the PMS since the last Annual Survey can be credited for class at the discretion of the attending Surveyor.

(vi) Implementation Survey

(1) The Implementation Survey shall be carried out by the Surveyor within one year from the date of approval of the PMS.

(2) During the Implementation Survey the following shall be verified by the Surveyor to ensure:

a) the PMS is implemented according to the approval documentation and is adapted to the type and complexity of the components/system on board.

b) the PMS is producing the documentation required for the Annual Audit and the requirements of surveys and testing for retention of class are complied with.

c) the onboard personnel is familiar with the PMS.

(3) When this survey is carried out and the implementation is found in order, a report describing the PMS shall be submitted to the Society and the approved PMS may replace the MCS.

(vii) Annual Audit*

(1) An Annual Audit of the PMS shall be carried out by the Surveyor and preferably concurrently with the Annual Survey of machinery.

(2) The Surveyor shall review the annual report or verify that it has been reviewed by the Society.

(3) The purpose of this survey shall be to verify that the scheme is being correctly operated and that the machinery has been functioning satisfactorily since the previous survey. A general examination of the items concerned shall be carried out.

(4) The performance and maintenance records shall be examined to verify that the machinery has functioned satisfactorily since the previous survey or action has been taken in response to machinery operating parameters exceeding acceptable tolerances and the overhaul intervals have been maintained.

(5) Written details of break-down or malfunction shall be made available.

(6) Description of repairs carried out shall be examined. Any machinery part, which has been replaced by a spare one, due to damage, is to be retained on board, where possible, until examined by the Surveyor.

(7) Upon satisfactory completion of the above requirements, the Society shall retain the PMS.

Note: * The term audit, in this context, is not related to ISM audit.

(viii) Damage and repairs

(1) The damage of components/machinery shall be reported to the Society. The repairs of such damaged components/machinery shall be carried out to the satisfaction of the Surveyor.

(2) Any repair and corrective action regarding machinery under PMS system shall be recorded in the PMS logbook and repair verified by the Surveyor at the Annual Audit.

(3) In the case of overdue outstanding recommendations or a record of unrepaired damage which would affect the PMS the relevant items shall be kept out of the PMS until the recommendation is fulfilled or the repair is carried out.

(ix) Planned Maintenance (PM)

Owners may conduct Planned Maintenance on any item(s) of equipment. However, the following equipment cannot be enrolled into the PMS and credit will not be given towards periodic surveys.

(1) System piping (All)

(2) Valves (All)

(3) Sea chests

(4) All operational tests

(5) Fire pumps

(6) Fire fighting equipment

(7) All safety devices, trips and relief valves

(8) Air receivers with associated relief valves and safety devices

(9) Heat exchangers and unfired pressure vessels with design pressures over 6.9 bar (7 kgf/cm$^2$) and associated relief valves

(10) Steering gear piping, pumps and control/relief valves

(11) Steam turbines

(~~2~~x) Open-up survey

The following machinery is, in principle, to be opened and examined in the attendance of the Surveyor in accordance with the survey schedule table.

(1) Crankpins and bearings, crank-journals and bearings, and crosshead bearings for main diesel engines.

(2) Rotors, blades, casings, main bearings, couplings between turbine and reduction gear, nozzle valves and maneuvering valves for main steam turbine.

(3) Aux. steam turbine for main generator.

(4) Thrust shaft and bearings for main propulsion.

(5) Reduction gear for main propulsion.

(6) Flexible coupling for main propulsion.

(7) Other items deemed necessary by the Society.

~~(x) Occasional survey~~

~~Where serious damage is found on the important components/machinery, occasional survey is to be carried out by the Surveyor.~~

(~~iii~~xi) For engine with bore 300 mm or under of the non-ocean going vessels, special consideration may be given to modify the above PMS requirements based on the manufacturer's recommendation of maintenance manual.

(h) Condition Monitoring and Condition Based Maintenance Schemes

(i) Application

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

(2) This scheme may be applied to components and systems covered by Machinery Continuous Survey (MCS), and other components and systems as requested by the owner. The extent of Condition Based Maintenance and associated monitoring equipment to be included in the maintenance scheme is decided by the Owner.

(3) These requirements can be applied only to ships operating on approved PMS survey scheme.

(4) The scheme may be applied to any individual items and systems. Any items not covered by the scheme shall be surveyed and credited in accordance with the requirements of 2.7.2 and / or 1.6.4(g) of this Part.

(ii) Definitions

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

(1) Condition monitoring: acquisition and processing of information and data that indicate the state of a machine over time. The machine state deteriorates if faults or failures occur.

(2) Diagnostic: examination of symptoms and syndromes to determine the nature of faults or failures.

(3) Condition Based Maintenance: maintenance performed as governed by condition monitoring programmes.

(iii) Condition Monitoring (CM)

(1) Where an approved condition monitoring system is fitted, credit for survey may be based on acceptable condition monitoring results. The condition monitoring results are to be reviewed during the Annual Audit.

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

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

(4) The condition monitoring system shall be approved in accordance with the Society's procedures.

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

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

(7) The Society retains the right to test or open-up the machinery, irrespective of the CM results, if deemed necessary.

(iv) Condition Based Maintenance (CBM)

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

(2) Where an agreed planned maintenance and CBM scheme is in operation, the MCS and other survey intervals may be extended based on OEM maintenance recommendations and acceptable condition monitoring results.

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

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

(5) The scheme shall be approved in accordance with the Society's procedures.

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

(v) Procedures and Conditions for approval of CM and CBM

(1) Onboard Responsibility

a) The chief engineer shall be the responsible person on board in charge of the CM and CBM.

b) Documentation on the overhaul of items covered by CM and CBM schemes shall be reported by the chief engineer.

c) Access to computerized systems for updating of the maintenance documentation and maintenance program shall only be permitted by the chief engineer or other authorized person.

d) All personnel involved in CM and CBM shall be appropriately qualified.

Note: CM does not replace routine surveillance or the chief engineer's responsibility for taking decisions in accordance with his judgement.

(2) Equipment and System Requirements

a) CM equipment and systems shall be approved in accordance with a procedure of the Society.

b) The CM/CBM scheme and its extent, are to be approved by the Society.

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

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

e) Where CM and CBM schemes use remote monitoring and diagnosis (i.e. data is transferred from the ship and analysed remotely), the system is to meet the applicable standards for Cyber Safety and Security. The system shall be capable of continued onboard operation in the event of loss of the communication function.

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

g) Systems shall include a method of backing up data at regular intervals.

(3) Documentation and Information

a) The following documentation shall be made available to the Society for the approval of the scheme:

i) Procedure for changes to software system and CM parameters

ii) Listing of equipment to be included in the scheme

iii) Listing of acceptable condition monitoring parameters

iv) Description of CBM scheme

v) Listing, specifications and maintenance procedures for condition monitoring equipment

vi) Baseline data for equipment with condition monitoring

vii) Qualification of personnel and company responsible for analysing CM results

b) In addition to the above documentation the following information shall be available on board:

i) All clauses in 1.6.4(h)(v)(3)a) above in an up-to-date fashion

ii) Maintenance instructions (manufacturer's and shipyard's)

iii) Condition monitoring data including all data since last opening of the machine and the original base line data

iv) Reference documentation (trend investigation procedures etc.)

v) Records of maintenance including repairs and renewals carried out

vi) Records of changes to software systems and parameters

vii) Sensors calibration records / certification / status

(4) Approval validity

a) An Annual Audit shall be carried out to maintain the validity of the CM/CBM scheme.

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

c) The case of sale or change of management of the ship or transfer of class shall cause the approval to be reconsidered.

d) The ship owner may, at any time, cancel the survey arrangement for machinery under the scheme by informing the Society in writing and for this case the items which have been inspected under the scheme since the last Annual Audit can be credited for class at the discretion of the attending Surveyor.

(vi) Surveys

(1) Installation Survey

a) Condition monitoring equipment is to be installed and surveyed in accordance with the Rules of the Society, and a set of base line readings is to be taken.

(2) Implementation Survey

a) The Implementation Survey shall be carried out by the Society's Surveyor no earlier than 6 months after installation survey and no later than the first Class Annual Survey.

b) During the Implementation Survey the following shall be verified by the Surveyor:

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

ii) the scheme is producing the documentation required for the Annual Audit and the requirements of surveys and testing for the maintenance of class are complied with;

iii) the onboard personnel are familiar with operating the scheme.

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

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

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

(3) Annual Audit

a) An Annual Audit of the CM and CBM scheme shall be carried out by the Surveyor concurrently with the Class Annual Survey.

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

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

d) Written details of break-down or malfunction shall be made available.

e) At the discretion of the Surveyor, function tests, confirmatory surveys and random check readings, where Condition Monitoring / Condition Based Maintenance equipment is in use, shall be carried out as far as practicable and reasonable.

f) The familiarity of the chief engineer and other personnel involved with the CM system shall be verified.

g) Calibration status of sensors and equipment shall be verified.

h) Verification that the suitability of the CM/CBM scheme has been reviewed following defects and failures shall be carried out.

(4) Damage and repairs

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

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

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

*Paragraph 1.6.5(a) has been amended as follows:*

1.6.5 Annual Survey

(a) Annual Survey are to be carried out within 3 months ~~either way of~~ before or after each anniversary date ~~after~~ of the date of ~~build~~ the initial classification survey or the completion of the last ~~assigned date of a previous~~ Special Survey.

*Paragraph 1.6.6~1.6.9 have been amended as follows:*

1.6.6 Intermediate Survey~~s~~

(a) Intermediate Survey~~s~~ ~~are~~ is to be carried out either at or between the ~~second~~ 2nd and ~~or third~~ 3rd Annual Survey. ~~after the classification initial survey during construction or a Special Survey. Annual Surveys are not required to be carried out when an Intermediate Survey is carried out. Parts of the Intermediate Surveys which are additional to the requirements of the Annual Survey may be surveyed either at or between the second or third Annual Survey.~~

(b) Those items which are additional to the requirements of the Annual Survey may be surveyed either at or between the 2nd or 3rd Annual Survey.

1.6.7 Bottom Survey

(a) Survey intervals

(i) There is to be a minimum of 2 examinations of the outside of the ship's bottom and related items during each 5-year Special Survey period. One such examination is to be carried out in conjunction with the Special Survey. In all cases the interval between any 2 such examinations is not to exceed 36 months.

~~At least two Bottom Surveys are to be carried out during five year Special Survey period. In all cases, taking account of extension of Special Survey, the maximum interval between two Bottom Survey is not to exceed 36 months and one of the two Bottom Surveys required in each five year Special Survey period is to be coincided with the Special Survey.~~ For ships ~~vessels~~ operating solely in fresh water, the maximum interval is not to exceed 5 years.

(ii) An extension of examination of the ship's bottom up to 3 months ~~A maximum three months extension of Bottom Survey~~ beyond the due date may be granted in exceptional circumstance(1) provided an occasional survey has been carried out satisfactorily with the survey items required by the Head Office of the Society.

Note: (1) "Exceptional circumstances" means, e.g., unavailability of repair facilities, unavailability of essential materials, equipment or spare parts, or delays incurred by action taken to avoid severe weather conditions.

~~(iii) For ESP ships exceeding fifteen years of age, Bottom Surveys are to be carried out in dry dock.~~

(b) In-Water Survey in lieu of Bottom Survey in dry dock

(i) An approved In-water survey equivalent to a docking survey may be considered as an alternative to a docking survey, subject to the provisions of 2.2.2 of this Part.

(ii) An In-water survey not credited as a Bottom Survey of the Special Survey may be carried out with the ship afloat.

(iii) Special consideration is to be given to ships of 15 years or over before being permitted to have such inspection.

(iv) For ESP ships of 15 years of age and over, such examinations are to be carried out with the ship in drydock.

(c) Bottom Survey at Special Survey

A Bottom Survey in dry dock is to be a part of the Special Survey.

(d) For passenger ships, the Bottom Surveys are to be carried out at each Annual Survey and Special Survey, at least 2 Bottom Surveys to be carried out in dry dock within each 5 years period of the classification Special Survey and the maximum interval between the 2 Bottom Survey in dry dock is not to exceed 36 months. The In-Water Surveys may be carried out and credited as the other Bottom Survey.

1.6.8 Surveys of propeller shafts and tube shafts

(a) Survey intervals

(i) Oil lubricated shafts or closed loop system fresh water lubricated shafts (closed system)

Normal survey interval is 5 years. Detailed requirements are in accordance with 2.3.2 of this Part.

(ii) Water lubricated shafts (open systems)

The survey interval of water lubricated shafts (open systems) is in accordance with 2.3.3 of this part.

~~(i) Water-lubrication bearings~~

~~The normal survey interval of the following propeller shaft is five years:~~

~~(1) For propeller shaft fitted with approved keyway and approved propeller hub, which are designed for avoiding excessive stress concentration, and protected by a continuous liner or by an approved equivalent arrangement, to prevent seawater from contacting the steel shaft effectively, or which has shafts of corrosion-resistance material.~~

~~(2) For the propeller shaft lubricated with fresh water exclusively in bearing.~~

~~(3) For multiple screw propeller shaft.~~

~~(ii) Oil-lubrication bearings~~

~~Normal survey interval is five years.~~

~~(iii) Tube shaft survey:~~

~~Tube shaft, if fitted, is to be examined at the same interval as propeller shaft.~~

(~~iv~~iii) Controllable pitch propellers for main propulsion purposes are to be surveyed at the same intervals as the propeller shaft.

(iv) Directional propellers for main propulsion purposes are to be surveyed at intervals not exceeding 5 years.

(v~~i~~) Waterjet units for main propulsion purposes are to be surveyed at intervals not exceeding 5 years provided the impeller shafts are made of approved corrosion resistant material or have approved equivalent arrangements.

(vi) Dynamic positioning and/or thruster-assisted mooring and athwartship thrust propellers and shaftings are to be surveyed at intervals not exceeding 5 years.

(vii) All other shafts not covered above, their normal survey interval is 3 years.

(b) Survey ~~E~~extensions ~~of normal survey~~ for propeller shaft and tube shaft

~~(i) Extension up to 1 year~~

~~(1) Water-lubricated bearings~~

~~An extension up to one year may be considered, when requested by the Owner, provided a survey is carried out in accordance with 2.3.7(a)(i) of this Part.~~

~~(2) Oil-lubricated bearings~~

~~Up to two separate extensions of approximately one year may be considered when requested by the Owner, provided a survey is carried out in accordance with 2.3.7(a)(ii) of this Part.~~

~~(ii) Extension up to 5 years~~

~~In lieu of (b)(i)(2) above, up to two(2) separate extensions may be granted by the Society, when requested by the Owner, provided a survey is carried out at the fifth year and at the fifth year after the first extension in accordance with 2.3.7(b) of this Part.~~

An extension with specified period may be granted by the Society, when requested by the Owner, provided the extension survey is carried out to the satisfaction of the Surveyor.

(i) For oil lubricated shafts, the survey extensions are in accordance with 2.3.2(c)(ii) of this Part.

(ii) For closed loop system fresh water lubricated shafts, the survey extensions are in accordance with 2.3.2(d)(ii) of this Parts.

(iii) For water lubricated shafts (open systems), the survey extensions are in accordance with 2.3.3(c)(ii) if this Part.

If the extension survey is carried out within 1 month of the shaft survey due date, then the extension will take effect from the Shaft Survey due date.

If the extension survey is carried out more than 1 month prior to the Shaft Survey due date, then the period of extension will take effect from the date on which the extension survey was completed.

1.6.9 Boiler Surveys and thermal oil heater surveys

(a) Survey intervals for boiler

(i) For ship fitted with more than one water tube boiler for propulsion, a minimum of 2 surveys is to be carried out during each 5-year Special Survey period. One such survey is to be carried out in conjunction with the Special Survey. In all cases, the interval between any 2 such surveys is not to exceed 36 months. An extension of the survey up to 3 months may be granted by the Surveyor in exceptional circumstances(1), provided a survey is carried out in accordance with 2.4.1(i) of this Part. In addition, Annual Examinations are to be carried out in accordance with 2.4.1(h) of this Part. ~~the interval between two consecutive surveys of each boiler is not to exceed 2.5 years.~~

For ships fitted with only one water tube boiler for propulsion, the interval between 2 consecutive surveys ~~of the boiler~~ is not to exceed 2.5 years for the first 7.5 years. ~~until the boiler is 7.5 years old; thenceforth~~ Thereafter the boiler is to be surveyed annually. An extension of the survey not exceeding 6 months may be granted by the Surveyor provided a survey is carried out in accordance with 2.4.1(i) of this Part, and provided the boiler is surveyed twice in every 5-year period for the first 7.5 years.

In addition, Annual Examinations are to be carried out in accordance with 2.4.1(h) of this Part for the first 7.5 years.

(ii) For ships fitted with fire tube boilers for propulsion, a minimum of 2 surveys are to be carried out during first 5-year Special Survey period. Thereafter, boilers are to be surveyed annually. The interval between any 2 surveys is not to exceed 36 months. ~~the boiler are to be surveyed when 4 four years and 6 six years old;~~ In addition, Annual Examinations are to be carried out in accordance with 2.4.1(h) of this Part for the first 5-year Special Survey period.

(iii) Auxiliary boilers or thermal oil heaters, waste heat steam generators/economizers having a working pressure exceeding 0.35 MPa and heating surface exceeding 4.5 $m^2$, a minimum of 2 surveys are to

be carried out during each 5-year Special Survey period. One such survey is to be carried out in conjunction with the Special Survey. In all cases, the interval between any 2 such surveys is not to exceed 36 months. An extension of the survey up to 3 months may be granted by the Surveyor in exceptional circumstances(1), provided a survey is carried out in accordance with 2.4.1(i) of this Part. In addition, Annual Examinations are to be carried out in accordance with 2.4.1(h) of this Part. ~~are to be surveyed twice in every 5-year Special Survey period and one of the two boilers or thermal oil heaters, etc. surveys is to be coincided with the Special Survey. The period between surveys will not exceed three years.~~

Note: (1) "Exceptional circumstances" means, e.g., unavailability of repair facilities, unavailability of essential materials, equipment or spare parts, or delays incurred by action taken to avoid severe weather conditions.

(b) Extension of boiler surveys, as specified in 1.6.9 (a)(i) and (iii) above.

~~When requested by Owners, subject to a survey for extension, an extension for a boiler survey may be granted by the Surveyor after a satisfactory external examination of the boiler and review of boiler operation and feed water records.~~

*Section 1.13 and 1.14 have been amended as follows:*

## 1.13 International Conventions and Codes

Where authorized by the Administration of a country signatory thereto and upon request of the Owners of a classed ship or one intended to be classed, the Society will survey a new or existing ship of the applicable size for compliance with the provisions of applicable International Conventions and Codes including the following, and certify thereto in the manner prescribed in the Convention and Code.

- International Convention on Load Line, 1996, as amended.
- International Convention for the Safety of Life at Sea, 1974, as amended.
- International Convention on Tonnage Measurement of Ships, 1969.
- International Convention for the Prevention of Pollution from Ships, 1973/78, as amended.
- International Code for the Constuction and Equipment of Ships Carrying Liquefied Gases in Bulk.
- International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk.
- International Code for Safety for High Speed Craft (HSC Code), 2000.

~~Where authorized by the government of the country in which a ship is registered or intended to be registered and upon request by builders or owners of the ship, the Society is to survey a new or existing ship for compliance with the provisions of International Conventions and Codes.~~

## 1.14 Governmental Regulations

Where authorized by a government agency and/or upon request of the Owners of ~~the ships~~ a classed ship or one intended to be classed, the Society will survey and certify a new or existing ships for compliance with particular regulations of that government on their behalf.

All work performed on behalf of governments shall be governed by the terms and conditions of the Rules unless the government specifies otherwise.

Owners of a classed ship are required to notify the Society when a vessel changes flag so that appropriate action can be determined with respect to the scope of CR's authorization by the new flag Administration.

*Paragraph 1.17.1(a)(iii) has been amended as follows:*

## 1.17 Liability and Compensation

1.17.1 Article 1

(a) CR CLASSIFICATION SOCIETY is a Society (the "Society") whose purpose is the classification (« Classification ») of any ship or vessel or structure of any type or part of it or system therein collectively hereinafter referred to as a "Unit" whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

The Society:

(i) prepares and publishes Rules for classification, Guidance Notes and other documents (« Rules »);

(ii) issues Certificates, Attestations and Reports following its interventions (« Certificates »);

(iii) publishes Registers on the CR Website.

*Table I 1-3 has been amended as follows:*

**Table I 1-3**
**List of Additional Service Notation**

| Notation | Description | Reference |
|---|---|---|
| **CSR** | This notation will be assigned to bulk carriers or oil tankers which fully comply with the IACS's **C**ommon **S**tructural **R**ules. | IACS's **C**ommon **S**tructural **R**ules |
| **BC-A** | This notation will be assigned to bulk carriers designed to carry dry bulk cargoes of cargo density 1.0 t/m$^3$ and above with specified holds empty at maximum draught in addition to **BC-B** conditions. | Part III/1.2 of the Rules |
| **BC-B** | This notation will be assigned to bulk carriers designed to carry dry bulk cargoes of cargo density of 1.0 t/m$^3$ and above with all cargo holds loaded in addition to **BC-C** conditions. | Part III/1.2 of the Rules |
| **BC-C** | This notation will be assigned to bulk carriers designed to carry dry bulk cargoes of cargo density less than 1.0 t/m$^3$. | Part III/1.2 of the Rules |
| **{Maximum cargo density (t/m$^3$)}** | This service feature will be indicated within the annotation for notations **BC-A** and **BC-B** if the maximum cargo density is less than 3.0 t/m$^3$. | Part III/1.2 of the Rules |
| **{No MP}** | This service feature will be indicated within the annotation for notation **BC-A**, **BC-B** and **BC-C** if the ship has not been designed for loading and unloading in multiple ports in accordance with the conditions specified in 1.2.5(c) of Part III. | Part III/1.2 of the Rules |
| **{Holds a, b,…… may be empty}** | This service feature will be indicated within the annotation for notation **BC-A**, for the combination of specified empty holds. | Part III/1.2 of the Rules |
| **GRAB [X]** | This notation will be assigned to ships, of which the holds are to be designed for loading/unloading by grabs having a maximum specific weight **X** equal to or greater than 20 tons. | Part III/1.2 of the Rules |
| **GRAB** | This notation will be assigned to ships strengthened for loading/unloading cargoes by means of grabs or buckets deemed as appropriate by the Society. | Rules for the Construction and Classification of Steel Ships |
| **Flash Point > 60°C** | For oil tankers intended to carry oil having flash point above 60°C (closed cup test). | Part III Chapter 2 and 2A of the Rules |
| **ESP** | This notation (**E**nhanced **S**urvey **P**lan) will be assigned to oil tankers, combination carriers, bulk carriers, ore carriers and chemical tankers, as defined in 2.1.2 of Part I of the Rules which are subject to an enhanced survey plan. | Part I Chapter 2 of the Rules |
| **PSPC** | This notation (**P**erformance **S**tandard for **P**rotective **C**oating) will be assigned to any ship where the applicable requirements in 23.1.4 of Part II of the Rules are complied with. | Part II/23.1.4 of the Rules |
| ~~**HSC-N**~~ | ~~This notation, with **N** being **PA, PB** or **C**, will be assigned to ships which fully comply with the Rules for the Construction and Classification of High-Speed Craft.~~ | ~~Rules for the Construction and Classification of High-Speed Craft~~ |
| **HSC-PA or HSC-PB** | This notation will be assigned to the craft meeting the Rules for High-Speed Craft and the requirements of category A (up to 450 passengers) or B (over 450 passengers) of International Code of Safety for High-Speed Craft (hereinafter referred to as HSC Code). | The Rules for High-Speed Craft and HSC Code |
| **HSC-C** | This notation will be assigned to the cargo craft meeting the Rules for High-Speed Craft and the requirements of cargo craft category of HSC Code. | The Rules for High-Speed Craft and HSC Code |

| Notation | Description | Reference |
|---|---|---|
| **LSC** | ~~This notation (Light Structure Craft) will be assigned to ships which comply with the requirements of structure, fire safety, escape measures and life-saving appliances and arrangements for high speed craft, as appropriate, and are capable of maximum speed 3.7V0.1667 (m/s) (∇ = displacement in $m^3$ corresponding to the load line) and not to proceed in the course of their voyage more than the time as specified in 1.3.4 of the Rules for the Construction and Classification of High Speed Craft.~~<br>This notation (**L**ight **S**tructure **C**raft) will be assigned to craft not engaged in international voyages which are capable of maximum speed $2.36 \leq V/\sqrt{L}$ and not to proceed in the course of their voyage more than the time as specified in 1.3.4 of the HSC Code.<br>The craft with **LSC** notation are to comply with the requirements of the Rules for High-Speed Craft, and in addition the requirements of Chapter 4, 7 and 8 of HSC Code as applicable. | ~~Chapter 3, 4, 7 and 8 in Rules for the Construction and Classification of High-Speed Craft~~<br>The Rules for High-Speed Craft and Chapter 4, 7 and 8 of HSC Code |
| **PMA** | This notation (**P**ermanent **M**eans of **A**ccess) will be assigned to ships where the applicable requirements in Chapter 28 of Part II of the Rules are complied with. | Part II Chapter 28 of the Rules |
| **GBS** | This notation will be assigned to GBS ships which fully comply with the requirements of Part XIV | Part XIV of the Rules |
| **BP[X]** | This notation will be assigned to ships which have a maximum bollard pull load **X** in tons. | Part III/11.9 of the Rules |
| **NR** | This notation (the comfort **R**ating of **N**oise) will be assigned to ships where the applicable requirements in Chapter 34 of Part II of the Rules are complied with. | Part II Chapter 34 of the Rules |
| **BC-XII** | This notation will be assigned to ships where the applicable requirements in Chapter 14 of Part III of the Rules are complied with. | Part III Chapter 14 of the Rules |
| **SPS** | This notation will be assigned to ships which comply with the IMO Code of Safety for Special Purpose Ships (SPS Code). | SPS Code |
| **VR** | This notation will be assigned to ships which comply with the limits for vibration of ISO 20283-5:2016, as given in Table II 34-2. | Part II Chapter 34 of the Rules |
| **Smartship{Hx; Mx; Ex; Nx; Cx; Ix}** | This notation will be assigned to ships which comply with the requirements of the Guidelines in terms of smart hull, smart machinery, smart energy efficiency management, smart navigation, smart cargo management, smart integration platform. If the ship complies with the additional requirements for specific operations or design condition, the corresponding qualifiers specified in GUIDELINES FOR SMART SHIPS will be affixed to this notation. | GUIDELINES FOR SMART SHIPS |

*Table I 1-4 has been amended as follows:*

**Table I 1-4**
**List of Service Restriction Notation**

| Notation | Description | Reference |
|---|---|---|
| **Coastal Service** | Service along a coast, the geographical limits of which will be indicated in the Register, and for a distance out to sea generally not exceeding 30 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.<br>The operation/service limitations, such as significant wave height, or maximum voyage etc., may be indicated in the bracket affixed after this notation. | |
| **Greater Coastal Service** | Service along a coast, the geographical limits of which will be indicated in the Register, and for a distance out to sea generally farther than the area of **Coastal Service** in domestic voyage.<br>The operation/service limitations, such as significant wave height, or maximum voyage etc., may be indicated in the bracket affixed after this notation. | |
| **Protected Waters Service** | Service in sheltered water adjacent to sand banks, reefs, breakwaters or other coastal features, and in sheltered waters between islands. | |
| **Specified Operating Area Service** | Service within one or more geographical area(s) which will be indicated in the Register. | |
| **Specified Route Service** | Service between two or more ports or other geographical features which will be indicated in the Register. | |

*Table I 1-6 has been amended as follows:*

**Table I 1-6**
**List of Special Equipment Notation**

| Notation | Description | Reference |
|---|---|---|
| **CCB** | This notation (**C**entralized System for **C**argo and **B**allast Water Handling) will be assigned to ships provided with centralized system for cargo and ballast water handling. | Part VIII/7.10 of the Rules |
| **DPS-N** | This notation (**D**ynamic **P**ositioning **S**ystem), with N being **I**, **II** or **III**, will be assigned to ships provided with dynamic positioning system. | Part IV Chapter 10 of the Rules |
| **ETA** | This notation (**E**mergency **T**owing **A**rrangement) will be assigned to tankers provided with emergency towing arrangements. | Part II/25.7 of the Rules |
| **Helideck-N** | This notation(**Heli**copter **deck**), with N being **I**, **II, III** or **IV**, will be assigned to ships provided with helicopter facilities in accordance with related requirements of the Rules. | Part II Chapter 12A of the Rules |
| **HHA** | This notation (**H**igh **H**olding **A**nchor) will be assigned to ships receiving the equipment symbol **E,** with a specially considered anchor of approved superior holding ability for which the mass of the anchor may be reduced up to a maximum of 25% from the mass specified in Table II 25-1. | Part II/25.3 and Part XI Chapter 12 of the Rules |
| **SHHA** | This notation (**S**uper **H**igh **H**olding **A**nchor) will be assigned to ship receiving the equipment symbol **E,** with a specially considered and approved anchor that have at least 4 times the holding power of ordinary stockless anchors of the same weight.<br>The mass of each bower anchor can be reduced by up to 50% of the mass specified in Part III 5.1.4(a), (see Table III 5-1), of the Rules. | Part II/25.3 and Part XI Chapter 12 of the Rules and/or Part III/ 5.1.4(a) of the Rules for High-Speed Craft |
| **IGS**[(1)] | This notation (**I**nert **G**as **S**ystem) will be assigned when a ship intended for the carriage of oil in bulk, or for the carriage of liquid chemicals in bulk, fitted with an approved system for producing gas for inert the cargo tanks. | Part VI/5.8 of the Rules |
| **LCS** | This notation (**L**oading **C**omputer **S**ystem) will be assigned where an approved loading computer system has been installed as a classification requirement in 1.1.13 of Part I of the Rules. | Part I/1.1.13 & Appendix 1 & Part II/3.5 of the Rules |
| **VEC** | This notation (**V**apor **E**mission **C**ontrol) will be assigned to ships equipped with cargo vapor emission control system in compliance with the requirements in 3.16 of Part VI of the Rules. The notation **–T** is added to the notation where, in addition, the ship is fitted with specific arrangements for transferring cargo vapors to another ship. | Part VI/3.16 of the Rules |
| **AIP**[(1)] | This notation (**A**ir **I**ndependent **P**ropulsion System) will be assigned if submarines provided with an Air Independent Propulsion system which complying with the requirements of section 4.4 of the Rules for Submarines. | Section 4.4 of the Rules for Submarines |
| **CSS** | This notation (**C**ontainer **S**ecuring **S**ystems) will be assigned to ships which have a certified container securing system for unrestricted service. | Guidelines for Certification of Container Securing Systems |
| **CSP** | This notation (**C**ontainer **S**ecuring **P**rogram) will be assigned to ships which have certified container securing program provided onboard. | Guidelines for Certification of Container Securing Systems |
| **CSP-RSS** | This notation (**C**ontainer **S**ecuring **P**rogram**)** with suffix **(R**oute **S**pecific **S**ervice) will be assigned to ships which signify the certification of the container securing program's capability to address both unrestricted service and route specific service. | Guidelines for Certification of Container Securing Systems |

| Notation | Description | Reference |
|---|---|---|
| **Elev** | The notation (**Elev**ator) may be assigned to ships under owner's request and where the applicable requirements in the Guidelines are complied with. | Guidelines for Elevators |
| **AccGui Elev** | The notation (**Acc**essible and **Gui**de **Elev**ator) will be assigned to ships which have accessible and guide facilities for disabled passengers under owner's request and where the applicable requirements in the Guidelines are complied with. | Guidelines for Elevators |
| **FC Energy**(1) | This notation (**F**uel **C**ell **Energy**) will be assigned to ships where the fuel cell energy source is used for essential, important or emergency services. | Guidelines for Fuel Cell Installations |
| **FC Installation**(1) | This notation (**F**uel **C**ell **Installation**) will be assigned to ships complying with the safety and environmental requirements where the fuel cell energy source is not used for essential, important or emergency services. | Guidelines for Fuel Cell Installations |
| **Gas Fuel**(1) | This notation (**Gas Fuel**) will be assigned to ships where only the gas fuel is used for main propulsion engines. | Guidelines for Natural Gas-Fuelled Engine Installations |
| **Dual Fuel**(1) | This notation will be assigned to ships where the gas fuel and oil fuel are used for main propulsion engines. | Guidelines for Natural Gas-Fuelled Engine Installations |

Note:

(1) It means that the notation, when assigned, is to be added after the classification symbol **CMS**.

# Chapter 2 Survey Requirements of Steel Ship

*Paragraph 2.1.1(f) has been amended as follows:*

## 2.1 General

2.1.1 General

~~(f) Additional requirements to prevent from the detention by Port State Control and to ensure the safety for bulk carriers, general dry cargo ships and tankers over 15 years old and for non-general dry cargo ships over 20 years old when carry out the periodical survey:~~

~~(i) For spaces where coatings are found to be in a POOR condition, the spaces are to be de-rusted/de-scaled, thickness measured and examined. If the measured areas were found in substantial corrosion condition, the areas are to be cropped and renewed before the periodical survey was completed. Otherwise, the spaces are to be de-rusted/de-scaled, thickness measured and examined annually. If the measured spaces were not in substantial corrosion condition, the spaces are to be re-coated to be at least in FAIR condition before the periodical survey was completed. Otherwise, the spaces are to be de-rusted/de-scaled, thickness measured and examined annually.~~

~~(ii) For spaces where the substantial areas are found, although the coatings are in a FAIR or GOOD condition, the substantial corrosion areas are to be cropped and renewed before the periodical survey was completed. Otherwise, the substantial corrosion areas are to be de-rusted/de-scaled, thickness measured and examined annually.~~

(f) The survey requirements to maintain a Class Notation for an additional system or service are contained in Chapter 3.

*Paragraph 2.1.2~2.1.5 have been amended as follows:*

2.1.2 Definitions

(~~b~~a) Ballast Tank

(i) Ballast Tank - All Vessels

A Ballast Tank ~~for all vessels~~ is a tank which is used primarily for the carriage of salt water ballast.

(ii) Ballast Tank - Tankers ESP

A Ballast Tank ~~for ESP tanksers~~ is a tank which is used solely for the carriage of salt water ballast.

(iii) Ballast Tank - Bulk Carriers ESP

A Ballast Tank ~~for ESP Bulk Carriers~~ is a tank which is used solely for salt water ballast, or where applicable, a space which is used for both cargo and salt water ballast will be treated as a Ballast tank when substantial corrosion has been found in that space. A double side tank is to be considered as a separate tank even if it is in connection to either the topside tank or the hopper side tank.

(~~a~~b) Spaces

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

(~~m~~c) Overall Survey

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

(~~f~~d) Close-up Survey

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

(~~x~~e) Transverse Section

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

(~~e~~f) Representative Tanks/Spaces

Representative Tanks/Spaces are those which are expected to reflect the condition of other tanks/spaces of similar type and service and with similar corrosion prevention systems. When selecting Representative Tanks/Spaces account is to be taken of the service and repair history on board and identifiable Critical Structural Areas and/or Suspect Areas.

(~~u~~g) Suspect Areas

Suspect Areas are locations showing Substantial Corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

(~~j~~h) Critical Structural Area

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

(i) Renewal Thickness

Renewal thickness ($t_{ren}$) is the minimum allowable thickness, in mm, below which renewal of structural members is to be carried out.

(~~t~~j) Substantial Corrosion

Substantial Corrosion is an extent of corrosion such that assessment of corrosion pattern indicates a wastage in excess of 75% of allowable margins, but within acceptable limits.
For vessels built under the IACS Common Structural Rules, substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a measured thickness between $t_{ren}$ + 0.5 mm and $t_{ren}$.

(~~i~~k) Corrosion Prevention System

A Corrosion Prevention System is normally considered as a full hard coating.

Hard Protective Coating is usually to be epoxy coatings or equivalent.
Other coating systems, which are neither soft nor semi-hard coatings, may be considered acceptable as alternatives, provided that they are applied and maintained in compliance with the manufacturers' specification.

(~~g~~l) Coating Condition

Coating condition ~~of hard coatings~~ is defined as follows:

(i) GOOD is a condition with only minor spot rusting.

(ii) FAIR is a condition with local breakdown at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition.

(iii) POOR is a condition with general breakdown of coating over 20% or more of areas, or hard scale at 10% or more of areas under consideration.

(~~p~~m) Prompt and Thorough Repair

A Prompt and Thorough repair is a permanent repair completed at the time of the survey to the satisfaction of the Surveyor, therein removing the need for the imposition of any associated condition of classification or recommendation.

(~~s~~n) Special consideration

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

(~~a~~o) Air pipe head

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

(~~k~~p) General Dry Cargo Ships

"General dry cargo ships" are ships carrying solid cargoes other than: (see Note)

(i) bulk carriers (~~including single and double skin~~ Double Skin or Non-Double Skin, subject to ESP);

(ii) dedicated container carriers;

(iii) dedicated forest product carriers (not timber or log carriers);

(iv) ro-ro cargo ships;

(v) refrigerated cargo ships;

(vi) dedicated wood chip carriers;

(vii) dedicated cement carriers;

(viii) livestock carriers;

(ix) deck cargo ship (A deck cargo ship is a ship that is designed to carry cargo exclusively above deck without any access for cargo below deck); and

(x) general dry cargo ships of double side-skin construction , with double side-skin extending for the entire length of the cargo area, and for the entire height of the cargo hold to the upper deck.

Note: At Annual Survey and Special Survey, an examination and a test to the water ingress detection system and their alarms also apply to those cargo ships, which, although belonging to the ship types listed herein that are excluded from the application of IACS UR, are fitted with a single cargo hold.

(~~v~~q) Tanker

A tanker is a ship which is constructed primarily to carry liquid cargo in bulk. Oil Tankers, Chemical Tankers and Liquefied Gas Carriers are included in this category.

(i) Oil Tanker (OT)

An oil tanker is a ship, which is constructed primarily to carry oil in bulk and includes ship types such as combination carriers (ore/oil and ore/bulk/oil ships, etc).

(ii) Double Hull Oil Tanker (DHOT)

A double hull oil tanker is a ship which is constructed primarily for the carriage of oil in bulk, which has the cargo tanks protected by a double hull which extends for the entire length of the cargo area, consisting of double sides and double bottom spaces for the carriage of water ballast or void spaces.

(iii) Chemical Tanker (CT)

A chemical tanker is a ship constructed or adapted and used for the carriage in bulk of any liquid product listed in Chapter 17 of the IBC Code

(iv) Liquefied Gas Carrier (LGC)

A liquefied gas carrier is a ship constructed or adapted and used for the carriage in bulk of any liquefied gas or other products listed in either "the IGC Code" or "the GC Code".

(~~d~~r) Bulk Carrier (BC)

(i) A bulk carrier is a ship which is constructed generally with single deck, double bottom, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk. It includes a vessel of such type as ore carrier or Combination carriers. Ore and combination carriers are not covered by the IACS Common Structural Rules.

(ii) A double skin bulk carrier is a ship which is constructed generally with single deck, double bottom, hopper side tanks and topside tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk, ~~It includes a vessel of~~ including such type as ore carrier or combination carrier, in which all cargo holds are bounded by a double-side skin (regardless of the width of the wing space). Ore and combination carriers are not covered by the IACS Common Structural Rules.

(~~e~~s) Cargo Area (Tanker) or Cargo Length Area (all ships)

Cargo Area is that part of the ship that contains cargo tanks, slop tanks, and cargo/ballast pump rooms, cofferdams, ballast tanks~~, fuel tanks~~ and void spaces adjacent to cargo tanks~~ or slop tanks;~~ and also ~~including~~ deck areas throughout the entire length and breadth of the part of the ship over the mentioned spaces.
Cargo Length Area is that part of the ship that contains cargo holds and adjacent areas including cofferdams, ballast tanks, fuel tanks and void spaces.

(~~h~~t) Combined Cargo/ Ballast Tank – Oil Tanker and Chemical Tanker

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

(~~n~~u) Panel

Panel is the area between adjacent transverse frames from longitudinal stiffener to longitudinal stiffener.

~~(w) Thickness Measurements and Close-up Survey~~

~~In any kind of survey, i.e. annual, intermediate, special or other surveys having the scope of the foregoing ones, thickness measurements of structures in areas where close-up surveys are required, are to be carried out simultaneously with close-up surveys. In Annual Survey, thickness measurements for close-up survey may be waived if the coating condition is in FAIR or GOOD condition and no substantial corrosion is found.~~

(~~y~~v) Wind and Water Strakes

Wind and water strakes are the strakes of a ship's side shell plating between the ballast and deepest load waterline.

(~~l~~w) Oil

Oil is petroleum in any form including crude oil, fuel oil, sludge, oil refuse, and refined products others than petrochemicals which are subject to the provisions of Annex II of the MARPOL 73/78.

(~~e~~x) Bay

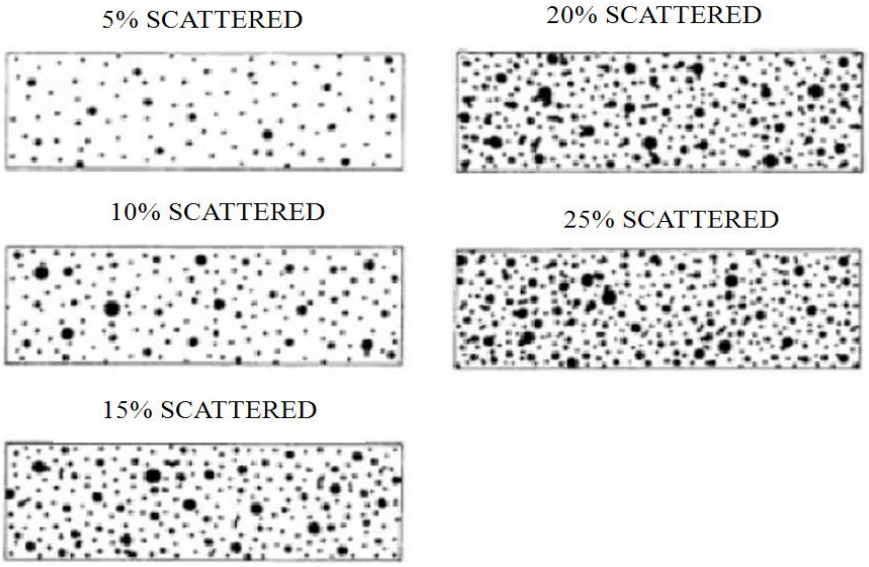
Bay is the area between adjacent transverse frames from longitudinal bulkhead to longitudinal bulkhead (or side shell).

(y) Remote Inspection Techniques (RIT)

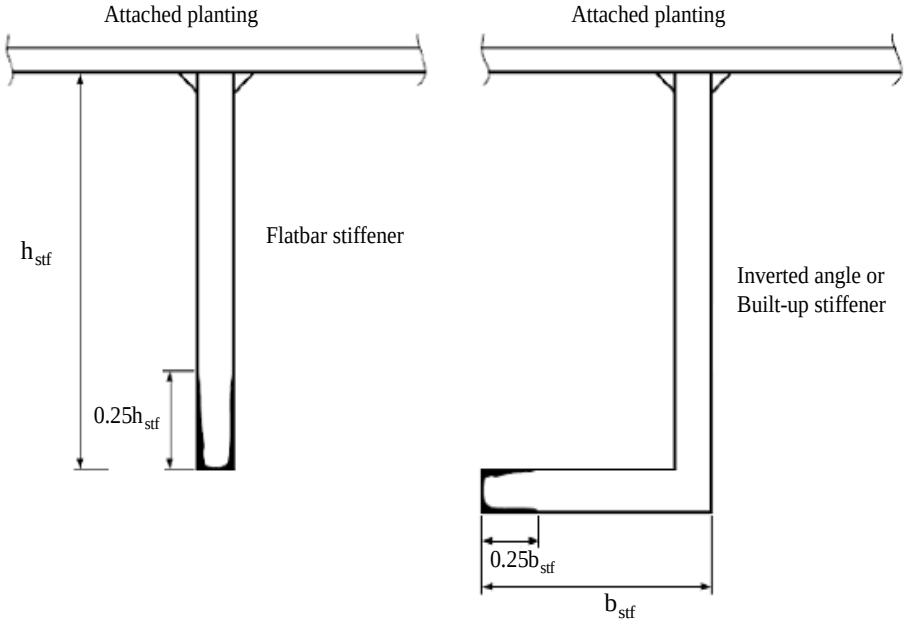
Remote Inspection Techniques is a means of survey that enables examination of any part of the structure without the need for direct phisical access of the Surveyor.

(~~e~~z) Pitting Corrosion , Edge Corrosion and Grooving Corrosion

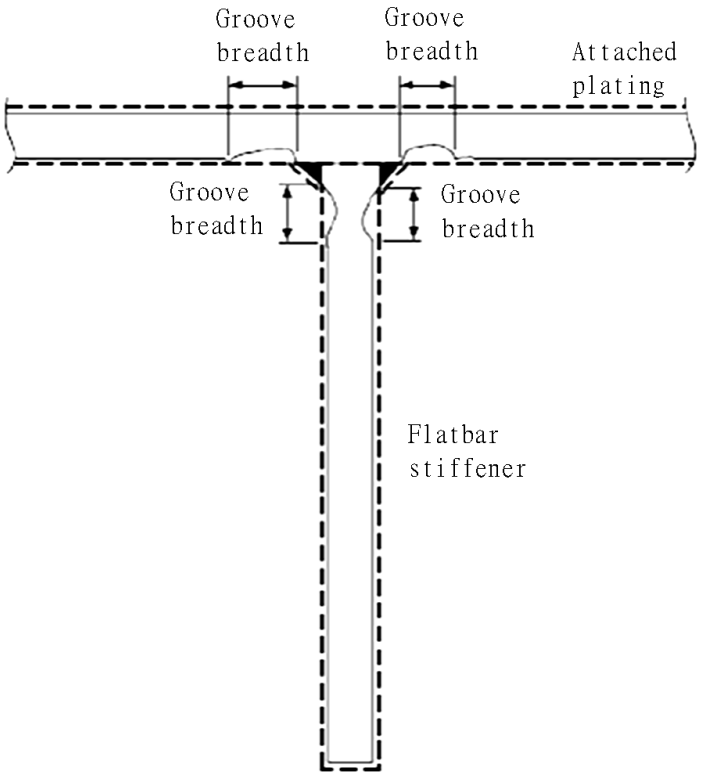
(i) Pitting Corrosion is defined as scattered corrosion spots/areas with local material reductions which are greater than the general corrosion in the surrounding area. Pitting intensity is defined as shown below:




(ii) Edge Corrosion is defined as local corrosion at the free edges of plates, stiffeners, primary support members and around openings. An example of edge corrosion is shown in below:



(iii) Grooving Corrosion is typically local material loss adjacent to weld joints along abutting stiffeners and at stiffener or plate butts or seams. An example of groove corrosion is shown in below:




2.1.3 Repairs

(a) Any damage in association with wastage over the allowable limits (including buckling, grooving, detachment or fracture), or extensive areas of wastage over the allowable limits, which affects or, in the opinion of the Surveyor, will affect the ship's structural, watertight or weathertight integrity, is to be promptly and thoroughly (see 2.1.2 (m)) repaired. Area to be considered include:

(1) side shell frames, their end attachments and adjacent shell plating;

(2) deck structure and deck plating;

(3) bottom structure and bottom plating;

(4) watertight or oiltight bulkheads;

(5) hatch covers and hatch coamings;

(6) the weld connection between air pipes and deck plating;

(7) all air pipe heads installed on the exposed decks;

(8) ventilators, including closing devices, if any.

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

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

(c) Where the damage found on structure mentioned in 2.1.3(a) is isolated and of a localised nature which does not affect the ship's structural integrity, consideration may be given by the Surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity and impose a Recommendation/Condition of Class in accordance with IACS PR 35, with a specific time limits.

2.1.~~3~~4 Procedures for class related services

(a) Thickness measurements and close-up surveys - hull structures

(i) Thickness measurements are to be carried out by a firm approved by the Society in accordance with the procedures for certification of firms engaged in thickness measurement of hull structures as specified in "Guidelines for Approval of Service Suppliers" of the Society, except that in respect of measurements of non-ESP ships less than 500 gross tonnage and all fishing vessels, the firm need not be so approved.
~~The certification of firms engaged in thickness measurement of hull structures is to be referred to the "Procedures for certification of firms engaged in thickness measurement of hull structures" described in Appendix 3.~~

(ii) Thickness measurement is normally to be carried out under the supervision of the Surveyor. However, the Surveyor may accept thickness measurement not carried out under his supervision, in which case provisions is to be made for the Surveyor to recheck the measurements as deemed necessary to ensure acceptable accuracy.

(iii) A thickness measurement report is to be prepared by the approved firm carrying out the thickness measurement, the thickness measured as well as the corresponding original thickness. The report is to give the date when the measurement was carried out, the type of measuring equipment, names of personnel and their qualifications and is to be signed by the operator and the Surveyor.

(iv) The thickness measurement report is to be verified by the Surveyor.

(v) Additional ESP requirements for bulk carriers and oil Tankers, including combinations carriers.

(1) The required thickness measurements, if not carried out by the ~~Surveyor~~ Society, are to be witnessed by the Surveyor. The Surveyor is to be on board to the extent necessary to control the process.

(2) The thickness measurement firm is to be part of the survey planning meeting to be held prior to commencing the survey.

(3) In all cases the extent of the thickness measurements is to be sufficient as to represent the actual average condition.

(vi) In any kind of survey, i.e. Special, Intermediate, Annual or other surveys having the scope mentioned in 1.6.4, 1.6.5 and 1.6.6, thickness measurements of structures in areas where close-up surveys are required, shall be carried out simultaneously with close-up surveys.

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

(viii) For structure built with a material other than steel, alternative thickness measurement requirements may be developed and applied as deemed necessary by the Society.

(ix) Thickness Measurements Acceptance Criteria.

The Acceptance Criteria for thickness measurements are according to Table I 2-27 to Table I 2-31 and/or specific IACS URs depending on ship age and structural elements concerned, e.g URs S18 for corrugated transverse bulkhead, URs S21A for all hatch covers and coamings on exposed decks.

(x) Remote Inspection Techniques (RIT)

(1) The RIT is to provide the information normally obtained from a close-up survey. RIT surveys are to be carried out in accordance with the requirements given here-in and the requirements of IACS Recommendation 42 "Guidelines for use of Remote Inspection Techniques for surveys". These considerations are to be included in the proposals for use of a RIT which are to be

submitted in advance of the survey so that satisfactory arrangements can be agreed with the Society.

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

(3) When using a RIT as an alternative to close-up survey, if it is not carried out by the Society itself, it is to be conducted by a firm approved as a service supplier according to UR Z17 and is to be witnessed by an attending Surveyor of the Society.

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

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

(6) If the RIT reveals damage or deteriotation that requires attention, the Surveyor may require traditional survey to be undertaken without use of a RIT.

(b) In-Water Surveys

(i) The In-Water Survey is to be carried out under the surveillance of the Surveyor by an In-Water Survey firm approved by the Society according to CR "Guidelines for Approval of Service Suppliers", by diver or Remotely Operated Vehicle (ROV).

(ii) The Society's approval is to be granted to the ~~companies~~ firms whose organization and management structure are satisfactorily established, which employ the divers using closed-circuit television with two-way communication or operators using Remotely Operated Vehicle (ROV) for the In-Water Survey work ~~with sufficient knowledge and experience of the maintenance and repair work of ships as well as with the capability of operating in-water television and in-water cameras, or~~ and which have sufficient equipment proved suitable for the work undertaken.

(iii) The continued approval of the ~~company~~ firm is to depend on its original standards and ability being maintained. Any changes in the information originally supplied are to be reported to the Society; however, the approval is to be renewed after a period not exceeding 5 years.

2.1.~~4~~5 Provision for surveys

(a) Conditions for survey

(i) The owner is to provide the necessary facilities for a safe execution of the survey.

(ii) Tanks and spaces are to be safe for access, i.e. gas freed, ventilated, and illuminated.

(iii) Tanks and spaces are to be sufficiently clean and free from water, scale, dirt, oil residues, etc. to reveal corrosion, deformation, fractures, damages or other structural deterioration. In particular, this applies to areas which are subject to thickness measurement.

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

(b) Access to structures

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

(ii) For ~~close up~~ survey in cargo holds and water ballast tanks, one or more of the following means for access, acceptable to the Surveyor, is to be provided.

(1) Permanent staging and passages through structures.

(2) Temporary staging and passages through structures ~~ladders~~.

(3) Hydraulic arm vehicles such as conventional cherry pickers, lifts and moveable platforms.

(4) Boats or rafts.

(5) Other equivalent means.

(iii) For Surveys conducted by use of a Remote Inspection Technique (RIT), one or more of the following means for access, acceptable to the Surveyor, is to be provided:

(1) Unmanned robot arm

(2) Remotely Operated Vehicles (ROV)

(3) Unmanned Aerial Vehicles / Drones

(4) Other means acceptable to the Society.

(c) Equipment for survey

(i) Thickness measurement is normally to be carried out by means of ultrasonic test equipment. The accuracy of the equipment is to be proven to the Surveyor as required.

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

(1) Radiographic equipment.

(2) Ultrasonic equipment.

(3) Magnetic particle equipment.

(4) Dye penetrate.

(iii) Rescue and emergency response equipment (for ESP ships)

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

(d) Surveys at sea or at anchorage

(i) Surveys at sea or at anchorage may be accepted provided the Surveyor is given the necessary assistance from the personnel on board. Necessary precautions and procedures for carrying out the survey are to be in accordance with 2.1.5(a), (b) and (c) above.

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

(iii) Explosimeter, oxygen-meter, breathing apparatus, life-line and whistles are to be at hand during the survey.

(iv) When boats or rafts are used appropriate life jackets are to be available for all participants. Boats or rafts are to have satisfactory residual buoyancy and stability even if one chamber is ruptured. A safety check-list is to be provided.

(~~i~~v) Surveys of tanks by means of boats or rafts may only be undertaken ~~with the agreement of~~ at the sole discretion of the Surveyor, who is to ~~should~~ take into account the safety arrangements provided, including weather forecasting and ship response in reasonable sea conditions.

2.1.~~5~~6 Preparation for ~~the~~ enhanced ~~plan of~~ survey for ESP ships

The regime of enhanced surveys given in 2.11, 2.12, 2.13, 2.14 and 2.15 of this Chapter as appropriate, are applicable to a number of ship types falling within the broad definitions of oil tankers, chemical tankers and bulk carriers contained in the Rules.

(a) Survey ~~plan~~ Programme

(i) The Owner in cooperation with the Society is to work out a specific Survey Programme prior to the commencement of any part of:

~~(1)~~ the Special Survey

~~(2)~~ the Intermediate Survey for ships over 10 years of age ~~of age by the Owner in cooperation with the Society~~. ~~The survey plan is to be written to format. Reference can be made to IMO 2011 ESP CODE and as amended.~~

The Survey Programme is to be in a written format based on the information in IACS UR-Z10.1 Annex IVA (for oil tanker), Z10.2 Annex VIA (for bulk carrier) and Z10.3 Annex IIIA(for chemical tanker).

The survey is not to commence until the Survey Programme has been agreed.

(1) Prior to the development of the Survey Programme, the survey planning questionnaire is to be completed by the owner based on the information set out in IACS UR-Z10.1 Annex IVB, Z10.2 Annex VIB and Z10.3 Annex IIIB and forwarded to the Society.

(2) The Survey Programme at Intermediate Survey may consist of the Survey Programme at the previous Special Survey supplemented by the Executive Hull Summary of that Special Survey and later relevant survey reports.

The Survey Programme is to be worked out taking into account any amendments to the survey requirements after the last Special Survey carried out.

~~(ii) A survey programme is intended to identify critical structural areas and to stipulate the minimum extent, locations and means for close-up survey and thickness measurements with respect to sections and internal structures as well as to nominate Suspect Areas.~~

(ii~~i~~) In developing the Survey Programme, the following documentation is to be collected and consulted with a view to selecting tanks, holds, areas, and structural elements to be examined.

(1) Survey status and basic ship information;

(2) Documentation on-board as described in ~~(b) and (c)~~ 2.1.6(c)(ii) and 2.1.6(c)(iii);

(3) Main structural plans (scantlings drawings), including information regarding use of high tensile steels(HTS);

(4) Documentation for oil tanker and chemical tanker

a) Executive Hull Summary;

b) Relevant previous damage and repair history;

c) Relevant previous survey and inspection reports from both the Society and the Owner;

d) Cargo and ballast history for the last 3 years, including carriage of cargo under heated conditions;

e) Details of the inert gas plant and tank cleaning procedures;

f) Information and other relevant data regarding conversion or modification of the ship's cargo and ballast tanks since the time of construction;

g) Description and history of the coating and corrosion protection system (including previous class notations), if any;

h) Inspections by the Owner's personnel during the last 3 years with reference to structural deterioration in general, leakages in tank boundaries and piping and condition of the coating and corrosion protection system if any. Guidance for reporting is shown in IACS-UR Z10.1 Table V (for Oil Tanker) and Z10.3 Annex IIIC (for Chemical Tanker);

i) Information regarding the relevant maintenance level during operation including port state control reports of inspection containing hull related deficiencies, Safety Management System non-conformities relating to hull maintenance, including the associated corrective action(s); and

j) Any other information that will help identify suspect areas and critical structural areas;

(5) Documentation for bulk carrier

~~(4~~a) Relevant previous survey and inspection reports from both the Society and the Owner;

~~(5~~b) Information regarding the use of the ship's holds and tanks, typical cargoes and other relevant data;

~~(6~~c) Information regarding corrosion prevention level on the newbuilding;

~~(7~~d) Information regarding the relevant maintenance level during operation.

(~~iv~~iii) The submitted Survey ~~plan~~ Programme is to account for and comply, as a minimum, with the requirements for close-up survey, thickness measurement and tank testing, respectively, and is to include relevant information including at least:

(1) Basic ship information and particulars;

(2) Main structure plans (scantling drawings), including information regarding use of high tensile steels (HTS);

(3) Plan of holds and tanks;

(4) List of holds and tanks with information on their use, protection and condition of coating;

(5) Conditions for survey (e.g., information regarding hold/tank cleaning, gas freeing, ventilation, lighting, etc.);

(6) Provisions and methods for access to structures;

(7) Equipment for surveys;

(8) Nomination of holds and tanks and areas for close-up survey;

(9) Nomination of sections and structures for thickness measurement;

(10) Nomination of tanks for tank testing; and the pipes that are to undergo pipe testing for chemical tanker;

(11) Nominations of the thickness measurement firm;

(12) Damage experience related to the ship in question; and

(13) Critical structural areas and suspect areas, where relevant.

(iv) The Society will advise the Owner of the maximum acceptable structural corrosion diminution levels applicable to the vessel.

(b) Survey planning meeting

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

(ii) Prior to commencement of any part of the Special and Intermediate Survey, a Survey Programme meeting should be held between the attending Surveyor(s), the owner's representative in attendance, the thickness measurement ~~company~~ firm operator (as applicable) and the master of the ship or an appropriately qualified representative appointed by the master or ~~company~~ firm for the purpose to ascertain that all the arrangements envisaged in the Survey Programme are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out. See also 2.1.4(a)(v)(2).

(iii) The following is an indicative list of items that are to be addressed in the meeting:

(1) Schedule of the ship (i.e. the voyage, docking and undocking manoeuvres, periods alongside, cargo and ballast operations, etc.);

(2) Provisions and arrangements for thickness measurements (i.e. access, cleaning/de-scaling, illumination, ventilation, personal safety);

(3) Extent of the thickness measurements;

(4) Acceptance criteria (refer to the list of minimum thicknesses);

(5) Extent of close-up survey and thickness measurement considering the coating condition and suspect areas/areas of substantial corrosion;

(6) Execution of thickness measurements;

(7) Taking representative readings in general and where uneven corrosion/pitting is found;

(8) Mapping of areas of substantial corrosion;

(9) Communication between attending Surveyor(s) the thickness measurement company firm operator(s) and owner representative(s) concerning findings.

(c) Documentation on board

(i) General

(1) The Owner is to supply and maintain onboard documentation as specified in (ii) and (iii) of this subparagraph, which are to be readily available for the Surveyor.

(2) The documentation is to be kept on board for the life time of the ship.

(ii) Survey report file

(1) A survey report file is to be a part of the documentation on board consisting of:

a) report of structural surveys.

b) condition evaluation report.

c) thickness measurement report.

(2) The survey report file is to be available also in the Owner's and the Society's offices.

(iii) Supporting documents

The following additional documentation is to be available on board:

(1) Main structural plans of cargo tanks/holds and ballast tanks.

(2) Previous repair history.

(3) Cargo and ballast history.

(4) Extent of use of inert gas plant and tank cleaning procedures (for tankers only).

(5) Inspections by ship's personnel with reference to:

a) Structural deterioration in general;

b) Leakage in bulkheads and piping;

c) Condition of coating or corrosion prevention system, if any.

~~d)~~(6) A guidance for reporting;

~~e)~~(7) Any other information that will help to identify Suspect Areas requiring inspection,

~~f)~~(8) Any other information that will help to identify critical structural areas and/or Suspect Areas requiring inspection.

(iv) Review of documentation on board

Prior to inspection, the Surveyor is to examine the completeness of the documentation on board, and its contents as a basis for the survey.

(d) Reporting of evaluation of survey

(i) Evaluation of survey report

(1) The data and information on the structural condition of the ship collected during the survey are to be evaluated for acceptability and continued structural integrity of the ship.

(2) The analysis of data is to be carried out and endorsed by the Society and the conclusions of the analysis are to form a part of the condition evaluation report.

(3) The final result of evaluation of the ship's longitudinal strength required as 2.1.6(f) or 2.1.6(g) below, after renewal or reinforcement work of structural members, if carried out as a result of initial evaluation, is to be reported as a part of the Executive Hull Summary.

(ii) Reporting

A condition evaluation report of the survey and results is to be issued to the Owner and placed on board the ship for reference at future surveys. The condition evaluation report is to be endorsed by the Society.

(e) Technical assessment in conjunction with the planning of enhanced surveys for oil tankers

(i) As with other aspects of survey programme, the technical assessments described below are to be completed out by the Owner or operator in co-operation with the Society well in advance of the commencement of the Special Survey, i.e., prior to commencing the survey and normally at least 12 to 15 months before the survey's completion due date.

(ii) Technical assessments of the relative risks of susceptibility to damage or deterioration of various structural elements and areas are to be judged and decided. Technical assessments, which may include quantitative or qualitative evaluation of relative risks of possible deterioration, of the following aspects of a particular ship may be used as a basis for the nomination of tanks and areas for survey:

(1) design features such as stress levels on various structural elements, design details and extent of use of high tensile steel;

(2) former history with respect to corrosion, cracking, buckling, indents and repairs for the particular ship as well as similar vessels, where available; and

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

(iii) There are three basic types of possible failure which may be the subject of technical assessment in connection with planning of surveys; corrosion, cracks and buckling. Contact damages are not normally covered by the survey programme since indents are usually noted in memoranda and assumed to be dealt with as a normal routine by Surveyors. Technical assessments performed in conjunction with the survey programme process are, in principle to be as shown schematically in Fig. I 2-1. The approach is basically an evaluation of the risk based on the knowledge and experience related to design and corrosion. The design is to be considered with respect to structural details which may be susceptible to buckling or cracking as a result of vibration, high stress levels or fatigue. Corrosion is related to the ageing process, and is closely connected with the quality of corrosion protection at newbuilding, and subsequent maintenance during the service life. Corrosion may also lead to cracking and/or buckling.

(iv) Damage experience related to the ship in question and similar ships, where available, is the main source of information to be used in the process of planning. In addition, a selection of structural details from the design drawings is to be included. Typical damage experience to be considered will consist of:

(1) number, extent, location and frequency of cracks; and

(2) location of buckles.

This information may be found in the survey reports and/or the Owner's files, including the results of the Owner's own inspections. The defects are to be analyzed, noted and marked on sketches. The review of the main structural drawings, is to include checking for typical design details where cracking has been experienced. The factors contributing to damage are to be carefully considered. The use of high tensile steel (HTS) is an important factor. Details showing good service experience where ordinary, mild steel has been used may be more susceptible to damage when HTS, and its higher associated stresses, are utilized. There is extensive and, in general, good experience, with the use of HTS for longitudinal material in deck and bottom structures. Experience in other locations, where the dynamic stresses may be higher, is less favorable, e.g. side structures. In this respect, stress calculations of typical and important components and details, in accordance with relevant methods, may prove useful and are to be considered. The selected areas of the structure identified during this process are to be recorded and marked on the structural drawings to be included in the survey programme.

(v) In order to evaluate relative corrosion risks, the following information is generally to be considered:

(1) Usage of tanks and spaces;

(2) Condition of coatings;

(3) Condition of anodes;

(4) Cleaning procedures;

(5) Previous corrosion damage;

(6) Ballast use and time for cargo tanks;

(7) Corrosion risk scheme; and

(8) Location of heated tanks.

The evaluation of corrosion risks is to be based on the age of the ship and relevant information on the anticipated condition as derived from the information collected in order to prepare the survey programme. The various tanks and spaces are to be listed with the corrosion risks nominated accordingly.

(vi) On the basis of the table of corrosion risks and the evaluation of design experience, the locations of initial close-up survey and thickness measurement (sections) may be nominated. The sections subject to thickness measurement one normally to be nominated in tanks and spaces where corrosion risk is judged to be the highest. The nomination of tanks and spaces for close-up survey initially, to be based on highest corrosion risk, and is always to include ballast tanks. The principle for the selection is to be that the extent is increased by age or where information is insufficient or unreliable.

(f) Evaluation of longitudinal strength of hull girder for oil tankers of 130 m in length and upwards and of over 10 years of age for survey report.

(i) Evaluation of longitudinal strength

The longitudinal strength of the ship's hull girder is to be evaluated on the basis of the thickness measured, renewed or reinforced, as appropriate, during the Special Survey.

The condition of the hull girder for longitudinal strength evaluation is to be determined in accordance with the methods specified in IACS Z10.1 Annex III-appendix 3.

(ii) Transverse sectional areas of deck flange (deck plating and deck longitudinals) and bottom flange (bottom shell plating and bottom longitudinals) of the ship's hull girder are to be calculated ~~within 0.4L amidships for the extent of the hull girder length that contains tanks therein and within 0.5L amidships for adjacent tanks which may extend beyond 0.4L amidships (where tanks means ballast tanks and cargo tanks),~~ by using the thickness measured, renewed or reinforced, as appropriate, during the Special Survey. ~~as below:~~

(iii) If the diminution of sectional areas of either deck or bottom flange exceeds 10% of their respective as-built area (i.e. original sectional area when the ship was built), either one of the following measures is to be taken:

(~~ii~~1) the ship is to be taken to renew or reinforce the deck or bottom flanges so that the actual sectional area is not less then 90% of the as-built area; or

(~~iii~~2) to calculate the actual section moduli ($Z_{act}$) of transverse section of the ship's hull girder by applying the calculation method specified in 3.2.5 of Part II, by using the thickness measured, renewed or reinforced, as appropriate, during the Special Survey.

(iv) for ships constructed on or after 1 July 2002, the actual section moduli ($Z_{act}$) of the transverse section of the ship's hull girder calculated in accordance 2.1.6(f)(iii)(2) above is to be not less than the diminution limits determined by the Society (Note：The $Z_{act}$ is not to be less than 90% of the required section modulus for new buildings, whichever is the greater. c = 1.0 $C_n$ is to be used for the purpose of this calculation.), or

(v) for ships constructed before 1 July 2002, the actual section moduli ($Z_{act}$) of the transverse section of the ship's hull girder calculated in accordance 2.1.6(f)(iii)(2) above is to meet the criteria for minimum section modulus for ships in service required by the Society, provided that in no case $Z_{act}$ is to be less than the diminution limit of the minimum section modulus ($Z_{mc}$) as specified below:

(1) The diminution limit of the minimum section modulus ($Z_{mc}$) of oil tankers in service is given by the following formula:

$$Z_{mc} = cL^2B\,(C_b + 0.7)\,k \quad cm^3$$

where

L = Length of ships. L is the distance, in meters, on the summer load waterline from the fore side of stem to the after side of the rudderpost, or the center of the rudderstock if there is no rudderpost. L is not to be less than 96%, and need not be greater than 97%, of the extreme length on the summer load waterline. In ships with unusual stern and bow arrangement, the length L may be specially considered.

B = Greatest moulded breadth in metres.

$C_b$ = Molded block coefficient at draught d, corresponding to summer load waterline, based on L and B. $C_b$ is not to be taken less than 0.60, and

c = 0.9 $C_n$

$C_n$ = $10.75 - \left(\frac{300-L}{100}\right)^{1.5}$ for 130 m ≤ L ≤ 300 m

= 10.75 for 300 m < L < 350 m

= $10.75 - \left(\frac{L-350}{150}\right)^{1.5}$ for 350 m ≤ L ≤ 500 m

k = Material factor, e.g.

k = 1.0 for mild steel with yield stress of 235 N/mm$^2$ and over,

k = 0.78 for high tensile steel with yield stress of 315 N/mm$^2$ and over,

k = 0.72 for high tensile steel with yield stress of 355 N/mm$^2$ and over.

(2) Scantlings of all continuous longitudinal members of the ship's hull girder based on the section modulus requirement in (1) above are to be maintained within 0.4L amidships. However, in special cases, based on consideration of type of ship, hull form and loading conditions, the

scantlings may be gradually reduced towards the end of 0.4L part, bearing in mind the desire not to inhibit the ship's loading flexibility.

(3) However, the above standard may not be applicable to ships of unusual type or design, e.g. for ships of unusual main proportions and /or weight distributions.

(g) For CSR bulk carriers, the ship's longitudinal strength is to be evaluated by using the thickness of structural members measured, renewed and reinforced, as appropriate, during the Special Surveys carried out after the ship reached 15 years of age (or during the Special Survey no. 3, if this is carried out before the ship reaches 15 years) in accordance with the criteria for longitudinal strength of the ship's hull girder for CSR bulk carriers specified in Part 1, Ch 13 of ~~CSR~~ IACS Common Structural Rules for Bulk Carriers and Oil Tankers.

*Section 2.2~2.7 have been amended as follows:*

## 2.2 Bottom Surveys

2.2.1 Bottom Surveys in dry dock

At each Bottom Survey in dry dock the following requirements are to be complied with:

(a) Normally the ship is to be placed on blocks of sufficient height in a dry dock or on a slipway and cleaned, and proper staging is to be erected as may be necessary for examination. A docking survey covers an examination of elements such as shell plating including bottom and bow plating, stern frame and rudder, sea chests and vlaves, propellers, etc. The shell plating is to be examined for excessive corrosion, or deterioration due to chafing or contact with the ground and for any undue unfairness or buckling. Special attention is to be paid to the connection between the bilge strakes and the bilge keels. Important plate unfairness or other deterioration which do not necessitate immediate repairs are to be recorded.
~~A docking survey covers an examination of the bottom and side plating, stern frame and rudder, as well as steering fins, shaft brackets, propeller(s) and other stern appendages, if fitted. Attention is to be given to parts of the structure particularly liable to excessive corrosion or to deterioration from causes such as chafing and lying on the ground and to any undue unfairness of the plating of the bottom.~~

(b) Sea chests and their gratings, sea connections and overboard discharge valves and cocks and their fastenings to the hull or sea chests are to be examined. Valves and cocks need not be opened up more than once in a Special Survey period unless considered necessary by the Surveyor. ~~Sea inlets and overboard discharges below the water line are to be examined, and valves, cocks together with their fastenings to the hull are to be examined. Dismantling of them may be dispensed with at the discretion of the Surveyor if the interval of the overhauling inspection does not exceed 5 years.~~

(c) ~~The clearance in the rudder bearing is to be ascertained and recorded.~~ Visible parts of rudder, rudder pintles, rudder shafts and couplings, stern frame, gudgeons, etc. are to be examined. If considered necessary by the Surveyor, the rudder is to be lifted or the inspection plates removed for the examination of pintles. The clearance in the rudder bearing is to be ascertained and recorded. Where applicable, pressure test of the rudder may be required as deemed necessary by the Surveyor. ~~The lifting or removal of the rudder may be dispensed with provided the Surveyor is satisfied with the bearing condition of the rudder by a measurement of the clearance.~~

(d) Visible parts of propeller and stern bush, are to be examined. The clearance in the stern bush and the efficiency of the oil gland, if fitted, are to be ascertained and recorded. For controllable pitch propellers, the Surveyor is to be satisfied with the fastenings and tightness of hub and blade sealing. Dismantling need not to be carried out unless considered necessary by the Surveyor.
Survey in place for the propeller shaft and stern tube shaft is to be carried out as per requirement of 2.3.5.

(e) Visible parts of side thrusters are to be examined. Other propulsion systems which also have manoeuvring characteristics (such as directional propellers, vertical axis propellers, water jet units) are to be examined externally with focus on the condition of gear housing, propeller blades, bolt locking and other fastening arrangements. Sealing arrangement of propeller blades, propeller shaft and steering column shall be verified. Dismantling may be required to the extent found necessary by the Surveyor.

(f) Anchor and anchor chains are to be arranged and examined. Chain lockers are to be internally examined. The diameter of anchor chain cables is to be measured at Special Survey No. 2 and subsequent Special Survey.

(g) Special consideration may be given in application of relevant requirements of this section to commercial ships owned or chartered by Governments, which are utilized in support of military operations or service.

2.2.2 In-Water Survey

(a) General requirements

(i) The underwater body is to be protected against corrosion by a full hard coating system and strongly recommended to be also protected by an impress current cathodic protection system.

(ii) The information obtained from the In-Water survey is to be as reliable as that obtained from the docking survey.

(iii) ~~Proposals for an in-water survey are to be submitted in advance of the survey being required by the Society.~~ The In-Water Survey is to provide the information normally obtained from a docking survey. Special consideration shall be given to ascertaining rudder bearing clearances and stern bush clearances of oil stern bearings based on a review of the operating history, on board testing and stern oil sample reports. These considerations are to be included in the proposals for In-Water Survey which are to be submitted in advance of the survey so that satisfactory arrangements can be agreed with the Society.

(iv) Application for the subsequent In-Water Survey is also to be submitted to the Society for acceptance.

(v) The In-Water Survey is to be carried out with the ship in sheltered water and preferably with weak tidal streams and currents. The in-water visibility and the cleanliness of the hull below the waterline is to be clear enough to permit a meaningful examination which allows the Surveyor and the In-Water Survey firm to determine the condition of the plating, appendages and the welding. The Society is to be satisfied with the methods of orientation of the divers or Remotely Operated Vehicle (ROV) on the plating, which should make use where necessary of permanent markings on the plating at selected points.

(vi) The equipment, procedure for observing and reporting the survey are to be discussed with the parties involved prior to the In-water Survey, and suitable time is to be allowed to permit the In-Water Survey firm to test all equipment beforehand.

(vii) The In-Water Survey is to be carried out under the surveillance of the Surveyor by an In-Water Survey firm approved as a service supplier according to "Guidelines for Approval of Service Suppliers" of the Society.

(viii) The Surveyor is to be satisfied with the method of pictorial representation, and a good two-way communication between the Surveyor and divers is to be provided.

(ix) If the In-Water Survey reveals damage or deterioration that requires early attention, the Surveyor may require that the ship be drydocked in order that a detailed survey can be undertaken and the necessary repairs carried out.

(~~ix~~ x) The In-Water Survey may not be applicable if there are outstanding recommendations for repairs to the propeller, rudder, stern frame, underwater hull structure, or sea valves.

(b) Plans and documents

When ships are intended to be subjected to an In-Water Survey, the following plans and documents are to be submitted to the Society:

(i) Plans of the shell plating below waterline showing the details of the location and sizes of shell opening, location of bottom plugs, location of water and oil tight bulkheads;

(ii) Detailed information or drawings of constructions and arrangement indicated in the item (c) below together with their colour photographs and detailed instruction for inspection of such constructions and arrangements; and

(iii) Other data, if deemed necessary.

(c) Constructions and arrangement

The constructions and arrangements of ships which are intended to be subjected to an In-Water Survey are to comply with the following:

(i) Anodes are to be attached in such a manner as to be easily replaced where necessary.

(ii) Rudder is to be provided with the means of facilitating the measurement of clearances in way of each pintle. Liners on rudder stock and pintles are to be marked in such a way so that any relative movements can be checked.

(iii) Rope guard ring plates are to be of such constructions as to facilitate the inspection of shafts between propeller hubs and stern frame boss.

(iv) In case of water lubricating type stern-tube bearings, the devices which may indicate the clearance of propeller shaft strut and stern bearings are to be provided.

(v) In case of oil lubricating type stern-tube bearings, suitable means of ascertaining the performances of stern-tube bearings including oil sealing devices are to be provided.

(vi) Suitable means of ascertaining the position and identifying each blade of propellers from inboard are to be provided.

(vii) Sea connections are to be provided with the means of blanking their openings to the sea from outboard so that the sea connections may be opened up from inboard for examination and repairs. Grating of sea suctions are to be of hinged type as far as practicable.

(viii) To the hull below load water line, provision is to be made for ready identification of the position of bulkheads and transverses (including indication of the number of transverses). To bottom shell plating, provision is to be made for ready identification of the flat bottom and of ship's lengthwise (fore and aft) and athwartship (port side or starboard side) direction.

(d) Performance of In-Water Survey

(i) The In-Water Survey is to be carried out in sufficiently clear and calm waters. The ship is to be as light as possible. The shell side below the waterline and the bottom are to be sufficiently clean.

~~(ii) The in-water survey is to be carried out in the presence of the Surveyor, and there is to be satisfactory two-way communication between the Surveyor and the diver.~~

(ii~~i~~) The underwater pictures on the surface monitor screen are to offer reliable technical information such as to enable the Surveyor to judge the parts surveyed.

(~~iv~~iii) The In-Water Survey is to provide the information normally obtained from a Bottom Survey in dry dock. It at least covers an examination of the bottom and side plates of the shell plating, including any attachments and the rudder, an external examination of propellers as well as propeller shafts, and the cleaning condition of sea chests.

~~(iv) 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 further survey can be undertaken and the necessary work carried out.~~

## 2.3 Surveys of Propeller Shafts and Tube Shafts ~~Surveys~~

### 2.3.1 General

(a) Application

(i) Unless alternative means are provided to assure the condition of the propeller shaft assembly, the requirements specified in 2.3.2 and 2.3.3 apply to all vessels with conventional shafting fitted with a propeller.

(ii) The surveys for miscellaneous propellers including controllable pitch propellers, directional propeller units and water jet units are to be carried out in accordance with 2.3.4.

(iii) Propeller shaft condition monitoring, survey in place and wear-down limits are to in accordance with 2.3.5 to 2.3.7.

(b) Definitions (See also Fig. I 2-6.)

(i) Shaft

For the purpose of this paragraph shaft is a general definition that includes:

(1) Propeller shaft

(2) Tube shaft

The definition does not include the intermediate shaft(s) which is(are) considered part of the propulsion shafting inside the vessel.

(ii) Propeller Shaft

Propeller shaft is the part of the propulsion shaft to which the propeller is fitted. It may also be called screwshaft or tailshaft.

(iii) Tube Shaft

Tube shaft is a shaft placed between the intermediate shaft and propeller shaft, normally arranged within a stern tube or running in open water. It may also be called Stern Tube Shaft.

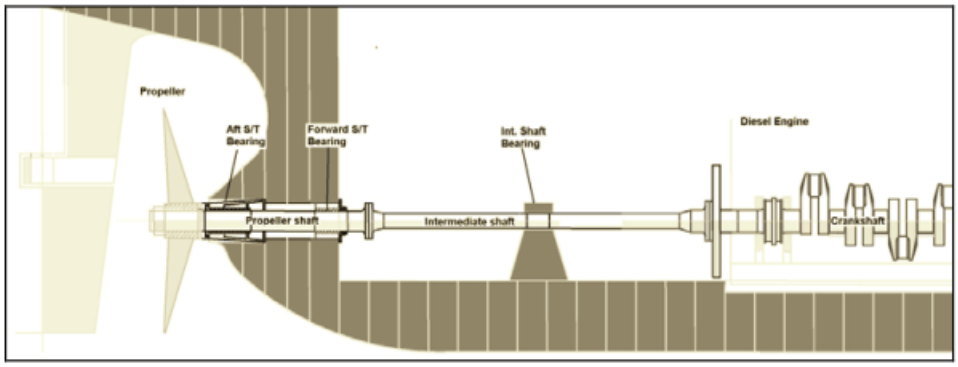



**Fig. I 2-6**
**Typical Shafting Arrangement**

(iv) Sterntube

Tube or pipe fitted in the shell of a ship at the stern (or rear part of the ship), below the water-line, through which passes the tube shaft or aftermost section of the propeller-shaft.

Sterntube is the housing of the shaft bearings, generally two (one aft and one fore), that sustain the shaft and allows its rotation with less frictional resistance. The stern tube also accommodates the shaft sealing arrangement.

(v) Closed loop (system) oil lubricated bearing

Closed loop oil lubricating systems use oil to lubricate the bearings and are sealed against the environment (seawater) by adequate sealing / gland devices.

(vi) Water Lubricated Bearing

Water lubricated bearings are bearings cooled / lubricated by water (fresh or salt).

(vii) Closed Loop System Fresh Water Lubricated Bearing

Closed loop water lubricating systems use fresh water to lubricate the bearings and are sealed against the environment (such as seawater) by adequate sealing / gland devices.

(viii) Open Systems (water)

Open water lubricating systems use water to lubricate the bearings and are exposed to the environment.

(ix) Adequate means for protection against corrosion

An adequate means for protection against corrosion is an approved means for full protection of the core shaft against sea water intrusion and subsequent corrosion attack. Such means are used for the protection of common steel material against corrosion particularly in combination with water lubricated bearings.

Typical means are for example:

(1) continuous metallic, corrosion resistant liners,

(2) continuous cladding,

(3) multiple layer synthetic coating,

(4) multiple layer of fiberglass,

(5) combinations of above mentioned,

(6) rubber / elastomer covering coating.

The means for protection against corrosion are installed / applied according to the Society approved procedures.

(x) Corrosion Resistant Shaft

Corrosion resistant shaft is made in approved corrosion resistant steel as core material for the shaft.

(xi) Sterntube Sealing System

Sterntube Sealing system is the equipment installed on the inboard extremity and, for closed systems, at outboard extremity of the sterntube. Inboard Seal is the device fitted on the fore part of the sterntube that achieve the sealing against the possible leakage of the lubricant media in to the ship internal.

Outboard seal is the device fitted on the aft part of the sterntube that achieve the sealing against the possible sea water ingress and the leakage of the lubricant media.

(xii) Service records

Service records are regularly recorded data showing in-service conditions of the shaft(s) and may include, as applicable: lubricating oil temperature, bearing temperature and oil consumption records (for oil lubricated bearings) or water flow, water temperature, salinity, pH, make-up water and water pressure (for closed loop fresh water lubricated bearings depending on design).

(xiii) Oil sample examination

An oil sample examination is a visual examination of the stern tube lubricating oil taken in presence of the Surveyor with a focus on water contamination.

(xiv) Lubricating oil analysis

Lubricating oil analysis is to be carried out at regular intervals not exceeding six (6) months taking into account IACS Rec. 36.

The documentation on lubricating oil analysis is to be available on board.

Oil samples, to be submitted for the analysis, should be taken under service conditions.

(xv) Fresh Water sample test

Fresh water sample test should be carried out at regular intervals not exceeding six (6) months.

Samples are to be taken under service conditions and are to be representative of the water circulating within the sterntube.

Analysis results are to be retained on board and made available to the Surveyor.

At time of survey the sample for the test has to be taken at the presence of the Surveyor.

Fresh water sample test shall include the following parameters:

(1) chlorides content,

(2) pH value,

(3) presence of bearing particles or other particles (only for laboratory analysis, not required for tests carried out in presence of the Surveyor).

(xvi) Keyless connection

Keyless connection is the forced coupling Methodology between the shaft and the propeller without a key achieved through interference fit of the propeller boss on the shaft tapered end.

(xvii) Keyed connection

Keyed connection is the forced coupling Methodology between the shaft and the propeller with a key and keyway achieved through the interference fit of the propeller boss on the shaft tapered end.

(xviii) Flanged connection

Flanged connection is the coupling Methodology, between the shaft and the propeller, achieved by a flange, built in at the shaft aft end, bolted to propeller boss.

(xix) Alternative means

Shafting arrangements such as, but not limited to, an approved Condition Monitoring Scheme and / or other reliable approved means for assessing and monitoring the condition of the tail shaft, bearings, sealing devices and the stern tube lubricant system capable to assure the condition of the propeller shaft assembly with an equivalent level of safety as obtained by survey methods as applicable herein.

2.3.2 Oil lubricated shafts or closed loop system fresh water lubricated shafts (closed system)

(a) Shaft survey methods

(i) METHOD 1

The survey is to consist of:

- Drawing the shaft and examining the entire shaft, seals system and bearings
- For keyed and keyless connections:
  - Removing the propeller to expose the forward end of the taper,
  - Performing a non-destructive examination (NDE) by an approved surface crack-detection method all around the shaft in way of the forward portion of the taper section, including the keyway (if fitted). For shaft provided with liners the NDE shall extended to the after edge of the liner.
- For flanged connection:
  - Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs or when deemed necessary by the Surveyor, the coupling bolts and flange radius are to be examined by means of an approved surface crack detection method.
- Checking and recording the bearing clearances.
- Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- Verification of the satisfactory conditions of inboard and outboard seals during the re-installation of the shaft and propeller.
- Recording the bearing weardown measurements (after re-installation)

(ii) METHOD 2

The survey is to consist of:

- For keyed and keyless connections:
  - Removing the propeller to expose the forward end of the taper,
  - Performing a non-destructive examination (NDE) by an approved surface crack-detection Method all around the shaft in way of the forward portion of the taper section, including the keyway (if fitted).
- For flanged connection:
  - Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs or when deemed necessary by the Surveyor, the coupling bolts and flange radius are to be examined by means of a an approved surface crack detection Method.
- Checking and recording the bearing weardown measurements.
- Visual Inspection of all accessible parts of the shafting system.

- Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- Seal liner found to be or placed in a satisfactory condition.
- Verification of the satisfactory re-installation of the propeller including verification of satisfactory conditions of inboard and outboard seals.

Pre-requisites to satisfactorily verify in order to apply METHOD 2:

- Review of service records.
- Review of test records of:
  - Lubricating Oil analysis (for oil lubricated shafts), or
  - Fresh Water Sample test (for closed system fresh water lubricated shafts).
- Oil sample Examination (for oil lubricated shafts), or Fresh Water Sample test (for closed system fresh water lubricated).
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.

(iii) METHOD 3

The survey is to consist of:

- Checking and recording the bearing weardown measurements.
- Visual Inspection of all accessible parts of the shafting system.
- Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- Seal liner found to be or placed in a satisfactory condition.
- Verification of the satisfactory conditions of inboard and outboard seals.

Pre-requisites to satisfactorily verify in order to apply METHOD 3:

- Review of service records.
- Review of test records of
  - Lubricating Oil analysis (for oil lubricated shafts), or
  - Fresh Water Sample test (for closed system fresh water lubricated shafts).
- Oil sample Examination (for oil lubricated shafts), or Fresh Water Sample test (for closed system fresh water lubricated).
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.

(b) Shaft extension surveys - Extension types

(i) Extension up to 2.5 years

The survey is to consist of:

- Checking and recording the bearing weardown measurements, as far as practicable.
- Visual Inspection of all accessible parts of the shafting system.
- Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- Verification of the effectiveness of the inboard seal and outboard seals.

Pre-requisites to satisfactorily verify in order to apply EXTENSION UP TO 2.5 YEARS:

- Review of service records.
- Review of test records of
  - Lubricating Oil analysis (for oil lubricated shafts), or
  - Fresh Water Sample test (for closed system fresh water lubricated shafts).

- Oil sample Examination (for oil lubricated shafts), or Fresh Water Sample test (for closed system fresh water lubricated).
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

(ii) Extension up to 1 year

The survey is to consist of:

- Visual Inspection of all accessible parts of the shafting system.
- Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- Verification of the effectiveness of the inboard seal and outboard seals.

Pre-requisites to satisfactorily verify in order to apply EXTENSION UP TO 1 YEAR:

- Review of the previous weardown and/or clearance recordings.
- Review of service records.
- Review of test records of
  - Lubricating Oil analysis (for oil lubricated shafts), or
  - Fresh Water Sample test (for closed system fresh water lubricated shafts).
- Oil sample Examination (for oil lubricated shafts), or Fresh Water Sample test (for closed system resh water lubricated).
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

(iii) Extension up to 3 months

The survey is to consist of:

- Visual Inspection of all accessible parts of the shafting system.
- Verification of the effectiveness of the inboard seal.

Pre-requisites to satisfactorily verify in order to apply EXTENSION UP TO 3 MONTHS:

- Review of the previous weardown and/or clearance recordings.
- Review of service records.
- Review of test records of.
  - Lubricating Oil analysis (for oil lubricated shafts), or
  - resh Water Sample test (for closed system fresh water lubricated shafts).
- Oil sample Examination (for oil lubricated shafts), or Fresh Water Sample test (for closed system fresh water lubricated).
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

(c) Oil lubricated shafts

(i) Survey intervals

For surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

(1) Flanged propeller connection
The following Methods are applicable:

a) Method 1 every 5 years, or

b) Method 2 every 5 years (pre- requisites have to be fulfilled), or

c) Method 3 every 5 years (pre-requisites have to be fulfilled).

(2) Keyless propeller connection

The following Methods are applicable:

a) Method 1 every 5 years, or

b) Method 2 every 5 years (pre-requisites have to be fulfilled), or

c) Method 3 every 5 years (pre-requisites have to be fulfilled). The maximum interval between 2 surveys carried out according to Method 1 or Method 2 shall not exceed 15 years, except in the case when one extension for no more than three months is granted.

(3) Keyed propeller connection
The following Methods are applicable:

a) Method 1 every 5 years, or

b) Method 2 every 5 years (pre-requisites have to be fulfilled).

(ii) Survey extensions

For all types of propeller connections, the interval between two consecutive surveys may be extended after the execution of extension survey as follows:

(1) Extension up to a maximum of 2.5 years: no more than one extension can be granted. No further extension, of other type, can be granted.

(2) Extension up to a maximum of 1 year: no more than two consecutive "one year extensions" can be granted. In the event an additional extension is requested the requirements of the "2.5 year extension" are to be carried out and the shaft survey due date, prior to the previous extension(s), is extended for a maximum of 2.5 years.

(3) Extension up to a maximum of 3 months: no more than one "three months extension" can be granted. In the event an additional extension is requested the requirements of the "one year extension" or "2.5 years extension" are to be carried out and the shaft survey due date, prior to the previous extension, is extended for a maximum of one year or 2.5 years.

The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date.

If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed.

(d) Survey intervals of closed loop system fresh water lubricated shafts

The maximum interval between two surveys carried out according to Method 1 shall not exceed 15 years. An extension for no more than three months can be granted.

(i) For surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

(1) Flanged propeller connection
The following Methods are applicable:

a) Method 1 every 5 years, or

b) Method 2 every 5 years (pre-requisites have to be fulfilled), or

c) Method 3 every 5 years (pre-requisites have to be fulfilled).

(2) Keyless propeller connection
The following Methods are applicable:

a) Method 1 every 5 years, or

b) Method 2 every 5 years (pre-requisites have to be fulfilled), or

c) Method 3 every 5 years (pre-requisites have to be fulfilled).

(3) Keyed propeller connection
The following Methods are applicable:

a) Method 1 every 5 years, or

b) Method 2 every 5 years (pre-requisites have to be fulfilled).

(ii) Survey extensions

For all types of propeller connections, the interval between two consecutive surveys may be extended after the execution of extension survey as follows:

(1) Extension up to a maximum of 2.5 years, no more than one extension can be granted. No further extension, of other type, can be granted.

(2) Extension up to a maximum of 1 year, no more than two consecutive extensions can be granted. In the event an additional extension is requested the requirements of the "2.5 year extension" are to be carried out and the shaft survey due date, prior to the previous extension(s), is extended for a maximum of 2.5 years.

(3) Extension up to a maximum of 3 months, no more than one "three months extension" can be granted. In the event an additional extension is requested the requirements of the "one year extension" or "2.5 years extension" are to be carried out and the shaft survey due date, prior to the previous extension, is extended for a maximum of one year or 2.5 years.

The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date.

If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed.

The maximum interval between two surveys carried out according to Method 1 shall not exceed 15 years, except in the case when one extension for no more than 3 months is granted.

(e) Survey Intervals for closed systems are as follows.

**Survey Intervals for Closed Systems**

| Survey Intervals (closed systems) | | | |
|---|---|---|---|
| **Oil Lubricated** | | | |
| | Flanged Propeller Coupling | Keyless Propeller Coupling | Keyed Propeller Coupling(2) |
| Every 5 years(1) | Method 1 or Method 2 or Method 3 | Method 1 or Method 2 or Method 3(3) | Method 1 or Method 2 |
| Extension 2.5 years | Yes(4) | Yes(4) | Yes(4) |
| Extension 1 year | Yes(5) | Yes(5) | Yes(5) |
| Extension 3 months | Yes(6) | Yes(6) | Yes(6) |
| | | | |
| **Closed Loop System Fresh Water Lubricated** | | | |
| | Flanged Propeller Coupling | Keyless Propeller Coupling | Keyed Propeller Coupling(2) |
| Every 5 years(1) | Method 1(7) or Method 2 or Method 3 | Method 1(7) or Method 2 or Method 3 | Method 1(7) or Method 2 |
| Extension 2.5 years | Yes(4) | Yes(4) | Yes(4) |
| Extension 1 year | Yes(5) | Yes(5) | Yes(5) |
| Extension 3 months | Yes(6) | Yes(6) | Yes(6) |
| | | | |
| Footnotes:<br>For surveys (Method 1, or Method 2, or Method 3) completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.<br>The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date. If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed. | | | |

Notes:

(1) Unless an Extension type (Extension 2.5 years, Extension 1 year, Extension 3 months) is applied in between.

(2) Method 3 not allowed.

(3) The maximum interval between two surveys carried out according to Method 1 or Method 2 shall not exceed 15 years, except in the case when one extension for no more than three months is granted.

(4) No more than one extension can be granted. No further extension of other type can be granted.

(5) No more than two consecutive extensions can be granted. In the event an additional extension is requested the requirements of the "2.5 years extension" are to be carried out and the shaft survey due date, prior to the previous extension(s), is extended for a maximum of 2.5 years.

(6) No more than one three months extension can be granted. In the event an additional extension is requested the

requirements of the "1 year extension" or "2.5 years extension" are to be carried out and the shaft survey due date, prior to the previous extension, is extended for a maximum of one year or 2.5 years.

(7) The maximum interval between two surveys carried out according to Method 1 shall not be more than 15 years.

2.3.3 Water Lubricated shafts (open systems)

(a) Shaft Survey Methods

(i) METHOD 4

The survey is to consist of:

- Drawing the shaft and examining the entire shaft (including liners, corrosion protection system and stress reducing features, where provided), inboard seal system and bearings.
- For keyed and keyless connections:
  - removing the propeller to expose the forward end of the taper,
  - performing a non-destructive examination (NDE) by an approved surface crack-detection Method all around the shaft in way of the forward portion of the taper section, including the keyway (if fitted). For shaft provided with liners the NDE shall be extended to the after edge of the liner
- For flanged connection:
  - Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs or when deemed necessary by the Surveyor, the coupling bolts and flange radius are to be examined by means of an approved surface crack detection method.
- Checking and recording the bearing clearances.
- Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- Verification of the satisfactory conditions of inboard seal during re-installation of the shaft and propeller.

(b) Shaft extension surveys - Extension types

(i) Extension up to 1 year

The survey is to consist of:

- Visual Inspection of all accessible parts of the shafting system.
- Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- Checking and recording the clearances of bearing.
- Verification of the effectiveness of the inboard seal.

Pre-requisites to satisfactorily verify in order to apply EXTENSION UP TO 1YEAR:

- Review of the previous clearance recordings.
- Service records.
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

(ii) Extension up to 3 months

The survey is to consist of:

- Visual Inspection of all accessible parts of the shafting system.
- Verification that the propeller is free of damages which may cause the propeller to be out of balance.

- Verification of the effectiveness of the inboard seal.

Pre-requisites to satisfactorily verify in order to apply extension up to 3 months:

- Review of the previous clearance recordings.
- Service records.
- Verification of no reported repairs by grinding or welding of shaft and/or propeller.
- Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

(c) Shaft Survey Intervals

(i) The following survey intervals between surveys according to Method 4 are applicable to all types of propeller connections.

- For keyless propeller connections the maximum interval between 2 consecutive dismantling and verifications of the shaft cone by means of non-destructive examination (NDE) shall not exceed 15 years.
- For surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

(1) Configurations allowing 5 year intervals

- Single shaft operating exclusively in fresh water.
- Single shaft provided with adequate means of corrosion protection, or single corrosion resistant shaft.
- All kinds of multiple shafts arrangements.

(2) Other systems

Shaft not belonging in one of the configurations listed in (1) above has to be surveyed according to Method 4 every 3 years.

(ii) Survey extensions

For all types of propeller connections, the interval between 2 consecutive surveys may be extended after the execution of extension survey as follows:

(1) Extension up to a maximum of 1 year: no more than 1 extension can be granted.
No further extension, of other type, can be granted.

(2) Extension up to a maximum of 3 months: no more than 1 "3 months extension" can be granted.
In the event an additional extension is requested the requirements of the "1 year extension" are to be carried out and the shaft survey due date prior to the previous extension is extended for a maximum of 1 year.

The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date.

If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed.

(d) Survey intervals for open systems are as follows.

**Survey Intervals for Open Systems**

<table>
<tr><td colspan="4">Survey Intervals (Open Systems)</td></tr>
<tr><td colspan="2">- Single shaft operating exclusively in fresh water.<br>- Single shaft provided with adequate means of corrosion protection, single corrosion resistant shafts<br>- All kinds of multiple shafts arrangements</td><td colspan="2" rowspan="2">Other shaft configuration</td></tr>
<tr><td colspan="2">All kinds of propeller coupling(4)</td></tr>
<tr><td>Every 5 years(1)</td><td>Method 4</td><td>Every 3 years(1)</td><td>Method 4</td></tr>
<tr><td>Extension 1 year</td><td>Yes(2)</td><td>Extension 1 year</td><td>Yes(2)</td></tr>
<tr><td>Extension 3 months</td><td>Yes(3)</td><td>Extension 3 months</td><td>Yes(3)</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">Footnotes:<br>For surveys (Method 4) completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.<br>The extension survey should normally be carried out within 1 month of the shaft survey due date and the extension counts from the shaft survey due date. If the extension survey is carried out more than 1 month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed.</td></tr>
</table>

Notes:

(1) Unless an Extension type (Extension 1 Y, Extension 3 M) is applied in between.

(2) No more than one extension can be granted. No further extension, of other type, can be granted.

(3) No more than one extension can be granted. In the event an additional extension is requested the requirements of the one year extension are to be carried out and the shaft survey due date prior to the previous extension is extended for a maximum of one year.

(4) For keyless propeller connections the maximum interval between two consecutive dismantling and verifications of the shaft cone by means of non-destructive examination (NDE) shall not exceed 15 years.

~~2.3.1 Tapered Shafts~~

~~The following survey details, apply to a shafting arrangement where the propeller is taper fitted to the shaft.~~

~~(a) Water-lubricated bearings~~

~~The survey is to consist of removing the propeller and drawing in and examining the entire shaft. During each survey, the shaft is to be examined by a surface crack detection method (such as magnetic particle or dye penetration) all around the shaft from the after edge of the liner for one-third of the length of the taper, including forward end of keyway (if fitted).~~

~~(b) Oil-lubricated bearings~~

~~The survey may be carried out as described in (a) above. Alternatively, on the basis of satisfactory service record, lubricating oil analysis, bearing weardown and the condition of the inboard and outboard seal assemblies, the survey may consist of removing the propeller to expose the forward end of the taper and performing a nondestructive examination by a surface crack detection method (such as magnetic particle or dye penetration) all around the shaft in way of the forward portion of the taper section, including the end of key way (if fitted).~~

~~2.3.2 Flanged propeller shafts~~

~~The surveys detailed below are applicable where the propeller is fitted to the shaft by means of a coupling flange.~~

~~(a) Water-lubricated bearings~~

~~The survey is to consist of withdrawing the shaft in its entirety.~~

~~(b) Oil-lubricated bearings~~

~~The survey may be carried out as described above. Alternatively, the survey may consist of the verification of a satisfactory service record, lubricating oil analysis, stern bearing wear down, shaft seal effectiveness, and for controllable pitch propellers, a blade seal leak and function test.~~

~~(c) Coupling bolts and flange radius~~

~~Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul or repairs, the coupling bolts and flange radius are to be examined by means of a surface crack detection method.~~

2.3.~~3~~4 Miscellaneous propellers

(a) Controllable pitch propellers where fitted are to be opened up and the working parts examined, together with the control gear.

(b) Directional propeller units are to be examined as the following requirements.

(i) Lubrication oil samples are to be taken and sent to a recognised laboratory for analysis at regular intervals, not exceeding 3 months. Records of lubrication oil analysis are to include trends of previous analysis, and be available onboard at all times. A representative oil sample is to be taken before the filters and with the unit in its normal running condition. Oil analysis is to detect iron (Fe) and other solid contamination in addition to possible water content. Acceptance criteria for wear particles and water content are set by the relevant thruster maker (in case thruster maker criteria are not available due to e.g. bankruptcy of gear thruster maker, the water content due to condensation is normally not to exceed 0.5%). The oil analysis is to cover all of the following areas, if applicable:

(1) lubrication oil for gears, bearings;

(2) sealing boxes;

(3) steering gear; and

(4) propeller.

If the propeller shafts seal oil systems do not allow for sampling unless the vessel is in dry dock, a representative oil analysis is to be taken in connection with the Bottom Survey in dry-dock.

(ii) The thrusters are to be subjected to complete survey every 5 years. The complete survey is to include:

(1) evaluation of oil analysis of gear lubrication oil, propeller hydraulic system oil and sealing system oil as specified in 2.3.~~3~~4(b)(i) above.

(2) opening up of protection covers.

(3) inspection of power transmission gear, bearings, visible parts of shafts and general condition of housing internally. Gear clearance and axial play of bearings shall be measured.

(4) examination of controllable pitch mechanism oil transmission system and feedback system.

(5) full stroke ahead and astern are to be verified and correct blade position feed-back and indication verified.

(6) examination of steering column and related sealing and bearing.

(7) running test at MCR (max continuous rating).

(iii) Inboard parts of the thruster accessible from the inside, such as drive motors, shafting system, gear transmissions, pumps and piping systems, alarm, safety and control systems are covered by the class surveys of machinery. This will be applicable for e.g. Voith-Schneider and pump type thrusters.

(iv) Outboard parts of the thruster, accessible from the outside, are to be externally examined during by the Bottom Surveys.

(v) If the thruster is overhauled at the time of the complete survey, NDT for TIFF (tooth interior fatigue fracture) shall be carried out according to maker's requirements and acceptance criteria. If the thruster is overhauled during the interval between two scheduled surveys, satisfactory documentation for NDT (TIFF) performed according to maker's requirements and acceptance criteria is to be submitted to the attending Surveyor at the next survey. Mounting of the thruster on board is to be verified and function tested.

(c) Waterjet units~~ are to be dismantled for examination of the impeller, casing, shaft, shaft seal, shaft bearing, inlet and outlet channels, steering nozzle, reversing arrangements and control gear.~~

Waterjet units for main propulsion purposes, including the impeller, casing, shaft, shaft seal, shaft bearing, inlet and outlet channels, steering nozzle, reversing arrangements, and control gear are to be surveyed at intervals not exceeding 5 years, provided the impeller shafts are made of approved corrosion-resistant material or have approved equivalent arrangements. They are to be generally examined so far as practicable. Dismantling may be required to the extent found necessary by the Surveyor.

(d) Dynamic positioning and/or thruster-assisted mooring and athwartship thrust propellers and shaftings are to be surveyed at intervals not exceeding 5 years. They are to be generally examined so far as possible in dry dock and tested under working conditions afloat for satisfactory operation. All accessible parts, including sealing, locking and bearing faces, and any other moving parts are to be examined. Non-destructive examination is to be carried out as considered necessary by the Surveyor on blade/fin roots. Consideration may be given to condition monitoring schemes for determining the condition of the unit.

2.3.~~4~~5 Propeller shaft condition monitoring (PCM)

(a) Where oil lubricated shaft with approved oil glands are fitted, a class notation **PCM** may be assigned, if its monitoring manuals or maintenance manuals of preventive maintenance system together with relative diagrams, are submitted and approved by the Society. The management systems are to comply with the following:

(i) Lubricating oil analysis is to be carried out regularly at intervals not exceeding 6 months. The lubricating oil analysis documentation is to be available on board. Each analysis is to include the following minimum parameters:

(1) Water content;

(2) Chloride content;

(3) Bearing material and metal particles content; and

(4) Oil ageing(resistance to oxidation).

Oil samples are to be taken under service conditions and representative of the oil within the stern-tube.

(ii) Oil consumption is to be recorded monthly.

(iii) Bearing temperatures are to be recorded daily, (two temperature sensors with alarm or other approved arrangements are to be provided).

(iv) Facilities are to be provided for measurement of bearing wear down.

(v) Oil glands are to be capable of being replaced without withdrawal of the propeller shaft or removal of the propeller.

(b) For maintenance of the **PCM** notation, Annual Survey is to be carried out as follows:

(i) Satisfactory operating conditions of the propeller shaft are to be confirmed, including the verification of the records of lubricating oil analysis, lubricating oil consumption, bearing temperatures and wear down readings.

(c) Where the notation **PCM** has been assigned, the propeller shaft need not be withdrawn at surveys as required by 1.6.8 provided all condition monitoring data is found to be within permissible limits and all exposed areas of the shaft are examined by a magnetic particle crack detection method. Where the Surveyor considers that the data presented is not entirely to his satisfaction the shaft will be required to be withdrawn in accordance with 1.6.8.

(d) For ships with **PCM** notation, ~~the propeller shaft survey interval required by 2.3.2(c) or (d) of the Part will be extended up to 15 years provided:~~ the maximum propeller shaft survey interval required by ~~1.6.8(a)(ii)~~ 2.3.2(c) or (d) of this part shall not exceed 15 years provided:

(i) Annual Surveys are carried out to the satisfaction of the attending Surveyors, and

(ii) The followings are carried out at each propeller shaft survey due date required by ~~1.6.8(a)(ii)~~ 2.3.2(c) or (d).

(1) Bearing weardown measurement.

(2) Verification that the propeller is free of damage which may cause the propeller to be out of balance.

(3) Verification of effective inboard seal.

(4) Renewal of outboard seal in accordance with manufacturer's recommendation.

(5) For keyed propellers, the fore part of the shaft taper and shaft keyway are to be examined by an appropriate surface crack detection method(such as magnetic particle or dye-penetration), for which dismantling of the propeller and removal of the key will be required.

(e) Initial survey for existing vessels obtaining **PCM** notation

(i) All systems required by 2.3.~~4~~5(a) of this Part are to be examined and tested in accordance with the approval plans, and

(ii) Propeller shaft survey as per 2.3 of this Part will be required if the last propeller shaft survey was carried out more than 5 years prior to the initial survey, or

(iii) The propeller shaft survey may be waived subject to satisfactory review of the following records:

(1) Six-monthly records of stern bearing oil analysis for water and metal contents, covering the last 5 years.

(2) Monthly records of stern bearing oil consumption, covering the last 5 years.

(3) Monthly records of stern bearing temperature monitoring, covering the last 5 years.

(4) Propeller shaft, stern bearing assembly and propeller operation and repair records, if available.

(5) Records of stern bearing clearance and weardown measurement from new building and last dry docking.

2.3.~~5~~6 Survey in place

The scope of a survey of propeller shafts and tube shafts in place consists of:

(a) Checking of the clearances of the stern tube shafts,

(b) Checking of the tightness of the oil sealing glands,

(c) Examination of propeller,

(d) Where a controllable pitch propeller is fitted, it is to be ascertained that the pitch control device is in good working order, and if considered necessary, the device is to be opened up for further examination.

2.3.~~6~~7 Wear-down Limits

(a) The after water-lubricated bearing other than rubber is to be rebushed when clearance has reached the maximum allowable wear-down limit ~~of aft lignum vitae bush is to be~~ as follows:

~~(i) For machinery placed amidships:~~

| | Machinery amidship: C | Machinery after: C |
|---|---|---|
| $D \leq 230$ | 6.4 mm | 4.8 mm |
| $230 < D \leq 305$ | 8.0 mm | 6.4 mm |
| $305 < D$ | 9.5 mm | 8.0 mm |
| D = Diameter of propeller shaft, in mm.<br>C = Max. allowable wear-down limit, in mm. | | |

~~$C = 5+D/100$ when $D \leq 400$ mm~~
~~$C = 9$ when $D > 400$ mm~~
~~where:~~
~~D = Diameter of propeller shaft, in mm.~~
~~C = Max. allowable wear-down limit, in mm.~~

~~(ii) For machinery placed aft, the clearance is to be 1.5 mm less than the above values.~~

(b) Water lubricated rubber bearing are to be rebushed when any water groove is 50% of the original depth, or whenever the clearance exceeds the limits as given in (a) above for water-lubricated bearings other than rubber, whichever occurs first.

(c) Oil-lubricated bearings are to be rebushed when the wear down exceeds manufacturer's recommendations.

~~2.3.7 Extensions of propeller shaft surveys~~

~~(a) Up to approximately one year~~
~~(i) Water lubricated bearings~~
~~Satisfactory service record and an external examination of the inboard and outboard propeller shaft assemblies, together with the bearing wear down check at the end of the normal survey period.~~
~~(ii) Oil lubricated bearings~~
~~(1) Verification of satisfactory service and oil loss records.~~
~~(2) An external examination of the inboard and outboard seal assemblies.~~
~~(3) An examination of oil sample at the time of granting each requested extension. (The sample oil analysis is to be done in accordance with the applicable requirements in 2.3.4(a)(i))~~
~~(4) Confirmation at the fifth year that the bearing wear down is within allowable limits.~~

~~(b) Not exceeding five years~~
~~(i) Verification of satisfactory service including oil loss records.~~
~~(ii) Oil sample examination and test. (The sample oil analysis is to be done in accordance with the applicable requirements in 2.3.4(a)(i))~~
~~(iii) Confirmation of no any repairs by grinding or welding without approval of the Society.~~
~~(iv) Bearing weardown measurement.~~
~~(v) Verification that the propeller is free of damages which may cause the propeller to be out of balance.~~
~~(vi) Bearing inboard seal assemblies are to be externally examined and to be found or placed in a satisfactory condition.~~
~~(vii) Bearing outboard seals are to be renewed and the seal liner found to be or placed in a satisfactory condition.~~
~~(viii) For keyed propellers, the fore part of the shaft taper and shaft keyway are to be examined by an appropriate surface crack detection method(such as magnetic particle or dye-penetration), for which dismantling of the propeller and removal of the key will be required.~~

## 2.4 Boiler Survey and Thermal Oil Heater Surveys

2.4.1 Boiler surveys

(a) At each survey, boilers, superheaters, and economizers are to be examined internally and externally in cleaned condition, including seat buffers and stays, if provided.

(b) Boiler mountings including safety valves are to be examined and opened up for further examination if deemed necessary by the Surveyor. Safety valves are to be set as the requirements in Part V. All studs fastening directly to boiler shells or heads, if provided, are to be examined.

(c) In case the dimensions of boiler plates, tubes and stays are required to be ascertained, an efficient non-destructive examination is to be carried out. The allowable working pressure may be required to reduce from its designed working pressure if the dimension is found to be undersized due to corrosion or waste.

Boiler safety valve relieving gear (easing gear) is to be examined and tested to verify satisfactory operation. This test is to be carried out prior to any safety valve operation or setting test under steam

For waste heat boilers, if steam cannot be raised at port, the safety valves may be tested and set by the Chief Engineer at sea, and the results recorded in the log book for review by the Surveyor.

(d) The oil fuel burning system together with its safety appliances, valves, control gears, oil discharge pipes between pumps and burners are to be examined under working condition.

(e) Automatic combustion control devices, if provided, are to be tested under working condition.

(f) In case an important repair carried out or if deemed necessary by the Surveyor, the hydraulic test may be required.

Note: Hydraulic test pressures are as follows:

| Boiler's age | Test pressure | Remarks |
|---|---|---|
| Age < 12 years | $P = 1.25\ P_o$ | $P_o \leq 4$ MPa |
| | $P = 1.2\ P_o + 0.2$ | $P_o > 4$ MPa |
| Age ≥ 12 years | $P = 1.15\ P_o$ | |

$P_o$ is the working pressure.

(g) In fired boilers employing forced circulation, the pumps used for this service are to be opened and examined at each boiler survey.

(h) Annual Examination

External examination of boilers including test of safety and protective devices, and test of safety valve using its relieving gear, is to be carried out within the window of the Annual Survey of the ship.

(i) Survey extensions

An extension may be granted by the Surveyor after the following is satisfactorily carried out:

(i) External examination of the boiler

(ii) Boiler safety valve relieving gear (easing gear) is to be examined and operationally tested

(iii) Boiler protective devices (alarms and shutdowns) operationally tested

(iv) Review of the following records since the last Boiler Survey:

Operation record, maintenance record, repair history record, and feedwater chemistry record.

(j) Auxiliary Boiler Alternative Survey Program

Ships with an approved program of Preventative Maintenance will be given special consideration for an alternative survey program of auxiliary boilers at the first Boiler Survey carried out during each 5-year Special Survey period. The Boiler Survey carried out in conjunction with the Special Survey is not eligible for the alternative survey program.

2.4.2 Thermal oil heater surveys

(a) Thermal oil plants are to be subjected to functional tests, while in operation.

(b) The following items are to be examined:
  (i) The entire thermal oil plant for leakage.
  (ii) The condition of the insulation.
  (iii) The functioning of the indication, control and safety equipment.
  (iv) Remote controls for the shut-off and discharge valves.
  (v) Leakage monitors for heaters (for exhausting gas heating).
  (vi) The testing of safety devices.

(c) Heating surfaces and, where appropriate, the combustion chamber, are to be examined for contamination, corrosion, deformations and leakage.

(d) As a rule, tightness tests are to be carried out to the admissible working pressure.

## 2.5 Annual Surveys

2.5.1 Annual Surveys - hull

At each Annual Survey, the general condition of hull and equipment is to be examined so far as can be seen and placed in satisfactory condition as necessary, attention being paid to the following items:

(a) Examination of weather decks, ship side plating above water line, hatch covers and coamings ~~Hull and deck plating and its closing appliances~~ and watertight penetrations.

~~(b) Hatch covers and coaming~~

  (i) ~~It is to be confirmed~~ Confirmation is to be obtained that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

  (ii) Where mechanically operated steel covers are fitted, checking the satisfactory condition, as applicable, of:
    (1) Hatch covers;
    (2) Tightness devices of longitudinal, transverse and intermediate cross junctions (gaskets, gasket lips, compression bars, drainage channels);
    (3) Clamping devices, retaining bars, cleating;
    (4) Chain or rope pulleys;
    (5) Guides;
    (6) Guide rails and track wheels;
    (7) Stoppers, etc;
    (8) Wires, chains, gypsies, tensioning devices;
    (9) Hydraulic system essential to close and securing;
    (10) Safety locks and retaining devices.

  (iii) Where portable covers, wooden or steel pontoons are fitted, checking the satisfactory condition, where applicable, of:
    (1) Wooden covers and portable beams, and their securing devices;
    (2) Steel pontoons;
    (3) Tarpaulins;
    (4) Cleats, battens, wedges;
    (5) Hatch securing bars and their securing devices;
    (6) Loading pads/bars and the side plate edge;

(7) Guide plates and chocks;

(8) Compression bars, drainage channels and drain pipes (if any).

(iv) Checking the satisfactory condition of hatch coaming plating and their stiffeners, including close-up survey where applicable.

(v) Random checking of the satisfactory operating of mechanically operated hatch covers is to be made including:

(1) Stowage and securing in open condition;

(2) Proper fit and efficiency of sealing in closed condition; and

(3) Operational testing of hydraulic and power components, wires, chains and link drives.

(vi) Examination of the weld connection between air pipes and deck plating.

(vii) External examination of all air pipe heads installed on the exposed decks.

(viii) Examination of flame screens on vents to all bunker tanks.

(ix) Examination of ventilators, including closing devices, if any.

(b) Suspect Areas and Examination of Ballast Tanks

(i) Suspect Areas identified at previous surveys are to be examined. Thickness measurements are to be taken of the areas of substantial corrosion and the extent of thickness measurements is to be increased to determine areas of substantial corrosion. Table I 2-4A may be used as guidance for these additional thickness measurements. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed.

Note: these requirements are not applicable to cargo tanks of oil tankers, chemical tankers and double hull oil tankers.

(ii) Examination of ballast tanks when required as a consequence of the results of the Special Survey and Intermediate Survey is to be carried out. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the extent of thickness measurements is to be increased to determine areas of substantial corrosion. Table I 2-4A may be used as guidance for these additional measurements. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed.

~~(iv) If considered necessary by the Surveyor, the effectiveness of sealing arrangement of all hatch covers is to be confirmed.~~

~~(v) Checking the condition of hatch coaming plating and their stiffeners. Where significant wastage of hatch covers is noted, thickness measurement is to be carried out and renewal made as necessary.~~

~~(vi) Proper operating and functioning of hatch cover and securing arrangements are to be confirmed.~~

(c) Protection of other openings

(i) Hatchways, manholes, and scuttles in freeboard and superstructure decks.

(ii) Machinery casings, fiddley covers, companion-ways and deckhouses protecting openings in freeboard or enclosed superstructure decks.

(iii) Portlights together with dead covers, cargo ports, bow or stern access, chutes and similar openings in ship's sides or ends below the freeboard deck or in way of enclosed superstructures.

(iv) Ventilators, air pipes together with flame screens, scuppers and discharges serving spaces on or below the freeboard deck.

(v) Watertight bulkheads, bulkhead penetrations and wall of enclosed superstructure.

(vi) Weather-tight and watertight doors and closing appliances for all of the above including proper operation of such doors.

(d) Freeing ports together with bars, shutters and hinges.

(e) Protection of the crew

Guard rails, lifelines, gangways, accommodation ladders with accessory wires, winches and gears and deck houses accommodating crew.

(f) Verification of loading guidance and stability data

(i) For ship provided with the loading manual continuous such means in ready use.

(ii) For ship provided with the loading computer, confirmed that a loading computer installed on board have the performance and functions as deemed appropriate by the Society.

(iii) Confirmed that an approved stability booklet is kept on board for ready use.

(g) Verification that no alternations have been made to the hull or superstructures which would affect the calculation determining the position of load lines. The load line marks (see Appendix 3) are to be sighted, found plainly visible, and recut and/or painted as required. Surveys carried out by the National Authorities of the countries in which the ships are registered may be accepted as meeting these requirements.

(h) Anchoring and mooring equipment including the working test of windlass.

(i) Bow doors, inner doors, side shell doors and stern doors are to be surveyed as per Annual Survey, see IACS UR Z24-4.

(j) Fire protection and fire fighting arrangements including operation tests as far as practicable

Confirmation as far as practicable, that no significant changes have been made to the arrangement of structural fire protection is also to be carried out. Surveys carried out by the National Authorities of the countries in which the ships are registered may be accepted as meeting these requirements.

~~(k) Ballast tanks for vessels of age over 5 years~~

~~(i) Ballast tanks, excluding double bottoms, of which protective coating was not applied from the time of construction, the spaces in question are to be internally examined and gauged as necessary.~~

~~Ballast tanks which were required as a consequence of the outstanding notes set up at the intermediate or Special Survey due to no protective coating, soft or semi-hard coating or Poor condition without dealing with are to be internally examined. When extensive corrosion is found, thickness measurement is to be carried out.~~

~~(l) Additional ESP requirements for oil tankers~~

~~(i) General~~

~~The survey is to consist of an examination for the purpose of ensuring, as far as practical, that the hull and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.~~

~~(ii) Examination of weather decks~~

~~(1) Examination of cargo tank opening including gaskets, covers, coamings and flame screens.~~

~~(2) 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.~~

~~(3) Examination of flame screens on vents to all bunker, oily ballast and oily slop tanks.~~

~~(4) Examination of cargo, crude oil washing, bunker and vent piping systems, including vent masts and headers.~~

~~(iii) Examination of cargo pump rooms and pipe tunnels if fitted.~~

~~(1) Examination of all pumproom bulkheads for signs of oil leakage or fractures and, in particular, the sealing arrangements of all penetrations of pumproom bulkheads.~~

~~(2) Examination of the condition of all piping systems.~~

(iv) Examination of ballast tanks

(1) Examination of ballast tanks is to be carried out where required as a consequence of the results of the Special Survey and Intermediate Survey. When considered necessary by the Surveyor, thickness measurement is to be carried out.

(2) Where Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements in Table I 2-4B.

(3) For oil tankers exceeding 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 internally. When considered necessary by the Surveyor, thickness measurements are to be carried out and if the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements of Table I 2-4B. Tanks or areas where coating was found to be in Good condition at the previous intermediate or Special Survey may be specially considered by the Society.

(v) Verification that at least one portable detector for measuring flammable vapour concentrations is available, together with a sufficient set of spares and a suitable means of calibration.

(m) Additional ESP requirements for bulk carriers

(i) General

The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull, hatch covers, coamings and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file..

(ii) Close-up survey of hatch covers and coamings.

(iii) Examination of ballast tanks when required as a consequence of the results of the Special Survey

When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-4C.

(iv) Examination of cargo holds

(1) Bulk carrier over 10 years and up to 15 years of age

- Overall survey of all cargo holds. Where the protective coating in cargo holds is found to be in Good condition, the extent of close-up surveys and thickness measurement may be specially considered.
- Close-up examination of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approx. lower one third length of side frame at side shell and side frame end attachment and the adjacent shell plating in the forward cargo hold. Where this level of survey reveals the need for remedial measures, the survey is to be extended to include close-up survey of all of the shell frames and adjacent shell plating of that cargo hold as well as close-up survey of sufficient extent of all remaining cargo holds.
- When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurement shell be increased in accordance with the Table I 2-4C.
- All piping and penetration in cargo holds, including overboard piping, is to be examined.

(2) Bulk Carrier over 15 years of age

- Overall survey of all cargo holds. Where the protective coating in cargo holds is found to be in Good condition, the extent of close-up surveys and thickness measurement may be specially considered.
- Close-up examination of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approx. lower one third length of side frame at side shell and side frame end attachment and the adjacent shell plating in the forward cargo hold and one other selected cargo hold. Where this level of survey reveals

~~the need for remedial measures, the survey is to be extended to include close-up survey of all of the shell frames and adjacent shell plating of that cargo hold as well as close-up survey of sufficient extent of all remaining cargo holds.~~

~~— When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurement is to be increased in accordance with the Table I 2-4C.~~

~~— All piping and penetration in cargo holds, including overboard piping, is to be examined.~~

~~(3) The following examination of the foremost cargo hold is to be carried out for ships of 150 m in length and upwards of single side skin construction, carrying solid bulk cargoes having a density of 1,780 kg/m3 and above, constructed before 1 July 1999, and constructed with an insufficient number of transverse watertight bulkheads to enable them to withstand flooding of the foremost cargo hold in all loading conditions and remain afloat in a satisfactory condition of equilibrium as specified in regulation XII/4.4 of the SOLAS.~~

~~(A) For bulk carriers of 5 < age ≤ 15:~~

~~— An overall survey of the foremost cargo hold, including close-up survey of sufficient extent, minimum 25% of frames, is to be carried out to establish the condition of shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads; and areas found to be Suspect Areas at the previous Special Survey.~~

~~— Where considered necessary by the Surveyor as a result of overall and close-up survey as described above, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of the cargo hold.~~

~~(B) For bulk carriers of age > 15:~~

~~— An overall survey of the foremost cargo hold, including close-up survey is to be carried out to establish the condition of all shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads, and areas found to be Suspect Areas at the previous Special Survey.~~

~~(C) Extent of thickness measurement~~

~~— Thickness measurement is to be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey, as described in (1) and (2) above. The minimum requirement for thickness measurements are areas found to be Suspect Areas at the previous Special Survey. Where Substantial Corrosion is found, the extent of thickness measurements is to be increased with the requirements of Table I 2-4C.~~

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

~~— The gauging of the vertically corrugated transverse watertight bulkhead between holds No. 1 and No. 2, including each corrugation flange, web, shedder plate and gusset plate, is to be carried out at the levels as described below:~~

~~Level (a) and (b) (see Fig. I 2-2 and Fig. I 2-3):~~

~~The mid-breadth of each corrugation flanges and webs at approximately 200 mm above the top of shedder plates and top of hopper plates;~~

~~The middle of gusset plates between corrugation flanges, if fitted;~~

~~The middle of the shedder plates;~~

~~The mid-breadth of each corrugation flanges and webs at approximately 200 mm and where as deemed necessary by the Surveyor below upper stool, if fitted.~~

~~Level (c) (see Fig. I 2-2 and I 2-3):~~

~~For ships with or without lower stool~~

~~Locations:~~

~~The mid-breadth of the corrugation flanges and webs at about the mid-height of the corrugation.~~

~~- Where the thickness changes within the horizontal levels, the thinner plate is to be gauged.~~

(~~n~~k) Where ships have timber load lines, metal sockets or equivalent means for securing upright and eye plates for lashing are to be examined.

(~~o~~l) Additional requirements for navigational arrangements for periodical one man watch, and where applicable integrated bridge system. Annual Surveys are to be carried out to ascertain that the equipment and arrangements required for the applicable class notation are being maintained in good working order. At the time of the survey relevant statutory certificates may be accepted as evidence of satisfactory operation.

(~~p~~m) Helicopter deck

Where areas of the ship are designated for helicopter operations, the helicopter deck, deck supporting structure, deck surface, deck drainage, tie downs, markings, lighting, wind indicator, securing arrangements where fitted and safety netting or equivalent are to be examined.

(~~q~~n) Ships constructed of reinforced plastic

In addition to the applicable requirements of the Annual Survey - hull is also to include the following:

(i) All accessible parts particularly liable to rapid deterioration.

(ii) The deck to hull connection, and superstructure and deckhouse connections to the deck.

~~(r) Barges~~

~~In addition to the applicable requirements of 2.5.1, the Annual Survey is also to include the following:~~

~~(i) For barges engaged in the dry bulk cargo trade, at each Annual Survey after Special Survey No. 3, holds, with particular attention being paid to tank tops, underside of main deck and side shell plating, framing and attachments. Thickness measurements may be required and access is to be provided for inaccessible areas as considered necessary by the attending Surveyor.~~

~~(ii) For manned barges Annual Survey is to include the following:~~

~~(1) Fire safety measures.~~

~~(2) Fire extinguishers.~~

~~(3) Power supply including emergency source of power.~~

~~(4) Lifesaving appliances and equipment.~~

~~(5) Radio communication installation.~~

~~(6) Windlass, anchors and chains.~~

~~(7) Fire mains are to be pressurized to the working pressure and surveyed over their full length where accessible.~~

~~(s) High speed craft – hull for high speed craft of FRP construction~~

~~In addition to the applicable requirements of the Annual Survey - hull is also to include the following:~~

~~(i) The craft is to be placed in dry dock or slipway and all applicable items of the Annual Survey - hull are to be examined.~~

~~(ii) The deck to hull connection, and superstructure and deckhouse connections are to be examined.~~

~~(iii) The ship is to be thoroughly checked and sounded for any apparent delaminations. Where it is thought a delamination is found, a 50 mm diameter plug is to be removed from the area and examined for core to skin adhesion and water permeation.~~

2.5.2 Annual Survey – machinery

At each Annual Survey, the following requirements are to be complied with:

(a) At each Annual Survey, a general examination of the propelling machinery and essential auxiliaries, is to be made. The Surveyor may in addition, require such further items to be opened up as considered necessary to ascertain that they are in good working condition.

(b) Machinery and boiler spaces with particular attention to the fire and explosion hazards, and also emergency escape routes are to be generally examined.

(c) All main and auxiliary steering gears including their associated and control systems are to be examined and tested in operation.

(d) All the means of communication between the navigation bridge and the machinery control position, as well as the bridge and the alternative steering position, if fitted, are to be tested.

(e) Bilge pumping systems and bilge wells including operation of pumps, remote reach-rods and level alarms, where fitted, are to be examined as far as practical.

(f) Boilers, thermal oil heaters heated by flame or combustion gas, pressure vessels and their mountings including safety devices, foundations, controls, releasing gear, high pressure and steam escape piping, insulation and gauges are to be externally examined. Confirmation of the safety devices of the boilers and the thermal oil heaters may be required as considered necessary by the Surveyor.

In addition, boilers are to be examined in accordance with 2.4.1(h) of this Chapter.

(g) Electrical machinery, emergency sources of electrical power switchgear and other electrical equipment are to be generally examined and also to be tested in operation as far as practicable.

(h) Confirmation as far as practicable of the operation of all emergency sources of power is to be made. If they are automatic, also in the automatic mode.

(i) Where automatic and/or remote controls are fitted for essential machinery, they are to be tested to demonstrate that they are in good working condition.

(j) Parts which are opened up for maintenance at Owner's option are to be examined as necessary.

(k) For hydraulic power units, hoses, piping for any damage, corrosion or leakages, and hydraulic oil cooling system condition and operation are to be checked. Operational test of all emergency stops, controls and remote controls are also to be checked.

(l) Additional requirements for oil tankers and ships carrying dangerous chemicals in bulk

At each Annual Survey, the following are to be examined and placed in good order:

(i) All electrical equipment and cables in dangerous zones on weather decks and cargo pump rooms.

(ii) Cargo, bilge, ballast and stripping pumps including pump foundation in cargo pump rooms as far as practicable.

(iii) Electrical and mechanical remote operating and shutdown devices including operation tests in cargo pump rooms.

2.5.3 Annual Survey – **CAS**, **CAU** and **CAB**

The following performances are to be made and placed in order. Where appropriate records of daily checks and periodical maintenance have been kept, some of the tests may be dispensed with at the Surveyor's discretion.

(a) Safety devices for main propulsion machinery or controllable pitch propellers, and emergency stopping devices for main propulsion machinery fitted in the remote control station for the main propulsion machinery or controllable pitch propellers.

(b) Safety devices for boilers.

(c) Safety devices for electric generating sets.

(d) Communication system specified in 2.9 in Part VIII.

2.5.4 Annual Survey - marine oil pollution prevention installations

Marine oil pollution prevention installations including operation tests as far as practicable are to be surveyed according to the IMO Resolution A.1053(27) - Guidelines for Surveys under Annex I of MARPOL 73/78 with its amendments. Surveys carried out by the National Authorities of the countries in which the ships are registered may be accepted as meeting these requirements.

~~2.5.5 Annual Survey - refrigerated cargo installations~~
~~See 2.8.1.~~

~~2.5.6 Annual Survey – inert gas system~~
~~See 2.9.1Annual Survey~~

~~2.5.7 Annual Survey - liquefied gas carriers~~
~~See 2.10.1.~~

~~2.5.8 Annual Survey - chemical carriers~~
~~See 2.11.1.~~

~~2.5.9 Annual Survey – general dry cargo ship~~
~~See 2.12.1.~~

~~2.5.10 Annual Survey – double hull oil tankers~~
~~See 2.13.1.~~

~~2.5.11 Annual Survey – passenger ships, See 2.14.1~~

~~2.5.12 Annual Survey – double skin bulk carriers~~
~~See 2.15.1~~

## 2.6 Intermediate Surveys

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

2.6.2 Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

2.6.~~1~~3 At each Intermediate Survey for hull, in addition to all the requirements for Annual Survey in 2.5, the following additional applicable requirements in ~~2.6.2 ~~2.6.4~~, 2.6.7 and 2.6.14~~ are also to be complied with depending on the type of ship.

2.6.~~2~~4 Additional hull requirements for ships other than tankers, combination carriers and bulk carriers

(a) For ships between 5 and 10 years of age, a general, internal examination of representative ballast tanks is to be carried out. If there is no hard protective coating, soft or semi-hard coating, or POOR coating condition, the examination is to be extended to other ballast spaces of the same type.

~~(a) Ships of age over 5 years and up to 10 years: A general, internal examination of representative sea water ballast tanks which include at least one peak tank and one deep/wing tank in way of cargo length area, excluding double bottom tanks, is to be carried out as follows:~~

~~(i) If such inspections reveal no visible structural defects, the examination may be limited to a verification that the coatings remain efficient.~~

~~(ii) Where no protective coating, soft or semi hard coating or Poor coating condition without dealing with is found, the examination is to be extended to other ballast spaces of the same type.~~

~~(iii) In ballast tanks, where no protective coating, soft or semi hard coating or Poor coating condition without dealing with is found, maintenance of class is to be made subject to the tanks in question being internally examined and gauged as necessary at annual intervals.~~

(b) For ships over 10 years of age, a general, internal examination of all spaces used for water ballast is to be carried out.

~~(b) Ships over 10 years of age~~

~~An internal general examination of all sea water ballast tanks is to be carried out as follows:~~

(~~i~~c) If such ~~inspection~~ examinations, in 2.6.4(a) and (b) above, reveals no visible structural defects, the examination may be limited to a verification that the coatings remain efficient.

(~~ii~~d) ~~In ballast spaces other than~~ For ballast tanks, excluding double bottom tanks, ~~where~~ if there is no hard protective coating, soft or semi-hard coating or Poor coating condition and it is not renewed, the spaces in question are to be internally examined at annual intervals. ~~without dealing with is found, maintenance of class is to be made subject to the tanks in question being internally examined and gauged as necessary at annual intervals.~~

(~~iii~~e)When such conditions, in 2.6.4(d) above, are found in water ballast double bottom tanks, the spaces in question may be internally examined at annual intervals. ~~Also in case of double bottom tanks, Annual Surveys may have to carry out.~~

(f) In the case of dry cargo ships over 15 years old, other than bulk carriers subject to 2.12 or 2.15 or general dry cargo ships subject to 2.9 of this Chapter, an internal examination of selected cargo holds is to be carried out.

(g) In the case of ships over 10 years of age, other than ships engaged in the carriage of dry cargoes only or ships subject to 2.10(LGC), 2.11(OT), 2.13(CT), or 2.14(DHOT) of this Chapter, an internal examination of selected cargo spaces is to be carried out.

~~(c) In addition to the requirements in (a) and (b) above, the following requirements are also to be complied with for ships excluding oil tankers and bulk carriers over 15 years of age.~~

~~An internal examination of at least one forward and one after cargo holds is to be carried out. For the ship which has only two cargo holds, either one cargo hold is to be examined.~~

~~2.6.3 Additional ESP hull requirements for oil tankers including combination carriers~~

~~(a) For weather decks, an examination as far as applicable of cargo, crude oil washing, bunker, ballast, steam and vent piping systems on weather decks as well as vent masts and headers is to be carried out. If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure tested or thickness measured or both.~~

~~(b) Oil tankers of 5 < age ≤ 10~~

~~(i) For tanks used for salt water ballast, an overall survey of representative tanks selected by the Surveyor is to be carried out. If such inspections reveal no visible structural defects, the examination may be limited to a verification that the protective coating remains effective.~~

~~(ii) Where Poor coating condition, corrosion or other defects are found in salt water ballast tanks or where a protective coating has not applied from the time of construction, the examination is to be extended to other ballast tanks of the same type.~~

~~(iii) In salt water ballast tanks where a protective coating is found in Poor condition, it is not renewed, or where soft or semi-hard coating has been applied, or where a protective coating was not applied from the time of construction, the tanks in question is to be examined and thickness measurements carried out as considered necessary at annual intervals.~~

~~(c) Oil tankers of 10 < age ≤ 15~~

~~(i) The requirements of the intermediate enhanced survey are to be to the same extent as the previous Special Survey required in 2.7.5 and 2.1.5(a). However, pressure testing of tanks and cargo holds used for ballast is not required unless deemed necessary by the attending Surveyor.~~

~~(ii) In application of 2.6.3(c)(i) above the intermediate enhanced survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey.~~

~~(d) Oil tankers exceeding 15 years of age~~

~~(i) The requirements of the intermediate enhanced survey are to be to the same extent as the previous Special Survey required in 2.7.5 and 2.1.5(a). However, pressure testing of tanks and cargo holds used for ballast is not required unless deemed necessary by the attending Surveyor.~~

~~(ii) In application of (i) above the intermediate enhanced survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey.~~

~~(e) Survey programme~~

~~For ships age > 10 years, survey programme is to be carried out in accordance with 2.1.5 (a).~~

~~(f) Drydocking requirements~~

~~For ships age > 15 years, the ship is to be placed in a dry dock or upon a slipway and all items of 2.2.1 (a) through (f) are to be examined. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks are to be carried out in accordance with the applicable requirements for Intermediate Survey, if not already surveyed.~~

~~2.6.4 Additional ESP hull requirements for bulk carriers~~

~~(a) For bulk carriers of 5 < Age ≤ 10~~

~~(i) Ballast tanks~~

(1) For spaces used for salt water ballast, an overall survey of representative spaces selected by the Surveyor is to be carried out. If such inspections reveal no visible structural defects, the examination may be limited to a verification that the coating remains effective.

(2) Where Poor coating condition, corrosion or other defects are found in salt water ballast spaces or where protective coating was not applied from the time of construction, the examination is to be extended to other ballast tanks of the same type.

(3) In salt water ballast spaces other than double bottom tanks, where a protective coating is found in Poor condition and it is not renewed, where soft or semi-hard coating has been applied, or where a protective coating was not applied from the time of construction, the tanks in question are to be examined and thickness measurement carried out as considered necessary at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

(4) In addition to the requirements in (1) to (3) above, areas found to be Suspect Areas at the previous Special Survey are to be overall and close-up surveyed.

(ii) Cargo holds

(1) An overall survey of all cargo holds, including close-up survey of sufficient extent, minimum 25% of frames, is to be carried out to establish the condition of shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads in the forward cargo hold and one other selected cargo hold; and areas found to be Suspect Areas at the previous Special Survey.

(2) Where considered necessary by the Surveyor as a result of the overall and close-up survey, as described in (1) above, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of that cargo hold as well as a close-up survey of sufficient extent of all remaining cargo holds.

(iii) Extent of thickness measurements

(1) Thickness measurements is to be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey, as described in 2.6.4(a)(i) and 2.6.4(a)(ii). The minimum requirements for thickness measurements at the intermediate enhanced survey are areas found to be Suspect Areas at the previous Special Survey.

(2) Where Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements of Table I 2-4C.

(3) The thickness measurement may be dispensed with provided the Surveyor is satisfied with the close-up survey, that there is no structural diminution and the protective coating, where applied, remains effective.

(4) Where the protective coating in cargo holds is found to be in Good condition, the extent of close-up surveys and thickness measurements may be specially considered.

(b) For bulk carriers 10 < age ≤ 15

(i) The requirements of the intermediate enhanced survey are to be to the same extent as the previous Special Survey required in 2.7.5 and 2.1.5(a). However, pressure testing of tanks and cargo holds used for ballast is not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.6.4(b)(i) above the intermediate enhanced survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey.

(c) For bulk carriers of age > 15

(i) The requirements of the intermediate enhanced survey are to be to the same extent as the previous Special Survey required in 2.7.5 and 2.1.5(a). However, pressure testing of tanks and cargo holds used for ballast is not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.6.4(c)(i) above the intermediate enhanced survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey.

~~(d) Survey programme~~

~~For ships age > 10 years, survey programme is to be carried out in accordance with 2.1.5(a).~~

~~(e) Drydocking requirements~~

~~For ships age > 15 years, the ship is to be placed in a dry dock or upon a slipway and all items of Section 2.2.1 (a) through to (f) are to be examined.~~

~~The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and water ballast tanks are to be carried out in accordance with the applicable requirements for Intermediate Survey, if not already surveyed.~~

~~(f) Bulk carriers subject to IACS UR S31~~

~~Side shell frames of cargo holds bounded by a single side shell are to be assessed for compliance with the requirements of IACS UR S31 with revisions and steel renewal, reinforcement or coating, where required in accordance with IACS UR S31 with revisions is to be carried out.~~

2.6.5 Intermediate Survey – machinery

(a) At each Intermediate Survey, all the requirements for Annual Survey are to be complied with.

(b) For tankers, in addition to the above, insulation resistance of electrical circuits in dangerous spaces is to be measured. Consideration may be given to accept the recent readings by the crew.

2.6.6 Intermediate Survey – marine oil pollution prevention installations

Marine oil pollution prevention installations including operation tests as far as practicable are to be surveyed according to the IMO Resolution A.1053(27) – Guidelines for Surveys under Annex 1 of MARPOL 73/78 with its amendments. Surveys carried out by the National Authorities of the countries in which the ships are registered may be accepted as meeting these requirements.

~~2.6.7 Intermediate Survey – liquefied gas carrier~~

~~See 2.10.2.~~

~~2.6.8 Intermediate Survey – chemical carrier~~

~~See 2.11.2.~~

~~2.6.9 Intermediate Survey – general dry cargo ships~~

~~See 2.12.2.~~

~~2.6.10 Intermediate Survey – double hull oil tankers~~

~~See 2.13.2.~~

~~2.6.11 Intermediate Survey – passenger ships~~

~~See 2.14.2.~~

~~2.6.12 Intermediate Survey – double skin bulk carriers~~

~~See 2.15.2.~~

~~2.6.13 Barges – hull~~

~~In addition to the applicable requirements of 2.6.1, the Intermediate Survey is also to include the following:~~

~~(a) Salt water ballast spaces~~

~~In lieu of 2.6.1, an overall survey of three representative salt water ballast spaces including one rake tank and one upper wing tank, if applicable, and one additional space selected by the Surveyor.~~

~~(b) Deck cargo barges~~

~~At each Intermediate Survey after Special Survey No.3 – hull, in addition to the required salt water ballast spaces, at least two void spaces are to be examined internally, as considered necessary by the attending Surveyor.~~

~~(c) Dry cargo barges~~

~~At each Intermediate Survey after Special Survey No.3 – hull, in addition to the required salt water ballast spaces, at least two cargo holds are to be examined and dealt with, as deemed necessary by the attending Surveyor. Where extensive corrosion or structural damage is found, the remaining holds may also be required to be examined and dealt with.~~

~~(d) Oil/fuel oil tank barges and chemical tank barges – hull~~

~~At each Intermediate Survey after Special Survey No.2 – hull, in addition to the required salt water ballast spaces, at least three cargo tanks: one center tank, one port wing tank and one starboard wing tank, are to be examined internally and dealt with, as deemed necessary by the attending Surveyor. Thickness gauging and means of access to the upper part of the tanks may be required. Where extensive corrosion or structural damage is found, the remainder of the cargo tanks may be required to be examined.~~

~~2.6.14 Fishing ships – hull~~

~~In addition to the applicable requirements of 2.6.1, at each Intermediate Survey after Special Survey No.3 – Hull, an overall survey of at least two of the fish holds.~~

## 2.7 Special Surveys

Procedures for class related services, see 2.1.4 of this Chapter.

Provision for surveys, see 2.1.5 of this Chapter. A survey planning meeting is to be held prior to the commencement of the survey, see 2.1.6(b) of this Chapter.

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

2.7.1 Special Survey - hull

All Annual Survey requirements together with the following are to be complied with:

(a) The examinations of the hull are to be supplemented by thickness measurements and testing as required in 2.7.1(j) ~~2.2.11~~ and 2.7.1(k) ~~2.2.12,~~ , ~~deemed necessary,~~ to ensure that the structural integrity remains effective. The aim of the examination is ~~and are to be sufficient~~ to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.
~~The close ceiling in holds of single bottom ships is to be lifted to such an extent that at least two strakes on each side (one strake being at the bilge) and all portable hatches in holds and flooring plates in machinery and boiler spaces are to be removed for examination of the structure below. Where a double bottom is fitted, a sufficient ceiling is to be lifted from the inner bottom to enable the Surveyors to satisfy themselves as to the condition of the tank top plating, and if necessary, all ceiling is to be removed for ascertaining the condition. The cement or other composition on the inner space of the bottom plating is to be carefully examined. The removal of this covering may be dispensed with provided that it is tested by beating or chipping, and found sound and adhering satisfactorily to the steel plating.~~

(~~k~~b) A Bottom Survey in dry dock in accordance with the requirements of 2.2.1 of this Chapter ~~Part~~ is to be carried out as part of the Special Survey.

~~(b) Internal examinations of spaces and tanks~~

~~(i) At Special Surveys, paying due attention to (1) through (8) below, examinations of structures and fittings such as piping, etc. in tanks and spaces are to be carried out carefully.~~

~~(1) Structural members, piping, hatch covers, etc. sensitive to corrosion in the cargo holds where high corrosive cargoes to steel such as logs, salt, coal, sulfide ore, etc. have been loaded.~~

~~(2) Portions sensitive to wearing down by heat such as plating under boilers.~~

~~(3) Structurally discontinuous portions such as corners of hatchway openings on deck, openings including side scuttles, cargo port, etc. on shell.~~

~~(4) Condition of coating and corrosion prevention system if applied.~~

~~(5) Condition of striking plates under sounding pipes.~~

~~(6) Condition of cement or deck composition, if fitted.~~

~~(7) Locations on which defects such as cracking, buckling, corrosion, etc. have been found in similar ships or similar structures.~~

~~(8) Critical structural areas which may effect the strength and structural are to be examined.~~

~~(ii) At Special Surveys, paying attention to 2.7.1(b)(i) above, internal examinations of tanks or spaces listed in Table I 2-1A are to be carried out. In case where postponement of the Special Survey, a kind of the Special Survey to be applied to the ship is to be determined based on the original expiry date of the Certificate of Classification of the ship.~~

~~(iii) At Special Surveys for tankers, in addition to (i) and (ii) above, an internal examination of tanks and spaces listed in Table I 2-1B is to be carried out.~~

~~(iv) At Special Surveys for bulk carriers, in addition to (i) and (ii) above, an internal examination of tanks and spaces listed in Table I 2-1C is to be carried out.~~

(~~f~~c) ~~The equipment required by the Rules is to be verified.~~ The anchors and chain cables are to be ranged, examined and the required complement and condition verified. The chain locker, holdfasts, hawse pipes and chain stoppers are to be examined and pumping arrangements of the chain locker tested.

At Special Survey No. 2 and subsequent Special Surveys, chain cables are to be gauged and renewed in cases where their mean diameter is 12% worn below the requirement limits allowed by the Society.

(d) All spaces including holds and their 'tween decks where fitted; double bottom, deep, ballast, peak and cargo tanks; pumprooms, pipe tunnels, duct keels, machinery spaces, dry spaces, cofferdams and voids are to be internally examined including the plating and framing, bilges and drain wells, sounding, venting, pumping and drainage arrangements.

Internal examination of fuel oil, lube oil and fresh water tanks is to be carried out in accordance with Table I 2-1.

At Special Survey No.3 and subsequent Special Surveys, structural downflooding ducts and structural ventilation ducts are to be internally examined.

(~~j~~e) Engine room structure is to be examined. Particular attention is to be given to tank tops, shell plating in way of tank tops, brackets connecting side shell frames and tank tops, and engine room bulkheads in way of tank top and bilge wells. Particular attention is to be given to the sea suctions, sea water cooling pipes and overboard discharge valves and their connections to the shell plating. Where wastage is evident or suspect, thickness measurements are to be carried out, and renewals or repairs made when wastage exceeds allowable limits.

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

(g) When such breakdown of hard protective coating is found in double bottom ballast tanks and it is not renewed, where a soft or semi-hard coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

(~~e~~h) Extent of Tank Testing

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

(ii) Boundaries of fuel oil, lube oil and fresh water tanks are to be tested with a head of liquid to the highest point that liquid will rise under service conditions.

(iii) Tank testing of fuel oil, lube oil and fresh water tanks may be specially considered based on a satisfactory external examination of the tank boundaries, and a confirmation from the Master stating that the pressure testing has been carried out according to the requirements with satisfactory results. The Surveyor may extend the testing as deemed necessary.

~~At Special Surveys, a pressure test of tanks is to be carried out according to (1) through (3) below.~~

~~(1) A pressure test is to be carried out under the pressure as specified below:~~

~~For tanks: the pressure corresponding to the maximum head that can be experienced in service.~~

~~For piping: the working pressure.~~

~~(2) A pressure test of tanks may be carried out when the ship is afloat, provided that an internal examination of bottom of the tank is also carried out afloat.~~

~~(3) At Special Surveys for ships having many water tanks and oil tanks, some water tanks or oil tanks may be exempted from a pressure test where deemed appropriate by the Surveyor taking account of present ship's condition, ship's age and an interval from the previous testing.~~

~~(ii) At Special Surveys for cargo ships, a pressure test is to be carried out according to 2.7.1(c)(i) above for tanks listed in Table I 2-2A (Requirements of Pressure Tests at Special Survey for Cargo Ships), and Table I 2-2B (Minimum Requirements of Pressure Test at Special Survey of Oil Tankers, Ore/Oil Carriers and etc.), and Table I 2-2C (Requirements of Pressure Tests at Special Survey of Bulk Carriers).~~

~~(d) Decks, casings and superstructures are to be examined, especially the corners of openings and other discontinuities in way of strength decks and top sides. Wood decks or sheathings are to be examined and sections to be removed to ascertain the condition of the plating if found not adhering closely to the plating.~~

(i) Hatch covers and coamings are to be surveyed as follows:

(i) A thorough inspection of the items listed in 2.5.1(a), including close-up survey of hatch cover plating and hatch coaming plating, is to be carried out.

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

(ii) ~~Random~~ Checking of the satisfactory operation of all mechanically operated hatch covers is to be made, including:

(1) Storage and securing in open condition;

(2) Proper fit and efficiency of sealing in closed condition;

(3) Operational testing of hydraulic and power components, wires, chains, and link drives;

(iii) Checking the effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent is to be carried out.

(~~e~~j) Thickness measurements are to be carried out in accordance with Table I 2-3A. The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to determine areas of substantial corrosion. Table I 2-4A may be used as guidance for these additional thickness measurements. These extended thickness measurements are to be carried out before the survey is credited as completed.
~~The requirements for thickness measurement are given in Table I 2-3A and the structural members in any locations proved to be rapidly wasted or showing excessive corrosion are to be measured in accordance with the requirements of Table I 2-4A which is to be carried out by an appropriate ultrasonic equipment or other approved means.~~

~~(f) The equipment required by the Rules is to be verified. The anchors and chain cables are to be ranged, examined and the required complement and condition verified. The chain locker holdfasts, hawse pipes and chain stoppers are to be examined and pumping arrangements of the chain locker tested.~~

(~~g~~k) All bilge and ballast piping systems are to be examined and operationally tested to working pressure to the attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory.

(l) For all ships except for passenger ships, automatic air pipe heads are to be completely examined (both externally and internally) as indicated in Table I 2-~~28~~23.
For designs where the inner parts cannot be properly inspected from outside, this is to include removal of the head from the air pipe. Particular attention is to be paid to the condition of the zinc coating in heads constructed from galvanized steel.

(~~h~~m) When spaces are insulated in connection with refrigeration, hatches and limbers are to be removed and the condition of the structural members examined.

~~(i) Hatch covers and coamings are to be examined as follows:~~

~~(i) A thorough inspection of the items listed in 2.5.1(a) 3.2.3 is to be carried out.~~

~~(ii) Random checking of the satisfactory operation of mechanically operated hatch covers is to be made, including:~~

~~(1) Storage and securing in open condition;~~

~~(2) Proper fit and efficiency of sealing in closed condition;~~

~~(3) Operational testing of hydraulic and power components, wires, chains, and link drives;~~

~~(iii) The effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent is to be checked.~~

~~(j) Engine room structure is to be examined. Particular attention is to be given to tank tops, shell plating in way of tank tops, brackets connecting side shell frames and tank tops, and engine room bulkheads in way of tank top and bilge wells. Where wastage is evident or suspect, thickness measurements are to be carried out, and renewals or repairs made when wastage exceeds allowable limits.~~

~~(k) A Bottom Survey in dry dock in accordance with the requirements of 2.2.1 of this Part is to be carried out as part of the Special Survey.~~

~~(l) For all ships except for passenger ships, automatic air pipe heads are to be completely examined (both externally and internally) as indicated in Table I 2-28.
For designs where the inner parts cannot be properly inspected from outside, this is to include removal of the head from the air pipe. Particular attention is to be paid to the condition of the zinc coating in heads constructed from galvanized steel.~~

~~(m) Survey programme~~

~~Survey programme is to be carried out for ESP ships in accordance with 2.1.5(a).~~

(n) Gangways, accommodation ladders with accessory wires, winches and gears are to be load tested and operationally tested with maximum operational load.

(o) Bow doors, inner doors, side shell doors and stern doors are to be surveyed as per Special Survey, see IACS UR Z24-3.

~~2.7.2 Special Survey No.2 – hull~~

~~All items specified in 2.7.1 together with the following are to be complied with:~~

~~(a) A sufficient amount of ceiling in the holds is to be lifted from bilges and satisfy themselves as to the condition of the structure in bilge, the inner bottom plating, the pillar feet, the lower end plating of bulkheads and the tunnel side. In ships having a single bottom, the close ceiling in holds is to be lifted to such an extent that at least 3 strakes on each side (one strake being at the bilge) and all portable hatches in holds and flooring plates in machinery and boiler spaces are to be removed for examination of the structure below. But in either case the whole of the ceiling may be lifted for examination of the structure below when considered necessary by the Surveyor.~~

~~(b) The requirements with regard to internal examination, thickness measurement and tank pressure testing same as those stated in 2.7.1(b), (c) and (e) are to be complied with.~~

~~(c) 2.2.4 The anchors and chain cables are to be ranged, examined and the required complement and condition verified. The chain locker, holdfasts, hawse pipes and chain stoppers are to be examined and pumping arrangements of the chain locker tested. At Special Survey No. 2 and subsequent Special Surveys, chain cables are to gauged and renewed in cases where their mean diameter is 12% worn below the requirement limits allowed by the Society.~~
~~Chain cables are to be ranged out and examined, and chain lockers examined internally. When any length of a chain cable is so worn that its mean diameter is 12% below the requirement, it is to be renewed.~~

~~2.7.3 Special Survey No.3 – hull~~

~~All items specified in 2.7.2 together with the following are to be complied with:~~

~~(a) A sufficient amount of ceiling and lining in the holds and flooring plates in the machinery spaces are to be removed as required by the Surveyor. The ship is to be made free from rust inside and outside in order to expose for examination of the framing and plating together with discharges, scuppers, air and sounding pipes, and the structure is to be examined.~~

~~(b) Wood sheathing and deck composition on steel decks are to be removed as required by the Surveyor and plating below examined. Cement chocks on the ship's sides at bilges and decks are to be examined, and portions of them removed so that the condition of the shell plating and adjacent steel work can be ascertained.~~

~~(c) The lining in way of side scuttles is to be removed as required by the Surveyor, and the shell plating examined.~~

~~(d) The requirements with regard to internal examination, thickness measurement and tank pressure testing same as those stated in 2.7.1(b), (c) and (e) are to be complied with.~~

~~2.7.4 Special Survey No.4 and subsequent – hull~~

~~In addition to all items specified in 2.7.3 the requirements with regard to internal examination, thickness measurement and tank pressure testing same as those stated in 2.7.1(b), (c) and (e) are to be complied with.~~

~~2.7.5 Special Survey - additional ESP hull requirements for oil tankers (combination carrier included)/bulk carrier~~

~~(a) General~~

~~(i) All cargo tanks/holds, ballast tanks, pump rooms (for tankers), pipe tunnels, cofferdams and void spaces bounding cargo tanks/holds, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing as deemed necessary, to ensure that the structural integrity remains effective. The examination is to be sufficient to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration.~~

~~(ii) For both bulk carriers and oil tankers, all piping systems on weather deck and in the above tanks and spaces and only for oil tankers, cargo piping on deck, including crude oil washing (COW) piping, are to be examined and operationally tested under working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory. When considered necessary by the Surveyor pressure tests and gauging for pipings are to be carried out and results of the gauging are to be reported. For oil tanker, special attention is to be given to any ballast piping in cargo tanks and any cargo piping in ballast tanks and void spaces, and Surveyors are to be advised on all occasions when this piping, including valves and fittings are open during repair periods and can be examined internally.~~

~~(iii) The survey extent of combined ballast/cargo oil tanks or combined ballast cargo holds is to be evaluated based on the records of ballast history and the condition of the corrosion prevention system provided and extent of corrosion found.~~

~~(iv) The survey extent of ballast tanks converted to void spaces is to be specially considered in relation to the requirements for ballast tanks.~~

~~(b) Tank corrosion prevention system~~

~~Where provided, the condition of coating or corrosion prevention system of ballast tanks and cargo tanks is to be examined. For salt water ballast tanks, excluding double bottom tanks of bulk carriers, where a protective coating is found in Poor condition and it is not renewed, where soft or semi-hard coating has been applied or where a protective coating was not applied from the time of construction, the tanks in question are to be examined at annual intervals. Thickness measurement is to be carried out as considered necessary. When such breakdown of coating is found in salt water ballast double bottom tanks and it is not renewed, where a soft or semi-hard coating has been applied, or where a coating was not applied from the time of construction the tanks in question are to be examined at annual intervals. Thickness measurement is to be carried out as deemed necessary by the Surveyor.~~

~~(c) Extent of overall and close-up surveys~~

~~(i) An overall survey of all tanks and spaces except fresh water, fuel oil, diesel oil and lubricating oil tanks is to be carried out. Fresh water, fuel oil, diesel oil and lubricating oil tanks are to be dealt with according to the requirements of~~

~~Table I 2-1A (Minimum Requirements for Internal Examination at Hull Special Surveys),~~
~~Table I 2-1B (Additional Requirements of Internal Examinations for Oil Tankers), and~~
~~Table I 2-1C (Additional Requirements of Internal Examinations for Bulk Carrier).~~

~~(ii) For the purpose of establishing the condition of internal members in cargo tanks/holds and ballast tanks, the requirements for the close-up survey are given in~~

~~Table I 2-5A (Minimum Requirements for Close-up Surveys at Hull Special Survey of Oil Tankers, Ore/Oil Carriers and etc.) and~~
~~Table I 2-5B (Minimum Requirements for Close-up Surveys at Hull Special Survey of Bulk Carriers).~~

~~(iii) For oil tankers, the Surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also in the following cases:~~

(1) in particular, tanks having structural arrangements or details which have suffered defects in similar tanks or on similar ships according to an available information;

(2) in tanks which have structures with reduced scantlings in association with a corrosion prevention system approved by the Society.

(iv) For areas in spaces where coatings are found to be in a Good condition, the extent of close-up surveys according to Table I 2-5A and Table I 2-5B may be specially considered by the Surveyor.

(d) Extent of thickness measurement

(i) The requirements for thickness measurements are given in Table I 2-3B (Minimum Requirements for Thickness Measurements at Hull Special Survey of Oil Tankers, Ore/Oil Carriers and etc.), and Table I 2-3C (Minimum Requirement for Thickness Measurement at Hull Special Surveys of Bulk Carriers).

(ii) For bulk carriers, representative thickness measurement to determine both general and local levels of corrosion in the shell frames and their end attachments in all cargo holds and ballast tanks is to be carried out. Thickness measurement is also to be carried out to determine the corrosion levels on the transverse bulkhead plating. The thickness measurement may be dispensed with provided the Surveyor is satisfied with the close up examination, that there is no structural diminution, and the protection coating where applied remains efficient.

(iii) The Surveyor may extend the thickness measurement as deemed necessary. Where Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements of

Table I 2-4B (Requirements for Extent of Thickness Measurement in way of Substantial Corrosion at Hull Special Survey of Oil Tankers, Ore/Oil Carriers and etc. within the Cargo Tank Length) and Table I 2-4C (Requirements for Extent of Thickness Measurement in way of Substantial Corrosion at Hull Special Survey of Bulk Carriers within the Cargo Area.), and may be additionally specified in planning document as described in 2.1.5(a).

(iv) For areas in spaces where coatings are found to be in a Good condition, the extent of thickness measurements according to Table I 2-3B and I 2-3C may be specially considered by the Surveyor.

(v) Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

(vi) For oil tankers,

(1) Transverse sections are to be chosen such that thickness measurements can be taken for as many different tanks in corrosive environments as possible, e.g. ballast tanks sharing a common plane boundary with cargo tanks fitted with heating coils, other ballast tanks, cargo tanks permitted to be filled with sea water and other cargo tanks, and are to be clear of areas which have been locally renewed or reinforced;

(2) In cases where two or three sections are to be measured, at least one includes a ballast tank within 0.5L amidships;

(3) However, ballast tanks sharing a common plane boundary with cargo tanks fitted with heating coils and cargo tanks permitted to be filled with sea water are to be selected where present;

(4) The thickness of each component is to be determined by averaging all of the measurements taken in way of the transverse section on each component;

(5) Where one or more of the transverse sections are found to be deficient in respect of the longitudinal strength, the number of transverse sections for thickness measurement is to be increased such that each tank within the 0.5L amidships region has been sampled. Tank spaces that are partially within, but extend beyond the 0.5L region, are to be sampled; and

(6) Additional thickness measurements are also to be performed on one transverse section forward and one aft of each repaired area.

(e) Extent of tank pressure testing

(i) The requirements for tank pressure testing are given in Table I 2-2B.

Cargo tank testing of oil tankers carried out by the vessel's crew under the direction of the Master may be accepted by the Surveyor provided the following conditions are complied with:

~~(1) A tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the owner and reviewed by this Society prior to the testing being carried out;~~

~~(2) There is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;~~

~~(3) The tank testing has been satisfactorily carried out within Special Survey window not more than 3 months prior to the date of the survey on which the overall or close-up survey is completed;~~

~~(4) The satisfactory results of the testing is recorded in the vessel's logbook;~~

~~(5) The internal and external condition of the tanks and associated structure are found satisfactory by the Surveyor at the time of the overall and close up survey.~~

~~(ii) The Surveyor may extend the tank pressure testing as deemed necessary.~~

~~(iii) Tanks are to be tested with a head of liquid to the top of hatches for cargo holds, ballast/cargo holds or top of air pipes for ballast tanks or oil tanks, if this gives a higher pressure.~~

2.7.~~6~~2 Special Survey–machinery

(a) Pumps and the pumping system including valves, cocks, pipes and strainers are to be examined. For hydraulic power units, records of hydraulic oil replacement are to be checked. Oil samples for analysis may be required at the discretion of the Society. Other systems are to be tested if considered necessary.

(b) All shafts (except propeller and stern tube shafts which are detailed in propeller shaft survey), thrust blocks, line shaft bearings are to be opened up for examination. The lower halves of bearings need not be exposed if alignment and wear are found acceptable.

(c) Steering machinery including auxiliary arrangement is to be examined and operation tested. The machinery may be opened up for examination if deemed necessary by the Surveyor.

(d) Holding down bolts and chocks of main and auxiliary engines and shafting bearing blocks are to be examined.

(e) All air vessels for essential services, together with their mountings, valves and safety devices, are to be cleaned internally, and examined internally and externally. If internal examination of the air vessels is not practicable, they are to be tested hydraulically to at 1.25 times the working pressure. Safety valves setting are to be checked.

(f) Fuel tanks which do not form part of ship's structure together with their fittings are to be examined and, if deemed necessary by the Surveyor, they are to be tested as specified for new tanks.

(g) The reduction gears are to be examined, and opened up if deemed necessary by the Surveyor, in order to confirm the condition of the gears, pinions, gear teeth, spiders, shafts, bearings and lubrication system. Alternative means of accertaining the condition of epicyclic gearing will be specially considered.

(h) The machinery and heat exchangers which are not included in the boiler survey requirements are to be examined and opened up for further examination if deemed necessary by the Surveyor.

(i) The windlass and mooring winches are to be examined including operation test. They are to be opened up for examination if deemed necessary by the Surveyor.

(j) The bilge system including valves, cocks, strainers and bilge injections are to be opened up for examination if deemed necessary by the Surveyor. The system is to be tested in working condition.

(k) Air compressor of essential services is to be opened up for examination. Safety valve setting is to be checked.

(l) Evaporators are to be opened up and examined. Safety valve settings are to be checked.

(m) Main and auxiliary engines are to be tested in working condition if deemed necessary by the Surveyor.

(n) Engine room remote control quick closing valves are to be opened up, examined and tested in working condition.

(o) Feed pumps, burning pumps and boiler water circulating pumps for boilers are to be opened up and examined.

(p) Steam turbines

In addition to the foregoing items (a) to (o) of 2.7.2 above, steam turbines used as main and auxiliary engines are to be examined as follows:

(i) Steam turbine blades, rotors, stop valves, shafts glands, thrust and adjusting bearings together with oil drains and sealing pipes are to be examined.

(ii) Exhaust steam turbines, gears, clutches, and electric motors are to be opened up and examined; coned ends of internal driving shafts are to be examined.

(iii) For main steam pipes, a selected section is to be removed and examined when they are 12 years old and thenceforth at each Special Survey. Sufficient lagging is to be removed for examination and hydraulically tested to twice the working pressure. When deemed necessary by the Surveyor the thickness of pipes is to be ascertained to determine the future working pressure.

(iv) Condensers are to be examined and tested if repaired.

(v) Safety devices are to be examined and tested.

(q) Diesel engine

(i) In addition to the foregoing items (a) to (o) of 2.7.2 above, diesel engines used as main and auxiliary engines are to be examined as follows:

Cylinders, covers, valves and valve gears, pistons, piston rod, crossheads, guides, connecting rods, crankshafts and all bearings, crankcases, bed-plates, entablatures, crankcase door fastenings and explosion relief devices, scavenge pumps, scavenge blowers, superchargers and their associated coolers, air compressors and their intercoolers, filters and/or separators and safety devices, fuel injection pumps and fittings, camshaft drives and balancer units, torsional vibration dampers or de-tuners, flexible couplings, clutches, reverse gears, attached pumps and cooling arrangements are to be examined.

Special consideration as to the requirements for Special Surveys may be given for diesel engines with bores 300 mm or under, provided the engine is maintained under a manufacturer's scheduled maintenance program.

(1) The records of the program, including lubrication servicing, are to be made available to the Surveyor. Periodical overhauls, required by the manufacturer's scheduled maintenance program, are to be witnessed by the Surveyor.

(2) For ships not engaged in international voyages, the survey may be carried out by reviewing the records of the program and other effective means, such as the verification runs specified in (s) of 2.7.2 below, to confirm that engines are in good order. Periodical overhauls, required by the manufacturer's scheduled maintenance program, are to be witnessed by the Surveyor.

(ii) Tie rods are to be re-tensioned, as necessary. Engine entablature bolting is to be checked for tightness, and crankshaft deflections of medium-speed and low-speed type engines are to be measured and placed in good order.

(r) Electrical installations.

(i) The survey is to comprise examination of the electrical installation with regard to fire and explosion hazards and injury from accidental touching. The survey is also to include testing of correct functioning of equipment covered by the requirements of the Rules.

(ii) As far as practicable, the following equipment is to be examined for satisfactory condition:

(1) Main and emergency switchboards.

(2) Generators.

(3) Distribution boards.

(4) Motor starters.

(5) Electrical motors.

(6) Converters (e.g. transformers, rectifiers, chargers).

(7) Cable installations.

(8) Enclosures for electrical equipment.

(9) Lighting equipment.

(10) Heating equipment.

(11) Battery installation.

(iii) The following are to be tested to the extent deemed necessary by the Surveyor to ascertain the proper functioning of the equipment:

(1) Generator load test.

(2) Generator parallel operation.

(3) Generator protection relays.

(4) Generator remote speed control.

(5) Generator synchronizing equipment.

(6) Power plant interlocking systems.

(7) Insulation resistance indicating device.

(8) Emergency generator including switchboard.

(9) Battery chargers.

(10) Mechanical ventilation of battery rooms /lockers.

(11) Navigation lights, with controllers including alarms.

(iv) Measurements of insulation resistance on main and emergency switchboards, generators, exciters, propulsion motors if the ship is of electrical propulsion and all electrical installations and their wiring are to be performed as follows:

| Part to be tested | Insulation resistance | |
|---|---|---|
| Switchboard with all out-going circuit breakers and switches opened, and control and measuring instrument disconnected | Between each busbar, and busbar to hull | 1 megohm |
| Generator and motor | Each generator or motor to hull | 1,000 times the rated voltage of the machine in ohms |
| All wiring measured from switchboard with circuit breakers and protective devices closed, except those of the generator | Between each conductor and conductor to hull | 100,000 ohms |

(v) Tests of emergency stopping means of all oil transfer systems, and boiler and engine room ventilations are to be performed.

(vi) For the main electric propelling machinery, windings, commutators and slip-rings, all air ducts in stator coil and ventilating holes in rotors are to be examined.

(s) Machinery verification runs for ships not engaged in international voyages

As part of the Special Survey of Machinery, a dock trial in the presence of the Surveyor is to be carried out in order to confirm satisfactory operation of main and auxiliary machinery. A sea trial may be carried out if deemed necessary by the Surveyor.

If significant repairs are carried out to main or auxiliary machinery or steering gear, consideration should be given to a sea trial to the satisfaction of the Surveyor.

2.7.~~7~~3 Special Survey – **CAS**

The following are to be performance tested and placed in order:

(a) Main propulsion machinery and controllable pitch propellers
  (i) Change-over devices of control positions between main control station and local control station.
  (ii) Safety devices.

(b) Boilers
  (i) Automatic and remote control systems.
  (ii) Safety devices.

(c) Electric generating sets
  (i) Automatic and remote control systems.
  (ii) Safety devices.

(d) Automatic change-over devices (or remote start/stop devices) of essential pumps and automatic starting devices (or remote start/stop devices) of air compressors.

(e) Alarm systems
  (i) Function of alarm systems and indicator devices.
  (ii) Confirmations of setting points of alarms.

(f) Remote control and monitoring systems

2.7.~~8~~4 Special Survey – **CAU**, **CAB**

The following are to be performance tested and placed in order:

(a) Main propulsion machinery and controllable pitch propellers
  (i) Change-over devices of control positions between navigation bridge and main control station and between main control station and local control station, or between main monitoring and control station on bridge and local station or sub-control station.
  (ii) Safety devices.

(b) Boilers
  (i) Automatic and remote control systems.
  (ii) Safety devices.

(c) Electric generating sets
  (i) Automatic and remote control systems.
  (ii) Safety devices.
  (iii) Automatic start of stand-by power supply unit after black-out, where applicable.

(d) Automatic change-over devices of essential pumps and automatic starting devices (or remote start/stop devices) of air compressors.

(e) Communication systems specified in 2.9 of Part VIII of the Rules.

(f) Alarm systems

(i) Function of alarm systems and indicator devices.

(ii) Confirmations of setting points of alarms.

(g) Remote control and monitoring systems

Where considered necessary by the Surveyor, sea trials may be required upon completion of the above mentioned tests.

2.7.~~9~~5 Special Survey – marine oil pollution prevention installations

Marine oil pollution prevention installations including operation tests as far as practicable are to be surveyed according to the IMO resolution A.1053(27) – Guidelines for Surveys under Annex I of MARPOL 73/78 with its amendments. Surveys carried out by the National Authorities of the countries in which the ships are registered may be accepted as meeting these requirements.

~~2.7.10 Special Survey – cargo refrigerating machinery appliances, See 2.8.2.~~

~~2.7.11 Special Survey – inert gas system, See 2.9.2.~~

~~2.7.12 Special Survey – liquefied gas carrier, See 2.10.3.~~

~~2.7.13 Special Survey – chemical carrier, See 2.11.3, 2.11.4, and 2.11.5.~~

~~2.7.14 Special Survey – general dry cargo ships, See 2.12.3.~~

~~2.7.15 Special Survey – double hull oil tankers, See 2.13.3.~~

~~2.7.16 Special Survey – passenger ships, See 2.14.2.~~

~~2.7.17 Special Survey – double skin bulk carriers, See 2.15.3.~~

~~2.7.18 High speed craft – hull~~

~~In addition to the applicable requirements of 2.7.1, 2.7.2, 2.7.3 and 2.7.4, the Special Survey is also to include the following requirements for craft of FRP construction:~~

~~(a) Engine foundations and their attachments to the hull are to be examined.~~

~~(b) A minimum of five plugs, each 50 mm in diameter, are to be removed from the hull bottom and topsides from locations deemed appropriate from the attending Surveyor and examined for core to skin adhesion and water permeation.~~

*Section 2.8 has been deleted as follows:*

## ~~2.8 Surveys of Refrigerated Cargo Installations~~

~~2.8.1 Annual Surveys~~

~~(a) Where practicable, the entire refrigerating machinery is to be examined under working condition on the ship's arrival at the port of discharge before the refrigerated cargo is unloaded. Log books or other records are to be examined and any breakdown or malfunctions of the refrigerating plant in the past are to be noted and reported to the Surveyor.~~

~~(b) Cargo chambers are to be examined throughout to check that insulation linings, fastenings as well as sheathings on decks, tank tops and tunnel tops are free from damages, and airtight. Where the insulation deficiency is known or suspected, the removal or boring of the insulation may be required by the Surveyor in order to determine fullness and dryness; test holes are to be properly closed thereafter.~~

~~(c) Air trunks and casing for air ducts and coolers, and fastenings and supports for ducts, grids and meat rails, etc. are to be examined as far as practicable for damage or deterioration.~~

~~(d) Hatch covers and seals, doors and frames of cargo or cooler spaces, covers of bilges and manholes, air refreshing ducts and their closing appliances as well as thermometer tubes with their connections and fastenings are to be examined to see that they are in good condition and airtight.~~

~~(e) Bilges are to be cleaned and suction pipes, suction rose boxes, sounding pipes as well as liquid sealed traps and non return valves for chamber drainage examined to ascertain that all sounding and drainage devices are in efficient working condition.~~

~~(f) Cooling grids, air cooler coils and air cooler drip pans with drainage are to be examined to ascertain that they are clean and in good working order.~~

~~(g) Brine coils and grids and brine return tanks, together with valves and fittings are to be examined under working condition.~~

~~(h) Primary refrigerant cooler coils and cooling grids together with valves and fittings are to be examined under working condition.~~

~~(i) Shells of shell and tube and double pipe type condensers and evaporators, separators, receivers, filters, driers, coil terminals of coil in casing type condensers and evaporators and other pressure vessels as well as primary refrigerant gas and liquid piping, headers, condenser cooling water piping and valves are to be examined externally as far as practicable.~~

~~(j) Thermometers concerned are to be examined. The Surveyor may request one or more thermometers to be calibrated by a competent person.~~

~~(k) A general examination is to be made of refrigerant compressors, condenser cooling water pumps, brine and primary refrigerant circulating pumps, air circulating fans together with their motors, control gears and cables and the insulation resistance measured. The acceptable insulation resistance measured is to be shown in 2.7.6(r) of this Part. The results of insulation resistance measuring carried out by a competent person may be acceptable at the discretion of the Surveyor.~~

~~(l) The generating plant supplying electric power to the refrigerating machinery is to be examined generally with a view to ascertaining that the plant is being efficiently maintained.~~

~~2.8.2 Special Survey~~

~~(a) Special Survey No.1~~

~~In addition to the requirements of Annual Surveys as detailed in 2.8.1 above the following are to be complied with:~~

~~(i) All refrigerant compressors together with their prime movers are to be opened up for examination. Relief devices, suction filters and lubricating arrangements are also to be examined.~~

~~(ii) Water end covers of shell-and-tube and double-pipe type condensers are to be removed for examination of tubes, tube plates and covers.~~

~~(iii) Condenser cooling water pumps, including the reserve pump which may be used for other services, as well as brine and primary refrigerant circulating pumps are to be examined under working condition and if deemed necessary by the Surveyor, these pumps may be opened up for examination.~~

~~(iv) Brine coils and grids are to be hydraulically tested for tightness to a pressure of 1.5 times the working pressure or 0.4 MPa, whichever is the greater.~~

~~(v) Primary refrigerant cooler coils and cooling grids together with valves and fittings, gas condensers, evaporators and receivers are to be leak tested for tightness when under the refrigerant pressure prevailing the system with the refrigerating machinery at rest and the regulating valves opened sufficiently to obtain an approximate balance of pressure throughout the system.~~

~~(vi) The Surveyor is to satisfy himself that all pressure relief valves and safety discs throughout the refrigerating machinery and appliances are in good order.~~

~~(vii) At exposed places a sufficient amount of the insulation of refrigerant and brine pipes is to be removed and pipes examined, if deemed necessary by the Surveyor.~~

~~(b) Subsequent Special Surveys~~

~~In addition to the requirements for Special Surveys No.1 as defined in 2.8.2(a) above, the following are to be complied with:~~

~~(i) Coils of coil in casing condensers and evaporators are to be removed for examination and pressure tested to a pressure as specified in 4.17 of Part X or their relief valve setting pressure, whichever is the smaller, to prove tight. Where it is impracticable to remove the coils they may be examined from inspection holes and pressure tested in place.~~

~~(ii) Shell and tube condensers and evaporators are to have end covers removed and to be pressure tested under the same pressure as that required in (i) above.~~

~~(iii) Where brine or water is used for sub-cooling the primary refrigerating liquid in heat exchangers of the shell and tube type, the heat exchangers are to be examined and pressure tested in the same manner as that required for condensers in (ii) above. Double pipe type heat exchangers are to be examined as far as practicable with the refrigerant gas piping under the same pressure as that required for condensers in (ii) above. Other types of heat exchangers using brine or water are to be examined and pressure tested at the discretion of the Surveyor according to the design of such equipment.~~

~~(iv) Primary refrigerant cooling grids or air cooler coils in the refrigerated chamber are to be pressure tested in place under a pressure as specified in 4.17 of Part X.~~

~~2.8.3 Loading port surveys~~

~~(a) When a loading port certificate is required by the owner or his representative, a survey as detailed in (d) hereunder is to be carried out at the loading port.~~

~~(b) In the case of ships engaged on voyages of less than 2 months duration, a Loading Port Certificate is to be considered valid for 2 months, provided cargoes carried are such a nature as not to damage the insulation or appliances in refrigerated chambers, nor to affect by taint or mould refrigerated cargoes loaded during that period.~~

~~(c) If the ship loads at more than one port, one survey only at the first loading port is to be required, provided it includes the examination of all refrigerated chambers which are to be used for refrigerated cargo during the voyage and general cargo is not subsequently carried in any of the chambers prior to loading the refrigerated cargo.~~

~~(d) Requirements of loading port survey are to be as follows:~~

~~(i) Refrigerated chambers are to be examined in any empty state to ascertain that they are cleaned and free of odour which may adversely affect the cargo to be loaded.~~

~~(ii) Brine or other refrigerant pipe grids, cooler coils and connections are to be examined to ascertain that they are free from leakage.~~

~~(iii) Wood sheathings and cargo battens are to be examined to ascertain that they are well fitted in position.~~

~~(iv) Insulation and linings are to be examined to ascertain that no damage has been sustained prior to the loading of the refrigerated cargo.~~

~~(v) Scuppers and bilge suctions draining refrigerated chambers are to be examined to ascertain that they are in good working order, and that liquid sealed traps are primed.~~

~~(vi) The refrigerating machinery is to be examined under working condition, and temperatures in the refrigerated chambers are to be noted.~~

~~(e) Where any repair is deemed necessary by the Surveyor, it is to be carried out immediately to his satisfaction before the new cargo is loaded. Any indication of defective insulation not considered to warrant immediate attention is to be noted and specially reported.~~

*Section 2.16 has been renumbered and amended as follows:*

## 2.~~16~~8 Classification Survey of Ships not Built under Survey

2.~~16~~8.1 The following drawings and documents, necessary for classification purpose, are to be submitted as far as practicable together with the application for classification:

(a) Hull
- (i) General arrangement.
- (ii) Mid-ship section.
- (iii) Scantling profile and deck plans.
- (iv) Shell expansion.
- (v) Capacity plan.
- (vi) Piping and pumping diagrams.
- (vii) Rudder and stern frames.
- (viii) Data of chain cable and anchor.
- (ix) Lines and hydrostatic curves (if freeboard assignment is required).
- (x) Lumber storage plan (if timber freeboard assignment is required).
- (xi) Loading and stability information (i.e. loading manual).
- (xii) Outfitting arrangement of ship's side fittings.
- (xiii) Inert gas system (if required to be installed).
- (xiv) COW system (if required to be installed).

(b) Machinery
- (i) Engine room arrangement.

(ii) Piping system in engine room.
(iii) Detail and arrangement of propulsion shafting.
(iv) Machinery particulars.
(v) General arrangement of electric equipment.
(vi) Electric wiring diagram of power, lighting and interior communication system.
(vii) Electric equipment particulars.
(viii) Main switchboard.

(c) **CAS/CAU/CAB**

(i) Machinery arrangement plans showing location of control stations in relation to controlled units.
(ii) Arrangements and details of control consoles including front view, installation arrangements together with schematic diagrams for all power, control and monitoring systems including their functions.
(iii) Kinds and sizes of all electrical cables and wiring associated with control systems including voltage rating, service voltage and currents together with overload and short circuit protection.
(iv) Schematic plans of hydraulic and pneumatic control systems together with all interconnections, piping sizes and materials including working pressures and relief valve settings.
(v) Description of all alarms and emergency tripping arrangements, functional sketches or description of all special valves, actuators, sensors and relays.
(vi) Schematic plans and supporting data of fire protection and extinguishing systems, including fire detection and alarm system, bilge high water level alarms.

(d) Cargo refrigerating machinery and installations

(i) General arrangement of the insulated chamber in elevation and plan.
(ii) Drainage arrangement and detail of non-return trap.
(iii) Arrangement of air ducts, fan coolers and thermometers.
(iv) General arrangement of the refrigerating machinery.
(v) Piping diagram of primary and secondary refrigerant systems including full particulars of safety devices, valves and pipes.
(vi) Electric wiring diagram.
(vii) The log book of the refrigerating machinery for the preceding years is to be submitted for investigation.
(viii) Weights and descriptions of cargoes required to be cooled down in each chamber.
(ix) Proposed time required for cooling down.
(x) Initial temperature at which the cargo is to be loaded.
(xi) Carrying temperature of the cargo in refrigerated chamber.
(xii) Proposed air circulation and fresh air quantity required to cool down refrigerated chamber.

2.~~16~~8.2 Ships without classification

For the ships which have not been classed with any other Classification Society, all surveys to the extent as specified in the Rules, are to be carried out by the Surveyor who is to take into account the age, the standard of construction, the past maintenance, and the present status of the ships concerned.

2.~~16~~8.3 Ships with classification

If the ship keeps the Class of another recognized Classification Society with sufficient status, in general, a survey to the extent of ~~an Intermediate Survey~~ the Special Survey corresponding to the ship's age is to be conducted except the ship being within 3 months of the due date of Special Survey. Some ~~Intermediate Survey~~ Special Survey items may be omitted by the Surveyor in view of the ship's condition. In such case, the period of class is to remain as assigned by the previous Classification Society.

2.~~16~~8.4 Subsequent surveys

Subsequent surveys are to be carried out as in the case of ships built under survey.

*Section 2.9 has been deleted as follows:*

**~~2.9 Surveys of Inert Gas Systems~~**

~~2.9.1 Annual Surveys~~

~~At each Annual Survey the inert gas system is to be generally examined so far as can be seen and placed in satisfactory condition. The survey is to include the following items:~~

~~(a) External examination of all components and piping including scrubbers, fans, cooling water pumps, compressors, washing equipment, valves, stand pipes and screens.~~

~~(b) Confirmation of proper operation of inert gas blowers.~~

~~(c) Observation of the operation of the scrubber room ventilation system.~~

~~(d) Deck seal or double block and bleed assemblies, and non-return valves are to be examined externally and proven in operation. Automatic filling and draining of deck seals, operation of non-return valves and double block and bleed assemblies, and the water carryover are to be checked.~~

~~(e) Verification of the operation of all remotely operated or automatically controlled valves and, in particular, flue gas isolating valves.~~

~~(f) Verification of the operation of the inter-locking feature of soot blowers.~~

~~(g) Verification of the automatic operation of gas pressure regulating valves.~~

~~(h) On completion of general repair work, a tightness test and a functional test are to be performed.~~

~~(i) Verification of the operation of the following alarms and safety devices using simulated conditions where necessary.~~

~~(i) Flue gas systems~~

~~(1) Low water pressure or low water flow rate to the flue gas scrubber.~~

~~(2) High water level in the flue gas scrubber.~~

~~(3) High gas temperature at inert gas blower discharge.~~

~~(4) Failure of inert gas blowers.~~

~~(5) Oxygen content in excess of 8% by volume.~~

~~(6) Failure of the power supply to the automatic control system for the gas regulating valve and to the oxygen content and gas pressure indicating devices.~~

~~(7) Low water level in the water seal.~~

~~(8) Gas pressure less than 100 mm water gauge.~~

~~(9) High gas pressure.~~

~~(10) Accuracy of fixed and portable oxygen measuring equipment by means of a calibration gas.~~

~~(ii) Gas generating systems~~

(1) Low water pressure or low water flow rate to the flue gas scrubber.

(2) High gas pressure.

(3) High gas temperature at inert gas blower discharge.

(4) Oxygen content in excess of 8% by volume.

(5) Insufficient fuel oil supply.

(6) Failure of the power supply to the generator.

(7) Failure of the power supply to the automatic control system for the generator.

(8) Accuracy of fixed and portable oxygen measuring equipment by means of a calibration gas.

(j) The Surveyor is to examine the permanent records to check the operation and maintenance of the system. Consideration may be given by the Surveyor for the crediting of certain items that have been properly documented and recorded.

(k) Additional requirements for separate inert gas generator

(i) Automatic combustion control system is to be examined and tested.

(ii) Combustion chamber and mountings are to be examined internally and externally.

(iii) Forced draft fans are to be examined.

(iv) Fuel oil service pumps are to be examined.

(l) Additional requirements for inert gas stored in bottles

(i) Bottles are to be examined internally and externally. If they can not be examined internally they are to be gauged. When considered necessary by the Surveyor, they are to be hydrostatically tested to at least 1.2 times the working pressure. Relief valves are to be proven operable.

(ii) Where an alkali (or other) scrubber is fitted in the system the scrubber, circulating pump, valves and piping are to be examined internally and externally.

2.9.2 Special Survey of inert gas system

At each Special Survey of inert gas system in addition to the requirements for the Annual Surveys in 2.9.1, the following are to be complied with:

(a) All valves, including valves at boiler uptakes, air seal valves at uptakes, scrubber isolating valves, fan inlet and outlet isolating valves, main isolating valves, re-circulating valves (if fitted), pressure/vacuum breakers and cargo tank isolating valves are to be examined.

(b) Scrubbers are to be examined.

(c) Fans (blowers) including casing drain valves are to be examined.

(d) Fan (blower) drives, either electric motor or steam turbine, are to be examined.

(e) Bellows expansion pieces are to be examined.

(f) Sea water pumps, valves and strainers for scrubbers and water seals together with piping connections at scrubbers, water seals, shell plating and the remainder of the sea water piping are to be examined.

(g) Stand pipes, where fitted, for purging in each cargo tank are to be examined.

~~(h) Deck seals or double block and bleed assemblies, and non-return valves are to be examined externally and internally.~~

~~(i) The Special Survey may be commenced at 4th Annual Survey and be progressed during the succeeding year with a view to completion by the 5th anniversary date. The flue gas system is to be presented for survey within 3 months before the due date of the Special Survey. The requirements for survey to qualify for the commencement of the Special Survey are to be no less than those of an Annual Survey as outlined in paragraph 2.9.1.~~

*Section 2.12 has been renumbered and amended as follows:*

## 2.~~12~~9 Hull Surveys of General Dry Cargo Ships ~~– Hull~~

2.9.1 General

Procedures for class related services, see 2.1.4 of this Chapter. Provision for surveys, see 2.1.5 of this Chapter.

(a) The requirements apply to all self-propelled general dry cargo ships of 500 gross tonnage and above carrying solid cargoes other than (see Note 1):

- ships subject to 2.12 or 2.15 of this Chapter;
- dedicated container carriers;
- ro-ro cargo ships;
- refrigerated cargo ships;
- dedicated wood chip carriers;
- dedicated cement carriers;
- livestock carriers;
- deck cargo ships (see Note 2);
- general dry cargo ships of double-side skin construction, with double-side skin extending for the entire length of the cargo area, and for the entire height of the cargo hold to the upper deck.

Note 1: The requirements of paragraphs 2.9.3(g) and 2.9.4(h) also apply to those cargo ships, which, although belonging to the ship types listed in 2.9.1(a) above that are excluded from the application of this requirements , are fitted with a single cargo hold.

Note 2: A deck cargo ship is a ship that is designed to carry cargo exclusively above deck without any access for cargo below deck.

(b) For General Dry Cargo Ships with hybrid cargo hold arrangements, e.g. with some cargo holds of single-side skin and others of double-side skin, the requirements herein are to be applied only to structure in way of the single-side skin cargo hold region.

(c) The requirements apply to surveys of hull structure and piping systems in way of cargo holds, cofferdams, pipe tunnels, void spaces and fuel oil tanks within the cargo area and all ballast tanks. The requirements are additional to the classification requirements applicable to the remainder of the ship. Refer to 2.5~2.7 of this Chapter.

(d) The requirements contain the minimum extent of examination, thickness measurements and tank testing. The survey is to be extended when Substantial Corrosion and/or structural defects are found and include additional close-up survey when necessary.

~~2.12.1~~2.9.2 Annual Survey

(a) General

(i) ~~The due range of Annual Survey is to be in accordance with the applicable requirements of 2.5.~~ In addition to the applicable requirements of the Annual Survey in 2.5, those items herein are to be carried.

(ii) Annual Survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull, hatch covers, coamings and piping are maintained in a satisfactory condition.

(b) Examination of the hull

(i) Examination of the hull plating and its closing appliances as far as can be seen.

(ii) Examination of watertight penetrations as far as practicable.

(c) Examination of weather decks, hatch covers and coamings

(i) Confirmation is to be obtained that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

(ii) Where mechanically operated steel covers are fitted, checking the satisfactory condition of:

(1) Hatch covers; including close-up survey of hatch cover plating;

(2) Tightness devices of longitudinal, transverse and intermediate cross junctions (gaskets, gaskets lips, compression bars, drainage channels );

(3) Clamping devices, retaining bars, cleating;

(4) chain or rope pulleys;

(5) Guides;

(6) Guide rails and track wheels;

(7) Stoppers, etc.;

(~~5~~8) Wires, chains, gypsies, tensioning devices;

(~~6~~9) Hydraulic system essential to closing and securing; and

(~~7~~10) Safety locks and retaining devices.

(iii) Where portable covers, wooden or steel pontoons are fitted, checking the satisfactory condition where applicable of:

(1) Wooden covers and portable beams, carriers or sockets for the portable beams, and their securing devices;

(2) Steel pontoons, including close-up survey of hatch cover plating;

(3) Tarpaulins;

(4) Cleats, battens and wedges;

(5) Hatch securing bars and their securing devices;

(6) Loading pads/bars and the side plate edge;

(7) Guide plates and chocks; and

(8) Compression bars, drainage channels and drain pipes (if any).

(iv) Checking the satisfactory condition of hatch coaming plating and their stiffeners including close-up survey.

(v) Random checking of the satisfactory operating of mechanically operated hatch covers is to be made including:

(1) Stowage and securing in open condition;

(2) Proper fit and efficiency of sealing in closed condition; and

(3) Operational testing of hydraulic and power components, wires, chains and link drives.

(vi) Examination of the weld connection between air pipes and deck plating.

(vii) External examination of all air pipe heads installed on the exposed decks.

(viii) Examination of flame screens on vents to all bunker tanks.

(ix) Examination of ventilators, including closing devices, if any.

(d) Suspect Areas

Suspect Areas identified at previous ~~special or Intermediate~~ surveys are to be examined. ~~overall and close-up surveyed.~~ Thickness measurements are to be taken of the area of Substantial Corrosion and the extent ~~number~~ of thickness measurement is to be increased to determine the extent of Substantial Corrosion. ~~as deemed necessary by the Surveyor.~~ Table I 2-4A may be used ~~as guidance~~ for these additional thickness measurements. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed.

(e) Examination of cargo holds

(i) For Ships 10-15 years of age, the following is to apply:

(1) Overall survey of one forward and one after cargo hold and their associated tween deck spaces.

(2) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. Table I 2-4A may be used as guidance for these additional measurements. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed.

(ii) For Ships over 15 years of age, the following is to apply:

(1) Overall survey of all cargo holds and tween deck spaces.

(2) Close-up examination of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approx. lower one third length of side frame at side shell and side frame end attachment and the adjacent shell plating in a forward lower cargo hold and one other selected lower cargo hold. Where this level of survey reveals the need for remedial measures, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of those cargo holds and associated tween deck spaces (as applicable) as well as a close-up survey of sufficient extent of all remaining cargo holds and tween deck spaces (as applicable).

(3) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. Table I 2-4A may be used as guidance for these additional measurements. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed.

(4) Where the protective coating in cargo holds, as applicable, is found to be in GOOD condition the extent of close-up surveys may be specially considered.

(5) All piping and penetrations in cargo holds, including overboard piping, are to be examined.

(f) Examination of ballast tanks

Examination of ballast tanks ~~is required~~ when required as a consequence of the results of the Special Survey and Intermediate Survey is to be carried out. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the ~~number~~ extent of thickness measurements is to be increased to determine the extent of Substantial Corrosion. ~~as deemed necessary by the Surveyor.~~ Table I 2-4A may be used as guidance for these additional measurements. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed.

(g) Additional requirements for single hold cargo ships (see Note 1 of 2.9.1(a)) after determining compliance with SOLAS II-I/23-3 and II-I/25

(i) For ships complying with the requirements of SOLAS II-I/23-3 and II-I/25 for hold water level detectors, the Annual Survey is to include an examination and a test, at random, of the water ingress detection system and of their alarms.

~~(g) When thickness measurements as stated in 2.9.1(d), 2.9.1(e) and 2.9.1(f) above, indicate Substantial Corrosion, the number of thickness measurements is to be increased to determine the extent of Substantial Corrosion. Table I 2-16 may be used as guidance for additional thickness measurements.~~

~~(h) Randomly examine and test the water level detectors and their alarms for single hold dry cargo ships.~~

~~2.12.2~~2.9.3 Intermediate Survey

(a) General

~~(i) Due range of Intermediate Survey is to be in accordance with the applicable requirements of 2.6.~~

(~~i~~ii) At each Intermediate Survey, in addition to the requirements of the Annual Survey in 2.9.2 and the applicable requirements of the Intermediate Survey in 2.6, the following items are to be surveyed.

~~(iii) For general dry cargo ships exceeding 15 years of age, the requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.12.3. However, an under water survey may be considered as equivalent in lieu of the requirements of 2.12.3(b) and pressure testing of ballast tanks and cargo holds used for ballast water, as applicable, is not required unless deemed necessary by the attending Surveyor.~~

(ii) A survey planning meeting is to be held prior to the commencement of the survey.

(iii) Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(b) The survey extent is dependent on the age of the vessel as specified in 2.9.3(b)(i) to 2.9.3(b)(iii).

(i) Ships 5-10 Years of Age, the following is to apply:

(1) Ballast Tanks

a) For tanks used for water ballast, an overall survey of Representative Tanks selected by the Surveyor is to be carried out. If such overall survey reveals no visible structural defects, the examination may be limited to a verification that the corrosion prevention system remains efficient.

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

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

d) In addition to the requirements above, areas found suspect at previous surveys are to be surveyed in accordance with the provisions indicated in 2.9.2(d).

(2) Cargo Holds

a) An overall survey of all cargo holds and tween deck spaces.

b) Areas found suspect at previous surveys are to be surveyed in accordance with the provisions indicated in 2.9.2(d).

(ii) Ships 10-15 Years of Age, the following is to apply:

(1) Ballast Tanks

a) For tanks used for water ballast, an overall survey of all tanks is to be carried out. If such overall survey reveals no visible structural defects, the examination may be limited to a verification that the corrosion prevention system remains efficient.

b) The requirements of 2.9.3(b)(i)(1)c) and d) also apply .

(2) Cargo Holds

a) An overall survey of all cargo holds and tween deck spaces.

b) Areas found suspect at previous surveys are to be surveyed in accordance with the provisions indicated in 2.9.2(d).

c) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. Table I 2-4A may be used as guidance for these additional measurements. These extended thickness measurements are to be carried out before the survey is credited as completed.

(iii) Ships over 15 Years of Age, the following is to apply:

(1) The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.9.4, except for item 2.c. in column 4 of Table I 2-11. However, tank testing specified in 2.9.4(g), survey of automatic air pipe heads (see Notes in 2.9.4(a)(vi) and 2.9.4(e)(iv)) and internal examination of fuel oil, lube oil and fresh water tanks (see 2.9.3(e)(i)) are not required unless deemed necessary by the attending Surveyor.

(2) In application of 2.9.3(b)(iii)(1) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of Part I-1.6.4(b)&(c).

(3) In lieu of the requirements of 2.9.4(b), an In-water survey, according to the provisions of item 2.2.2 of this Chapter, may be considered as equivalent.

~~Examination of ballast tanks for Intermediate Survey of general dry cargo ships is to be carried out as given in Table I 2-11.~~

~~(c) Examination of cargo holds~~

~~Examination of cargo holds for Intermediate Survey of general dry cargo ships is to be carried out as given in Table I 2-12.~~

~~2. 12.3~~2.9.4 Special Survey

(a) General

~~(i) The due range of special is to be in accordance with the applicable requirements in 2.7.~~

(~~i~~ii) A survey planning meeting is to be held prior to the commencement of the survey.

(ii) Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(iii) The Special Survey is to include, in addition to the requirements of the Annual Survey in 2.9.1 and the applicable requirements of the Special Survey in 2.7, examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 2.9.3(a)(v) are in a satisfactory condition and fit for the intended purpose for the new period of class of 5 years to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

(iv) All cargo holds, ~~salt~~ water ballast tanks including double bottom tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull are to be examined ~~as given in Table I 2-13~~, and this examination is to be supplemented by thickness measurement and testing as required in 2.9.4(f) and 2.9.4(g)~~, deemed necessary,~~ to ensure that the structural integrity remains effective. The aim of the examination is to be sufficient to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

(v) All piping systems within the above spaces are to be examined and operationally tested ~~conditions~~ to working pressure to attending Surveyor's satisfaction to ensure that ~~the~~ tightness and condition remain satisfactory.

(vi) The survey extent of ballast tanks converted to void spaces is to be specially considered in relation to the requirements for ballast tanks.

Note: For survey of automatic air pipe heads refer to Table I 2-23.

~~(vii) A survey in dry dock is to be a part of the Special Survey.~~

(b) Bottom Survey in dry dock

A Bottom Survey in dry dock is to be a part of the Special Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and water ballast tanks(1) are to be carried out in accordance with the applicable requirements for Special Surveys, if not already performed.

Note:

(1) Lower portions of the cargo holds and ballast tanks are considered to be the parts below light ballast water line.

(~~b~~c) Tank protection

(i) Where provided, the condition of the corrosion prevention system of ballast tanks is to be examined. For tanks used for ~~salt~~ water ballast, excluding double bottom tanks, where a protective coating is found in Poor condition and it is not renewed, where a soft or semi-hard coating has been applied, or where a protection coating was not applied from the time of construction, the tank in question is to be examined at annual intervals. Thickness measurements are to be carried out as deemed necessary by the Surveyor.

(ii) When such breakdown of coating is found in ~~salt~~ water ballast double bottom tanks and it is not renewed, where a soft or semi-hard 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 at annual intervals. When deemed necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

(iii) Where the hard protective coating in spaces is found to be in Good condition, the extent of close-up surveys and thickness measurements may be specially considered.

(d) Hatch covers and coamings

~~In addition to the requirements of the Annual Survey, the following items~~ The hatch covers and coamings are to be surveyed as follows :

(i) A thorough inspection of the items listed in 2.9.2(c) is to be carried out.

(ii) Checking of the satisfactory operation of all mechanically operated hatch covers is to be made, including:

(1) Stowage and securing in open condition;

(2) Proper fit and efficiency of sealing in closed condition; and

(3) Operational testing of hydraulic and power components, wires, chains and link drives.

(iii) Checking the effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent.

(~~ii~~iv) Close-up survey and thickness measurement of the hatch cover and coaming plating and stiffeners is to be carried out as given in Table I 2-~~14~~10 and Table I 2-11, and the thickness measurement of hatch cover and coaming plating in way of Substantial Corrosion is to be carried out as given in Table I 2-~~16~~4.

(e) Extent of overall and close-up survey

(i) An overall survey of all tanks and spaces, excluding fuel oil, lube oil and fresh water tanks, is to be carried out at each Special Survey.

Note: For fuel oil, lube oil and fresh water tanks, reference is to be made to Table I 2-1.

~~(ii) Each Special Survey is to include a close-up survey at Special Survey of sufficient extent to establish the condition of the shell frames and their end attachments in all cargo holds and salt water ballast tanks as indicated in Table I 2-14.~~

(ii) The minimum requirements for close-up surveys at Special Survey are given in Table I 2-10.

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

(iv) For areas in spaces where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to Table I 2-10 may be specially considered.

Note: For survey of automatic air pipe heads, reference is to be made to Table I 2-23.

(f) Extent of thickness measurement

(i) The minimum requirements for thickness measurements at Special Survey are given in Table I 2-~~15~~11. ~~and Table III I 2-16~~.

~~(ii) Thickness measurement to determine both general and local levels of corrosion in the shell frames and their end attachments in all cargo holds and salt water ballast tanks is to be carried out. Thickness measurement is also to be carried out to determine the corrosion levels on the transverse bulkhead plating. The thickness measurements may be dispensed with provided the Surveyor is satisfied by the close up survey, that there is no structural diminution, and the protective coating where applied remains efficient.~~

(~~i~~ii) The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate Substantial Corrosion, the ~~number~~ extent of thickness measurements is to be increased to determine the extent of areas of Substantial Corrosion~~ as deemed necessary by the Surveyor~~. Table I 2-4A may be used as guidance for these additional thickness measurements.

(iii) For areas in spaces where hard protective coatings are found to be in a GOOD condition, the extent of thickness measurement according to Table I 2-11 may be specially considered.

(iv) Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

(g) Extent of tank testing

(i) All boundaries of ~~salt~~ water ballast tanks and deep tanks used for ~~salt~~ the water ballast within the cargo length area are to be pressure tested. For fuel oil tanks, only representative tanks are to be pressure tested.

(ii) The Surveyor may extend the tank testing as deemed necessary.

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

~~(iii) Tanks are to be tested with a head of liquid to the top of the air pipes for ballast tanks and deep tanks or the pressure corresponding to the maximum head that can be experienced in service for oil tanks.~~

(h) Additional requirements for single hold cargo ships after determining compliance with SOLAS II-I/23-3 and II-I/25.

(i) For ships complying with the requirements of SOLAS II-I/23-3 and II-I/25 for hold water level detectors, the Special Survey is to include an examination and a test of the water ingress detection system and their alarms.

*Section 2.10 has been amended as follows:*

## 2.10 Hull Surveys of Liquefied Gas Carriers

2.10.1 Annual Surveys

In addition to the surveys as per applicable requirements of 2.5, the components, equipment and outfit as listed below are to be examined as to whether they are in unobjectionable maintenance condition.

(a) Cargo handling systems are to be examined as follows:

(i) The cargo and process piping, expansion joints, cargo hoses and machinery, such as heat exchangers, vapourizers, pumps, compressors are to be externally examined.

(ii) The availability of the required spool pieces for piping separation is to be verified.

(iii) The log books are to be examined with regard to correct functioning of the cargo containment and cargo handling systems. The running hours per day of the re-liquefaction plants or the boil-off rate and the inert gas consumption are to be considered.

(iv) It is to be ensured that the relevant instructions and information material such as cargo handling plants, cargo tank loading limit information, cooling down procedures etc. are on board.

(b) Cargo containment venting systems are to be examined as follows:

(i) Venting system for cargo tanks, inter barrier spaces (in case of Type A tanks, cargo holds) are to be visually examined. It is to be verified that the cargo tank relief valves are sealed and that the certificate containing details on opening/closing pressure of the relief valves is kept on board.

(ii) Protection screens and flame arresters, if fitted, are to be examined for corrosion and cleanliness.

(c) Instrumentation and safety systems are to be examined as follows:

(i) The monitoring and control equipment for pressure, temperature and liquid levels is to be verified as to its good working order, by one or several of the following methods:

(1) Visual external examination.

(2) Comparison of read-outs of different indicators.

(3) Comparison of read-outs with the data of the cargo actually handled.

(4) Examination of repair and maintenance records with reference to the cargo plant repair.

(ii) Emergency shut-down valves at shore connections and tanks are to be tested without flow in the pipe lines. It is to be verified that operation of the emergency shut-down system is to cause the cargo pumps and compressors to stop.

(iii) The fixed and portable gas detection equipment, including indicators and alarms, is to be tested for correct functioning.

(d) In gas-dangerous spaces and zones the electrical equipment including cables and their supports, is to be visually examined, particularly regarding explosion protection.

(e) Ventilation systems for all spaces in the cargo area, including cargo pump rooms, cargo compressor rooms, electrical motor rooms, cargo control rooms, and other spaces used for cargo handling operations are to be examined as to their satisfactory operating condition.

(f) Inert gas/dry air systems, including the means for prevention of backflow of cargo vapour to gas-safe spaces are to be checked as to their satisfactory operating condition. See also 3.3.1 of this Part.

(g) All fire fighting systems in the cargo area, including the compressor room, are to be checked visually. See also 2.5.1(j).

(h) The following items of equipment are to be inspected for their condition and correct functioning:

(i) Means for ensuring gas-tightness of wheelhouse windows and doors, windows in end bulkheads of superstructures and deck house facing the cargo area or stern loading/unloading arrangements, and closing devices of all air intakes and openings into accommodation, service and control stations.

(ii) Sealing arrangements for tanks or tank domes penetrating decks or tank covers.

(iii) Drip trays or insulation for deck protection against cargo leakage.

(iv) Arrangements for heating of hull structural elements, if any. Access to the heated cofferdams etc. is normally not required.

(v) Electric bonding of cargo piping systems.

(vi) Arrangements for the use of boil-off gas as fuel, including alarm and safety systems.

2.10.2 Intermediate Surveys

In addition to the surveys as per Annual Survey in 2.10.1 and the applicable requirements of the Intermediate Surveys in 2.6, the checks mentioned below are to be carried out. The Intermediate Survey supplements the preceding Annual Survey by testing of cargo handling installations, with pertinent automatic controls, alarm and safety systems, for their correct functioning.

(a) Cargo systems and tanks are to be examined as follows:

(i) The piping system in cargo tanks is to be examined. Bonding of tanks and pipes is to be controlled.

(ii) It is to be checked whether the ship's cargo hoses are approved and in satisfactory condition. At intervals of not more than 2.5 years, the cargo hoses are to be subjected to a pressure and conductivity test.

(iii) Weather deck: Piping systems essential for operation of the ship, e.g. cargo transfer, bunkering and ballast lines, are to be examined.

(iv) For ships between 5 and 10 years of age, an overall survey of representative ballast tanks is to be carried out.

(v) For ships over 10 years of age, an overall survey of all ballast tanks is to be carried out.

(vi) Close-up survey as required in Table I 2-~~29A~~24.

(b) Cargo containment venting systems are to be examined as follows:

(i) The drainage arrangements of venting systems are to be examined.

(ii) If cargo tanks are equipped with relief valves with non-metallic membranes in main or pilot valves, such membranes are to be replaced by new ones and the valves are to be adjusted, function tested and sealed. These measures need not be taken simultaneously with the Intermediate Survey, provided that the non-metallic membranes are renewed at intervals not exceeding 3 years.

(c) Instrumentation and safety systems are to be examined as follows:

(i) The alarm, control and safety systems of the cargo installation are to be visually examined and tested by varying pressures, temperatures and liquid levels, as far as practicable, and comparisons are to be drawn, using test instruments. Simulated testing may be accepted for sensors which are not accessible or for sensors located within cargo tanks or inertised cargo holds. This test is to include testing of alarm and safety functions.

(ii) The gas detection equipment, including indicators and alarms, is to be tested for correct functioning. The piping of the gas detection system is to be visually inspected for corrosion and damages. The tightness and integrity of suction lines between suction points and analyzing units are to be verified as far as possible.

(iii) On ships having arrangements for the use of boil-off gases as fuel, safety, control, alarm and shut-down systems are to be checked. The extent of the checks is to be determined from case to case.

(d) Electrical installations are to be examined as follows:

Electrical equipment in gas-dangerous spaces and zones is to be examined in respect of the following:

(i) Protective earthing (spot check).

(ii) Integrity of certified safe-type equipment.

(iii) Damage to outer sheath of cables.

(iv) Function testing of pressurized equipment, and of associated alarms.

(v) Testing of systems for de-energizing noncertified safe electrical equipment located in spaces protected by air-locks, such as electric motor rooms, cargo control rooms, etc.

(vi) Checking of insulation resistance of circuits. Relevant measurements are only to be made when the ship is in gas free or inertised condition. If proper test reports are available on board, readings made by the crew may be accepted.

(vii) When the ship is in gas free condition, it is to be verified that the cargo tanks are electrically bonded to the hull.

2.10.3 Special Survey

Where applicable, in addition to the surveys as per requirements of the Intermediate Survey in 2.10.2 and applicable requirements of the Special Survey in 2.7, the examinations and tests as mentioned below are to be carried out:

(a) The cargo containment systems is to be examined as follows:

(i) All cargo tanks are to be examined internally.

(ii) As far as practicable, the outer surface of un-insulated cargo tanks or the outer surface of cargo tanks insulations, including vapour or protective cover if any, is to be examined, as are areas in way of supports, keys and anti-flotation chocks. Partial removal of insulation may be required in order to verify the condition of the tank or the insulation itself, if found necessary by the Surveyor. Where, e.g. in the case of membrane type cargo tanks, the insulation arrangement is such that it cannot be examined, the surrounding structures of wing tanks, double bottom tanks and cofferdams are to be examined for cold spots when cargo tanks are in cold condition. This examination may be dispensed with if the log book, together monitoring instruments gives sufficient evidence of the integrity of the insulation system.

(iii) Thickness measurements of cargo tanks may be required if deemed necessary by the Surveyor.

(iv) Non-destructive examination of main structural members, tank shells and highly stressed parts, including welded connections is to supplement cargo tank inspections as far as deemed necessary by the Surveyor. The following items are inter alia considered as highly stressed parts:

(1) Cargo tank supports and longitudinal and transverse securing devices.

(2) Y-connections between tank shells and longitudinal bulkheads of slop tanks.

(3) Web frames or stiffening rings.

(4) Swash bulkheads and their fixations.

(5) Dome and sump connection to tank shells.

(6) Foundations for pumps, towers, ladders, etc.

(7) Pipe connections.

(v) For independent Type B tanks, the extent of non-destructive examination is defined in a plan specially prepared for the particular cargo tank design.

(vi) The tightness of all cargo tanks is to be verified by an appropriate procedure provided that the effectiveness of the ship gas detection equipment has been confirmed, it is to be acceptable to utilize this equipment for the tightness test of independent tanks below deck during the first process of filling of the cargo tanks subsequent to the Special Survey.

(vii) Where the findings of checks according to 2.10.3(a)(i) to (vi) above ~~of this subparagraph~~ or an examination of the log book raise doubts as to the structural integrity of a cargo tank, a hydrostatic or hydro-pneumatic test is to be carried out. For integral tanks and for independent Type A and B tanks, the test pressure at the top of tank is to correspond to the MARVS (maximum allowable relief valve setting) of the tank. For independent Type C tanks, the test pressure at the top of the tank is not to less than 1.25 times the MARVS.

(viii) Extended tests

On the occasion of Special Surveys No.2, 4, 5, etc., all independent type C tanks are to be either

(1) Hydrostatically or hydro-pneumatically tested to a pressure at the upper edge of the tanks of 1.25 times MARVS and thereafter, non-destructively, in accordance with (iv)/(v) of this subparagraph, or

(2) Subjected to a thorough, systematically planned nondestructive examination procedure. These tests are to be carried out in accordance with a plan specially prepared for the particular tank design. If a special plan dose not exist, the following applies with regard to nondestructive testing:
Testing is to be concentrated on the detection of surface cracks in welded connections in highly stressed areas, as listed in 2.10.3(a)(iv) above ~~of this subparagraph~~. At least 10% of the length of the welded connections in each of the above mentioned areas are to be tested. This testing is to be carried out internally and externally, as far as practicable. Insulation is to be removed as necessary for the required nondestructive examination.

(b) Tank supporting structures and insulation are to be examined as follows:

(i) As far as practicable, all hold spaces and hull insulation (if provided), secondary barriers and tank supporting structures are to be visually examined. The secondary barrier of all tanks is to be checked for its effectiveness by means of a pressure/vacuum test, a visual examination or some other acceptable methods.

(ii) For membrane and semi-membrane tank systems, the inspection and testing as per 2.10.3(b)(i) above ~~of this subparagraph~~ are to be carried out in accordance with a plan and an approved method specially prepared for the actual tank system.

(c) Pressure and vacuum relief valves are to be examined as follows:

(i) The pressure relief valves for cargo tanks are to be opened up for examination, adjusted, function tested and sealed. The requirements of 2.10.2(b)(ii) regarding replacement of nonmetallic membrane apply. The following tolerances apply regarding the set pressures of cargo tank pressure relief valves:

| Set pressure P | Tolerance |
|---|---|
| P $\leq$ 0.15 MPa | $\pm$ 10 % |
| 0.15 MPa< P $\leq$ 0.3 MPa | $\pm$ 6 % |
| 0.3 MPa< P | $\pm$ 3 % |

(ii) Pressure/vacuum relief valves, rupture discs and other pressure relief devices for inter-barrier spaces and hold spaces are to be examined, opened and tested if necessary, depending on their design.

(d) It is to be verified that cargo tanks are to be electrically bonded to the hull.

(e) Piping systems are to be examined as follows:

(i) Cargo, liquid nitrogen and process piping systems, including their valves and actuators, compensators etc., are to be opened up for examination as deemed necessary by the Surveyor. Insulation is to be removed as deemed necessary to ascertain the external condition of pipes. At the Surveyor's discretion welded seams at branches and bends are to be subjected to non-destructive random crack tests. If the visual examination raises doubts as to the integrity of pipelines, they are to be pressure tested to 1.25 times MARVS. After reassembly the complete piping system is to be tested for leaks.

(ii) The pressure relief valves in piping systems are to be function tested. A random selection of valves is to be opened up for examination and adjusted.

(iii) Cargo pumps, booster pumps and gas compressors are to be inspected and tested.

(f) The re-liquefaction installation is to be examined as follows:

(i) The parts of compressors subject to wear, such as cylinders, pistons, connecting rods, glands, bearings, auxiliary components, such as shafts, rotors and diffusers of centrifugal pumps, etc., are to be examined.

(ii) The drives of compressors, including those components which are required for operation of the drives, are to be inspected.

(iii) All the covers of heat exchangers are to be dismounted for inspection of pipe plates, if necessary, pressure and tightness tests are to be connected. If only a few pipes have been exchanged, a tightness test may be sufficient.

(iv) The safety equipment (pressure relief valves, rupture discs) is to be checked.

(g) At Special Surveys No. 2 and subsequent, ~~4, 5 etc. all process pressure vessels are to be tested pneumatically at a pressure equal to 1.1 times the working pressure, unless the result of the survey requires a hydraulic pressure test to 1.5 times the working pressure.~~ all other pressure vessels in the reliquefaction/refrigeration system, gas fuel burning system and other handling systems are to be pneumatically tested to a pressure equal to the designed working pressure.

(h) The equipment connected with fuel gas evaporated from the LNG cargo is to be examined as follows:

(i) The gas conditioning plant is to be inspected externally.

(ii) The pipe or duct enclosing the fuel gas line is to be inspected for leaks. The ventilation system of that pipe or duct as well as the inertising equipment of a double wall piping system is to be checked for their operability. Heat exchangers are to be visually examined internally.

(iii) Safety devices: See 2.10.2(c).

(i) In addition to the visual examinations and tests as per 2.10.2(d) the protection devices of electric motors are to be tested.

(j) Miscellaneous items are to be examined as follows:

(i) Drainage systems for removal of water or cargo inter-barrier spaces and hold spaces are to be examined and tested where necessary.

(ii) All gas tight bulkheads are to be inspected. The effectiveness of gas tight shaft sealings is to be verified.

(iii) It is to be checked whether the spare parts stipulated in the GC code or IGC code are kept on board.

(iv) Any installations for heating of hull structures are to be examined for correct functioning.

(k) Close-up survey as required in Table I 2-~~29B~~25.

(l) Ballast tanks, including double bottom tanks, pump rooms, compressor rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull are to be examined. All piping systems within the above spaces are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction.

(m) Thickness measurement as required in Table I 2-~~29C~~26.

(n) Tank testing for ballast tanks and fuel oil tanks ~~as required in Table I 2-2B.~~

(i) All boundaries of water ballast tanks and deep tanks used for water ballast within the cargo area are to be pressure tested. For fuel oil tanks, the representative tanks are to be pressure tested.

(ii) The Surveyor may extend the tank testing as deemed necessary.

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

(o) Cargo tank testing

Cargo tank testing carried out by the vessel's crew under the direction of the Master may be accepted by the Surveyor provided the following conditions are complied with:

(i) A tank testing procedure has been submitted by the owner and reviewed by this Society prior to the testing being carried out;

(ii) There is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;

(iii) The tank testing has been satisfactorily carried out within Special Survey window not more than 3 months prior to the date of the survey on which the overall or close up survey is completed;

(iv) The satisfactory results of the testing is recorded in the vessel's logbook;

(v) The internal and external condition of the tanks and associated structure are found satisfactory by the Surveyor at the time of the overall and close up survey.

*Section 2.11 and 2.12 have been added as follows:*

## 2.11 Hull Survyes of Oil Tankers

Procedures for class related services, see 2.1.4 of this Chapter. Provision for surveys, see 2.1.5 of this Chapter. Preparation for enhanced survey for ESP ships, see 2.1.6 of this Chapter.

2.11.1 Annual Surveys

In addition to the requiements of the Annual Survey in 2.5, those items herein are to be carried out.

The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

(a) Examination of the Hull

(i) Examination of the hull plating and its closing appliances as far as can be seen.

(ii) Examination of watertight penetrations as far as practicable

(b) Examination of weather decks

(i) Examination of cargo tank openings including gaskets, covers, coamings and flame screens.

(ii) Examination of cargo tanks pressure/vacuum valves and flame screens.

(iii) Examination of flame screens on vents to all bunker tanks.

(iv) Examination of cargo, crude oil washing, bunker and vent piping systems, including vent masts and headers.

(c) Examination of Cargo pump rooms and pipe tunnels if fitted.

(i) Examination of all pumproom bulkheads for signs of oil leakage or fractures and, in particular, the sealing arrangements of all penetrations of pumproom bulkheads.

(ii) Examination of the condition of all piping systems.

(d) Examination of Ballast Tanks

Examination of Ballast Tanks where required as a consequence of the results of the Special Survey (see 2.11.3(c)) and Intermediate Survey (see 2.11.2(b)(i) and 2.11.2(b)(ii) ) is to be carried out. When considered necessary by the Surveyor, or when extensive corrosion exists, thickness measurements are to be carried out and if the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-4B. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

2.11.2 Intermediate Survey

Those items which are additional to the requirements of the Annual Surveys in 2.11.1 and the applicable requirements of the Intermediate Survey in 2.6 may be surveyed either at or between the 2nd and 3rd Annual Survey;

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) General

(i) The survey extent is dependent on the age of the vessel as specified in 2.11.2(b) to 2.11.2(d).

(ii) For weather decks, an examination as far as applicable of cargo, crude oil washing, bunker, ballast, steam and vent piping systems as well as vent masts and headers is to be carried out. If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure tested, thickness measured or both.

(b) Oil Tankers 5 – 10 Years of Age, the following is to apply:

(i) All Ballast Tanks are to be examined. When considered necessary by the Surveyor, thickness measurement and testing are to be carried out to ensure that the structural integrity remains effective.

(ii) A Ballast Tank is to be examined at subsequent annual intervals where:

(1) a hard protective coating has not been applied from the time of construction, or

(2) a soft or semi-hard coating has been applied, or

(3) substantial corrosion is found within the tank, or

(4) the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the Surveyor.

(iii) In addition to the requirements above, suspect areas identified at previous surveys are to be examined.

(c) Oil Tankers 10 - 15 years of Age, the following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.11.3 and 2.1.6(a). However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of Hull Girder as required in 2.1.6(f) are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.11.2(c)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of the Part.

(iii) In application of 2.11.2(c)(i) above, an In-water survey may be considered in lieu of the requirements of 2.11.3(b).

(d) Oil Tankers over 15 years of Age, the following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.11.3 and 2.1.6(a). However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of Hull Girder as required in 2.1.6(f) are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.11.2(d)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of the Part.

(iii) In application of 2.11.2(d)(i) above, a survey in dry dock is to be part of the Intermediate Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks(1) are to be carried out in accordance with the applicable requirements for Intermediate Surveys, if not already performed.

Note:

(1) Lower portions of the cargo and ballast tanks are considered to be the parts below light ballast water line.

2.11.3 Special Survey

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) General

(i) The Special Survey is to include, in addition to the requirements of the Annual Survey in 2.11.1 and the applicable requirements of the Special Survey in 2.7, examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 2.11.3(a)(iii), is in a satisfactory condition and is fit for its intended purpose for the new period of class of 5 years to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

(ii) All cargo tanks, Ballast Tanks, including double bottom tanks, pumprooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing required in 2.11.3(e) and 2.11.3(f), to ensure that the structural integrity remains effective. The aim of the examination is to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

(iii) Cargo piping on deck, including Crude Oil Washing (COW) piping, Cargo and Ballast piping within the above tanks and spaces are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory. Special attention is to be given to any ballast piping in cargo tanks and cargo piping in ballast tanks and void spaces, and Surveyors are to be advised on all occasions when this piping, including valves and fittings are open during repair periods and can be examined internally.

(b) Bottom Survey in dry dock

(i) A Bottom Survey in dry dock is to be a part of the Special Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and ballast tanks(1) are to be carried out in accordance with the applicable requirements for Special Surveys, if not already performed.

Note:

(1) Lower portions of the cargo and ballast tanks are considered to be the parts below light ballast water line.

(c) Tank Protection

(i) Where provided, the condition of the corrosion prevention system of cargo tanks is to be examined. A Ballast Tank is to be examined at subsequent annual intervals where:

(1) a hard protective coating has not been applied from the time of construction, or

(2) a soft or semi-hard coating has been applied, or

(3) substantial corrosion is found within the tank, or

(4) the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the Surveyor. Thickness measurements are to be carried out as deemed necessary by the Surveyor.

(d) Extent of overall and close-up survey

(i) An overall survey of all tanks and spaces is to be carried out at each Special Survey.

(ii) The minimum requirements for close-up surveys at Special Survey are given in Table I 2-5A.

(iii) The Surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also in the following cases:

(1) In particular, tanks having structural arrangements or details which have suffered defects in similar tanks or on similar ships according to available information.

(2) In tanks which have structures approved with reduced scantlings due to an approved corrosion control system.

(iv) For areas in tanks where hard protective coatings are found to be in a GOOD condition as defined in 2.1.2(l), the extent of close-up surveys according to Table I 2-5A may be specially considered.

(e) Extent of Thickness Measurement

(i) The minimum requirements for thickness measurements at Special Survey are given in Table I 2-3B

(ii) Provisions for extended measurements for areas with Substantial Corrosion are given in Table I 2-4B, and as may be additionally specified in the Survey Programme as required by 2.1.6(a). These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

(iii) The Surveyor may further extend the thickness measurements as deemed necessary.

(iv) For areas in tanks where hard protective coating are found to be in a GOOD condition as defined in 2.1.2(l), the extent of thickness measurements according to Table I 2-3B may be specially considered.

(v) Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

(vi) In cases where 2 or 3 sections are to be measured, at least one is to include a Ballast Tank within 0.5L amidships.

In case of oil tankers of 130 m in length and upwards (as defined in the International Convention on Load Lines in force) and more than 10 years of age, for the evaluation of the ship's longitudinal strength as required in 2.1.6(f), the sampling method of thickness measurements is given in IACS UR Z10.1-Annex III Appendix 3.

(f) Extent of Tank Testing

(i) The minimum requirements for ballast tank testing at Special Survey are given in 2.11.3(f)(iii) and Table I 2-2.

The minimum requirements for cargo tank testing at Special Survey are given in 2.11.3(f)(iv) and Table I 2-2.

Cargo tank testing carried out by the vessel's crew under the direction of the Master may be accepted by the Surveyor provided the following conditions are complied with:

(1) a tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the owner and reviewed by the Society prior to the testing being carried out;

(2) there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;

(3) the tank testing has been satisfactorily carried out within Special Survey window not more than 3 months prior to the date of the survey on which the overall or close up survey is completed;

(4) the satisfactory results of the testing is recorded in the vessel's logbook;

(5) the internal and external condition of the tanks and associated structure are found satisfactory by the Surveyor at the time of the overall and close up survey.

(ii) The Surveyor may extend the tank testing as deemed necessary.

(iii) Boundaries of ballast tanks are to be tested with a head of liquid to the top of air pipes.

(iv) Boundaries of cargo tanks are to be tested to the highest point that liquid will rise under service conditions.

## 2.12 Hull Surveys of Bulk Carriers

Procedures for class related services, see 2.1.4 of this Chapter. Provision for surveys, see 2.1.5 of this Chapter. Preparation for enhanced survey for ESP ships, see 2.1.6 of this Chapter.

2.12.1 Annual Survey

In addition to the applicable requirements of the Annual Survey in 2.5, those items herein are to be carried out.

The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull, weather decks, hatch covers, coamings and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

(a) Examination of the Hull

(i) Examination of the hull plating and its closing appliances as far as can be seen.

(ii) Examination of watertight penetrations as far as practicable.

(b) Examination of weather decks, Hatch covers and coamings

(i) Confirmation is to be obtained that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

(ii) A thorough survey of cargo hatch covers and coamings is only possible by examination in the open as well as closed positions and should include verification of proper opening and closing operation. As a result, the hatch cover sets within the forward 25% of the ship's length and at least one additional set, such that all sets on the ship are assessed at least once in every 5-year period, are to be surveyed open, closed and in operation to the full extent on each direction at each Annual Survey, including:

(1) stowage and securing in open condition;

(2) proper fit and efficiency of sealing in closed condition; and

(3) operational testing of hydraulic and power components, wires, chains, and link drives.

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

(iii) If there are indications of difficulty in operating and securing hatch covers, additional sets above those required by 2.12.1(b)(ii), at the discretion of the Surveyor, are to be tested in operation.

(iv) Where the cargo hatch securing system does not function properly, repairs are to be carried out under the supervision of the Classification Society. Where hatch covers or coamings undergo substantial repairs, the strength of securing devices should be upgraded to comply with S21.5 of IACS UR S21.

(v) For each cargo hatch cover set, at each Annual Survey, the following items are to be surveyed:

(1) Cover panels, including side plates, and stiffener attachments that may be accessible in the open position by close-up survey (for corrosion, cracks, deformation);

(2) sealing arrangements of perimeter and cross joints (gaskets for condition and permanent deformation, flexible seals on combination carriers, gasket lips, compression bars, drainage channels and non return valves);

(3) clamping devices, retaining bars, cleating (for wastage, adjustment, and condition of rubber components);

(4) closed cover locating devices (for distortion and attachment);

(5) chain or rope pulleys;

(6) guides;

(7) guide rails and track wheels;

(8) stoppers;

(9) wires, chains, tensioners, and gypsies;

(10) hydraulic system, electrical safety devices and interlocks; and

(11) end and interpanel hinges, pins and stools where fitted.

(vi) At each hatchway, at each Annual Survey, the coamings, with plating, stiffeners and brackets are to be checked for corrosion, cracks and deformation, especially of the coaming tops, including close-up survey.

(vii) Where considered necessary, the effectiveness of sealing arrangements may be proved by hose or chalk testing supplemented by dimensional measurements of seal compressing components.

(viii) Where portable covers, wooden or steel pontoons are fitted, checking the satisfactory condition, where applicable, of:

(1) wooden covers and portable beams, carriers or sockets for the portable beam, and their securing devices;

(2) steel pontoons, including close-up survey of hatchcover plating.

(3) tarpaulins;

(3) cleats, battens and wedges;

(4) hatch securing bars and their securing devices;

(5) loading pads/bars and the side plate edge;

(6) guide plates and chocks;

(7) compression bars, drainage channels and drain pipes (if any).

(ix) Examination of flame screens on vents to all bunker tanks.

(x) Examination of bunker and vent piping systems, including ventilators.

(c) Examination of Cargo Holds for Bulk Carriers 10-15 years of age, the following is to apply:

(i) Overall survey of all cargo holds.

(ii) Close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approx. lower one third length of side frame at side shell and side frame end attachment and the adjacent shell plating in the forward cargo hold. Where this level of survey reveals the need for remedial measures, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of that cargo hold as well as a close-up survey of sufficient extent of all remaining cargo holds.

(iii) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-4C. These thickness measurements are to be carried out before the Annual Survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For vessels built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition.

(iv) Where the protective coating in cargo holds, as defined by 23.1.7 of Part II of this Rules is found to be in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

(v) All piping and penetrations in cargo holds, including overboard piping, are to be examined.

(d) Examination of Cargo Holds for Bulk Carriers over 15 years of age, the following is to apply:

(i) Overall survey of all cargo holds.

(ii) Close-up survey of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approx. lower one third length of side frame at side shell and side frame end attachment and the adjacent shell plating in the forward cargo hold and one other selected cargo hold. Where this level of survey reveals the need for remedial measures, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of that cargo hold as well as a close-up survey of sufficient extent of all remaining cargo holds.

(iii) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance

with Table I 2-4C. These extended thickness measurements are to be carried out before the Annual Survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For vessels built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition.

(iv) Where a hard protective coating is fitted in cargo holds, as defined by 23.1.7 of Part II of this Rules and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

(v) All piping and penetrations in cargo holds, including overboard piping, are to be examined.

(e) Examination of Ballast Tanks

(i) Examination of Ballast Tanks when required as a consequence of the results of the Special Survey and Intermediate Survey is to be carried out. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-4C. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous survey are to have thickness measurements taken.

For vessels built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition.

(f) Additional Annual Survey requirements for the foremost cargo hold of ships subject to SOLAS XII/9.1

(i) Ships subject to SOLAS XII/9.1 are those meeting all the following conditions:

(1) Bulk Carriers of 150 m in length and upwards of single side skin construction,

(2) carrying solid bulk cargoes having a density of 1780 kg/m$^3$ and above,

(3) contracted for construction before 1 July 1999, and

(4) constructed with an insufficient number of transverse watertight bulkheads to enable them to withstand flooding of the foremost cargo hold in all loading conditions and remain afloat in a satisfactory condition of equilibrium as specified in SOLAS XII/4.3.

(ii) In accordance with SOLAS XII/9.1, for the foremost cargo hold of such ships, the additional survey requirements listed below shall apply:

(1) For bulk carriers of 5-15 years of age:

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

i) Shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads.

ii) Suspect areas identified at previous surveys (see 2.1.2(u) ).

b) Where considered necessary by the Surveyor as a result of the overall and close-up survey as described in a) above, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of the cargo hold.

(2) For bulk carriers exceeding 15 years of age:

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

i) All shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads.

ii) Suspect areas identified at previous surveys (see 2.1.2(u) ).

(3) Extent of Thickness Measurement

a) Thickness measurement is to be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey, as described in 2.12.1(f)(ii)(1)a) and 2.12.1(f)(ii)(2)a) above.

The minimum requirement for thickness measurements are suspect areas identified at previous surveys (see 2.1.2(u) ).
Where Substantial Corrosion as defined in 2.1.2(j) is found, the extent of thickness measurements should be increased with the requirements of Table I 2-4C.

b) The thickness measurement may be dispensed with provided the Surveyor is satisfied by the close-up survey, that there is no structural diminution and the Protective Coating where fitted remains effective.

(4) Special Consideration

a) Where the protective coating in the foremost cargo hold, as defined by 23.1.7 of Part II is found to be in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

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

(g) Additional Annual Survey requirements after determining compliance with SOLAS XII/12 and XII/13

(i) For ships complying with the requirements of SOLAS XII/12 for hold, ballast and dry space water level detectors, the Annual Survey is to include an examination and a test, at random, of the water ingress detection systems and of their alarms.

(ii) For ships complying with the requirements of SOLAS XII/13 for the availability of pumping systems, the Annual Survey is to include an examination and a test, of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

2.12.2 Intermediate Survey

Those items which are additional to the requirements of the Annual Survey in 2.12.1 and the applicable requirements of the Intermediate Survey in 2.6 may be surveyed either at or between the 2nd and 3rd Annual Survey.

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) Examination of Bulk Carriers 5 -10 years of age. The following is to apply:

(i) Ballast Tanks

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

(2) Where POOR coating condition, corrosion or other defects are found in water Ballast tanks or where a hard Protective Coating was not applied from the time of construction, the examination is to be extended to other Ballast tanks of the same type.

(3) In ballast tanks other than double bottom tanks, where a hard Protective Coating is found in POOR condition, and it is not renewed, or where soft or semi-hard coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question are to be examined and thickness measurements carried out as considered necessary at

annual intervals. When such breakdown of hard protective coating is found in ballast double bottom tanks, or where a soft or semi-hard coating has been applied, or where a hard protective coating has not been applied, the tanks in question may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

(4) In addition to the requirements above, suspect areas identified at previous surveys are to be overall and close-up surveyed.

(ii) Cargo Holds

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

a) Shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads in the forward cargo hold and one other selected cargo hold;

b) Areas found suspect at previous surveys.

(2) Where considered necessary by the Surveyor as a result of the overall and close-up survey as described in 2.12.2(a)(ii)(1) above, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of that cargo hold as well as a close-up survey of sufficient extent of all remaining cargo holds.

(iii) Extent of Thickness Measurements

(1) Thickness measurements are to be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey as described in 2.12.2(a)(ii)(1) above. The minimum requirement for thickness measurements at the Intermediate Survey are areas found to be Suspect Areas at previous surveys.

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

(3) Where Substantial Corrosion is found, the extent of thickness measurements is to increased in accordance with the requirements of Table I 2-4C. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

(4) For vessels built under IACS Common Structural Rules, the identified substantial corrosion areas may be:

a) protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition, or alternatively

b) required to be measured at annual intervals.

(5) Where the hard protective coating in cargo holds, as defined by 23.1.7 of Part II is found to be in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

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

(b) Examination of Bulk Carriers 10-15 years of age. The following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent to the previous Special Survey as required in 2.12.3 and 2.1.6(a). However, internal examination of fuel tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.12.2(b)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of this Part.

(iii) In application of 2.12.2(b)(i) above, an In-water survey may be considered in lieu of the requirements of 2.12.3(b).

(c) Bulk Carriers over 15 years of age. The following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent to the previous Special Survey as required in 2.12.3 and 2.1.6(a). However, internal examination of fuel tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.12.2(c)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of the Part.

(iii) In application of 2.12.2(c)(i) above, a survey in dry dock is to be part of the Intermediate Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and water ballast tanks(1) are to be carried out in accordance with the applicable requirements for Intermediate Surveys, if not already performed.

Note:

(1) Lower portions of the cargo holds and ballast tanks are considered to be the parts below light ballast water line.

2.12.3 Special Survey

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) General

(i) The Special Survey is to include, in addition to the requirements of the Annual Survey in 2.12.1 and the applicable requirements of the Special Survey in 2.7, examination, tests, and checks of sufficient extent to ensure that the hull and related piping as required in 2.12.3(a)(iii) below, is in a satisfactory condition and is fit for its intended purpose for the new period of class of 5 years to be assigned subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

(ii) All cargo holds, Ballast Tanks, including double bottom tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing as required in 2.12.3(f) and 2.12.3(g), to ensure that the structural integrity remains effective. The aim of the examination is to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

(iii) All piping systems within the above Spaces are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory.

(iv) The survey extent of ballast tanks converted to void spaces is to be specially considered in relation to the requirements for ballast tanks.

(b) Bottom Survey in dry dock

(i) A Bottom Survey in dry dock is to be a part of the Special Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks(1) are to be carried out in accordance with the applicable requirements for Special Surveys, if not already performed.

Note:

(1) Lower portions of the cargo holds and ballast tanks are considered to be the parts below light ballast water line.

(c) Tank Protection

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

When such breakdown of hard protective coating is found in water ballast double bottom tanks and it is not renewed, where a soft or semi-hard coating has been applied, or where a hard protective coating has not been applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

(ii) Where a hard protective coating is provided in cargo holds, as defined by 23.1.7 of Part II and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

(d) Hatch Covers and Coamings

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

(i) A thorough inspection of the items listed in 2.12.1(b) is to be carried out, in addition to all hatch covers and coamings.

(ii) Checking of the satisfactory operation of all mechanically operated hatch covers is to be made, including:

(1) stowage and securing in open condition;

(2) proper fit and efficiency of sealing in closed condition;

(3) operational testing of hydraulic and power components, wires, chains, and link drives.

(iii) Checking the effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent.

(iv) Close-up survey and thickness measurement (for accessible parts) of the hatch cover and coaming plating and stiffeners is to be carried out as given in Table I 2-5B and Table I 2-3C.

(e) Extent of Overall and close-up survey

(i) An overall survey of all tanks and spaces is to be carried out at each Special Survey.
Fuel oil tanks in the cargo length area are to be surveyed as follows:

| Special Survey No.1 Age ≤ 5 | Special Survey No.2 5 < Age ≤ 10 | Special Survey No.3 10 < Age ≤ 15 | Special Survey No.4 and ubsequent 15 < Age |
|---|---|---|---|
| 0 | 1 | 2 | Half, minimum 2 |

Notes:

1. These requirements apply to tanks of integral (structural) type.
2. If a selection of tanks is accepted to be examined, then different tanks are to be examined at each Special Survey, on a rotational basis.
3. Peak tanks (all uses) are subject to internal examination at each Special Survey.
4. At Special Survey No.3 and subsequent Special Surveys, 1 deep tank for fuel oil in the cargo area is to be included, if fitted.

(ii) The minimum requirements for close-up surveys at Special Survey are given in Table I 2-5B.

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

(iv) For areas in spaces where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to Table I 2-5B may be specially considered. Refer also to 2.12.3(c)(ii).

(f) Extent of Thickness Measurement

(i) The minimum requirements for thickness measurement at Special Survey are given in Table I 2-3C .

For additional thickness measurement guidelines applicable to the vertically corrugated transverse watertight bulkhead between cargo hold Nos. 1 and 2 on ships subject to compliance with IACS URs S19 and S23, reference is to be made to IACS Z10.2 - 1.1.4 and Annex III.
For additional thickness measurement guidelines applicable to the side shell frames and brackets on ships subject to compliance with IACS UR S31, reference is to be made to IACS 1.1.5 and Annex V.

(ii) Provisions for extended measurements for areas with Substantial Corrosion are given in Table I 2-4C and as may be additionally specified in the Survey Programme as required by 2.1.6(a). These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

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

a) protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition, or alternatively

b) required to be measured at annual intervals.

(iii) The Surveyor may further extend the thickness measurements as deemed necessary.

(iv) For areas in tanks where hard protective coatings are found to be in a GOOD condition, the extent of thickness measurement according to Table I 2-3C may be specially considered. Refer also to 2.12.3(c)(ii).

(v) Transverse sections are to be chosen where largest reductions are suspected to occur or are revealed from deck plating measurements, one of which is to be in the amidships area.

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

(g) Extent of Tank Testing

(i) All boundaries of water ballast tanks, deep tanks and cargo holds used for water ballast within the cargo length area are to be pressure tested. For Fuel Oil Tanks, only representative tanks are to be pressure tested.

(ii) The Surveyor may extend the tank testing as deemed necessary.

(iii) Boundaries of ballast tanks are to be tested with a head of liquid to the top of air pipes.

(iv) Boundaries of ballast holds are to be tested with a head of liquid to near to the top of hatches.

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

(vi) The testing of double bottom tanks and other spaces not designed for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tanktop is carried out.

(h) Additional Special Survey requirements after determining compliance with SOLAS XII/12 and XII/13

(i) For ships complying with the requirements of SOLAS XII/12 for hold, ballast and dry space water level detectors, the Special Survey is to include an examination and a test of the water ingress detection systems and of their alarms.

(ii) For ships complying with the requirements of SOLAS XII/13 for the availability of pumping systems, the Special Survey is to include an examination and a test of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

*Section 2.11 has been renumbered and amended as follows:*

## 2.~~11~~13 Hull Surveys of Chemical ~~Carriers~~ Tankers

Procedures for class related services, see 2.1.4 of this Chapter. Provision for surveys, see 2.1.5 of this Chapter. Preparation for enhanced survey for ESP ships, see 2.1.6 of this Chapter.

2.~~11~~13.1 Annual Surveys

In addition to the applicable requirements of Annual Survey in 2.5, those items herein are to be carried out.

The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

(a) Examination of the Hull

(i) Examination of the hull plating and its closing appliances which is accessible.

(ii) Examination of watertight penetrations as far as practicable.

(b) Examination of weather decks

(i) Examination of cargo tank openings including gaskets, covers, coamings and flame screens.

(ii) Examination of cargo tanks pressure/vacuum valves and flame screens.

(iii) Examination of flame screens on vents to all bunker tanks.

(iv) Examination of cargo, bunker and vent piping systems, including vent masts and headers.

(c) Examination of Cargo pump rooms and pipe tunnels if fitted

(i) Examination of all pump room bulkheads for signs of chemical leakage or fractures and, in particular, the sealing arrangements of all penetrations of pump room bulkheads.

(ii) Examination of the condition of all piping systems.

(d) Examination of Ballast Tanks

(i) Examination of Ballast Tanks where required as a consequence of the results of the Special Survey (see 2.13.3(c) ) and Intermediate Survey (see 2.13.2(b)(i) and 2.13.2(b)(ii) ) is to be carried out. When considered necessary by the Surveyor, or when extensive corrosion exists, thickness measurements are to be carried out and if the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-8. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous Surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

(e) ~~2.11.1 Annual Survey~~ Examination of installations, equipment and outfit

In addition to the surveys as per ~~applicable~~ requirements in 2.13.1(a)~(d) above, ~~2.5,~~ the following installations, items of equipment and outfit listed are to be checked as to their perfect maintenance condition:

(i) On weather deck within the cargo area, the following equipment, if fitted, is to be surveyed:

(1) Cargo tank hatches, including sealings and covers.

(2) The gauging devices, level alarms and overflow control with automatic closing valves.

(3) ~~Pressure/vacuum relief valves and flame arresters of cargo tank venting arrangements as well as~~ The devices for measuring the cargo tank vapour pressure.

(4) Sampling devices of cargo cooling or heating installation as well as temperature measuring devices and temperature alarm systems.

(5) Pump discharge pressure gauges and the distinctive marking of pumps, valves and cargo piping.

(6) Wheelhouse doors and wheelhouse windows, deckhouse and superstructure windows facing the cargo area (closed condition).

(ii) Cargo handling installations (including spool pieces of loading and unloading system, spray shields and drip trays, cargo hoses, etc.) arranged on the weather deck, possibly in the fore or aft area, are to be visually examined.

(iii) In cargo pump room and other enclosed spaces entered during cargo handling operations, the followings are to be surveyed:

(1) Remote operation of bilge system.

(2) Rescue arrangements.

(3) Ventilation systems.

(4) For fire extinguishing systems, see 2.13.1(e)(v) bellow. ~~(e).~~

(iv) In gas dangerous spaces and zones, the electrical equipment, including cables and their supports, is to be visually examined, particularly regarding explosion protection.

(v) The survey of fire extinguishing systems, including:

(1) External inspections of all systems for the cargo tank area and pump rooms.

(2) Checking of the foam fire extinguishing and/or water spray system on deck.

(vi) The following items, if fitted, are to be checked:

(1) Special arrangements related to damage control (e.g. sliding bulkhead doors) in accordance with the approved damage control plan (also for tanker of less than 100 m in length).

(2) Cargo sample storage spaces.

(3) Gas detection instruments.

(4) Cargo information and safety instructions.

2.13.2 Intermediate Survey

Those items which are additional to the requirements of the Annual Survey in 2.13.1 and the applicable requirements of the Intermediate Survey in 2.6 may be surveyed either at or between the 2nd and 3rd Annual Survey.

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) General

(i) The survey extent is dependent on the age of the vessel as specified in 2.13.2(b) to 2.13.2(d).

(ii) For weather decks, an examination as far as applicable of cargo, bunker, ballast, steam and vent piping systems as well as vent masts and headers is to be carried out. If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure tested, thickness measured or both.

(b) Chemical Tankers between 5 and 10 Years of Age

The following is to apply:

(i) For ballast tanks, an overall survey of Representative Tanks selected by the Surveyor is to be carried out. If such inspections reveal no visible structural defects, the examination may be limited to a verification that the hard protective coating remains in GOOD condition.

(ii) A Ballast Tank is to be examined at subsequent annual intervals where:

(1) a hard protective coating has not been applied from the time of construction, or

(2) a soft or semi-hard coating has been applied, or

(3) substantial corrosion is found within the tank, or

(4) the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the Surveyor.

(iii) In addition to the requirements above, suspect areas identified at previous surveys are to be examined.

(c) Chemical Tankers between 10 and 15 years of Age

The following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.13.3 and 2.1.6(a). However, pressure testing of cargo and ballast tanks is not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.13.2(c)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii).

(iii) In application of 2.13.2(c)(i) above, an In-water survey may be considered in lieu of the requirements of 2.13.3(b).

(d) Chemical Tankers over 15 years of Age

The following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.13.3 and 2.1.6(a). However, pressure testing of cargo and ballast tanks is not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.13.2(d)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii).

(iii) In application of 2.13.2(d)(i) above, a survey in dry dock is to be part of the Intermediate Survey.

The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks are to be carried out in accordance with the applicable requirements for Intermediate Surveys, if not already performed.

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

(e) ~~2. 11.2 Intermediate Surveys~~ In addition to the surveys as stipulated in 2.13.2(a)~(d) ~~above~~, the checks listed below are to be performed. If deemed necessary by the Surveyor, a functional test is to be carried out in addition to the survey.

~~(a) In the case of chemical tankers aged 10 years or over, at least 2 selected cargo tanks are to be internally inspected for corrosion and possible damages to their coatings, and structural equipment, such as piping, valves and fittings, instrumentation, etc. is to be inspected.~~

~~(b) Sea water ballast tanks.~~

~~See 2.6.2(a) and (b).~~

(i) All important piping systems in the cargo area are to be examined, e.g.:

(1) Cargo, tank cleaning, bunkering, ballast and steam pipings.

(2) Provisions for drainage of cargo tank vent lines.

(3) Bonding devices of all piping systems and independent cargo tanks.

(4) Cargo cooling systems.

(5) Cargo hoses.

(6) Tank heating systems.

(7) Spare parts for mechanical ventilation systems.

(ii) The electrical equipment in gas dangerous spaces and zones is to be surveyed with respect to the following:

(1) Protective earthing (spot checks).

(2) Integrity of certified safe type equipment.

(3) Damage to the outer sheet of cables.

(4) Function testing of pressurized equipment, and of associated alarms.

(5) Testing of insulation resistance of circuits, only when the ship is in gas free or inertised condition. If proper test reports are available on board, the readings made by the crew may be accepted.

2.13.3 Special Survey

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) General

(i) The Special Survey is to include, in addition to the requirements of the Annual Survey in 2.13.1 and the applicable requirements of the Special Survey in 2.7 , examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 2.13.3(a)(iii) below, is in a satisfactory condition and is fit for its intended purpose for the new period of class of 5 years to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

(ii) All cargo tanks, Ballast Tanks, including double bottom tanks, pump rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing as required in 2.13.3(e) and 2.13.3(f), to ensure that the structural integrity remains effective. The aim of the examination is to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

(iii) Cargo piping on deck and cargo and ballast piping within the above tanks and spaces are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory. Special attention is to be given to any ballast piping in cargo tanks and cargo piping in ballast tanks and void spaces, and Surveyors are to be advised on all occasions when this piping, including valves and fittings are open during repair periods and can be examined internally.

(b) Bottom Survey in dry dock

(i) A Bottom Survey in dry dock is to be a part of the Special Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and ballast tanks(1) are to be carried out in accordance with the applicable requirements for Special Surveys, if not already performed.

Note:

(1) Lower portions of the cargo and ballast tanks are considered to be the parts below light ballast water line.

(c) Tank Protection

(i) Where provided, the condition of the corrosion prevention system of cargo tanks is to be examined.

A Ballast Tank is to be examined at subsequent annual intervals where:

(1) a hard protective coating has not been applied from the time of construction, or

(2) a soft or semi-hard coating has been applied, or

(3) substantial corrosion is found within the tank, or

(4) the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the Surveyor.

Thickness measurements are to be carried out as deemed necessary by the Surveyor.

(d) Extent of Overall and close-up survey

(i) An overall survey of all tanks and spaces is to be carried out at each Special Survey.

(ii) The minimum requirements for close-up surveys at Special Survey are given in Table I 2-6A or Table I 2-6B. The survey of stainless steel tanks may be carried out as an overall survey supplemented by close-up survey as deemed necessary by the Surveyor.

(iii) The Surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also in the following cases:

(1) In particular, tanks having structural arrangements or details which have suffered defects in similar tanks or on similar ships according to available information.

(2) In tanks which have structures approved with reduced scantlings due to an approved corrosion control system.

(iv) For areas in tanks where hard protective coatings are found to be in a GOOD condition as defined in 2.1.2(l), the extent of close-up surveys according to Table I 2-6A or Table I 2-6B may be specially considered.

(e) Extent of Thickness Measurement

(i) The minimum requirements for thickness measurements at Special Survey are given in Table I 2-7. Thickness measurement of stainless steel hull structure and piping may be waived, except for clad steel plating.

(ii) Provisions for extended measurements for areas with Substantial Corrosion are given in Table I 2-8, and as may be additionally specified in the Survey Programme as required in 2.1.6(a). These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous Special Surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

(iii) The Surveyor may further extend the thickness measurements as deemed necessary.

(iv) For areas in tanks where hard protective coatings are found to be in a GOOD condition as defined in 2.1.2(l), the extent of thickness measurements according to Table I 2-7 may be specially considered.

(v) Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

(vi) In cases where 2 or 3 sections are to be measured, at least one is to include a Ballast Tank within 0.5L amidships.

(f) Extent of Tank Testing

(i) The minimum requirements for ballast tank testing at Special Survey are given in 2.13.3(f)(iii) below and Table I 2-9. The minimum requirements for cargo tank testing at Special Survey are given in 2.13.3(f)(iv) below and Table I 2-9. Cargo tank testing carried out by the vessel's crew under the direction of the Master may be accepted by the Surveyor provided the following conditions are complied with:

(1) a tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the owner and reviewed by the Society prior to the testing being carried out;

(2) there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;

(3) the tank testing has been satisfactorily carried out within Special Survey window not more than 3 months prior to the date of the survey on which the overall or close up survey is completed;

(4) the satisfactory results of the testing is recorded in the vessel's logbook;

(5) the internal and external condition of the tanks and associated structure are found satisfactory by the Surveyor at the time of the overall and close up survey.

(ii) The Surveyor may extend the tank testing as deemed necessary.

(iii) Boundaries of ballast tanks are to be tested with a head of liquid to the top of air pipes.

(iv) Boundaries of cargo tanks are to be tested to the highest point that liquid will rise under service conditions.

(v) The testing of double bottom tanks and other spaces not designed for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tanktop is carried out.

(g) Chemical Tankers over 10 Years of Age

(i) Selected steel cargo pipes outside cargo tanks and ballast pipes passing through cargo tanks are to be:

(1) Thickness measured at random or selected pipe lengths to be opened for internal inspection;

(2) Pressure tested to the maximum working pressure.

Special attention is to be given to cargo/slop discharge piping through Ballast Tanks and void spaces.

~~Intermediate Survey~~

~~2.11.3 Special Survey – hull~~

~~In addition to the applicable requirements in 2.7, the following items are to be surveyed:~~

~~(a) The internal examination including close up survey and pressure testing of all tanks and spaces are to be carried out according to Table I 2-1B, Table I 2-6A, Table I 2-6B and Table I 2-9. Cargo tank testing carried out by the vessel's crew under the direction of the Master may be accepted by the Surveyor provided the following conditions are complied with:~~

~~(i) A tank testing procedure has been submitted by the owner and reviewed by this Society prior to the testing being carried out;~~

~~(ii) There is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;~~

~~(iii) The tank testing has been satisfactorily carried out within Special Survey window not more than 3 months prior to the date of the survey on which the overall or close up survey is completed;~~

~~(iv) The satisfactory results of the testing is recorded in the vessel's logbook;~~

~~(v) The internal and external condition of the tanks and associated structure are found satisfactory by the Surveyor at the time of the overall and close up survey.~~

~~(b) The minimum requirements for thickness measurements are given in Table I 2-7. The extent of thickness measurements at those areas of substantial corrosion in cargo area length is given in Table I 2-8.~~

(h) ~~2.11~~13.4 ~~Special Survey –~~ Cargo area equipment

In addition to the requirements of the cargo system and pertinent safety devices stipulated in 2.13.2(e) ~~2.11.2~~, the following items are to be examined:

(i) Cargo and ballast piping systems including valves and fittings, are to be inspected for corrosion, as deemed necessary by the Surveyor. Subsequently a pressure test is to be carried out.

(ii) Cargo stripping and ballast pumps are to be examined. Pressure relief valves of pumps are to be function tested.

(iii) Pressure/vacuum valves of cargo tanks are to be function tested and are to be opened up and adjusted, if deemed necessary by the Surveyor.

(iv) Tank venting systems are to be examined. Flame arresters are to be opened up as far as necessary, and cleaned.

(v) Cargo tank heating systems are to be examined and pressure tested to 1.5 times the operating pressure.

(vi) The bilge systems of pump rooms are to be examined and tested.

(vii) All ventilation systems in cargo areas, including portable fans, are to be examined and function tested.

(viii) The following equipment is to be examined and function tested:

(1) Level indicators of cargo tanks.

(2) Liquid level alarms.

(3) Overflow controls.

(4) Pressure and temperature alarms.

(5) Remote control systems of cargo pumps.

(6) Sampling arrangements for cargo tanks, if fitted.

(7) Inert gas systems, see 3.2.2 of Chapter 3. ~~2.9.2.~~

(ix) ~~2. 11.5 Special Survey - machinery~~

~~In addition to the Special Surveys of the ship's machinery as required in 2.7.6 and~~ The protection devices of electric motors in gas dangerous spaces and zones are to be examined and tested.

*Section 2.13 has been renumbered and amended as follows:*

## 2.~~13~~14 Hull Surveys of Double Hull Oil Tankers ~~– Hull~~

Procedures for class related services, see 2.1.4 of this Chapter. Provision for surveys, see 2.1.5 of this Chapter. Preparation for enhanced survey for ESP ships, see 2.1.6 of this Chapter.

These requirements apply to surveys of hull structure and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels, void spaces within the cargo area and all ballast tanks for the double hull oil tankers with ESP notation.

2.~~13~~14.1 Annual Survey

(a) General

(i) ~~The due rang e of Annual Survey is to be in accordance with~~ In addition to the applicable requirements of the Annual Survey in 2.5, those items herein are to be carried out.

(ii) The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

(b) Examination of the hull

(i) Examination of the hull plating and its closing appliances as far as can be seen.

(ii) Examination of watertight penetrations as far as practicable.

(c) Examination of weather decks

(i) Examination of cargo tank openings including gaskets, covers, coamings and flame screens.

(ii) Examination of cargo tanks pressure/vacuum valves and flame screens.

(iii) Examination of flame screens on vents to all bunker, oily ballast and oily slop tanks.

(iv) Examination of cargo, crude oil washing, bunker and vent piping systems, including vent masts and headers.

(d) Examination of cargo pump rooms and pipe tunnels, if fitted.

(i) Examination of all pump room bulkheads for signs of oil leakage or fractures and, in particular, the sealing arrangements of all penetrations of pump room bulkheads.

(ii) Examination of the condition of all piping systems.

(e) Examination of ballast tanks

(i) Examination of ballast tanks where required as a consequence of the results of the Special Survey (see 2.14.3(b)) and Intermediate Survey (see 2.14.2(b)(i) and 2.14.2(b)(ii) ) is to be carried out. When considered necessary by the Surveyor, or when extensive corrosion exists, thickness measurement are to be carried out and if the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-15. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For vessels built under IACS Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out.

~~additional thickness measurements are to be carried out as deemed necessary by the Surveyor.~~

~~(ii) Double hull oil tankers exceeding 15 years of age, all ballast tanks adjacent to (i.e. with a common plan boundary) a cargo tank with any means of heating are to be examined internally. Ballast tanks which were found, at the previous Intermediate or Special Survey, to have no Substantial Corrosion within the tank and which were found in compliance with either of the following conditions may be specially considered by the Society:~~

~~(1) coating in Good condition; or~~

~~(2) coating of the common boundary, including adjacent structures, in Good condition and the coating of the remaining parts of the tank in Fair condition.~~

2.~~13~~14.2 Intermediate Survey

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) General

(i) ~~The due range of intermediate~~ In addition to the requirements of Annual Survey in 2.14.1 and ~~is to be in accordance with~~ the applicable requirements of the Intermediate Survey in 2.6, those items herein are to be carried out.

~~(ii) At each Intermediate Survey, in addition to the requirements of the Annual Surveys, the following items are to be surveyed.~~

(ii ~~iii~~) The survey extent is dependent on the age of the vessel as specified in 2.14.2(b) to 2.14.2(d) and shown in Table I 2-12.

~~For double hull oil tankers exceeding 15 years of age, the requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.1.5(a) and 2.14.3. However, pressure testing of cargo and ballast tanks is not required unless deemed necessary by attending Surveyor.~~

(iii ~~iv~~) For weather decks, an examination as far as applicable of cargo, crude oil washing, bunker, ballast, steam and vent piping systems as well as vent masts and headers is to be carried out. If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure-tested, thickness measured or both.

~~In application of (iii) above, a survey in dry dock is to be part of the Intermediate Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks are to be surveyed in accordance with the applicable requirements for the Intermediate Surveys, if not already surveyed.~~

(iv ~~v~~) For vessels built under IACS Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out.

~~For ships over 20 years of age after launching date, the applicable requirements specified in 2.6 are to be applied at the Intermediate Survey carried out within 3 months before or after the anniversary date from the previous Special Survey.~~

(b) Double Hull Oil Tankers between 5 and 10 years of age

The following is to apply:

(i) For tanks used for salt-water ballast, an overall survey of Representative Tanks selected by the Surveyor is to be carried out. If such inspections reveal no visible structural defects, the examination may be limited to a verification that the hard protective coating remains in GOOD condition.

(ii) A Ballast Tank is to be examined at subsequent annual intervals where:

(1) a hard protective coating has not been applied from the time of construction, or

(2) a soft or semi-hard coating has been applied, or

(3) substantial corrosion is found within the tank, or

(4) the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the Surveyor.

(iii) In addition to the requirements above, suspect areas identified at previous surveys are to be examined.

(c) Double Hull Oil Tankers between 10 and 15 years of age.

The following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.14.3 and 2.1.6(a). However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of Hull Girder as required in 2.1.6(f) are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.14.2(c)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of this Part.

(iii) In application of 2.14.2(c)(i) above, an under water survey may be considered in lieu of the requirements of 2.14.3(a)(iv).

(d) Double Hull Oil Tankers over 15 years of age.

The following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent as ~~2.13.3 and 2.1.5~~ 2.14.3 and 2.1.6.(a). However, pressure testing of cargo and ballast tanks and the requirements for longitudinal strength evaluation of Hull Girder as required in 2.1.6(f) are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.14.2(d)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of this Part.

(iii) In application of 2.14.2(d)(i) above, a survey in dry dock is to be part of the Intermediate Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and water ballast tanks(1) are to be surveyed in accordance with the applicable requirements for Intermediate Surveys, if not already surveyed.

Note:

(1) Lower portions of the cargo and ballast tanks are considered to be the parts below light ballast water line.

~~(b) For weather decks, an examination as far as applicable of:~~

~~(i) Cargo, crude oil washing, bunker, ballast, steam and vent piping systems as well as vent masts and headers is to be carried out.~~

~~(ii) If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure tested, thickness measured or both.~~

(~~e~~e) Extent of overall survey and close-up survey

The extent of overall survey and close-up survey for Intermediate Survey is to be in accordance with the requirements of Table I 2-~~17~~12.

(~~d~~f) Extent of Thickness Measurements

(i) The extent of thickness measurements is also given in Table I 2-~~17~~12.

(ii) The minimum requirements for thickness measurements at the Intermediate Survey are areas found to be Suspect Areas at the previous Special Survey.

(iii) Where Substantial Corrosion is found, the extent of the thickness measurements according to Table I 2-~~17~~12 is to be increased in accordance with the requirements of Table I 2-~~20~~15 These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous Special Surveys are to be examined.

(iv) Areas of Substantial Corrosion identified at previous special or Intermediate Survey are to have thickness measurements taken. ~~Intermediate SurveyIntermediate SurveyIntermediate Survey~~

2.~~13~~14.3 Special Survey

(a) General

~~(i) The due range of Special Survey is to be in accordance with the applicable requirements of 2.7.~~

(~~ii~~i) The Special Survey is to include, in addition to the requirements of the ~~Intermediate Survey~~Annual Survey in 2.14.1 and the applicable requirements of Special Survey in 2.7, examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 2.14.3(a)(iii) below, is in a satisfactory condition.

(~~ii~~iii) All cargo tanks, ~~all salt water~~ ballast tanks, pump rooms, pipe tunnels, cofferdams and void spaces bounding cargo tanks, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and pressure testing as required in 2.14.3(d) and 2.14.3(e), ~~deemed necessary,~~ to ensure that the structural integrity remains effective. The aim of the examination is to be sufficient to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration that may be present.

(iii ~~iv~~) Cargo piping on deck, including crude oil washing (COW) piping, and all piping systems within the above tanks and spaces are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory. Where provided, special attention is to be given to any ballast piping in cargo tanks and cargo piping in ballast tanks and void spaces, and Surveyors are to be advised on all occasions when this piping, including valves and fittings are opened during repair periods and can be examined internally.

(iv ~~v~~) A Bottom Survey in dry dock is to be a part of the Special Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo tanks and ballast tanks(1) are to be carried out in accordance with the applicable requirements for Special Surveys, if not already performed.

Note:

(1) Lower portions of the cargo and ballast tanks are considered to be the parts below light ballast water line.

(b) Tank protection

(i) Where provided, the condition of corrosion prevention of cargo tanks is to be examined.

(ii) A Ballast Tank is to be examined at subsequent annual intervals where:

(1) a hard protective coating has not been applied from the time of construction, or

(2) a soft or semi-hard coating has been applied, or

(3) substantial corrosion is found within the tank, or

(4) the hard protective coating is found to be in less than GOOD condition and the hard protective coating is not repaired to the satisfaction of the Surveyor.

Thickness measurements are to be carried out as deemed necessary by the Surveyor.

~~For tanks used for salt water ballast, where a protective coating is found in Poor condition and it is not renewed, where a soft or semi-hard 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 at annual intervals.~~

(c) Extent of overall and close-up survey

(i) An overall survey of all tanks and spaces~~, excluding fuel oil, lube oil and fresh water tanks,~~ is to be carried out at each Special Survey.

(ii) The minimum requirements for close-up surveys at Special Survey are given in Table I 2-~~18~~13.

(iii) The Surveyor may extend the close-up survey as deemed necessary taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also in the following cases:

(1) In particular, tanks having structural arrangements or details which have suffered defects in similar tanks or on similar ships according to available information.

(2) In tanks which have structures approved with reduced scantlings due to an approved corrosion control system.

(iv) For areas in tanks where coatings are found in Good condition, the extent of close-up surveys according to Table I 2-~~18~~13 may be specially considered.

(d) Extent of thickness measurement

(i) The minimum requirements for thickness measurements at Special Survey are given in Table I 2-~~19~~14.

(ii) Provisions for extended measurements for areas with Substantial Corrosion are given in Table I 2-~~20~~15, and as may be additionally specified in the survey programme as required in 2.1.6(a). These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous Special Surveys are to be examined. Areas of Substantial Corrosion identified at previous special or Intermediate Survey are to have thickness measurements taken.

For vessels built under IACS Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out at annual and Intermediate Surveys.

(iii) The Surveyor may further extend the thickness measurements as deemed necessary.

(iv) For areas in tanks where coating are found to be in a Good condition, the extent of thickness measurements according to Table I 2-~~19~~14 may be specially considered.

(v) Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements.

(vi) In cases where 2 or 3 sections are to be measured, at least 1 is to include a ballast tank within 0.5L amidships.

In case of oil tankers of 130 m in length and upwards (as defined in the International Convention on Load Lines in force) and more than 10 years of age, for the evaluation of the ship's longitudinal strength as required in 2.1.6(f), the sampling method of thickness measurements is given in IACS Z10.4 Annex III Appendix 3.

(e) Extent of tank testing

(i) The minimum requirements for cargo and ballast tank testing at Special Survey are given in 2.14.3(e)(iii) and 2.14.3(e)(iv) below, and Table I 2-~~21~~16.

Cargo tank testing carried out by the vessel's crew under the direction of the Master may be accepted by the Surveyor provided the following conditions are complied with:

(1) a tank testing procedure, specifying fill heights, tanks being filled and bulkheads being tested, has been submitted by the owner and reviewed by the Society prior to the testing being carried out;

(2) there is no record of leakage, distortion or substantial corrosion that would affect the structural integrity of the tank;

(3) the tank testing has been satisfactorily carried out within Special Survey window not more than 3 months prior to the date of the survey on which the overall or close up survey is completed;

(4) the satisfactory results of the testing is recorded in the vessel's logbook;

(5) the internal and external condition of the tanks and associated structure are found satisfactory by the Surveyor at the time of the overall and close up survey.

(ii) The Surveyor may extend the tank testing as deemed necessary.

(iii) Boundaries of ballast tanks are to be tested with a head of liquid to the top of air pipes.

(iv) Boundaries of cargo tanks are to be tested to the highest point that liquid will rise under service conditions.

(v) The testing of double bottom tanks and other spaces not designed for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tanktop is carried out.

~~Tanks are to be tested with a head of liquid to the top of access hatches for cargo tanks, or top of air pipes for ballast tanks, if this gives a higher pressure.~~

*Section 2.15 has been amended as follows:*

## 2.15 Hull Surveys of Double Skin Bulk Carriers~~ – Hull~~

Procedures for class related services, see 2.1.4 of this Chapter. Provision for surveys, see 2.1.5 of this Chapter. Preparation for enhanced survey for ESP ships, see 2.1.6 of this Chapter.

2.15.1 Annual Survey

(a) General

(i) In addition to the requirements of the Annual Survey in 2.5, those items herein are to be carried out.

(ii) The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull, weather decks, hatch covers, coamings and piping are maintained in a satisfactory condition and should take into account the service history, condition and extent of the corrosion prevention system of ballast tanks and areas identified in the survey report file.

(b) Examination of the hull

(i) Examination of the hull plating and its closing appliances as far as can be seen.

(ii) Examination of watertight penetrations as far as practicable.

(c) Examination of weather decks, hatch covers and coamings

(i) Confirmation is to be obtained that no unapproved changes have been made to the hatch covers, hatch coamings and their securing and sealing devices since the last survey.

(ii) A thorough survey of cargo hatch covers and coamings is only possible by examination in the open as well as closed positions and is to include verification of proper opening and closing operation. As a result, the hatch cover sets within the forward 25% of the ship's length and at least one additional set, such that all sets on the ship are assessed at least once in every 5-year period, are to be surveyed open, closed and in operation to the full extent on each direction at each Annual Survey, including:

(1) Stowage and securing in open condition;

(2) Proper fit and efficiency of sealing in closed condition; and

(3) Operational testing of hydraulic and power components, wires, chains, and link drives.

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

(iii) If there are indications of difficulty in operating and securing hatch covers, additional sets above those required by 2.15.1(c)(ii) above, at the discretion of the Surveyor, are to be tested in operation.

(iv) Where the cargo hatch securing system does not function properly, repairs are to be carried out under the supervision of the Society. Where hatch covers or coamings undergo substantial repairs, the strength of securing devices should be upgraded to comply with S21.5 of IACS UR S21.

(v) For each cargo hatch cover set, at each Annual Survey, the following items are to be surveyed:

(1) Cover panels, including side plates, and stiffener attachments that may be accessible in the open position by close-up survey (for corrosion, cracks, deformation);

(2) Sealing arrangements of perimeter and cross joints (gaskets for condition and permanent deformation, flexible seals on combination carriers, gasket lips, compression bars, drainage channels and non return valves);

(3) Clamping devices, retaining bars, cleating (for wastage, adjustment, and condition of rubber components);

(4) Closed cover locating devices (for distortion and attachment);

(5) Chain or rope pulleys;

(6) Guides;

(7) Guide rails and track wheels;

(8) Stoppers;

(9) Wires, chains, tensioners, and gypsies;

(10) Hydraulic system, electrical safety devices and interlocks; and

(11) End and interpanel hinges, pins and stools where fitted.

(vi) At each hatchway, at each Annual Survey, the coamings, with plating, stiffeners and brackets are to be checked for corrosion, cracks and deformation, especially of the coaming tops, including close-up survey.

(vii) Where considered necessary, the effectiveness of sealing arrangements may be proved by hose or chalk testing supplemented by dimensional measurements of seal compressing components.

(viii) Where portable covers, wooden or steel pontoons are fitted, checking the satisfactory condition, where applicable, of:

(1) Wooden covers and portable beams, carriers or sockets for the portable beam, and their securing devices;

(2) Steel pontoons, including close-up survey of hatchcover plating;

(3) Tarpaulins;

(4) Cleats, battens and wedges;

(5) Hatch securing bars and their securing devices;

(6) Loading pads/bars and the side plate edge;

(7) Guide plates and chocks;

(8) Compression bars, drainage channels and drain pipes (if any).

(ix) Examination of flame screens on vents to all bunker tanks.

(x) Examination of bunker and vent piping systems, including ventilators.

(d) Examination of Cargo Holds

(i) Double Skin Bulk Carriers 10-15 years of age. The following is to apply:

(1) Overall survey of two selected cargo holds.

(2) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-22. These extended thickness measurements are to be carried out

before the Annual Survey is credited as complete. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For ships built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition.

(3) All piping and penetrations in cargo holds, including overboard piping, are to be examined.

(ii) Double Skin Bulk Carriers over 15 years of age. The following is to apply:

(1) Overall survey of all cargo holds.

(2) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurement is to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-22. These extended thickness measurements are to be carried out before the Annual Survey is credited as complete. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For ships built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition.

(3) All piping and penetrations in cargo holds, including overboard piping, are to be examined.

(e) Examination of Ballast Tanks

(i) Examination of Ballast Tanks when required as a consequence of the results of the Special Survey and Intermediate Survey is to be carried out. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with Table I 2-22. These extended thickness measurements are to be carried out before the survey is credited as complete. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For ships built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition.

(f) Additional Annual Survey Requirements after Determining Compliance with SOLAS XII/12 and XII/13

(i) For ships complying with the requirements of SOLAS XII/12 for hold, ballast and dry space water level detectors, the Annual Survey is to include an examination and a test, at random, of the water ingress detection systems and of their alarms.

(ii) For ships complying with the requirements of SOLAS XII/13 for the availability of pumping systems, the Annual Survey is to include an examination and a test, of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

~~(a) In addition to the requirements of Annual Surveys of non-general dry cargo ships in 2.5, following items are also to be carried out:~~

~~(i) A thorough survey of all cargo hatch covers and coamings including opening and closing operation of hatch covers.~~

~~(ii) Examination of all piping and penetrations in cargo holds, including overboard piping.~~

~~(iii) Examination and test, at random, of water ingress detection systems.~~

~~(iv) Examination and test of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.~~

~~(v) Double Skin Bulk Carriers $10 < age \leq 15$~~

~~(1) Overall survey of two selected cargo holds.~~

~~(2) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If substantial corrosion is found, the extent of thickness measurements is to be increased.~~

~~(vi) Double Skin Bulk Carriers 15 < age~~

~~(1) Overall survey of all cargo holds.~~

~~(2) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If substantial corrosion is found, the extent of thickness measurements is to be increased.~~

2.15.2 Intermediate Survey

(a) General

(i) In addition to the requirements of Annual Survey in 2.15.1 and the applicable requirements of the Intermediate Survey in 2.6, those items herein are to be carried out.

(ii) Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(iii) The survey extent is dependent on the age of the ship as specified in 2.15.2(b) to 2.15.2(d) and shown in Table I 2-21.

(b) Double Skin Bulk Carriers 5 - 10 years of age. The following is to apply:

(i) Ballast Tanks

~~(a) In addition to the requirements of Annual Surveys in 2.15.1, following items are also to be carried out:~~

~~(i) Double Skin Bulk Carriers 5 < age ≦ 10~~

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

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

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

(4) In addition to the requirements above, suspect areas identified at previous surveys are to be overall and close-up surveyed.

(ii) Cargo Holds

(1) An overall survey of all cargo holds is to be carried out.

(2) Where considered necessary by the Surveyor as a result of the overall survey as described in 2.15.2(b)(ii)(1) above, the survey is to be extended to include a close-up survey of those areas of structure in the cargo holds selected by the Surveyor.

(iii) Extent of Thickness Measurements

(1) Thickness measurements are to be carried out to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey, where required as per 2.15.2(b)(ii)(2), and as provided in 2.15.2(b)(i)(3).

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

(3) Where Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements of Table I 2-22. These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.
For ships built under IACS Common Structural Rules, the identified substantial corrosion areas may be:

a) protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition, or alternatively

b) required to be measured at annual intervals.

(4) Where the hard protective coating in cargo holds, as defined by 23.1.7 of Part II is found to be in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

Explanatory note:

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

(c) Double Skin Bulk Carriers 10 – 15 years of age

The following is to apply:

(i) The requirements of the Intermediate Survey are to the same extent as the previous Special Survey as required in 2.15.3 and 2.1.6(a). However, internal examination of fuel oil tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.15.2(c)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of this Part.

(iii) In application of 2.15.2(c)(i) above, an In-water survey may be considered in lieu of the requirement of 2.15.3(b).

(d) Double Skin Bulk Carriers over 15 years of age

The following is to apply:

(i) The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in 2.15.3 and 2.1.6(a). However, internal examination of fuel oil tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.

(ii) In application of 2.15.2(d)(i) above, the Intermediate Survey may be commenced at the second Annual Survey and be progressed during the succeeding year with a view to completion at the third Annual Survey in lieu of the application of 1.6.4(c)(ii) of this Part.

(iii) In application of 2.15.2(d)(i) above, a survey in dry dock is to be part of the Intermediate Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks are to be carried out in accordance with the applicable requirements for Intermediate Surveys, if not already performed.

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

~~(ii) Double Skin Bulk Carriers 10 < age ≦ 15~~

~~The requirements of the Intermediate Survey are to the same extent as the previous Special Survey. However, internal examination of fuel oil tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.~~

~~(iii) Double Skin Bulk Carriers 15 < age~~

~~(1) The requirements of the Intermediate Survey are to the same extent as the previous Special Survey. However, internal examination of fuel oil tanks and pressure testing of all tanks are not required unless deemed necessary by the attending Surveyor.~~

~~(2) A survey in dry dock is to be part of the Intermediate Survey.~~

~~(iv) Minimum requirements of overall and Close-up survey and thickness measurements at Intermediate Survey are to be surveyed as Table I 2-26 for double skin bulk carriers.~~

2.15.3 Special Survey

Concurrent crediting to both Intermediate Survey (IS) and Special Survey (SS) for surveys and thickness measurements of spaces are not acceptable.

(a) General

(i) The Special Survey is to include, in addition to the requirements of the Annual Survey in 2.15.1 and the applicable requirements of Special Survey in 2.7, examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 2.15.3(a)(iii), is in a satisfactory condition and is fit for its intended purpose for the new period of class of 5 years to be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.

(ii) All cargo holds, ballast tanks, including double bottom and double side tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull are to be examined, and this examination is to be supplemented by thickness measurement and testing as required in 2.15.3(f) and 2.15.3(g), to ensure that the structural integrity remains effective. The aim of the examination is to discover Substantial Corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

(iii) All piping systems within the above spaces are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory.

(iv) The survey extent of ballast tanks converted to void spaces is to be specially considered in relation to the requirements for ballast tanks.

(b) Bottom Survey in dry dock

(i) A Bottom Survey in dry dock is to be a part of the Special Survey. The overall and close-up surveys and thickness measurements, as applicable, of the lower portions of the cargo holds and ballast tanks(1) are to be carried out in accordance with the applicable requirements for Special Surveys, if not already performed.

Note:

(1) Lower portions of the cargo holds and ballast tanks are considered to be the parts below light ballast water line.

(c) Tank Protection

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

When such a breakdown of hard protective coating is found in water ballast double bottom tanks and it is not renewed, where a soft or semi-hard coating is applied, or where a hard Protective Coating has not been applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

(ii) Where a hard protective coating is provided in cargo holds, as defined by 23.1.7 of Part II and is found in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

(d) Hatch Covers and Coamings

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

(i) A thorough inspection of the items listed in 2.15.1(c) is to be carried out, in addition to all hatch covers and coamings.

(ii) Checking of the satisfactory operation of all mechanically operated hatch covers is to be made, including:

(1) stowage and securing in open condition;

(2) proper fit and efficiency of sealing in closed condition;

(3) operational testing of hydraulic and power components, wires, chains, and link drives.

(iii) Checking the effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent.

(iv) Close-up survey and thickness measurement of the hatch cover(1) and coaming plating and stiffeners is to be carried out as given in Table I 2-18 to Table I 2-20.

Note:

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

(e) Extent of Overall and close-up surveys

(i) An overall survey of all tanks and spaces is to be carried out at each Special Survey.

Fuel oil tanks in the cargo length area are to be surveyed in accordance with Table I 2-~~22~~17.

(ii) The minimum requirements for close-up surveys at Special Surveys are given in Table I 2-18 for double skin bulk carriers, excluding ore carriers and in Table I 2-19 for ore carriers, respectively.

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

(iv) For areas in spaces where hard protective coatings are found to be in a GOOD condition, the extent of close-up surveys according to Table I 2-18 and Table I 2-19 may be specially considered, refer also to 2.15.3(c)(ii).

(f) Extent of Thickness Measurements

(i) The minimum requirements for thickness measurements at Special Surveys are given in Table I 2-20.

(ii) Provisions for extended measurements for areas with Substantial Corrosion are given in Table I 2-22 and as may be additionally specified in the Survey Programme as required by 2.1.6(a). These extended thickness measurements are to be carried out before the survey is credited as completed. Suspect Areas identified at previous surveys are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken.

For ships built under IACS Common Structural Rules, the identified substantial corrosion areas may be:

(1) protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition, or alternatively

(2) required to be measured at annual intervals.

(iii) The Surveyor may further extend the thickness measurements as deemed necessary.

(iv) For areas in tanks where hard protective coatings are found to be in a GOOD condition, the extent of thickness measurements according to Table I 2-20 may be specially considered. Refer also to 2.15.3(c)(ii).

(v) Transverse sections are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements, one of which is to be in the amidships area.

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

(g) Extent of Tank Testing

(i) All boundaries of water ballast tanks, deep tanks and cargo holds used for water ballast within the cargo length area are to be pressure tested. For Fuel Oil Tanks, only representative tanks are to be pressure tested.

(ii) The Surveyor may extend the tank testing as deemed necessary.

(iii) Boundaries of ballast tanks are to be tested with a head of liquid to the top of air pipes.

(iv) Boundaries of ballast holds are to be tested with a head of liquid to near to the top of hatches.

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

(vi) The testing of double bottom tanks and other spaces not designed for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tanktop is carried out.

(h) Additional Special Survey requirements after determining compliance with SOLAS XII/12 and XII/13

(i) For ships complying with the requirements of SOLAS XII/12 for hold, ballast and dry space water level detectors, the Special Survey is to include an examination and a test of the water ingress detection systems and of their alarms.

(ii) For ships complying with the requirements of SOLAS XII/13 for the availability of pumping systems, the Special Survey is to include an examination and a test of the means for draining and pumping ballast tanks forward of the collision bulkhead and bilges of dry spaces any part of which extends forward of the foremost cargo hold, and of their controls.

~~(a) In addition to the requirements of Annual Surveys in 2.15.1, following items are also to be carried out:~~

~~(i) All cargo holds, ballast tanks, including double bottom and double side tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull are to be examined.~~

~~(ii) All piping systems within the above spaces are to be examined and operationally tested to working pressure.~~

~~(iii) Bottom Survey in dry dock is to be part of the Special Survey.~~

~~(iv) An overall survey of all tanks and spaces is to be carried out. Fuel oil tanks in cargo length area are to be surveyed as Table I 2-22.~~

~~(v) Minimum Close-up survey is to be surveyed as Table I 2-23 for double skin bulk carriers, excluding ore carriers and as Table I 2-24 for ore carriers, respectively.~~

~~(vi) Minimum thickness measurements are to be carried out as Table I 2-25.~~

~~(vii) All boundaries of water ballast tanks, deep tanks and cargo holds used for water ballast within the cargo length area are to be pressure tested. For fuel oil tanks, only representative tanks are to be pressure tested.~~

~~2.15.4 Extended thickness measurements is to be increased in accordance with Table I-2-27A, B, C and D when considered necessary by the Surveyor, or where substantial corrosion exists in each survey.~~

*Section 2.16 has been amended as follows:*

**~~2.16 Classification Survey of Ships not Built under Survey~~**

~~2.16.1 The following drawings and documents, necessary for classification purpose, are to be submitted as far as practicable together with the application for classification:~~

## 2.16 Hull Surveys of ~~High-Speed~~ Craft for FRP and Aluminum Alloys Constructuion

2.16.1 Annual Survey

(a) For ~~High-Speed~~ Craft of Fiber Reinforced Plastic (FRP) Construction, in addition to the applicable requirements of 2.5 of this Part, the Annual Survey - Hull is to include the following:

(i) All accessible parts particularly liable to rapid deterioration.

(ii) The craft is to be placed in drydock or slipway and all applicable items of the Annual Survey - Hull are to be examined.

(iii) The deck-to-hull connection, and superstructure and deckhouse connections are to be examined.

(iv) The craft is to be thoroughly checked and sounded for any apparent delaminations.

Where it is thought a delamination is found, a 50 mm diameter plug is to be removed from the area and examined for core to skin adhesion and water permeation.

(b) For ~~High Speed~~ Craft of Aluminum Alloys Construction, in addition to the applicable requirements of 2.5 of this Part, the Annual Survey - Hull is to include the following:

(i) All parts liable to rapid deterioration, particularly areas adjacent to dissimilar metals which are in close proximity.

(ii) In lieu of ballast tanks and combined cargo/ballast tanks, internal structure of a randomly selected cargo space, dry or liquid, together with any other space deemed necessary by the Surveyor, with particular attention to be given to bilges and drain wells.

(c) For ~~High Speed~~ Craft subject to the IMO HSC Code, in addition to the applicable requirements of.2.5 of this Part, Bottom Survey in dry dock is to be a part of the Annual Survey as required by 2.2.1 of this Part.

2.16.2 Special Survey

In addition to the Annual Survey in 2.16.1 above and the applicable requirements of Special Survey in 2.7 of this Part, the Special Survey is to include the following:

(a) Requirements for ~~High Speed~~ Craft of Fiber Reinforced Plastic (FRP) Construction

(i) Engine foundations and their attachments to the hull are to be examined.

(ii) A minimum of five plugs, each 50.8 mm in diameter, are to be removed from the hull bottom and topsides from locations deemed appropriate from the attending Surveyor and examined for core to skin adhesion and water permeation.

(iii) The framing and holds, hull laminate of the tween deck, deep tanks, peaks, bilges and drain wells, and machinery spaces are to be cleaned and examined. Linings, ceiling, tanks, and portable ballast are to be removed as considered necessary by the attending Surveyor.

(iv) Where there is evidence of cracking, distortion, wetness, or delamination, destructive or nondestructive testing and removal and repair of the defect is subject to the discretion of the attending Surveyor.

(v) The hull, fastenings, and backing reinforcements in way of hull fittings and attachments are to be examined. Fastenings are to be withdrawn as considered necessary by the attending Surveyor.

(vi) The efficiency of hand pumps or other drainage arrangements for end spaces is to be tested.

(vii) Additionally for Sailing and Unpowered craft, where applicable, ballast-keel fastenings and all openings to the sea, including sanitary and other overboard discharges, together with the cocks and valves connected therewith, are to be examined while the craft is in drydock. Mast foundation and connection to the hull are to be examined.

(b) Requirements for ~~High Speed~~ Craft of Aluminum Alloys Construction

In addition to the applicable requirements of Special Survey in 2.7, particular attention is to be given to insulation material in joints of shell connections between dissimilar metals, which is to be found or made effective as necessary.

*Section 2.14 has been renumbered and amended as follows:*

## 2.~~14~~17 Surveys of Passenger Ships

2.17.1 General

These requirements apply to ships carrying more than 12 passengers. Passenger ships are subjected to the following periodical surveys:

(a) Annual Survey

(b) Intermediate Survey

(c) Bottom Survey

(d) Special Survey

(e) Boiler Survey

(f) Propeller Shaft Survey

2.~~14~~17.2 Annual Survey:

In addition to the requirements of Annual Survey ~~Intermediate Surveys~~ in 2.5 ~~2.6~~, following items are also to be carried out:

(a) Hull:

(i) Bottom Survey in dry dock or in water.

(ii) Inspection of the piping and valves of cross flooding system and operation tests of its remote control system. Main valves for the system are to be overhauled and inspected.

(iii) Inspection and operation test of door indicators and water leakage detectors of shell doors.

(iv) Inspection of discharge pipes and valves on shells below bulkhead deck. These valves are to be overhauled and inspected, but may be dispensed with when the Bottom Survey was carried out in water.

(v) Inspection and tightness test of the fixed parts of fin-stabilizers.

(vi) Inspection of all shell connections below bulkhead deck.

(vii) Inspection of gangways, all shell ports (cargo ports included), ash and rubbish chutes below the bulkhead deck.

(viii) Inspection of portlights including deadlights and securing arrangements below the bulkhead deck.

(ix) Inspection of all openings and their closures in watertight bulkheads below the bulkhead deck including watertight doors and operation of same.

(x) The escapes and any cross-flooding arrangement are to be checked.

(b) Machinery:

(i) Sea trials are to be carried out, if deemed necessary.

(ii) The ability of the propulsion machinery to reverse the direction of the thrust of propellers and the ability to stop the ship are to be tested and verified.

(iii) Inspection of main and emergency electric power, and emergency lighting system.

(iv) Inspection of flooding detection system and/or water ingress alarm system for each watertight spaces below the bulkhead deck.

(c) Fire Protection and Fire Extinguishing System:

(i) Inspection of the general alarm system, fire alarm system, fire detection system, public addressing system, fire doors, fire dampers, draft stops and fire divisions.

(ii) Inspection and operation test of water sprinkler system including it's piping , valves, alarm system and automatic starting of fire pumps. Pressure tanks, if any, are to be pressure tested.

2.~~14~~17.3 Intermediate and Special Survey

In addition to the requirements of Special Surveys ~~of non-general dry cargo ships~~ in 2.7 and Annual Survey in 2.17.2 above ~~2.14.1~~, following items are also to be complied with.

(a) Hull:

(i) Check the light weight of the ship.

The light weight of the ship is to be checked during Special Survey. If the major conversion is found during Annual Survey or Intermediate Survey, the light weight of the ship is to be checked by the attending Surveyor.

Inclining experiments are to be carried out whenever the light weight is different from record by 2% or more or the longitudinal center of gravity is different from record by 1% of ship's length or more.

(b) Bottom Survey in dry dock is to be a part of intermediate or Special Survey.

While the thickness measurements is carried out, if substantial corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements of Table I 2-4A. Tanks or areas where coating was found to be in GOOD condition at the previous intermediate or periodical survey may be specially considered by the Society.

(c) For Intermediate Survey - machinery, the requirements of 2.7.~~6~~2 may be dispensed with at the discretion of the Society or the attending Surveyor.

*Paragraph 2.5.1(r) has been renumbered and amended as follows:*

## 2.18 ~~2.5.1(r)~~ Survey of Barges

2.18.1 Annual Survey

In addition to the applicable requirements of 2.5.1, the Annual Survey is also to include the following:

(a) For barges engaged in the dry bulk cargo trade, at each Annual Survey after Special Survey No. 3, holds, with particular attention being paid to tank tops, underside of main deck and side shell plating, framing and attachments. Thickness measurements may be required and access is to be provided for inaccessible areas as considered necessary by the attending Surveyor.

(b) For manned barges Annual Survey is to include the following:

(i) Fire safety measures.

(ii) Fire extinguishers.

(iii) Power supply including emergency source of power.

(iv) Lifesaving appliances and equipment.

(v) Radio communication installation.

(vi) Windlass, anchors and chains.

(vii) Fire mains are to be pressurized to the working pressure and surveyed over their full length where accessible.

*Paragraph 2.6.13 has been renumbered and amended as follows:*

2.18.2 ~~2.6.13~~ Intermediate Survey

In addition to the the requirements of Annual Survey in 2.18.1 above and the applicable requirements of 2.6.3, the Intermediate Survey is also to include the following:

(a) Salt water ballast spaces

In lieu of 2.6.1, an overall survey of 3 representative salt water ballast spaces including one rake tank and one upper wing tank, if applicable, and one additional space selected by the Surveyor.

(b) Deck cargo barges

At each Intermediate Survey after Special Survey No.~~3~~ 1– hull, in addition to the required salt water ballast spaces, at least 2 void spaces, 1 port and 1 starboard, are to be examined internally. Where extensive corrosion or structural damage is found, the remaining void spaces may also be required to be examined as considered necessary by the attending Surveyor.

(c) Dry cargo barges

At each Intermediate Survey after Special Survey No.~~3~~ 1– hull, in addition to the required salt water ballast spaces, at least 2 representative cargo holds are to be examined. ~~and dealt with,~~ Where extensive corrosion or structural damage is found, the remaining holds may also be required to be examined as considered ~~deemed~~ necessary by the attending Surveyor. See 2.18.1(a).

(d) Oil/fuel oil tank barges and chemical tank barges – hull

At each Intermediate Survey after Special Survey No.2 – hull, in addition to the required salt water ballast spaces, at least 3 cargo tanks: 1 center tank, 1 port wing tank and 1 starboard wing tank, are to be examined internally and dealt with as deemed necessary by the attending Surveyor. Thickness gauging and means of

access to the upper part of the tanks may be required. Where extensive corrosion or structural damage is found, the remainder of the cargo tanks may be required to be examined.

*Paragraph 2.18.3 has been added as follows:*

2.18.3 Special Survey

Special Survey is to be in accordance with the applicable requirements of 2.7.1 to 2.7.4 of this Chapter.

*Table I 2-1A has been amended as follows:*

**Table I 2-1~~A~~**
**Minimum Requirements for Internal Examination**
**at Hull Special Surveys of Fuel Oil, Lube Oil and Fresh Water Tanks**

| Spaces and Tanks [(1),(2),(3)] | SS No. 1 (Age ≤ 5) | SS No. 2 (5 < Age ≤ 10) | SS No. 3 (10 < Age ≤ 15) | SS No. 4 and Subsequent (15 < Age) |
|---|---|---|---|---|
| Fuel oil bunker tanks | | | | |
| - Engine room | 0 | 0 | 1 | 1 |
| - Cargo length area | 0 | 1 | 2[(4)] | Half, minimum 2[(4)] |
| - If no tanks in Cargo Length Area, additional fuel tank(s) outside of Engine Room (if fitted) | 0 | 1 | 1 | 2 |
| Lube oil | 0 | 0 | 0 | 1 |
| Fresh water | 0 | 1 | All | All |

~~Other spaces:~~

~~1. All spaces including holds and their 'tween decks where fitted; double bottom, deep, ballast, peak and cargo tanks; pump rooms, pipe tunnels, duct keels, machinery spaces, dry spaces, cofferdams and voids are to be internally examined including the plating and framing, bilges and drain wells, sounding, venting, pumping and drainage arrangements. At Special Survey No.3 and subsequent Special Surveys, structural down flooding ducts and structural ventilation ducts are to be internally examined.~~

~~2. Internal examination of fuel oil, lube oil and fresh water tanks is to be carried out in accordance with this Table above.~~

~~3. Engine room structure is to be examined. Particular attention is to be given to tank tops, shell plating in way of tank tops, brackets connecting side shell frames and tank tops, and engine room bulkheads in way of tank top and bilge wells. Particular attention is to be given to the sea suctions, sea water cooling pipes and overboard discharge valves and their connections to the shell plating. Where wastage is evident or suspect, thickness measurements are to be carried out, and renewals or repairs made when wastage exceeds allowable limits.~~

~~4. For spaces used for salt water ballast, excluding double bottom tanks, if there is no protective coating, soft or semi-hard coating, or Poor protective coating condition and it is not renewed, maintenance of class is to be subject to the spaces in question being internally examined at annual intervals. Waiver of internal examination at annual intervals for tanks of 12 $m^3$ or less in size, with soft or semi-hard coating, may be considered.~~

~~5. When such conditions are found in salt water ballast double bottom tanks, maintenance of class may be subject to the spaces in question being internally examined at annual intervals.~~

~~6. Hatch covers and coamings are to be examined to verify that no unapproved changes have been made, that hatch covers are structurally sound and weathertight, and where mechanically operated steel covers are fitted, satisfactory operation is to be verified.~~

Notes:

(1) These requirements apply to tanks of integral (structural) type.

(2) If a selection of tanks is accepted to be examined, then different tanks are to be examined at each Special Survey, on a rotational basis.

(3) Peak tanks (all uses) are subject to internal examination at each Special Survey.

(4) At Special Surveys No. 3 and subsequent surveys, One deep tank for fuel oil in the cargo length area is to be included, if fitted.

*Table I 2-1B and Table I 2-1C have been deleted as follows:*

**~~Table I 2-1B~~**
**~~Additional Requirements of Internal Examinations for Oil Tankers~~**

| ~~Special Survey~~ | ~~Tanks and Spaces subject to an Examination~~ | ~~Note~~ |
|---|---|---|
| ~~All Special Survey~~ | ~~1. All cargo tank~~ | ~~• For oil tankers, combined cargo/ballast tanks, if any, are to be examined carefully taking account of ballast history and the extent of the corrosion prevention system provided.~~<br>~~• For oil tankers, condition of the inner surface of the bottom plating of the tank is to be examined in order to ascertain that the there is no excessive pitting of the plating.~~<br>~~• For oil tankers, bell mouths of the cargo suction pipes are to be removed to enable examination of the bottom plating of the tank and bulkheads in that vicinity as considered necessary by the Surveyor.~~ |
| | ~~2. All tanks and spaces adjacent to cargo tanks (ballast tanks, pump rooms, pipe tunnels, cofferdams and void spaces)~~ | ~~• For oil tankers and ships carrying dangerous chemicals in bulk, an internal examination of ballast tanks is to be carried out at annual intervals, where a protective coating is found in Poor condition, and it is not renewed or where a protective coating has not been applied to the tanks.~~<br>~~• An internal examination of pump room is to be carried out carefully paying attention to the sealing arrangements of all penetrations of bulkheads, ventilating arrangements, foundations and gland seals of pumps.~~ |

**~~Table I 2-1C~~**
**~~Additional Requirements of Internal Examinations for Bulk Carrier~~**

| ~~Special Survey~~ | ~~Tanks and Spaces subject to an Examination~~ | ~~Note~~ |
|---|---|---|
| ~~All Special Surveys~~ | ~~1. All cargo holds~~ | ~~• Combined cargo/ballast tanks, if any, are to be examined taking account of ballast history and the extent of the corrosion prevention system provided.~~ |
| | ~~2. All tanks and spaces adjacent to cargo holds (ballast tanks, pipe tunnels, cofferdams and void spaces)~~ | ~~• For ballast tanks where a protective coating is found in Poor condition, and it is not renewed or where a protective coating has not been applied, an internal examination is to be carried out at annual intervals.~~<br>~~• Ballast tanks converted to void spaces are to be examined applying the provisions for ballast tanks correspondingly.~~ |

*Table I 2-2A and Table I 2-2C have been deleted as follows:*

**~~Table I 2-2A~~**
**~~Requirements of Pressure Tests for Cargo Ships~~**

| ~~Special Survey (SS)~~ | ~~Tanks subject to Pressure Test~~ |
|---|---|
| ~~SS No.1 (Age ≤ 5)~~ | ~~1. All water tanks including cargo holds used for ballast and all cargo tanks~~<br>~~Special consideration may be, however, given to limit testing of fresh water tanks to representative tanks provided that, after an internal and external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~<br>~~2. All fuel oil tanks~~<br>~~Special consideration is to be given to limit testing of fuel oil tanks to representative tanks provided that, after an internal and external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~<br>~~3. All lubrication oil tanks~~<br>~~Special consideration may be, however, given to limit testing of lubrication oil tanks to representative tanks provided that, after an external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~ |
| ~~SS No.2 (5 < Age ≤ 10)~~ | ~~1. Same requirements as Special Survey No.1~~ |
| ~~SS No.3 (10 < Age ≤ 15)~~ | ~~1. All water tanks including cargo holds used for ballast and all cargo tanks~~<br>~~2. All fuel oil tanks~~<br>~~Special consideration is to be given to limit testing of double bottom tanks to representative tanks including one forward and one aft tank and of deep tanks to representative tanks provided that, after an internal and external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~<br>~~3. All lubrication oil tanks~~<br>~~Special consideration is to be given to limit testing of lubrication oil tanks to representative tanks provided that, after an internal and external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~ |
| ~~SS No.4 (Age > 15)~~ | ~~1. All water tanks including cargo holds used for ballast, all cargo tanks, all fuel oil tanks and all lubrication oil tanks~~ |

~~**Table I 2-2C**~~
~~**Requirements of Pressure Tests at Special Survey of Bulk Carriers**~~

| ~~Special Survey (SS)~~ | ~~Tanks subject to Pressure Test~~ |
|---|---|
| ~~SS No.1 (Age ≤ 5)~~ | ~~1. All boundaries of ballast tanks, deep tanks and cargo holds used for ballast within the cargo length area~~<br>~~2. Representative tanks for fresh water, fuel oil and lubrication oil within the cargo length area~~<br>~~3. All water tanks~~<br>~~Special consideration may be, however, given to limit testing of fresh water tanks other than tanks specified in 1. and 2. above to representative tanks provided that, after an internal and external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~<br>~~4. All fuel oil tanks~~<br>~~Special consideration may be, however, given to limit testing of fuel oil tanks other than tanks specified in 2. above to representative tanks provided that, after an internal or external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~<br>~~5. All lubrication oil tanks~~<br>~~Special consideration may be, given to limit testing of lubrication oil tanks other than tanks specified in 2. above to representative tanks provided that, after an external examination of tanks, the Surveyor is satisfied with the condition of the tanks.~~ |
| ~~SS No.2 (5 <Age ≤ 10)~~ | ~~1. As Special Survey No.1~~ |
| ~~SS No.3 (10 <Age ≤ 15)~~ | ~~1. All water tanks including cargo holds used for ballast~~<br>~~2. All fuel oil tanks~~<br>~~Special consideration may be, however, given to limit testing of double bottom tanks to representative tanks including one forward and one aft tank and of deep tanks to representative tanks provided that, after an internal and external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~<br>~~3. All lubrication oil tanks~~<br>~~Special consideration may be, however, given to limit testing of lubrication oil tanks to representative tanks provided that, after an internal and external examination of the tanks, the Surveyor is satisfied with the condition of the tanks.~~ |
| ~~SS No.4 (Age > 15)~~ | ~~1. All water tanks including cargo holds used for ballast, all fuel oil tanks and all lubrication oil tanks~~ |

*Table I 2-2B has been renumbered and amended as follows:*

**Table I 2-2~~B~~**
**Minimum Requirements to Tank Testing at Hull Special Survey of Oil Tankers, Ore/Oil Ships and etc.**

| SS No. 1<br>(Age ≤ 5) | SS No. 2 and Subsequent<br>(5 < Age~~ ≤ 10~~) |
|---|---|
| 1. All ballast tank boundaries | 1. All ballast tank boundaries |
| 2. Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, pump-rooms or cofferdams | 2. All cargo tank bulkheads |

*Table I 2-3A to Table I 2-3C have been amended as follows:*

**Table I 2-3A**
**Minimum Requirements for Thickness Measurements at Hull Special Surveys**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. 4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| 1. Suspect Areas throughout the vessel | 1. Suspect Areas throughout the vessel | 1. Suspect Areas throughout the vessel | 1. Suspect Areas throughout the vessel |
| | 2. One transverse section of deck plating ~~abreast~~ in way of a cargo space within the amidships 0.5L(5) | 2. Two transverse sections within the amidships 0.5L ~~abreast~~ in way of 2 different cargo spaces(5) | 2. A minimum of 3 transverse sections in way of cargo spaces within the amidships 0.5L(5) |
| | | 3. Internals in forepeak and after peak ballast tanks | 3. Internals in forepeak and after peak ballast tanks |
| | | 4. All cargo hold hatch covers and coamings (plating and stiffeners) | 4. All cargo hold hatch covers and coamings (plating and stiffeners) |
| | | | 5. All exposed main deck plating full length |
| | | | 6. Representative exposed superstructure deck plating (poop, bridge, and forecastle deck) |
| | | | 7. Lowest strake and strakes in way of tween decks of all transverse bulkheads in cargo spaces together with internals in way(5) |
| | | | 8. All wind- and water strakes, port and starboard, full length |
| | | | 9. All keel plates full length. Also, additional bottom plates in way of cofferdams, machinery space, and aft end of tanks |
| | | | 10. Plating of sea chests. Shell plating in way of overboard discharges as considered necessary by the attending Surveyor |

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) Thickness measurements of internals may be ~~modified at the discretion of~~ specially considered by the Surveyor if the protective coating is in Good condition.

(3) For vessels less than 100 meters in length, the number of transverse sections required at Special Survey No. 3 may be reduced to 1, and the number of transverse sections required at Subsequent Special Surveys may be reduced to 2.

(4) For vessels more than 100 meters in length, at Special Survey No. 3, thickness measurements of exposed deck plating within amidships 0.5 L may be required.

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

(6) Subject to cargo hold hatch covers of approved design which structurally have no access to the internals, thickness measurement shall be done of accessible parts of hatch covers structures.

**Table I 2-3B**
**Minimum Requirements for Thickness Measurements**
**at Hull Special Survey of Oil Tankers, Ore/Oil Ships and etc.**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. 4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas |
| 2. One section of deck plating for the full beam of the ship within the cargo area (in way of a ballast tank, if any, or a cargo tank used primarily for water ballast) | 2. Within the cargo area:<br>a. Each deck plate<br>b. 1 Transverse section | 2. Within the cargo area:<br>a. Each deck plate<br>b. 2 Transverse sections<br>c. All wind and water strakes | 2. Within the cargo area:<br>a. Each deck plate<br>b. 3 Transverse sections(1)<br>c. Each bottom plate |
| | 3. Selected wind and water strakes outside the cargo area | 3. Selected wind and water strakes outside the cargo area | 3. All wind and water strakes, full length |
| 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-5A | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-5A | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-5A | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-5A |
| Note:<br>(1) At least 1 section is to include a ballast tank within 0.5L amidships. | | | |
| | | ~~5. All wind and water strakes within the cargo area~~ | ~~5. All wind and water strakes within the cargo area~~ |
| | | ~~6. Internals in peak tanks~~ | ~~6. Internals in peak tanks~~ |
| | | | ~~7. Exposed superstructure deck plating~~ |
| | | | ~~8. Exposed main deck plating full length~~ |
| | | | ~~9. The transverse bulkhead (lowest strake in cargo spaces and their internals)~~ |
| | | | ~~10. Sea chest plating~~ |

## Table I 2-3C
## Minimum Requirements for Thickness Measurements at Hull Special Surveys of Bulk Carriers

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. 4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas |
| | 2. Within the cargo length:<br>a. Two transverse section of deck plating outside line of cargo openings | 2. Within the cargo length:<br>a. Each deck plate outside line of cargo hatch openings<br>b. 2 Transverse Sections, 1 in the amidship area, outside line of cargo hatch opening<br>c. all wind and water strakes | 2. Within the cargo length:<br>a. Each deck plate outside line of cargo hatch openings<br>b. 3 transverse sections, 1 in the amidship area, outside line of cargo hatch opening.<br>c. Each bottom plate |
| | 3. Wind and water strakes in way of the two transverse sections considered above<br><br>Selected wind and water strakes outside the cargo length area | 3. Selected wind and water strakes outside the cargo length area | 3. All wind and water strakes ~~within the cargo length area~~, full length |
| | 4. Measurement for, general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-5B | 4. Measurement for, general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-5B | 4. Measurement for, general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-5B |
| | | 5. Additional thickness measurement applicable to the vertically corrugated transverse watertight bulkhead between cargo hold Nos. 1 and 2 on ships subject to compliance with IACS URs S19 and S23~~if applied~~ | 5. Additional thickness measurement applicable to the vertically corrugated transverse watertight bulkhead between cargo hold Nos. 1 and 2 on ships subject to compliance with IACS URs S19 and S23~~if applied~~ |
| | 5. Additional thickness measurement applicable to the side shell frames and brackets on ships subject to compliance with IACS UR S31 | 6. Additional thickness measurement applicable to the side shell frames and brackets on ships subject to compliance with IACS UR S31~~if applied~~ | 6. Additional thickness measurement applicable to the side shell frames and brackets on ships subject to compliance with IACS UR S31~~if applied~~ |
| | | 7. All cargo hold hatch covers and coaming (plate & stiffener) | 7. All cargo hold hatch covers and coaming (plate & stiffener) |
| | | 8. Internals in fore/afterpeak tanks, including plating and stiffeners of bulkheads | 8. Internals in fore/afterpeak tanks, including plating and stiffeners of bulkheads |
| | | | 9. All exposed main deck plating and Representative exposed first tier superstructure deck plating |
| | | | 10. All keel and bottom plates, full length |
| | | | 11. Duct keel or pipe tunnel plating and internals |
| | | | 12. Sea chest plating. Shell plating in way of overboard discharges as necessary by the attending Surveyor. |

*Table I 2-4A to Table I 2-4C have been amended as follows:*

**Table I 2-4A**
**Guidance for Additional Thickness Measurements ~~for Cargo Ships~~ in way of Substantial Corrosion**

| Structural Member | Extent of Measurement | Pattern of Measurement |
|---|---|---|
| Plating | Suspect area and adjacent plates | 5 point pattern over 1 $m^2$ |
| Stiffeners | Suspect area | 3 measurements each in line across web and flange |

**Table I 2-4B (1/2)**
**Requirements for Extent of Thickness Measurement at Those Areas of Substantial Corrosion at Hull Special Survey of Oil Tankers, Ore/Oil Carriers and etc. within the Cargo ~~Tank~~ Area Length ~~(1/2)~~**

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **Bottom Structure** | | |
| 1. Bottom plating | Minimum of 3 bays across tank ~~including~~ aft bay<br>Measurements around and under all bell mouths | 5 point pattern for each panel between longitudinals and webs |
| 2. Bottom Longitudinals | Minimum of 3 longitudinals in each bay where bottom plating measured | 3 measurements in line across flange and 3 measurements on vertically web |
| 3. Bottom girders and brackets | At fore and aft transverse bulkhead bracket toes and in center of tanks | Vertical line of 1 measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements.<br>2 measurements across face flat.<br>5 point pattern on girder/bulkhead brackets. |
| 4. Bottom transverse webs | 3 webs in bays where bottom plating measured, with measurements at both ends and middle | 5 points pattern over 2 $m^2$ area 1 measurements on face flat |
| 5. Panel stiffening | Where provided | 1 measurements |
| **Deck Structure** | | |
| 1. Deck plating | Two bands across tank | Minimum of 3 measurements per plate per band |
| 2. Deck longitudinals | Minimum of 3 longitudinals each of two bays | 3 measurements in line vertically on webs, and 2 measurements on flange (if fitted) |
| 3. Deck girders and brackets | At fore and aft transverse bulkhead, bracket toes and in center of tanks | Vertical line of 1 measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements<br>2 measurements across face flat<br>5 point pattern on girder/bulkhead brackets |
| 4. Deck transverse webs | Minimum of 2 webs, with measurements at middle and both ends of span | 5 point pattern over about 2 $m^2$ areas.<br>1 measurements on face flat. |
| 5. Panel stiffening | Where provided | Single measurements |

**Table I 2-4B (2/2)**
**Requirements for Extent of Thickness Measurement at Those Areas of Substantial Corrosion at Hull Special Survey of Oil Tankers, Ore/Oil Carriers and etc. within the Cargo Tank Length ~~(2/2)~~**

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **Side Shell and Longitudinal Bulkheads** | | |
| 1. Deckhead and bottom strakes, and strakes in way of stringer platforms | Plating between each pair of longitudinals in a minimum of 3 bays | 1 measurement |
| 2. All other strakes | Plating between every third pair of longitudinals in same 3 bays | 1 measurement |
| 3. Longitudinals on deckhead and bottom strakes | Each longitudinal in same three bays | 3 measurements across web and<br>1 measurement on flange |
| 4. Longitudinals - all others | Every third longitudinal in same 3 bays | 3 measurements across web and<br>1 measurement on flange |
| 5. Longitudinals - brackets | Minimum of three at top, middle and bottom of tank in same 3 bays | 5 point pattern over area of bracket |
| 6. Web frames and cross ties | 3 webs with minimum of three locations on each web, including in way of cross tie connections | 5 point pattern over about 2 $m^2$ area, plus 1 measurements on web frame and cross ties face flats |
| **Transverse Bulkheads and Swash Bulkheads** | | |
| 1. Deckhead and bottom strakes, and strakes in way of stringer platforms | Plating between pair of stiffeners at 3 locations: approx. 1/4, 1/2 and 3/4 width of tank | 5 point pattern between stiffeners over 1 m length |
| 2. All other strakes | Plating between pair of stiffeners at middle location | 1 measurement |
| 3. Strakes in corrugated bulkheads | Plating for each change of scantling at center of panel and at flange of fabricated connection | 5 point pattern over about 1 $m^2$ of plating |
| 4. Stiffeners | Minimum of 3 typical stiffeners | For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection and 1 at center of span)<br>For flange, single measurements at each bracket toe and at center of span |
| 5. Brackets | Minimum of three at top, middle and bottom of tank | 5 point pattern over areas of bracket |
| 6. Deep webs and girders | Measurements at toe of bracket and at center of span | For web, 5 point pattern over about 1 $m^2$<br>3 measurements across face flat. |
| 7. Stringer platforms | All stringers with measurements at both ends and middle | 5 point pattern over 1 $m^2$ of area plus 1 measurements near bracket toes and on face flats |

**Table I 2-4C (1/2)**
**Requirements for Extent of Thickness Measurement at Those Areas of Substantial Corrosion at Hull Special Survey of Bulk Carriers within the Cargo Area ~~(1/2)~~**

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **Shell structures** | | |
| 1. Bottom and side shell plating | a. Suspect plate, plus four adjacent plates<br>b. See other tables for particulars on gauging in way of tanks and cargo holds | a. 5 point pattern for each panel between longitudinals |
| 2. Bottom / Side shell longitudinals | Minimum of 3 longitudinals in way of Suspect Areas | 3 measurements in line across web<br>3 measurements on flange |
| **Transverse bulkheads in cargo holds** | | |
| 1. Lower stool | a. Transverse band within 25 mm of welded connection to inner bottom<br>b. Transverse band within 25 mm of welded connection to shelf plate | a. 5 point between stiffeners over 1 m length<br>b. Ditto |
| 2. Transverse bulkhead | a. Transverse band at approximately mid height<br>b. Transverse band at part of bulkhead adjacent to upper deck or below upper stool shelf plate (for those ships fitted with upper stools) | a. 5 point pattern over 1 $m^2$ of plating<br>b. 5 point pattern over 1 $m^2$ of plating |
| **Deck structure including cross strips, main cargo hatchways, hatch covers, coamings and topside tanks** | | |
| 1. Cross deck strip plating | Suspect cross deck strip plating | a. 5 point pattern between underdeck stiffeners over 1 m length |
| 2. Underdeck stiffeners | a. Transverse members<br>b. Longitudinal member | a. 5 point pattern at each end and mid span<br>b. 5 point pattern on both web and flange |
| 3. Hatch covers | a. Side and end skirts, each 3 locations<br>b. 3 longitudinal bands, outboard strakes (2) and centerline strake (1) | a. 5 point pattern at each location<br>b. 5 point measurement each band ~~end or side coaming~~ |
| 4. Hatch coamings | Each side and end of coaming, one band lower 1/3, one band upper 2/3 of coaming | 5 point measurement each band i.e. end or side coaming |
| 5. Topside water ballast tanks | a. Watertight transverse bulkheads<br>i. lower 1/3 of bulkhead<br>ii. upper 2/3 of bulkhead<br>iii. stiffeners | <br>i. 5 point pattern over 1 $m^2$ of plating<br>ii. 5 point pattern over 1 $m^2$ of plating<br>iii. 5 point pattern over 1 m length |
| | b. 2 representative swash transverse bulkheads<br>i. lower 1/3 of bulkhead<br>ii. upper 2/3 of bulkhead<br>iii. stiffeners | <br>i. 5 point pattern over 1 $m^2$ of plating<br>ii. 5 point pattern over 1 $m^2$ of plating<br>iii. 5 point pattern over 1 m length |
| | c. 3 representative bays of slope plating<br>i. lower 1/3 of tank<br>ii. upper 2/3 of tank | <br>i. 5 point pattern over 1 $m^2$ of plating<br>ii. 5 point pattern over 1 $m^2$ of plating |
| | d. Longitudinals, suspect and adjacent | 5 point pattern both web and flange over 1 m length |
| 6. Main deck plating | Suspect plates and adjacent in item 4 | 5 point pattern over 1 $m^2$ of plating |
| 7. Main deck longitudinals | Minimum of 3 longitudinals where plating measured | 5 point pattern on both web and flange over 1 m length |
| 8. Web frames / Transverses | Suspect plates | 5 point pattern over 1 $m^2$ |

**Table I 2-4C (2/2)**
**Requirements for Extent of Thickness Measurement at Those Areas of Substantial Corrosion at Hull Special Survey of Bulk Carriers within the Cargo Area ~~(2/2)~~**

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **Double bottom and hopper structure** | | |
| 1. Inner / Double bottom plating | Suspect plate plus all adjacent plates | 5 point pattern for each panel between longitudinals over 1 m length |
| 2. Inner / Double bottom longitudinals | 3 longitudinals where plates measured | 3 measurements in line across web and<br>3 measurements on flange |
| 3. Longitudinal Girders or Transverse floors | Suspect plates | 5 point pattern over about 1 $m^2$ |
| 4. Watertight Bulkheads (WT Floors) | a. lower 1/3 of tank<br>b. upper 2/3 of tank | a. 5 point pattern over 1 $m^2$ of plating<br>b. 5 point pattern alternate plates over 1 $m^2$ of plating |
| 5. Web Frames | Suspect plate | 5 point pattern over 1 $m^2$ of plating |
| 6. Bottom / side shell longitudinals | Minimum of 3 longitudinals in way of Suspect Areas | 3 measurements in line across web<br>3 measurements on flange |
| **Cargo holds** | | |
| 1. Side Shell frames | Suspect frame and each adjacent | a. At each end and mid span:<br>5 point pattern of both web and flange<br>b. 5 point pattern within 25 mm of welded attachment to both shell and lower slope plate |

*Table I 2-5A and Table I 2-5B have been amended as follows:*

**Table I 2-5A**
**Minimum Requirements for Close-up Surveys**
**at Hull Special Survey of Oil Tankers, Ore/Oil Ships and etc.**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. 4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| A) 1 web frame ring in a ballast wing tank, if any, or a cargo wing tank used primarily for water ballast<br>B) 1 deck transverse in a cargo oil tank<br>D) 1 transverse bulkhead in a ballast tank<br>D) 1 transverse bulkhead in a cargo oil wing tank<br>D) 1 transverse bulkhead in a cargo oil center tank | A) All web frame rings in a ballast wing tank, if any, or a cargo wing tank used primarily for water ballast<br>B) 1 deck transverse in each of the remaining ballast tanks, if any<br>B) 1 deck transverse in a cargo wing tank<br>B) 1 deck transverse in 2 cargo center tanks<br>C) Both transverse bulkheads in a wing ballast tank, if any, or a cargo wing tank used primarily for water ballast<br>D) 1 transverse bulkhead in each remaining ballast tank<br>D) 1 transverse bulkhead in a cargo oil wing tank<br>D) 1 transverse bulkhead in 2 cargo center tanks | A) All web frame rings in all ballast tanks<br>A) All web frame rings in a cargo wing tank<br>A) A minimum of 30% of all web frame rings in each remaining cargo wing tank(1)<br>C) All transverse bulkheads in all cargo and ballast tanks<br>E) A minimum of 30% of deck and bottom transverses including adjacent structural members in each cargo center tank<br>F) As considered necessary by the Surveyor | 1. As Special Survey No. 3<br>2. Additional transverses included as deemed necessary by the Society |

A) ~ (F) are areas to be subjected to close-up surveys.

A) Complete transverse web frame ring including adjacent structural members
B) Deck transverse including adjacent deck structural members
C) Transverse bulkhead complete - including girder system and adjacent members
D) Transverse bulkhead lower part - including girder system and adjacent structural members
E) Deck and bottom transverse including adjacent structural members
F) Additional complete transverse web frame ring

Notes:

(1) The 30% is to be rounded up to the next whole integer.

**Table I 2-5B**
**Minimum Requirement for Close-up Survey at Hull Special Surveys of Bulk Carriers**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. 4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| (A) 25% of shell frames in the forward cargo hold at representative positions<br>(A) selected frames in remaining cargo holds<br>(B) 1 transverse web with associated plating and longitudinals in 2 representative water ballast tanks of each type (i.e. topside, or hopper side tank).<br>(C) 2 selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted.<br>(D) All cargo hold hatch covers and coamings (plating and stiffeners). | (A) All shell frames in the forward cargo hold and 25% of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating.<br>For Bulk Carriers 100,000 DWT and above, all shell frames in the forward cargo hold and 50% of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating.<br>(B) 1 transverse web with associated plating and longitudinals in each water ballast tank.<br>(B) forward and aft transverse bulkhead in 1 ~~side~~ ballast tank, including stiffening system.<br>(C) All cargo hold transverse bulkheads including internal structure of upper and lower stools, where fitted.<br>(D) All cargo hold hatch covers and coamings (plating and stiffeners).<br>(E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches. | (A) All shell frames in the forward and one other selected cargo hold and 50% of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating<br>(B) All transverse webs with associated plating and longitudinals in each water ballast tank.<br>(B) All transverse bulkheads in ballast tanks, including stiffening system.<br><br>Areas (C), (D) and (E) as for Special Survey No. 2 | (A) All shell frames in all cargo holds including upper and lower end attachments and adjacent shell plating.<br><br>Areas (B) ~ (E) as for Special Survey No. 3 |

(A) ~ (E) are areas to be subjected to Close-up Surveys.

(A) Cargo hold transverse frames

(B) Transverse web frame or watertight transverse bulkhead in water ballast tanks

(C) Cargo hold transverse bulkheads plating, stiffeners and girders

(D) Cargo hold hatch covers and coamings. For cargo hold hatch covers of approved design which structurally have no access to the internals, Close-up Survey/ thickness measurement shall be done of accessible parts of hatch covers' structures.

(E) Deck plating inside line of hatch openings between cargo hold hatches

Notes: Close-up survey of transverse bulkheads to be carried out at 4 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 I 2-6A and Table I 2-6B have been amended as follows:*

**Table I 2-6A**
**Minimum Requirements for Close-up Survey at Hull Special Survey of Single Skin Chemical Tankers**

| SS No. 1 (Age ≤ 5) | SS No. 2 (5 < Age ≤ 10) | SS No. 3 (10 < Age ≤ 15) | SS No. 4 and Subsequent (15 < Age) |
|---|---|---|---|
| A 1 web frame ring in a ballast wing tank | A All web frame rings in a ballast wing tank or double bottom ballast tank(1) | A All web frame rings - in all ballast tanks<br>A All web frame rings - in a cargo wing tank | 1. As Special Survey No.3 |
| B 1 deck transverse in a cargo tank or on deck | B 1 deck transverse in each remaining ballast tank or on deck<br>B 1 deck transverse in a cargo wing tank or on deck<br>B 1 deck transverse in 2 cargo center tanks or on deck | A 1 web frame ring - in each remaining cargo tank | 2. Additional transverse areas as deemed necessary by the Society |
| D 1 transverse bulkhead - lower part in a ballast tank<br>D 1 transverse bulkhead - lower part in a cargo wing tank<br>D 1 transverse bulkhead - lower part in a cargo centre tank(2) | C Both transverse bulkheads in a ballast wing tank | C All transverse bulkheads - in all cargo tanks<br>C All transverse bulkheads - in all ballast tanks | |
| | D 1 Transverse Bulkhead - lower part in each remaining ballast tank<br>D 1 Transverse Bulkhead - lower part in 2 cargo center tanks(2)<br>D 1 Transverse Bulkhead - lower part in a cargo wing tank | | |

A ~ D are areas to be subjected to close-up surveys and thickness measurements. (See IACS URZ10.3, Fig. 2.1 and 2.2)

A Complete transverse web frame ring including adjacent structural members.

B Deck transverse including adjacent deck structural members.

C Transverse bulkhead complete – including girder system and adjacent structural members.

D Transverse bulkhead lower part – including girder system and adjacent structural members.

Notes:

(1) Ballast double hull tank: means double tank plus double side tank plus double deck tank, as Applicable, even if these tanks are separate.

(2) Where no center cargo tanks are fitted (as in case of center longitudinal bulkhead), transverse Bulkheads in wing tanks are to be surveyed.

**Table I 2-6B**
**Minimum Requirements for Close-up Survey at Hull Special Survey of Double Skin Chemical Tankers**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. 4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| (1) 1 web frame ring in a ballast double hull tank [1] | (1) All web frame rings in a ballast wing tank or ballast double hull tank [1] | (1) All web frame rings<br>- in all ballast tanks<br>(7) All web frame rings<br>- in a cargo wing tank | As Special Survey No.3 |
| (2) 1 deck transverse<br>- in a cargo tank or on deck | (6) The knuckle area and the upper part (3 m approx) of 1 web frame in each remaining ballast tank | (7) 1 web frame ring in each<br>- remaining cargo tank | Additional transverse areas as deemed necessary by the Society |
| (4) 1 transverse bulkhead<br>- in a ballast tank [1] | (2) 1 deck transverse<br>- in 2 cargo tanks | (3) All transverse bulkheads<br>- in all cargo tanks<br>(4) All transverse bulkheads<br>- in all ballast tanks | |
| (5) 1 transverse bulkhead<br>- in a cargo wing tank<br>(5) 1 transverse bulkhead<br>- in a cargo centre tank [2] | (4) 1 transverse bulkhead<br>- in each ballast tank(1)<br>(5) 1 transverse bulkhead<br>- in 2 cargo center tanks [2]<br>(5) 1 transverse bulkhead<br>- in a cargo wing tank | | |

(1) ~ (7) are areas to be subjected to Close-up Surveys and thickness measurements. (See IACS URZ10.3, Fig. 2.1 ~ 2.3)

(1) Web frame in a ballast tank means vertical web in side tank, hopper web in hopper tank, floor in double bottom tank and deck transverse in double deck tank ( where fitted ), including adjacent structural members. In fore and aft peak tanks web frame means a complete transverse web frame ring including adjacent structural members.

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

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

(4) Transverse bulkhead complete in ballast tanks, including girder system and adjacent structure members, such as longitudinal bulkheads, girder in double bottom tanks, inner bottom plating, hopper, connecting brackets.

(5) Transverse bulkhead lower part in cargo tank, including girder system, adjacent structural members (such as longitudinal bulkheads) and internal structure of lower stool, where fitted.

(6) The knuckle area and the upper part (3 meters approximately), including adjacent structural members. Knuckle area is the area of the web frame around the connections of the slope hopper plating to the inner hull bulkhead and the inner bottom plating, up to 2 meters from the corners both on the bulkhead and the double bottom.

(7) Web frame in a cargo tank means deck transverse, longitudinal bulkhead vertical girder and cross ties, where fitted, including adjacent structural members.

Notes:

1. Ballast double hull tank: means double bottom tank plus double side tank plus double deck tank, as applicable, even if these tanks are separate.
2. Where no center cargo tanks are fitted (as in the case of center longitudinal bulkhead), transverse bulkheads in wing tanks are to be surveyed.

*Table I 2-7 has been amended as follows:*

**Table I 2-7**
**Minimum Requirements for Thickness Measurements**
**at Hull Special Survey of Chemical ~~Carriers~~ Tankers**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. 4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas |
| 2. 1 section of deck plating for the full beam of the ship within the cargo area (in way of a ballast tank, if any, or a cargo tank used primarily for water ballast) | 2. Within the cargo area:<br>a. Each deck plate<br>b. 1 transverse section | 2. Within the cargo area:<br>a. Each deck plate<br>b. 2 Transverse sections(1)<br>c. All wind and water strakes | 2. Within the cargo area:<br>a. Each deck plate<br>b. 3 transverse sections (1)<br>c. Each bottom plate |
| | 3. Selected wind and water strakes outside the cargo area | 3. Selected wind and water strakes outside the cargo area | 3. All wind and water strakes, full length |
| 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-6A or Table I 2-6B, as applicable. ~~for general assessment and recording of corrosion pattern~~ | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-6A or Table I 2-6B, as applicable. ~~for general assessment and recording of corrosion pattern~~ | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-6A or Table I 2-6B, as applicable. ~~for general assessment and recording of corrosion pattern~~ | 4. Measurements, for general assessment and recording of corrosion pattern, of structural members subject to close-up survey according to Table I 2-6A or Table I 2-6B, as applicable. ~~for general assessment and recording of corrosion pattern~~ |

Note:

(1) At least one section is to include a ballast tank within 0.5L amidships.

*Table I 2-8 has been amended as follows:*

**Table I 2-8 (1/2)**
**Requirements for Extent of Thickness Measurements at Those Area of Substantial Corrosion at Hull Special Survey of Chemical ~~Carriers~~ Tankers within the Cargo ~~Tank~~ Area Length**

| ~~Structural member~~ | ~~Extent of measurement~~ | ~~Pattern of measurement~~ |
|---|---|---|
| ~~Double bottom and hopper structure~~ | | |
| ~~1. Inner bottom and bottom plating~~ | ~~Suspect plate plus adjacent plates Measurements around and under all bell mouths and pump wells~~ | ~~5 point pattern for each panel between longitudinals over 1 metre length~~ |
| ~~2. Inner bottom and bottom longitudinals~~ | ~~Three longitudinals where plates measured~~ | ~~3 measurements in line across flange and 3 measurements on vertical web~~ |
| ~~3. Longitudinal girders or transverse floors~~ | ~~Suspect plates~~ | ~~5 point pattern over about 1 $m^2$~~ |
| ~~4. Watertight bulkheads (WT floors)~~ | ~~a. lower 1/3 of tank b. upper 2/3 of tank~~ | ~~a. 5 point pattern over about 1 $m^2$ b. 5 point pattern alternate plates over 1 $m^2$ of plating~~ |
| ~~5. Web frames~~ | ~~Suspect plate~~ | ~~5 point pattern~~ |
| ~~Deck structure~~ | | |
| ~~1. Deck plating~~ | ~~Two bands across tank~~ | ~~Minimum of three measurements per plate per band~~ |
| ~~2. Deck longitudinals~~ | ~~Minimum of 3 longitudinals in each of two bays~~ | ~~3 measurements in line vertically on webs, and 2 measurements on flange (if fitted)~~ |
| ~~3. Deck girders and brackets~~ | ~~At fore and aft transverse bulkhead, bracket toes and in centre of tanks~~ | ~~Vertical line of single measurements on web plating with one measurement between each panel stiffener, or a minimum of three measurements Two measurements across face flat 5 point pattern on girder/bhd brackets~~ |
| ~~4. Deck transverse webs~~ | ~~Minimum of two webs with measurements at middle and both ends of span~~ | ~~5 points pattern over about 2 $m^2$ areas. Single measurements on face flat~~ |
| ~~5. Panel stiffening~~ | ~~Where provided~~ | ~~Single measurements~~ |
| ~~NOTE: For tanks where Substantial Corrosion covers more than 20% of the deck surface, the whole deck structure including longitudinal and web frames above the tank is to be thickness measured in accordance with above~~ | | |
| ~~Deck structure side shell and longitudinal bulkheads~~ | | |
| ~~1. Deckhead and bottom strakes, and strakes in way of stringer platforms~~ | ~~Plating between each pair of longitudinals in a minimum of 3 bays~~ | ~~Single measurement~~ |
| ~~2. All other strakes~~ | ~~Plating between every 3rd pair of longitudinals in same 3 bays~~ | ~~Single measurement~~ |
| ~~3. Longitudinals deckhead and bottom strakes~~ | ~~Each longitudinal in same 3 bays~~ | ~~3 measurements across web and 1 measurement on flange~~ |
| ~~4. Longitudinals - all others~~ | ~~Every third longitudinal in same 3 bays~~ | ~~3 measurements across web and 1 measurement on flange~~ |
| ~~5. Longitudinals - bracket~~ | ~~Minimum of three at top middle and bottom of tank in same 3 bays~~ | ~~5 point pattern over area of bracket~~ |
| ~~6. Web frames and cross ties~~ | ~~3 webs with minimum of three locations on each web, including in way of cross tie connections~~ | ~~5 point pattern over about 2 $m^2$ area, plus single measurements on web frame and cross tie face flats~~ |

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **BOTTOM, INNER BOTTOM AND HOPPER STRUCTURE** | | |
| 1. Bottom, inner bottom and hopper structure plating | Minimum of 3 bays across tank, including aft bay<br>Measurements around and under all suction bell mouths | 5 point pattern for each panel between longitudinals and floors |
| 2. Bottom, inner bottom and hopper structure longitudinals | Minimum of 3 longitudinals in each bay where bottom plating measured | 3 measurements in line across flange and 3 measurements on vertical web |
| 3. Bottom girders, including the watertight ones | At fore and aft watertight floors and in center of tanks | Vertical line of single measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements.<br>2 measurements across face flat where fitted. |
| 4. Bottom floors, including the watertight ones | 3 floors in bays where bottom plating measured, with measurements at both ends and middle | 5 point pattern over 2 $m^2$ area |
| 5. Hopper structure web frame ring | 3 floors in bays where bottom plating measured | 5 point pattern over 1 $m^2$ of plating.<br>Single measurements on flange. |
| 6. Hopper structure transverse watertight bulkhead or swash bulkhead | - lower 1/3 of bulkhead | - 5 point pattern over 1 $m^2$ of plating |
| | - upper 2/3 of bulkhead | - 5 point pattern over 2 $m^2$ of plating |
| | - stiffeners (minimum of 3) | - For web, 5-point pattern over span (2 measurements across web at each end and 1 at centre of span).<br>For flange, single measurements at each end and centre of span. |
| 7. Panel stiffening | Where applicable | Single measurements |
| **DECK STRUCTURE** | | |
| 1. Deck plating | 2 transverse bands across tank | Minimum of 3 measurements per plate per band |
| 2. Deck longitudinals | Every third longitudinal in each of two bands with a minimum of one longitudinal | 3 measurements in line vertically on webs, and 2 measurements on flange (if fitted) |
| 3. Deck girders and brackets | At fore and aft transverse bulkhead, bracket toes and in centre of tanks | Vertical line of single measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements.<br>2 measurements across face flat.<br>5 point pattern on girder/ bulkhead brackets |
| 4. Deck transverse webs | Minimum of 2 webs with measurements at both ends and middle of span | 5 points pattern over 1 $m^2$ areas.<br>Single measurements on face flat |
| 5. Vertical web and transverse bulkhead in wing ballast tank for double hull design (two metres from deck) | Minimum of 2 webs, and both transverse bulkheads | 5-point pattern over 1 $m^2$ area |
| 6. Panel stiffening | Where applicable | Single measurements |

**Table I 2-8 (2/2)**
**Requirements for Extent of Thickness Measurements at Those Area of Substantial Corrosion at Hull Special Survey of Chemical Tankers ~~Carriers~~ within the Cargo Area ~~Tank~~ Length**

| ~~Structural member~~ | ~~Extent of measurement~~ | ~~Pattern of measurement~~ |
|---|---|---|
| ~~Transverse bulkheads and swash bulkheads~~ | | |
| ~~1. Deckhead and bottom strakes, and strakes in way of stringer platforms~~ | ~~Plating between pair of stiffeners at three locations – approx. 1/4, 1/2 and 3/4 width of tank~~ | ~~5 points pattern between stiffeners over 1 meter length~~ |
| ~~2. All other strakes~~ | ~~Plating between pair of stiffeners at middle location~~ | ~~Single measurement~~ |
| ~~3. Strakes in corrugated bulkheads~~ | ~~Plating for each change of scantling at centre of panel and at flange or fabricated connection~~ | ~~5 point pattern over about 1 $m^2$ of plating~~ |
| ~~4. Stiffeners~~ | ~~Minimum of three typical stiffeners~~ | ~~For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection, and one at center of span).~~<br>~~For flange, single measurements at each bracket toe and at centre of span~~ |
| ~~5. Bracket~~ | ~~Minimum of three at top, middle and bottom of tank~~ | ~~5 point pattern over areas of bracket~~ |
| ~~6. Deep webs and girders~~ | ~~Measurements at toe of bracket and at centre of span~~ | ~~For web, 5 point pattern over about 1 $m^2$~~<br>~~3 measurements across face flat~~ |
| ~~7. Stringer platforms~~ | ~~All stringers with measurements at both ends and middle~~ | ~~5 point pattern over 1 $m^2$ of area plus single measurements near bracket toes and on face flats~~ |

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **SIDE SHELL AND LONGITUDINAL BULKHEADS** | | |
| 1. Side shell and longitudinal bulkhead plating:<br>- Deckhead and bottom strakes, and strakes in way of horizontal girders<br>- All other strakes | - Plating between each pair of longitidinals in a minimum of 3 bays (along the tank)<br>- Plating between every third pair of longitudinals in same 3 bays | Single measurement |
| 2. Side shell and longitudinal bulkhead longitudinals on:<br>- Deckhead and bottom strakes<br>- All other strakes | - Each longitudinal in same 3 bays<br>- Every third longitudinal in same 3 bays | 3 measurements across web and 1 measurement on flange |
| 3. Longitudinals - brackets | Minimum of 3 at top, middle and bottom of tank in same 3 bays | 5 point pattern over area of bracket |
| 4. Vertical web and transverse bulkheads of double side tanks (excluding deck area):<br>- Strakes in way of horizontal girders<br>- Other strakes | - Minimum of 2 webs and both transverse bulkheads<br>- Minimum of 2 webs and both transverse bulkheads | - 5 point pattern over approx. 2 $m^2$ area<br>- 2 measurements between each pair of vertical stiffeners |
| 5. Web frames and cross ties for other tanks than double side tanks | 3 webs with minimum of 3 locations on each web, including in way of cross tie connections and lower end bracket | 5 point pattern over approximately 2 $m^2$ area of webs, plus single measurements on flanges of web frame and cross ties |
| 6. Horizontal girders | Plating on each girder in a minimum of 3 bays | 2 measurements between each pair of longitudinal girder stiffeners |
| 7. Panel stiffening | Where applicable | Single measurements |
| **TRANSVERSE WATERTIGHT AND SWASH BULKHEADS** | | |
| 1. Upper and lower stool, where fitted | - Transverse band within 25mm of welded connection to inner bottom/deck plating<br>- Transverse band within 25mm of welded connection to shelf plate | 5 point pattern between stiffeners over one meter length |
| 2. Deckhead and bottom strakes, and strakes in way of horizontal stringers | Plating between pair of stiffeners at 3 locations: approximately 1/4, 1/2 and 3/4 width of tank | 5-point pattern between stiffeners over one metre length |
| 3. All other strakes | Plating between pair of stiffeners at middle location | Single measurement |
| 4. Strakes in corrugated bulkheads | Plating for each change of scantling at center of panel and at flange of fabricated connection | 5 point pattern over about 1 $m^2$ of plating |
| 5. Stiffeners | Minimum of 3 typical stiffeners | For web, 5 point pattern over span between bracket connections (2 measurements across web at each bracket connection, and 1 at center of span).<br>For flange, single measurements at each bracket toe and at center of span |
| 6. Bracket | Minimum of 3 at top, middle and bottom of tank | 5 point pattern over areas of bracket |
| 7. 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 |
| 8. Deep webs and girders | Measurements at toe of bracket and at centre of span | For web, 5 point pattern over about 1 $m^2$<br>3 measurements across face flat |

*Table I 2-9 has been amended as follows:*

**Table I 2-9**
**Minimum Requirements to Tank Testing at Hull Special Survey of Chemical ~~Carriers~~ Tankers**

| SS No. 1<br>Age ≤ 5 | SS No. 2 and subsequent<br>Age > 5 |
|---|---|
| 1. All ballast tank boundaries | 1. All ballast tank boundaries |
| 2. Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, pump-rooms or cofferdams | 2. All cargo tank bulkheads |

*Table I 2-10 to Table I 2-13 have been deleted as follows:*

~~**Table I 2-10**~~
~~**Examination of Cargo Holds for Hull Annual Survey of General Dry Cargo Ships**~~

| | ~~10 < Age ≤ 15(3)~~ | ~~Age > 15(1), (2), (3)~~ |
|---|---|---|
| ~~Overall Survey~~ | ~~1. 1 forward cargo hold (and their associated tween deck spaces, where fitted)~~<br>~~2. 1 after cargo hold (and their associated tween deck spaces, where fitted)~~ | ~~All cargo hold (and their associated tween deck spaces, where fitted)~~ |
| ~~Close-up Survey~~ | | ~~1. Cargo holds:~~<br>~~– 1 forward lower cargo hold~~<br>~~– 1 other lower cargo hold~~<br>~~2. Extent:~~<br>~~– Close-up examination of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approx. lower one third length of side frame at side shell and side frame end attachment and the adjacent shell plating~~ |
| ~~Others~~ | | ~~All piping and penetrations in cargo holds, including over-board piping, are to be examined~~ |

~~Notes:~~

~~(1) Where the protective coating in cargo holds, as applicable, is found to be in Good condition, the extent of close-up surveys may be specially considered by the Society~~

~~(2) Where this level of survey reveals the need for remedial measures, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent shell plating of those cargo holds and associated tween deck spaces (as applicable) as well as a close-up survey of sufficient extent of all remaining cargo holds and tween deck spaces (as applicable)~~

~~(3) When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the number of thickness measurements is to be increased to determine the extent of Substantial Corrosion~~

**~~Table I 2-11~~**
**~~Examination of Ballast Tanks for Hull Intermediate Survey of General Dry Cargo Ships~~**

| | ~~5 < Age ≤ 10~~ | ~~10 < Age≤ 15~~ | ~~Age > 15~~ |
|---|---|---|---|
| ~~Overall Survey~~ | ~~1. Representative salt ballast spaces(1), (2), (3)~~<br>~~2. Suspect area found at the previous Special Survey~~ | ~~1. All salt water ballast tanks (1), (3)~~<br>~~2. Suspect area found at the previous Special Survey~~ | ~~Same extent as the previous Special Survey~~ |
| ~~Closed-up Survey~~ | ~~Suspect area found at the previous Special Survey~~ | ~~Suspect area found at the previous Special Survey~~ | ~~Same extent as the previous Special Survey~~ |

~~Notes:~~

~~(1) If such inspections reveal no visible structural defects, the examination may be limited to a verification that the protective coating remains efficient.~~

~~(2) Where Poor coating condition, corrosion or other defects are found in salt water ballast spaces or where a protective coating was not applied from the time of construction, the examination is to be extended to other ballast spaces of the same type.~~

~~(3) In salt water ballast spaces where a protective coating is found in Poor condition and it is not renewed, where a soft or semi hard 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 at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.~~

**~~Table I 2-12~~**
**~~Examination of Cargo Holds for Hull Intermediate Survey of General Dry Cargo Ships~~**

| | ~~5 < Age ≤ 10~~ | ~~10 < Age ≤ 15~~ | ~~Age > 15~~ |
|---|---|---|---|
| ~~Overall Survey~~ | ~~1.1 forward cargo hold (and their associated tween deck spaces, where fitted)~~<br>~~2.1 after cargo hold (and their associated tween deck spaces, where fitted)~~<br>~~3.Suspect area found at the previous Special Survey~~ | ~~1.All cargo hold (and their associated tween deck spaces, where fitted)~~<br>~~2.Suspect area found at the previous Special Survey~~ | ~~Same extent as the previous Special Survey~~ |
| ~~Closed-up Survey~~ | ~~Suspect area found at the previous Special Survey~~ | ~~Suspect area found at the previous Special Survey~~ | ~~Same extent as the previous Special Survey~~ |

~~Note: When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out. If the results of these thickness measurements indicate that Substantial Corrosion is found, then the number of thickness measurements is to be increased to determine the extent of Substantial Corrosion.~~

**~~Table I 2-13~~**
**~~Requirements of Internal Examinations in addition to the Requirements of Table I 2-1A for Hull Special Survey of General Dry Cargo Ships~~**

| ~~Special Survey~~ | ~~Tanks and Spaces Subject to an Examination~~ | ~~Note~~ |
|---|---|---|
| ~~All Special Surveys~~ | ~~1. All cargo holds~~ | ~~-~~ |
| | ~~2. All tanks and spaces adjacent to cargo holds (ballast tanks, pipe tunnels, cofferdams and void spaces)~~ | ~~• For ballast tanks where a protective coating is found in Poor condition, and it is not renewed or where a protective coating has not been applied, excluding double bottom tanks, an internal examination is to be carried out at annual intervals. For double bottom ballast tanks with the condition as specified, where considered necessary by the Surveyor, an internal examination is to be carried out at annual intervals.~~<br>~~• Ballast tanks converted to void spaces are to be examined applying the provisions for ballast tanks correspondingly.~~ |

*Table I 2-14 has been renumbered and amended as follows:*

**Table I 2-~~14~~10**
**Minimum Requirements for Close-up Survey at Hull Special Surveys of General Dry Cargo Ships**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3,<br>(10 < Age ≤ 15) | SS No. 4 and subsequent<br>(15 < Age) |
|---|---|---|---|
| (A) Selected shell frames in 1 forward and 1 aft cargo hold and associated tween deck spaces | (A) Selected shell frames in all cargo holds and tween deck spaces | (A) All shell frames in the forward lower cargo hold and 25% frames in each of the remaining cargo holds and tween deck spaces including upper and lower end attachments and adjacent shell plating | (A) All shell frames in all cargo holds and tween deck spaces including upper and lower end attachments and adjacent shell plating Areas (B)~(F) as for Special Survey No. 3 |
| (B) 1 selected cargo hold transverse bulkhead | (B) 1 transverse bulkhead in each cargo hold<br>(B) Forward and aft transverse bulkhead in 1 side ballast tank, including stiffening system. | (B) All cargo hold transverse bulkheads<br>(B) All transverse bulkheads in ballast tanks, including stiffening system | |
| | (C) 1 transverse web with associated plating and framing in 2 representative water ballast tanks of each type (i.e. topside, hopper side, side tank or double bottom tank) | (C) All transverse webs with associated plating and framing in each water ballast tank (i.e. topside, hopper side, side tank or double bottom tank) | |
| (D)All cargo hold hatch covers and coamings (plating and stiffeners) | (D) All cargo hold hatch covers and coamings (plating and stiffeners) | (D) All cargo hold hatch covers and coamings (plating and stiffeners) | |
| | (E) Selected areas of all deck plating inside line of hatch openings between cargo hold hatches | (E) All deck plating inside line of hatch openings between cargo hold hatches | |
| | (F) Selected areas of inner bottom plating | (F) All areas of inner bottom plating | |

(A) ~ (F) are areas to be subjected to close-up surveys. (See IACS URZ7.1, Figure 1 and 2)

(A) Cargo hold transverse frames

(B) Cargo hold transverse bulkhead plating, stiffeners and girders

(C) Transverse web frame or watertight transverse bulkhead in water ballast tanks

(D) Cargo hold hatch covers and coamings

(E) Deck plating inside line of hatch openings between cargo hold hatches

(F) Inner bottom plating

Notes:

(1) Close-up survey of cargo hold transverse bulkheads to carried out at the following levels:

a. Immediately above the inner bottom and immediately above the tween decks, as applicable

b. Mid-height of the bulkheads for holds without tween decks

c. Immediately below the main deck plating and tween deck plating

*Table I 2-15 and Table I 2-16 have been renumbered and amended as follows:*

**Table I 2-~~15~~11**
**Minimum Requirements for the Thickness Measurement at Hull Special Surveys of General Dry Cargo Ships**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3,<br>(10 < Age ≤ 15) | SS No. 4 and subsequent<br>(15 < Age) |
|---|---|---|---|
| 1. Suspect Areas. | 1. Suspect Areas.<br>2. 1 transverse section of deck plating ~~abreast~~ in way of a cargo space within the amidships 0.5L.<br>3. Measurement for general assessment and recording of corrosion pattern of those structural members subject to close-up survey according to Table I 2-~~14~~10. | 1. Suspect Areas.<br>2. 2 transverse sections within the amidships 0.5L ~~abreast~~ in way of 2 different cargo spaces.<br>3. Measurement for general assessment and recording of corrosion pattern of those structural members subject to close-up survey according to Table I 2-~~14~~10.<br>4. Within the cargo length, each deck plate outside line of cargo hatch openings.<br>5. All wind and water strakes within the cargo length area.<br>6. Selected wind and water strakes outside the cargo length area. | 1. Suspect Areas.<br>2. Within the cargo length:<br>a. A minimum of 3 transverse sections within the amidships 0.5L.<br>b. each deck plate outside line of cargo hatch openings.<br>c. Each bottom plate, including lower turn of bilge.<br>d. Duct keel or pipe tunnel plating and internals.<br>3. Measurement for general assessment and recording of corrosion pattern of those structural members subject to close-up survey according to Table I 2-~~14~~10.<br>4. All wind and water strakes full length ~~port and starboard~~ |
| Notes: | | | |

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) For ships less than 100 m in length, the number of transverse sections required at special survey No. 3 may be reduced to one and the number of transverse sections at special survey No. 4 and subsequent special surveys may be reduced to two.

~~**Table I 2-16**~~
~~**Guidance for Additional Thickness Measurements in way of Substantial Corrosion – at Hull Special Survey of General Dry Cargo Ships –**~~

| ~~Structural Member~~ | ~~Extent of Measurement~~ | ~~Pattern of Measurement~~ |
|---|---|---|
| ~~Plating~~ | ~~Suspect area and adjacent plates~~ | ~~5 point pattern over 1 m$^2$~~ |
| ~~Stiffeners~~ | ~~Suspect area~~ | ~~3 measurements each in line across web and flange~~ |

*Table I 2-17 has been renumbered and amended as follows:*

**Table I 2-~~17~~12**
**Minimum Requirements for Overall and Close-up Survey and Thickness Measurements at Hull Intermediate Survey of Double Hull Oil Tankers**

<table>
<tr><td colspan="3">Age of ship at time of Intermediate Survey due date</td></tr>
<tr><td>(5 < Age ≤ 10)</td><td>(10 < Age ≤ 15)</td><td>(15 < Age)</td></tr>
<tr><td>Overall survey of representative ~~salt~~ water ballast tanks selected by the attending Surveyor ~~(the selection is to include fore and aft peak tanks and 3 other tanks)~~<br>(See 2.14.2(b) of this Part)</td><td rowspan="2">The requirements of the previous Special Survey<br>~~Thickness measurements of those areas are as same as for Special Survey given in Table I 2-18 and Table I 2-19~~<br>(See 2.14.2(c) of this Part)</td><td rowspan="2">The requirements of the previous Special Survey<br>~~Thickness measurements of those areas are as same as for Special Survey given in Table I 2-18 and Table I 2-19~~<br>(See 2.14.2(d) of this Part)</td></tr>
<tr><td>Suspect areas identified at previous surveys are to be examined<br>~~Thickness measurements of those areas found to be Suspect Areas at the previous Special Survey~~<br>(See 2.14.2(b) of this Part)</td></tr>
</table>

*Table I 2-18 has been renumbered and amended as follows:*

**Table I 2-~~18~~13**
**Minimum Requirements for Close-up Survey at Hull Special Survey of Double Hull Oil Tankers**

| ~~Age of ship (in years at time of Special Survey due date)~~ | | | |
|---|---|---|---|
| SS No.1<br>(Age ≤ 5) | SS No.2<br>(5 < Age ≤ 10) | SS No.3<br>(10 < Age ≤ 15) | SS No.4 and Subsequent<br>(15 < Age) |
| web frame (1), in a ~~complete~~ ballast tank~~*~~1 | All web frames (1), in a ~~complete~~ballast tank~~*~~1<br>The knuckle area and the upper part (5 meters approximately) of 1 web frame in each remaining ballast tank (6) | All web frames (1), in all ballast tanks | As for Special Survey for age from 10 to 15 years<br>Additional transverse areas as deemed necessary by the Society |
| 1 deck transverse, in a cargo oil tank (2) | 1 deck transverse (2), in 2 cargo oil tanks | All web frames (7), including deck transverse and cross ties, if fitted. in a cargo oil tank<br>1 web frame (7), including deck transverse and cross ties, if fitted, in each remaining cargo oil tank | |
| 1 transverse bulkhead (4), in a ~~complete~~ ballast tank~~*~~1 | 1 transverse bulkhead (4), in each ~~complete~~ ballast tank~~*~~1 | All transverse bulkheads in all cargo oil (3) tanks ~~and~~<br>All transverse bulkheads in all ballast (4) tanks | |
| 1 transverse bulkhead (5), in a cargo oil center tank<br>1 transverse bulkhead (5), in a cargo oil wing tank~~*~~2 | 1 transverse bulkhead (5), in 2 cargo oil center tanks<br>1 transverse bulkhead (5), in a cargo oil wing tank~~*~~2 | | |

~~(1), (2), (3), (4), (5), (6) and (7)~~ (1) ~ (7) are areas to be subjected to close-up surveys and thickness measurements. (See IACS URZ10.4, Figure 9 and Figure 10)

(1) Web frame in a ballast tank means vertical web in side tank, hopper web in hopper tank, floor in double bottom tank and deck transverse in double deck tank (where fitted), including adjacent structural members. In fore and aft peak tanks web frame means a complete transverse web frame ring including adjacent structural members

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

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

(4) Transverse bulkhead complete in ballast tanks, including girder system and adjacent structural members, such as longitudinal bulkheads, girders in double bottom tanks, inner bottom plating, hopper side, connecting brackets

(5) Transverse bulkhead lower part in cargo tank, including girder system, adjacent structural members (such as longitudinal bulkheads) and internal structure of lower stool, where fitted

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

(7) Web frame in a cargo oil tank means deck transverse, longitudinal bulkhead structural elements and cross ties, where fitted, including adjacent structural members

Notes:

~~*~~1. ~~Complete ballast tank: means double bottom tank plus double side tank plus double deck tank, as applicable, even if these tanks are separate~~

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

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

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

~~"~~2. Where no center cargo tanks are fitted (as in the case of center longitudinal bulkhead), transverse bulkheads in wing tanks are to be surveyed

*Table I 2-19 has been renumbered and amended as follows:*

**Table I 2-~~19~~14**
**Minimum Requirements for Thickness Measurements at Hull Special Survey of Double Hull Oil Tankers**

| ~~Age of ship (in years at time of Special Survey due date)~~ | | | |
|---|---|---|---|
| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No.4 and Subsequent<br>(15 < Age) |
| 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas | 1. Suspect Areas |
| 2. 1 section of deck plating for the full beam of the ship within the cargo area | 2. Within the cargo area:<br>a. each deck plate<br>b. 1 transverse section | 2. Within the cargo area:<br>a. each deck plate<br>b. 2 transverse sections(1)<br>c. all wind and water strakes | 2. Within the cargo area:<br>a. each deck plate<br>b. 3 transverse sections(1)<br>c. each bottom plate |
| | 3. Selected wind and water strakes outside the cargo area | 3. Selected wind and water strakes outside the cargo area | 3. All wind and water strakes, full length |
| 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-13~~18~~ | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-13~~18~~ | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-13~~18~~ | 4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-13~~18~~ |

Note:

**(**1) At least 1 section is to include a ballast tank ~~be~~ within 0.5L amidships.

*Table I 2-20 has been renumbered and amended as follows:*

**Table I 2-~~20~~15 (1/3)**
**Requirements for Extent of Thickness Measurements at Those Areas of Substantial Corrosion at Hull Special Survey of Double Hull Oil Tankers within the Cargo Area Length**

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **Bottom, inner bottom and hopper structure** | | |
| Bottom, inner bottom and hopper structure plating | Minimum of 3 bays across double bottom tank, including aft bay<br>Measurements around and under all suction bell mouths | 5-point pattern for each panel between longitudinals and floors |
| Bottom, inner bottom and hopper structure longitudinals | Minimum of 3 longitudinals in each bay where bottom plating measured | 3 measurements in line across flange and 3 measurements on vertical web |
| Bottom girders, including the watertight ones | At fore and aft watertight floors and in center of tanks | Vertical line of 1 measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements |
| Bottom floors, including the watertight ones | 3 floors in bays where bottom plating measured, with measurements at both ends and middle | 5-point pattern over 2 $m^2$ area |
| Hopper structure web frame ring | 3 floors in bays where bottom plating measured | 5-point pattern over 1 $m^2$ of plating.<br>1 measurements on flange |
| Hopper structure transverse water-tight bulkhead or swash bulkhead | lower 1/3 of bulkhead | 5-point pattern over 1 $m^2$ of plating |
| | upper 2/3 of bulkhead | 5-point pattern over 2 $m^2$ of plating |
| | stiffeners (minimum of 3) | For web, 5-point pattern over span (2 measurements across web at each end and one at center of span).<br>For flange, 1 measurements at each end and center of span |
| Panel stiffening | Where applicable | 1 measurements |
| **Deck structure** | | |
| Deck plating | 2 transverse bands across tank | Minimum of 3 measurements per plate per band |
| Deck longitudinals | Every third longitudinal in each of 2 bands with a minimum of 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 fore and aft transverse bulkhead, bracket toes and in center of tanks | Vertical line of 1 measurements on web plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements<br>2 measurements across flange.<br>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.<br>1 measurements on flange |
| Vertical web and transverse bulkhead in wing ballast tank (2 meters from deck) | Minimum of 2 webs, and both transverse bulkheads | 5-point pattern over 1 $m^2$ area |
| Panel stiffening | Where applicable | 1 measurements |

**Table I 2-~~20~~15 (2/3)**
**Requirements for Extent of Thickness Measurements at Those Areas of Substantial Corrosion at Hull Special Survey of Double Hull Oil Tankers within the Cargo Area Length**

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **Structure in wing ballast tanks** | | |
| Side shell and longitudinal bulkhead plating:<br>- upper strake and strakes in way of horizontal girders<br>- all other strakes | - Plating between each pair of longitudinals in a minimum of 3 bays (along the tank)<br>- Plating between every third pair of longitudinals in same 3 bays | - 1 measurement<br>- 1 measurement |
| Side shell and longitudinal bulkhead longitudinals on:<br>- upper strake<br>- all other strakes | - Each longitudinal in same 3 bays<br>- Every third longitudinal in same 3 bays | - 3 measurements across web and 1 measurement on flange<br>- 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):<br>- strakes in way of horizontal girders<br>- other strakes | - Minimum of 2 webs and both transverse bulkheads<br>- Minimum of 2 webs and both transverse bulkheads | - 5-point pattern over approx. 2 $m^2$ area<br>- 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 | 1 measurements |
| **Longitudinal bulkheads in cargo tanks** | | |
| Deckhead and bottom strakes, and strakes in way of the horizontal stringers of transverse bulkheads | Plating between each pair of longitudinals in a minimum of 3 bays | 1 measurement |
| All other strakes | Plating between every third pair of longitudinals in same 3 bays | 1 measurement |
| Longitudinals on deckhead and bottom strakes | Each longitudinal in same 3 bays | 3 measurements across web and 1 measurement on flange |
| All other longitudinals | Every third longitudinal in same 3 bays | 3 measurements across web and 1 measurement on flange |
| 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 1 measurements on flanges of web frame and cross ties |
| Lower end brackets (opposite side of web frame) | Minimum of 3 brackets | 5-point pattern over approximately 2 $m^2$ area of brackets, plus 1 measurements on bracket flanges |

**Table I 2-~~20~~15 (3/3)**
**Requirements for Extent of Thickness Measurements at Those Areas of Substantial Corrosion at Hull Special Survey of Double Hull Oil Tankers within the Cargo Area Length**

| Structural member | Extent of measurement | Pattern of measurement |
|---|---|---|
| **Transverse watertight and swash bulkheads in cargo tanks** | | |
| Upper and lower stool, where fitted | - Transverse band within 25 mm of welded connection to inner bottom/deck plating<br>- Transverse band within 25 mm of welded connection to shelf plate | 5-point pattern between stiffeners over 1 meter length |
| Deckhead and bottom strakes, and strakes in way of horizontal stringers | Plating between pair of stiffeners at 3 locations: approximately 1/4, 1/2 and 3/4 width of tank | 5-point pattern between stiffeners over 1 meter length |
| All other strakes | Plating between pair of stiffeners at middle location | Single measurement |
| Strakes in corrugated bulkheads | Plating for each change of scantling at center of panel and at flange of fabricated connection | 5-point pattern over about 1 $m^2$ of plating |
| Stiffeners | Minimum of 3 typical stiffeners | For web, 5-point pattern over span between bracket connections (two measurements across web at each bracket connection and one at center of span). For flange, 1 measurements at each bracket toe and at center 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 1 measurements near bracket toes and on flanges |

*Table I 2-21 has been renumbered and amended as follows:*

**Table I 2-~~21~~16**
**Minimum Requirements for Tank Testing at Hull Special Survey of Double Hull Oil Tankers**

| Age of ship (in years at time of Special Survey due date) | | |
|---|---|---|
| Special Survey No.1<br>Age ≤ 5 | Special Survey No.2 and Subsequent<br>5 < Age ~~≤ 10~~ | ~~Age > 10~~ |
| All ballast tank boundaries | All ballast tank boundaries | ~~All ballast tank boundaries~~ |
| Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, ~~representative fuel oil tanks,~~ pump rooms or cofferdams | ~~Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, representative fuel oil tanks, pump rooms or cofferdams~~<br>All cargo tank bulkheads | ~~Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, representative fuel oil tanks, pump rooms or cofferdams~~ |
| | ~~All cargo tank bulkheads which form the boundaries of segregated cargoes~~ | ~~All remaining cargo tank bulkheads~~ |

*Table I 2-22 has been renumbered and amended as follows:*

**Table I 2-~~22~~17**
**Overall Survey of Fuel Oil Tanks in the Cargo Length Area for Double Skin Bulk Carriers at Hull Special Survey**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No.4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| 0 | 1 | 2 | Half, minimum 2 |

Notes:

(1) These requirements apply to tanks of integral (structural) type.

(2) If a selection of tanks is accepted to be examined, then different tanks are to be examined at each Special Survey, on a rotational basis.

(3) Peak tanks (all uses) are subject to internal examination at each Special Survey.

(4) At Special Survey No. 3 and subsequent Special Surveys, 1 deep tank for fuel oil in the cargo area is to be included, if fitted.

*Table I 2-23 has been renumbered and amended as follows:*

**Table I 2-~~23~~18**
**Minimum Requirements for Close-Up Survey at Hull Special ~~Hull~~ Survey of Double Skin Bulk Carriers, Excluding Ore Carriers**

| SS No.1 (Age ≤ 5) | SS No.2 (5 < Age ≤ 10) | SS No.3 (10 < Age ≤ 15) | SS No.4 and Subsequent (15 < Age) |
|---|---|---|---|
| (A) 1 transverse web with associated plating and longitudinals in two representative water ballast tanks of each type. (This is to include the foremost topside and double side water ballast tanks on either side) | (A) 1 transverse web with associated plating and longitudinals as applicable in each water ballast tank.<br>(A) Forward and aft transverse bulkheads including stiffening system in a transverse section including topside, hopper side and double side ballast tanks on one side of the ship (i.e. port or starboard).<br>(B) 25% of ordinary transverse frames for transverse framing system or 25% of longitudinals for longitudinal framing system on side shell and inner side plating at forward, middle and aft parts, in the foremost double side tanks. | (A) All transverse webs with associated plating and longitudinals as applicable in each water ballast tank.<br>(A) All transverse bulkheads including stiffening system in each water ballast tank.<br>(B) 25% of ordinary transverse frames for transverse framing systems or 25% of longitudinals for longitudinal framing systems on side shell and inner side plating at forward, middle and aft parts in all double side tanks. | (A) All transverse webs with associated plating and longitudinals as applicable in each water ballast tank.<br>(A) All transverse bulkheads including stiffening system in each water ballast tank.<br>(B) All ordinary transverse frames for transverse framing systems or all longitudinals for longitudinal framing systems on side shell and inner side plating at forward, middle and aft parts in all double side tanks.<br><br>Areas (C) ~ (E) as for age interval 10 to 15 years. |
| (C) 2 selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. | (C) 1 transverse bulkhead in each cargo hold, including internal structure of upper and lower stools, where fitted. | (C) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. | |
| (D) All cargo hold hatch covers and coamings (platings and stiffeners). | (D) All cargo hold hatch covers and coamings (platings and stiffeners). | (D) All cargo hold hatch covers and coamings (platings and stiffeners). | |
| | (E) All deck plating and under deck structure, inside line of hatch openings between all cargo hold hatches. | (E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches | |

(A) ~ (E) are areas to be subjected to Close-up Surveys and thickness measurements. (See IACS URZ10.5, Figure 10 and 11).

(A) Transverse web frame or watertight transverse bulkhead in topside, hopper side and double side ballast tanks. In fore and aft peak tanks transverse web frame means a complete transverse web frame ring including adjacent structural members.

(B) Ordinary transverse frame or longitudinal frame in double side tanks.

(C) Cargo hold transverse bulkheads plating, stiffeners and girders.

(D) Cargo hold hatch covers and coamings. For cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/ thickness measurement shall be done of accessible parts of hatch covers' structures.

(E) Deck plating and under deck structure inside line of hatch openings between cargo hold hatches.

Note: Close-up survey of transverse bulkheads to be carried out at 4 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): Above 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 I 2-24 has been renumbered and amended as follows:*

**Table I 2-~~24~~19**
**Minimum Requirements for Close-Up Survey at Hull Special ~~Hull~~ Survey of Ore Carriers**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. ≥ 4<br>(Age > 15) |
|---|---|---|---|
| (A) 1 web frame ring complete including adjacent structural members in a ballast wing tank.<br><br>(A) 1 transverse bulkhead lower part including girder system and adjacent structural members in a ballast tank | (A) All web frame rings complete including adjacent structural members in a ballast wing tank.<br><br>(A) 1 deck transverse including adjacent deck structural members in each remaining ballast tank.<br><br>(A) Forward and aft transverse bulkheads complete including girder system and adjacent structural members in a ballast wing tank<br><br>(A) 1 transverse bulkhead lower part including girder system and adjacent structural members in each remaining ballast tank. | (A) All web frame rings complete including adjacent structural members in each ballast tank.<br><br>(A) All transverse bulkheads complete including girder system and adjacent structural members in each ballast tank.<br>(A) 1 web frame ring complete including adjacent structural members in each wing void space.<br><br>(A) Additional web frame rings in void spaces as deemed necessary by the Society. | As for Special Survey for age from 10 to 15 years. |
| (C) 2 selected cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. | (C) 1 transverse bulkhead in each cargo hold, including internal structure of upper and lower stools, where fitted. | (C) All cargo hold transverse bulkheads, including internal structure of upper and lower stools, where fitted. | Areas (C) ~ (E) as for age interval 10 to 15 years. |
| (D) All cargo hold hatch covers and coamings (platings and stiffeners). | (D) All cargo hold hatch covers and coamings (platings and stiffeners). | (D) All cargo hold hatch covers and coamings (platings and stiffeners). | |
| | (E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches. | (E) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches. | |

(A), (C) ~ (E) are areas to be subjected to close-up surveys and thickness measurements. (See Fig. I 2-4 and I 2-5).

(A) Transverse web frame or watertight transverse bulkhead in ballast wing tanks and void spaces. In fore and aft peak tanks transverse web frame means a complete transverse web frame ring including adjacent structural members.

(C) Cargo hold transverse bulkheads plating, stiffeners and girders.

(D) Cargo hold hatch covers and coamings. For cargo hold hatch covers of approved design which structurally have no access to the internals, close-up survey/thickness measurement shall be done of accessible parts of hatch covers' structures.

(E) Deck plating and under deck structure inside line of hatch openings between cargo hold hatches.

Note: Close-up survey of transverse bulkheads to be carried out at 4 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 I 2-25 and Table I 2-26 have been renumbered and amended as follows:*

**Table I 2-~~25~~20**
**Minimum Requirements for Thickness Measurements**
**at Hull Special ~~Hull~~ Survey of Double Skin Bulk Carriers**

| SS No.1<br>(Age ≤ 5) | SS No.2<br>(5 < Age ≤ 10) | SS No.3<br>(10 < Age ≤ 15) | SS No.4 and Subsequent<br>(15 < Age) |
|---|---|---|---|
| Suspect areas | Suspect areas | Suspect areas | Suspect areas |
| | Within the cargo length:<br>- 2 transverse sections of deck plating outside line of cargo hatch openings | Within the cargo length:<br>- each deck plate outside line of cargo hatch openings<br>- 2 transverse sections, 1 in the amidship area, outside line of cargo hatch openings<br>- all wind and water strakes | Within the cargo length:<br>- each deck plate outside line of cargo hatch openings<br>- 3 transverse sections, 1 in the amidship area, outside line of cargo hatch openings<br>- each bottom plate |
| | Wind and water strakes in way of the 2 transverse sections considered above.<br><br>Selected wind and water strakes outside the cargo length area. | Selected wind and water strakes outside the cargo length area. | All wind and water strakes, full length. |
| | Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-~~23~~18 or Table I 2-19, as applicable. | Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-~~23~~18 or Table I 2-19, as applicable. | Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-~~23~~18 or Table I 2-19, as applicable. |

**Table I 2-~~26~~21**
**Minimum Requirements of Overall and Close-Up Survey and Thickness Measurements**
**at Hull Intermediate Survey of Double Skin Bulk Carriers**

| Age of ship at time of Intermediate Survey due date | | |
|---|---|---|
| (5 < Age ≤ 10) | (10 < Age ≤ 15) | (15 < Age) |
| Overall survey of Representative ballast tanks selected by the attending Surveyor. (the selection is to include fore and aft peak tanks and a number of other tanks, taking into account the total number and type of ballast tanks) | The requirements of the previous Special Survey. | The requirements of the previous Special Survey. |
| Overall and close-up survey of Suspect Areas identified at previous surveys. | (see 2.15.2(c) of this Part) | (see 2.15.2(d) of this Part) |
| Overall survey of all cargo holds. | | |
| Thickness measurements to an extent sufficient to determine both general and local corrosion levels at areas subject to close-up survey at 'suspect areas' identified at previous surveys. | | |

*Table I 2-27A~Table I 2-27C have been renumbered and amended as follows:*

**Table I 2-~~27A~~ 22 (1/3)**
**Requirements for Extent of Thickness Measurements at Those Areas of Substantial Corrosion of Double Skin Bulk Carriers Within The Cargo Length Area ~~(1/4)~~**

| **BOTTOM, INNER BOTTOM AND HOPPER STRUCTURE** | | |
|---|---|---|
| Structural member | Extent of measurement | Pattern of measurement |
| Bottom, inner bottom and hopper structure plating | Minimum of 3 bays across double bottom tank, including aft bay<br><br>Measurements around and under all suction bell mouths | 5-point pattern for each panel between longitudinals and floors |
| Bottom, inner bottom and hopper structure longitudinals | Minimum of 3 longitudinals in each bay where bottom plating measured | 3 measurements in line across the flange and 3 measurements on the vertical web |
| Bottom girders, including the watertight ones | At fore and aft watertight floors and in center of tanks | Vertical line of 1 measurements on girder plating with 1 measurement between each panel stiffener, or a minimum of 3 measurements |
| Bottom floors, including the watertight ones | 3 floors in the bays where bottom plating measured, with measurements at both ends and middle | 5-point pattern over 2 $m^2$ area |
| Hopper structure web frame ring | 3 floors in bays where bottom plating measured | 5-point pattern over 1 $m^2$ of plating.<br>1 measurements on flange. |
| Hopper structure transverse watertight bulkhead or swash bulkhead | - lower 1/3 of bulkhead | - 5-point pattern over 1 $m^2$ of plating |
| | - upper 2/3 of bulkhead | - 5-point pattern over 2 $m^2$ of plating |
| | - stiffeners<br>(minimum of 3) | - For web, 5-point pattern over span (2 measurements across web at each end and 1 at center of span). For flange, 1 measurements at each end and center of span |
| Panel stiffening | Where applicable | 1 measurements |

**Table I 2-~~27B~~22 (2/3)**
**Requirements for Extent of Thickness Measurements at Those Areas of Substantial Corrosion of Double Skin Bulk Carriers Within The Cargo Length Area ~~(2/4)~~**

| **DECK STRUCTURE INCLUDING CROSS STRIPS, MAIN CARGO HATCHWAYS, HATCH COVERS, COAMINGS AND TOPSIDE TANKS** | | |
|---|---|---|
| Structural member | Extent of measurement | Pattern of measurement |
| Cross Deck Strip plating | Suspect Cross Deck Strip plating | 5-point pattern between underdeck stiffeners over 1 m length |
| Underdeck Stiffeners | Transverse members<br>Longitudinal member | 5-point pattern at each end and mid span<br>5-point pattern on both web and flange |
| Hatch Covers | Side and end skirts, each three locations<br>3 longitudinal bands, outboard strakes (2) and centerline strake (1) | 5-point pattern at each location<br>5-point measurement each band |
| Hatch Coamings | Each side and end of coaming, one band lower 1/3, one band upper 2/3 of coaming | 5-point measurement each band i.e. end or side coaming |
| Topside Ballast Tanks | a) watertight transverse bulkheads:<br>- Lower 1/3 of bulkhead<br>- Upper 2/3 of bulkhead<br>- Stiffeners | <br>5-point pattern over 1 $m^2$ of plating<br>5-point pattern over 1 $m^2$ of plating<br>5-point pattern over 1 m length |
| Topside Ballast Tanks | b) 2 representative swash transverse bulkheads:<br>- Lower 1/3 of bulkhead<br>- Upper 2/3 of bulkhead<br>- Stiffeners | <br>5-point pattern over 1 $m^2$ of plating<br>5-point pattern over 1 $m^2$ of plating<br>5-point pattern over 1 m length |
| Topside Ballast Tanks | c) 3 representative bays of slope plating<br>- Lower 1/3 of tank<br>- Upper 2/3 of tank | <br>5-point pattern over 1 $m^2$ of plating<br>5-point pattern over 1 $m^2$ of plating |
| Topside Ballast Tanks | d) Longitudinals, suspect and adjacent | 5-point pattern on both web and flange over 1 m length |
| Main Deck Plating | Suspect plates and adjacent (4) | 5-point pattern over 1 $m^2$ of plating |
| Main Deck Longitudinals | Suspect Plates | 5-point pattern on both web and flange over 1 m length |
| Web Frames/Transverses | Suspect Plates | 5-point pattern over 1 $m^2$ |

**Table I 2-~~27C~~22 (3/3)**
**Requirements for Extent of Thickness Measurements at Those Areas of Substantial Corrosion of Double Skin Bulk Carriers Within The Cargo Length Area ~~(3/4)~~**

| **STRUCTURE IN DOUBLE SIDE SPACES OF DOUBLE SKIN BULK CARRIERS INCLUDING WING VOID SPACES OF ORE CARRIERS** | | |
|---|---|---|
| Structural member | Extent of measurement | Pattern of measurement |
| Side shell and inner plating:<br>- Upper strake and strakes in way of horizontal girders | - Plating between each pair of transverse frames / longitudinals in a minimum of 3 bays (along the tank) | - 1 measurement |
| - All other strakes | - Plating between every third pair of longitudinals in same 3 bays | - 1 measurement |
| Side shell and inner side transverse frames / longitudinals on:<br>- upper strake | - Each transverse frame / longitudinal in same 3 bays | - 3 measurements across web and 1 measurement on flange |
| - all other strakes | - Every third transverse frame / longitudinal in same 3 bays | - 3 measurements across web and 1 measurement on flange |
| Transverse frames / Longitudinals<br>- 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:<br>- strakes in way of horizontal girders | - Minimum of 2 webs and both transverse bulkheads | - 5-point pattern over approx. 2 $m^2$ area |
| - other strakes | - Minimum of 2 webs and both transverse bulkheads | - 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~~ Plate stiffening | Where applicable | 1 measurements |
| **TRANSVERSE BULKHEADS IN CARGO HOLDS** | | |
| Structural member | Extent of measurement | Pattern of measurement |
| Lower stool, where fitted | - Transverse band within 25 mm of welded connection to inner bottom<br>- Transverse bands within 25 mm of welded connection to shelf plate | - 5-point pattern between stiffeners over 1 m length<br>- 5-point pattern between stiffeners over 1 m length |
| Transverse bulkheads | - Transverse band at approximately mid height<br>- 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<br>- 5-point pattern over 1 $m^2$ of plating |

*Table I 2-27D has been deleted as follows:*

~~**Table I 2-27D**~~
~~**Requirements for Extent of Thickness Measurements at Those Areas of Substantial Corrosion of Double Skin Bulk Carriers Within The Cargo Length Area (4/4)**~~

| ~~TRANSVERSE BULKHEADS IN CARGO HOLDS~~ | | |
|---|---|---|
| ~~Structural member~~ | ~~Extent of measurement~~ | ~~Pattern of measurement~~ |
| ~~Lower stool, where fitted~~ | ~~- Transverse band within 25 mm of welded connection to inner bottom~~<br>~~- Transverse bands within 25 mm of welded connection to shelf plate~~ | ~~- 5-point pattern between stiffeners over 1 m length~~<br>~~- 5-point pattern between stiffeners over 1 m length~~ |
| ~~Transverse bulkheads~~ | ~~- Transverse band at approximately mid height~~<br>~~- 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~~<br>~~- 5-point pattern over 1 $m^2$ of plating~~ |

*Table I 2-28 has been renumbered and amended as follows:*

**Table I 2-~~28~~23**
**Survey Requirements for Automatic Air Pipe Heads at Special Surveys**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3 and Subsequent<br>(10 < Age) |
|---|---|---|
| - 2 air pipe heads, 1 port and 1 starboard, located on the exposed decks in the forward 0.25L, preferably air pipes serving ballast tanks.<br>- 2 air pipe heads, 1 port and 1 starboard, on exposed decks, serving spaces aft of 0.25L, preferably air pipes serving ballast tanks.<br>(1), (2) | - All air pipe heads located on the exposed decks in the forward 0.25L.<br>- At least 20% of air pipe heads on the exposed decks serving spaces aft of 0.25L, preferably air pipes serving ballast tanks.<br>(1), (2) | - All air pipe heads located on the exposed decks.<br>(3) |

Notes:

(1) The selection of air pipe heads to be examined is left to the attending Surveyor.

(2) According to the results of this examination, the Surveyor may require the examination of other heads located on the exposed decks.

(3) Exemption may be considered for air pipe heads where there is substantial evidence of replacement after the last Special Survey.

*Table I 2-29A to Table I 2-29C have been renumbered and amended as follows:*

**Table I 2-~~29A~~24**

**Minimum Requirements for Close-up Survey at Hull Intermediate Surveys of Liquefied Gas Carrier**

| 10 < Age ≤ 15 | 15 < Age |
|---|---|
| Close-up survey of:<br>1. all web frames and both transverse bulkheads in a representative ballast tank~~(1),(2)~~ (1) and (2)<br>2. the upper part of 1 web frame in another representative ballast tank<br>3. 1 transverse bulkhead in another representative ballast tank~~(1)~~ (2) | Close-up survey of:<br>1. all web frames and both transverse bulkheads in two representative ballast tanks~~(1),(2)~~ (1) and (2) |

(1) Complete transverse web frame including adjacent structural members

(2) Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure

Notes:

1. Ballast tanks include topside, double hull side, double bottom, hopper side, or any combined arrangement of the aforementioned, and peak tanks where fitted.
2. For areas in tanks where protective coating is found to be in GOOD condition, the extent of close-up survey may be specially considered by the Society.
3. For ships having independent tanks of type C, with amidship section similar to that of a general cargo ship, the extent of close-up surveys may be specially considered by the Society.
4. The extent of close-up surveys may be extended by the Surveyor as deemed necessary, taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also in the following cases:
   - in particular, in tanks having structural arrangements or details which have suffered defects in similar tanks, or on similar ships according to available information;
   - in tanks having structures approved with reduced scantlings.

**Table I 2-~~29B~~25**
**Minimum Requirements for Close-up Survey**
**at Hull Special Surveys of Liquefied Gas Carriers**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. ≥ 3<br>(Age > 10) |
|---|---|---|
| 1. 1 web frame in a representative ballast tank of topside, hopper side and double hull side type. (1) | 1. All web frames in a ballast tank, which is to be a double hull side tank or a topside tank. If such tanks are not fitted, another ballast tank is to be selected. (1)<br>1 web frame in each remaining ballast tank. (1) | 1. All web frames in all ballast tanks. (1) |
| 2. 1 transverse bulkhead in a ballast tank. (3) | 2. 1 transverse bulkhead in each ballast tank. (2) | 2. All transverse bulkheads in all ballast tanks. (2) |

(1) Complete transverse web frame, including adjacent structural members

(2) Transverse bulkhead complete, including girder system and adjacent members, and adjacent longitudinal bulkhead structure

(3) Transverse bulkhead lower part, including girder system and adjacent structural members.

Notes:

1. Ballast tanks include topside, double hull side, double bottom, hopper side, or any combined arrangement of the aforementioned, and peak tanks where fitted.
2. For areas in tanks where protective coating is found to be in GOOD condition, the extent of close-up survey may be specially considered.
3. For ships having independent tanks of type C, with amidship section similar to that of a general cargo ship, the extent of close-up surveys may be specially considered.
4. ~~The extent of close-up surveys may be extended by the Surveyor~~ The Surveyor may extend the close-up surveys as deemed necessary, taking into account the maintenance of the tanks under survey, the condition of the corrosion prevention system and also in the following cases:
   - in particular, in tanks having structural arrangements or details which have suffered defects in similar tanks, or on similar ships according to available information;
   - in tanks having structures approved with reduced scantlings.

**Table I 2-~~29C~~26**
**Minimum Requirements for the Thickness Measurement at Hull Special Survey of Liquefied Gas Carriers**

| SS No. 1<br>(Age ≤ 5) | SS No. 2<br>(5 < Age ≤ 10) | SS No. 3<br>(10 < Age ≤ 15) | SS No. ≥ 4<br>(Age > 15) |
|---|---|---|---|
| 1. 1 section of deck plating for the full beam of the ship within 0.5 L amidships in way of a ballast tank, if any | 1. Within the cargo area :<br>- each deck plate<br>- 1 transverse section within 0.5 L amidships in way of a ballast tank, if any | 1. Within the cargo area:<br>- each deck plate<br>- 2 transverse sections (1)<br>- all wind and water strakes | 1. Within the cargo area:<br>- each deck plate<br>- 3 transverse sections (1)<br>- each bottom plate<br>- duct keel plating and internals |
| | 2. Selected wind and water strakes outside the cargo area | 2. Selected wind and water strakes outside the cargo area | 2. All wind and water strakes , full length |
| ~~2~~3. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-25 | 3 Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-25 | 3. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-25 | 3. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table I 2-25 |
| 4. Suspect areas | 4. Suspect areas | 4. Suspect areas | 4. Suspect areas |

(1) At least 1 section is to include a ballast tank within 0.5L amidships, if any.

Note:

1. For ships having independent tanks of type C, with a midship section similar to that of a general cargo ship, the extent of thickness measurements may be increased to include the tank top plating at the discretion of the Surveyor.
2. For areas in spaces where coatings are found to be in GOOD condition, the extent of thickness measurements may be specially considered.
3. The Surveyor may extend the thickness measurements as deemed necessary. Where substantial corrosion is found, the extent of thickness measurements is to be increased to the satisfaction of the Surveyor.

*Table I 2-28 to Table I 2-32 have been added as follows:*

**Table I 2-27**
**Individual Wastage Allowances, Non-CSR Tankers 90 m ≤ L[(5), (6), (7) and (8)]**

| Ordinary and High Strength Steel | Built 2005 or later | Built between 1962 and 2005 | Built 1962 Or later |
|---|---|---|---|
| | Double Bottom Tankers | Double Bottom Tankers | Single Bottom Tankers |
| Strength Deck Plating | 20% | 20% | 20% |
| Forecastle, Poop and Bridge Deck Plates; Superstructure End Bulkheads | 30% | 30% | 30% |
| Sheer Strake Plates | 20% | 20% | 20% |
| Side Shell Plates | 20% | 25% | 25% |
| Bilge Strake Plates | 20% | 25% | 20% |
| Bottom Plates | 20% | 25% | 20% |
| Keel Plates[(4)] | | | |
| Outermost Strake of Inner Bottom | 20% | 20% | -- |
| Other Plates of Inner Bottom | 20% | 25% | -- |
| Top Strake of Longitudinal Bulkheads and Top Strake of Topside Tank Sloping Plating | 20% | 20% | 20% |
| Bottom Strake of Longitudinal Bulkheads | 20% | 25% | 20% |
| Other Plates of Longitudinal Bulkheads, Topside tank Sloping Plating, Hopper Tank Sloping Plating and Transverse Bulkheads | 20% | 25% | 25% |
| Internals including Longitudinals, Girders, Transverses, Struts, Bulkhead Webs and Stringers, and Brackets | 20% | 25% | 25% |
| Plates in way of Top of Tanks | 25% | 30% | 30% |

Notes:

(1) Internals included in longitudinal strength must be continuous or be effectively developed at ends, throughout amidships 0.4L.

(2) Structure must meet individual member thickness and average wastage.

(3) If design was originally approved on basis of engineering analysis (such as car carriers and other specialized vessels), or if owner specially request, the wastage may be assessed on engineering basis (i.e., acceptable stress levels and structural stability).

(4) Keel plates are to be renewed when they reach the minimum allowed thickness for adjacent bottom plating.

(5) The individual wastage allowances are acceptable, provided the Section Modulus is not less than 90% of the greater Section Modulus required: a) at the time of new construction or b) $Z_{min}$ by 3.2.2 of Part II.

(6) For tankers 130 m in length and above and over 10 years of age, sectional area calculations are to be carried out by the Head Office of the Society.

(7) For vessels built to other society rules, the Head Office of the Society carrying out the initial plan review is to be contacted for wastage allowances.

(8) For CSR vessels type, the individual wastage allowance is defined in accordance with Part 1, Chapter 13 of IACS CSR for double hull oil tankers and for bulk carriers.

**Table I 2-28**
**Individual Wastage Allowances, Liquefied Gas Carriers, 90 m ≤ L (5) & (6)**

| Ordinary and High Strength Steel | Built 2008 or later | Built between 1962 and 2008 | Built 1962 or later |
|---|---|---|---|
| | Membrane LNG Carriers | Membrane LNG Carriers | Liquefied Gas Carriers with Independent Tanks |
| Strength Deck Plating | 20% | 20% | 20% |
| Continuous Long'l Hatch Coamings & Above Deck Box-Girders | 20% | 20% | 20% |
| Forecastle, Poop and Bridge Deck Plates; Superstructure End Bulkheads | 30% | 30% | 30% |
| Sheer Strake Plates | 20% | 20% | 20% |
| Side Shell Plates | 20% | 25% | 25% |
| Bilge Strake Plates | 20% | 25% | 25% |
| Bottom Plates | 20% | 25% | 25% |
| Keel Plates(4) | | | |
| Outermost Strake of Inner Bottom | 20% | 20% | 20% |
| Other Plates of Inner Bottom | 20% | 25% | 25% |
| Top Strake of Longitudinal Bulkheads and Top Strake of Topside Tank Sloping Plating | 20% | 20% | 20% |
| Bottom Strake of Longitudinal Bulkheads | 20% | 25% | 25% |
| Other Plates of Longitudinal Bulkheads, Topside Tank Sloping Plating, Hopper Tank Sloping Plating and Transverse Bulkheads | 20% | 25% | 25% |
| Internals including Longitudinals, Girders, Transverses, Struts, Bulkhead Webs and Stringers and Brackets | 20% | 25% | 25% |
| Plates in way of Top of Tanks | 25% | 30% | 30% |
| Underdeck Box Girders (Long'l or Transverse) | 20% | 20% | 20% |

Notes:

(1) Internals included in longitudinal strength must be continuous or be effectively developed at ends, throughout amidships 0.4L.

(2) Structure must meet individual member thickness and average wastage.

(3) If design was originally approved on basis of engineering analysis (such as car carriers and other specialized vessels), or if owner specially request, the wastage may be assessed on engineering basis (i.e., acceptable stress levels and structural stability).

(4) Keel plates are to be renewed when they reach the minimum allowed thickness for adjacent bottom plating.

(5) The individual wastage allowances are acceptable, provided the Section Modulus is not less than 90% of the greater Section Modulus required: a) at the time of new construction or b) $Z_{min}$ by 3.2.2 of Part II.

(6) For vessels built to other society rules, the Head Office of the Society carrying out the initial plan review is to be contacted for wastage allowances.

## Table I 2-29
## Individual Wastage Allowances, Ships, 90 m ≤ L [(9), (10) and (11)]

| Ordinary and High Strength Steel | Built 2018 or later | Built between 1962 and 2018 | Built 1962 or later | Long'ly framed vessels built prior to 1962. Transv'ly framed vessels of all ages. Dry cargo barges 90 m ≤ L. Tank Barges 90 to 122 m[(8)] | Vessels of all ages with a combination of transverse and longitudinal framing. |
|---|---|---|---|---|---|
| | Non-CSR Bulk Carriers, Ore Carriers and OBOs | | Container ships | | |
| Strength Deck Plating | 20% | 20% | 20% | 25% | 20% |
| Continuous Long'l Hatch Coamings & Above Deck Box-Girders | 20% | 20% | 20% | 25% | 20% |
| Deck Plates within Line of Hatches and at Ends. | 30% | 30% | 30% | 30% | 30% |
| Forecastle, Poop and Bridge Deck Plates; Superstructure End Bulkheads | 30% | 30% | 30% | 30% | 30% |
| Tween Deck Plates | -- | -- | -- | 30% | -- |
| Sheer Strake Plates | 20% | 20% | 20% | 25% | 20% |
| Side Shell Plates | 20% | 25% | 25% | 25% | 25% |
| Bilge Strake Plates | 20% | 25% | 25% | 25% | 25% |
| Bottom Plates | 20% | 25% | 25% | 25% | 25% |
| Keel Plates[(4)] | | | | | |
| Outermost Strake of Inner Bottom | 25% | 30% | 20% | 30% | 30% |
| Other Plates of Inner Bottom | 25% | 30% | 25% | 30% | 30% |
| Top Strake of Longitudinal Bulkheads and Top Strake of Topside Tank Sloping Plating | 20% | 20% | 20% | 25% | 25% |
| Bottom Strake of Longitudinal Bulkheads | 20% | 25% | 25% | 25% | 25% |
| Other Plates of Longitudinal Bulkheads, Topside Tank Sloping Plating, Hopper Tank Sloping Plating and Transverse Bulkheads [(5) & (6)] | 20% | 25% | 25% | 25% | 25% |
| Internals including Longitudinals, Girders, Transverses, Struts, Bulkhead Webs and Stringers, Brackets and Hatch Side Girders | 20% | 25% | 25% | 25% | 25% |
| Plates in way of Top of Tanks | 25% | 30% | 30% | 30% | 30% |
| Underdeck Box Girders (Long'l or Transverse) | 20% | 20% | 20% | 20% | 20% |
| Hatch Covers[(7)], Hatch coamings and brackets | 30% | 30% | 30% | 30% | 30% |

Notes:

(1) Internals included in longitudinal strength must be continuous or be effectively developed at ends, throughout amidships 0.4L.

(2) Structure must meet individual member thickness and average wastage.

(3) If design was originally approved on basis of engineering analysis (such as car carriers and other specialized vessels), or if owner specially request, the wastage may be assessed on engineering basis (i.e., acceptable stress levels and structural stability).

(4) Keel plates are to be renewed when they reach the minimum allowed thickness for adjacent bottom plating.

(5) Bulk Carriers for which IACS UR S19 applies to the corrugated transverse watertight bulkhead between cargo holds 1 and 2 are to be assessed in accordance with S19 for initial compliance and subsequent continued compliance at each Intermediate Survey and Special Periodical Survey – Hull.

(6) Bulk carriers for which UR S18 applies to the corrugated transverse W.T. bulkheads are to comply with the steel renewal provisions of S18.

(7) The hatch covers of bulk carriers to which IACS UR S21 applies are to comply with the steel renewal provisions of UR S21.6.

(8) Wastage allowances in columns 1, 2 or 3 of Table I 2-27, depending on the barge's construction, apply to tank barges over 122 m in length.

(9) The individual wastage allowances are acceptable, provided the hull girder Section Modulus is not less than 90% of the greater Section Modulus required: a) at the time of new construction or b) $Z_{min}$ by 3.2.2 of Part II.

(10) For vessels built to other society rules, the Head Office of the Society carrying out the initial plan review is to be contacted for wastage allowances.

(11) For CSR vessels type, the individual wastage allowance is defined in accordance with Part 1, Chapter 13 of IACS CSR for double hull oil tankers and for bulk carriers.

**Table I 2-30**
**Individual Wastage Allowances, Ships, L < 90 m**

| | |
|---|---|
| Main Deck Plating | 25% |
| Bottom Plating | 25% |
| Keel Plating | 25% |
| Sheer Strake | 25% |
| Bilge Strake | 25% |
| Side Shell Plating | 30% |
| Forecastle | 30% |
| Internals and Bulkheads | 30% |

For vessels built to other society rules, the Head Office of the Society carrying out the initial plan review is to be contacted for wastage allowances.

Notes:

(1) Internals included in longitudinal strength must be continuous or be effectively developed at ends, throughout amidships 0.4L.

(2) The values shown in the table are the minimum requirements for individual members and plates.

(3) In addition to satisfying the individual member and plate requirements, it should be verified that the hull girder section modulus is not less than 90% of the greater Hull Girder Section Modulus required either:

a) At the time of new construction

b) $Z_\sigma$ as specified in 3.2.1 of Part XV

(4) For vessels less than 60 m only, maximum loss of deck or bottom area is 20 percent of Rule required area.

(5) For vessels built to other society rules, wastage allowance based on the previous society requirements may apply.

**Table I 2-31**
**Aluminum Wastage Allowances, Ships, L < 90 m**

| | |
|---|---|
| Main Deck Plating | 15% |
| Bottom Plating | 15% |
| Keel Plating | 15% |
| Sheer Strake | 15% |
| Bilge Strake | 15% |
| Side Shell Plating | 20% |
| Forecastle | 20% |
| Internals and Bulkheads | 20% |

For Ships built to other society rules, the Head Office of the Society carrying out the initial plan review is to be contacted for wastage allowances.

## Chapter 3 Survey Requirements for Additional Systems and Services

*Chapter 3 has been added as follows:*

# Chapter 3

# Survey Requirements for Additional Systems and Services

### 3.1 General

In order to maintain a Class Notation for an additional system or service, that system, equipment, or installation is to be surveyed in accordance with this chapter.

*Section 2.8 and 2.9 have been renumbered as follows:*

### ~~2.8~~3.2 Surveys of Refrigerated Cargo Installations

~~2.8.1~~3.2.1 Annual Surveys

(a) Where practicable, the entire refrigerating machinery is to be examined under working condition on the ship's arrival at the port of discharge before the refrigerated cargo is unloaded. Log books or other records are to be examined and any breakdown or malfunctions of the refrigerating plant in the past are to be noted and reported to the Surveyor.

(b) Cargo chambers are to be examined throughout to check that insulation linings, fastenings as well as sheathings on decks, tank tops and tunnel tops are free from damages, and airtight. Where the insulation deficiency is known or suspected, the removal or boring of the insulation may be required by the Surveyor in order to determine fullness and dryness; test holes are to be properly closed thereafter.

(c) Air trunks and casing for air ducts and coolers, and fastenings and supports for ducts, grids and meat rails, etc. are to be examined as far as practicable for damage or deterioration.

(d) Hatch covers and seals, doors and frames of cargo or cooler spaces, covers of bilges and manholes, air refreshing ducts and their closing appliances as well as thermometer tubes with their connections and fastenings are to be examined to see that they are in good condition and airtight.

(e) Bilges are to be cleaned and suction pipes, suction rose boxes, sounding pipes as well as liquid sealed traps and non-return valves for chamber drainage examined to ascertain that all sounding and drainage devices are in efficient working condition.

(f) Cooling grids, air cooler coils and air cooler drip pans with drainage are to be examined to ascertain that they are clean and in good working order.

(g) Brine coils and grids and brine return tanks, together with valves and fittings are to be examined under working condition.

(h) Primary refrigerant cooler coils and cooling grids together with valves and fittings are to be examined under working condition.

(i) Shells of shell-and-tube and double-pipe type condensers and evaporators, separators, receivers, filters, driers, coil terminals of coil-in-casing type condensers and evaporators and other pressure vessels as well as primary refrigerant gas and liquid piping, headers, condenser cooling water piping and valves are to be examined externally as far as practicable.

(j) Thermometers concerned are to be examined. The Surveyor may request one or more thermometers to be calibrated by a competent person.

(k) A general examination is to be made of refrigerant compressors, condenser cooling water pumps, brine and primary refrigerant circulating pumps, air circulating fans together with their motors, control gears and cables and the insulation resistance measured. The acceptable insulation resistance measured is to be shown in 2.7.~~6~~2(r) of this Part. The results of insulation resistance measuring carried out by a competent person may be acceptable at the discretion of the Surveyor.

(l) The generating plant supplying electric power to the refrigerating machinery is to be examined generally with a view to ascertaining that the plant is being efficiently maintained.

~~2.8.2~~3.2.2 Special Survey

(a) Special Survey No.1

In addition to the requirements of Annual Surveys as detailed in ~~2.8.1~~ 3.2.1 above the following are to be complied with:

(i) All refrigerant compressors together with their prime movers are to be opened up for examination. Relief devices, suction filters and lubricating arrangements are also to be examined.

(ii) Water end covers of shell-and-tube and double-pipe type condensers are to be removed for examination of tubes, tube plates and covers.

(iii) Condenser cooling water pumps, including the reserve pump which may be used for other services, as well as brine and primary refrigerant circulating pumps are to be examined under working condition and if deemed necessary by the Surveyor, these pumps may be opened up for examination.

(iv) Brine coils and grids are to be hydraulically tested for tightness to a pressure of 1.5 times the working pressure or 0.4 MPa, whichever is the greater.

(v) Primary refrigerant cooler coils and cooling grids together with valves and fittings, gas condensers, evaporators and receivers are to be leak tested for tightness when under the refrigerant pressure prevailing the system with the refrigerating machinery at rest and the regulating valves opened sufficiently to obtain an approximate balance of pressure throughout the system.

(vi) The Surveyor is to satisfy himself that all pressure relief valves and safety discs throughout the refrigerating machinery and appliances are in good order.

(vii) At exposed places a sufficient amount of the insulation of refrigerant and brine pipes is to be removed and pipes examined, if deemed necessary by the Surveyor.

(b) Subsequent Special Surveys

In addition to the requirements for Special Surveys No.1 as defined in ~~2.8.2~~3.2.2(a) above, the following are to be complied with:

(i) Coils of coil-in-casing condensers and evaporators are to be removed for examination and pressure tested to a pressure as specified in 4.17 of Part X or their relief valve setting pressure, whichever is the smaller, to prove tight. Where it is impracticable to remove the coils they may be examined from inspection holes and pressure tested in place.

(ii) Shell-and-tube condensers and evaporators are to have end covers removed and to be pressure tested under the same pressure as that required in (i) above.

(iii) Where brine or water is used for sub-cooling the primary refrigerating liquid in heat exchangers of the shell-and-tube type, the heat exchangers are to be examined and pressure tested in the same manner as that required for condensers in (ii) above. Double-pipe type heat exchangers are to be examined as far as practicable with the refrigerant gas piping under the same pressure as that required for condensers in (ii) above. Other types of heat exchangers using brine or water are to be examined and pressure tested at the discretion of the Surveyor according to the design of such equipment.

(iv) Primary refrigerant cooling grids or air cooler coils in the refrigerated chamber are to be pressure tested in place under a pressure as specified in 4.17 of Part X.

~~2.8.3~~3.2.3 Loading port surveys

(a) When a loading port certificate is required by the owner or his representative, a survey as detailed in (d) hereunder is to be carried out at the loading port.

(b) In the case of ships engaged on voyages of less than 2 months duration, a Loading Port Certificate is to be considered valid for 2 months, provided cargoes carried are such a nature as not to damage the insulation or appliances in refrigerated chambers, nor to affect by taint or mould refrigerated cargoes loaded during that period.

(c) If the ship loads at more than one port, one survey only at the first loading port is to be required, provided it includes the examination of all refrigerated chambers which are to be used for refrigerated cargo during the voyage and general cargo is not subsequently carried in any of the chambers prior to loading the refrigerated cargo.

(d) Requirements of loading port survey are to be as follows:

(i) Refrigerated chambers are to be examined in any empty state to ascertain that they are cleaned and free of odour which may adversely affect the cargo to be loaded.

(ii) Brine or other refrigerant pipe grids, cooler coils and connections are to be examined to ascertain that they are free from leakage.

(iii) Wood sheathings and cargo battens are to be examined to ascertain that they are well fitted in position.

(iv) Insulation and linings are to be examined to ascertain that no damage has been sustained prior to the loading of the refrigerated cargo.

(v) Scuppers and bilge suctions draining refrigerated chambers are to be examined to ascertain that they are in good working order, and that liquid sealed traps are primed.

(vi) The refrigerating machinery is to be examined under working condition, and temperatures in the refrigerated chambers are to be noted.

(e) Where any repair is deemed necessary by the Surveyor, it is to be carried out immediately to his satisfaction before the new cargo is loaded. Any indication of defective insulation not considered to warrant immediate attention is to be noted and specially reported.

## ~~2.9~~3.3 Surveys of Inert Gas Systems

~~2.9.1~~3.3.1 Annual Surveys

At each Annual Survey the inert gas system is to be generally examined so far as can be seen and placed in satisfactory condition. The survey is to include the following items:

(a) External examination of all components and piping including scrubbers, fans, cooling water pumps, compressors, washing equipment, valves, stand pipes and screens.

(b) Confirmation of proper operation of inert gas blowers.

(c) Observation of the operation of the scrubber room ventilation system.

(d) Deck seal or double block and bleed assemblies, and non-return valves are to be examined externally and proven in operation. Automatic filling and draining of deck seals, operation of non-return valves and double block and bleed assemblies, and the water carryover are to be checked.

(e) Verification of the operation of all remotely operated or automatically controlled valves and, in particular, flue gas isolating valves.

(f) Verification of the operation of the inter-locking feature of soot blowers.

(g) Verification of the automatic operation of gas pressure regulating valves.

(h) On completion of general repair work, a tightness test and a functional test are to be performed.

(i) Verification of the operation of the following alarms and safety devices using simulated conditions where necessary.

(i) Flue gas systems

(1) Low water pressure or low water flow rate to the flue gas scrubber.
(2) High water level in the flue gas scrubber.
(3) High gas temperature at inert gas blower discharge.
(4) Failure of inert gas blowers.
(5) Oxygen content in excess of 8% by volume.
(6) Failure of the power supply to the automatic control system for the gas regulating valve and to the oxygen content and gas pressure indicating devices.
(7) Low water level in the water seal.
(8) Gas pressure less than 100 mm water gauge.
(9) High gas pressure.
(10) Accuracy of fixed and portable oxygen measuring equipment by means of a calibration gas.

(ii) Gas generating systems

(1) Low water pressure or low water flow rate to the flue gas scrubber.
(2) High gas pressure.
(3) High gas temperature at inert gas blower discharge.
(4) Oxygen content in excess of 8% by volume.
(5) Insufficient fuel oil supply.
(6) Failure of the power supply to the generator.
(7) Failure of the power supply to the automatic control system for the generator.
(8) Accuracy of fixed and portable oxygen measuring equipment by means of a calibration gas.

(j) The Surveyor is to examine the permanent records to check the operation and maintenance of the system. Consideration may be given by the Surveyor for the crediting of certain items that have been properly documented and recorded.

(k) Additional requirements for separate inert gas generator

(i) Automatic combustion control system is to be examined and tested.
(ii) Combustion chamber and mountings are to be examined internally and externally.
(iii) Forced draft fans are to be examined.
(iv) Fuel oil service pumps are to be examined.

(l) Additional requirements for inert gas stored in bottles

(i) Bottles are to be examined internally and externally. If they can not be examined internally they are to be gauged. When considered necessary by the Surveyor, they are to be hydrostatically tested to at least 1.2 times the working pressure. Relief valves are to be proven operable.

(ii) Where an alkali (or other) scrubber is fitted in the system the scrubber, circulating pump, valves and piping are to be examined internally and externally.

~~2.9.2~~3.3.2 Special Survey of inert gas system

At each Special Survey of inert gas system in addition to the requirements for the Annual Surveys in ~~2.9.1~~3.3.1, the following are to be complied with:

(a) All valves, including valves at boiler uptakes, air seal valves at uptakes, scrubber isolating valves, fan inlet and outlet isolating valves, main isolating valves, re-circulating valves (if fitted), pressure/vacuum breakers and cargo tank isolating valves are to be examined.

(b) Scrubbers are to be examined.

(c) Fans (blowers) including casing drain valves are to be examined.

(d) Fan (blower) drives, either electric motor or steam turbine, are to be examined.

(e) Bellows expansion pieces are to be examined.

(f) Sea water pumps, valves and strainers for scrubbers and water seals together with piping connections at scrubbers, water seals, shell plating and the remainder of the sea water piping are to be examined.

(g) Stand pipes, where fitted, for purging in each cargo tank are to be examined.

(h) Deck seals or double block and bleed assemblies, and non-return valves are to be examined externally and internally.

(i) The Special Survey may be commenced at 4th Annual Survey and be progressed during the succeeding year with a view to completion by the 5th anniversary date. The flue gas system is to be presented for survey within 3 months before the due date of the Special Survey. The requirements for survey to qualify for the commencement of the Special Survey are to be no less than those of an Annual Survey as outlined in paragraph ~~2.9.1~~3.3.1.

*Section 3.4 has been added as follows:*

## 3.4 Survey for Dynamic Positioning System (DP-system)

3.4.1 Annual Surveys

At each Annual Survey, the vessel is to be operated for a duration of at least two hours to demonstrate that the dynamic positioning system has been maintained properly and is in good working order. The operational testing is to be carried out to the Surveyor's satisfaction and the tests are to demonstrate the level of redundancy established by the FMEA (Failure Modes and Effects Analysis).

In addition, the following items are to be generally examined and tested so far as can be seen and placed in satisfactory condition:

(a) Documentation

The following accepted documents are to be confirmed onboard the vessel as applicable:

(i) DP FMEA

(ii) DP Trial Test Procedures/Results of Trials

(iii) DP Operations Manuals

(iv) ESD (Emergency Shutdown) Operations Manual

(b) Controls and alarms

Control system, including independent emergency shut-down facility for each thruster at the main dynamic positioning control station, position keeping redundancy, and alarms and instrumentation are to be generally examined and confirmed to be functioning satisfactorily.

(c) Position and environment sensors

All available position sensors, wind sensor(s) and gyro-compass(s) are to be generally examined and confirmed to be functioning satisfactorily.

(d) For **DPS-I** notation

The operation of the automatic control system and a manual position control system including manual transfer of control between the two systems is to be confirmed to be functioning satisfactorily.

(i) Verification that any DP-system hardware changes that may affect the **DPS-I** notation for the unit have been submitted, approved, and tested as required.

(ii) Confirmation that any software revisions since the time of last Survey have been tracked and tested as appropriate by Owner and suitably documented for record.

(iii) Any hardware or software changes that have not been tested since the last performance test shall have functionality proven and recorded by a supplementary trials program to verify the effect of the modifications with regard to the approved redundancy arrangements for the unit.

(e) For **DPS-II** notation

Completion of all items for **DPS-I** notation.

The operation of two automatic control systems and a manual position control system including automatic transfer of one automatic control system to another upon failure is to be confirmed to be functioning satisfactorily. Upon failure of the two automatic control systems, it is to be verified that the manual position control is possible. Also see 3.4.1(g) below.

Additionally the followings are to be confirmed or tested:

(i) General System

(1) Black out recovery test shall be conducted.

(2) The following redundant equipment shall be disabled or disconnected in order to demonstrate operational capability after such simulated failure/condition:

- Position reference systems
- Worse case failure (e.g. switchboard, transformer, engine, or thruster as applicable)
- Network arrangements

(3) Demonstration of open bus power management systems.

(4) Demonstration of closed bus power management systems where such closed bus arrangements have been reviewed and accepted by the Society.

(ii) Standby and power redundancy

(1) Test thruster supply and generator feeder automatic transfer switches

(2) The tests will exercise the changeover functions as well as the redundant supplies.

(3) The standby and power redundancy tests may be combined with the tests of the Worst Case Failure Design Intent identified in the DP FMEA. Changeover to the standby DP control station is to be tested.

(4) Changeover to standby auxiliary services, such as seawater or freshwater cooling pumps and hydraulic pumps, shall be tested where these auxiliaries provide essential redundancy as identified in the DP FMEA.

(5) Test the switchover and isolation of redundant DC power supplies, such as in control power circuits. Where one DC power supply is failed or removed, voltage or current from the redundant DC power supply or any other source should not be present at the failed power supply.

(f) For **DPS-III** notation

Completion of all items for **DPS-II** notation.

The operation of three automatic control systems and a manual position control system including automatic transfer of one automatic control system to another upon failure is to be confirmed to be functioning satisfactorily. Manual transfer of control is to be verified possible at the third automatic control system located in the emergency back-up control station. Upon failure of the automatic control systems, it is to be verified that the manual position control is possible. Also see 3.4.1(g) below.

Additionally, the following items are to be confirmed or tested:

(i) The following redundant compartments shall be disabled or disconnected in order to prove operational capability after failure

(1) Main Control station

(2) Worst case failure compartment (e.g., engine room, switchgear room, thruster room, or other space)

(ii) Verification that no changes have been made to the watertight integrity and fire subdivisions of compartments containing elements of the DP and associated systems.

(g) Manual position control system for **DPS-I**, **DPS-II**, and **DPS-III** notations

The operation of the manual position control system using one joystick on the Navigation Bridge or DP control station and supplemented by an automatic heading control is to be confirmed to be functioning satisfactorily.

(h) Manual thruster control system

In addition to 3.4.1(c) to 3.4.1(f), the operation of the manual thruster control system using individual levers on the Navigation Bridge or DP control station is to be confirmed to be functioning satisfactorily.

(i) Alarms and instrumentation

The following audible and visual alarms including indicators at each control station are to be examined, verified operational and confirmed to be functioning satisfactorily, as applicable:

(i) Thruster power system

(1) Engine lubricating oil pressure – low*

(2) Engine coolant temperature – high*

(3) CPP hydraulic oil pressure – low and high*

(4) CPP hydraulic oil temperature – high*

(5) CPP pitch**

(6) Thruster RPM**

(7) Thruster direction**

(8) Thruster motor/semiconductor converter coolant leakage*

(9) Thruster motor/semiconductor converter temperature**

(10) Thrust motor short circuit**

(11) Thruster motor exciter power available**

(12) Thruster motor supply power available**

(13) Thruster motor overload*

(14) Thruster motor high temperature*

(ii) Power distribution system

(1) Status of automatically controlled circuit breakers**

(2) Bus bar current and power levels**

(3) High power consumers – current levels**

(iii) System performance

(1) Excursion outside operating envelope*

(2) Control system fault*

(3) Position sensor fault*

(4) Vessel target and present position and heading**

(5) Wind speed and direction**

(6) Selected reference system**

(iv) In addition, for **DPS-II** and **DPS-III** notations

(1) Thruster location (pictorial)**

(2) Percentage thrust**

(3) Available thrusters on stand-by**

(4) DP alert through consequence analyzer*

(5) Position information of individual position reference systems connected**

Notes:

* : Alarm

** : Display

(j) Uninterruptible power systems (UPS)

The uninterruptible power systems (UPS) are to be operated and confirmed to be functioning satisfactorily. The uninterruptible power systems (UPS) are to be operated without the normal main power input for 30 minutes to confirm that the batteries are capable of supplying the output power and are in satisfactory condition. The schedule of batteries is to be examined to verify that the batteries have been maintained.

(k) Communication

(i) A means of voice communication between the DP control position (navigation bridge), and the thruster room(s) is to be tested and confirmed to be functioning satisfactorily.

(ii) A means of voice communication between the DP control position (Navigation Bridge), the engine control position and any operational control centers associated with DP is to be tested and confirmed to be functioning satisfactorily.

Note: No back up required.

(l) Dynamic positioning system (DP-system)

(i) Confirmation of DP-system operations manual onboard. Verification that the manual is up to date with any modifications performed on the installation.

(ii) Verification that the failure modes and effects of any modifications or upgrades have been considered and incorporated in the operations manual.

(iii) Fail safe tests for thrusters

A single fault in the thruster system is to be such that a thruster fails to a safe mode so that the vessel's position and heading are not affected. Fail to a safe mode could be a failure to zero thrust or motor stop.

(m) The thruster installation using for DP-system

The thruster installation is to be generally examined so far as can be seen and placed in satisfactory condition. The survey is also to include:

(i) Controls and alarms

Verification of effective means of control from both the Navigation Bridge and local control stations, including alarms and indicators. The following audible and visual alarms at each control station are to be visually examined, verified operational and considered satisfactory, as applicable:

(1) Engine low lubricating oil pressure

(2) Engine coolant high temperature

(3) Motor overload

(4) Thruster RPM

(5) Thrust direction (azimuthing type)

(6) Thruster power supply failure

(7) Controllable pitch propellers hydraulic low oil pressure

(8) Controllable pitch propellers hydraulic high oil pressure

(9) Controllable pitch propellers hydraulic oil high temperature

(10) Fire extinguishing systems

(ii) Communication

Means of voice communication between the bridge control station, main propulsion control station and the thruster room are to be tested and found satisfactory.

(iii) Thruster room

Thruster room arrangements, including adequate ventilation, bilge system and alarms for enclosed modules and firefighting systems are to be examined, tested and considered satisfactory.

3.4.2 First Bottom Survey in dry dock after delivery

At the first Bottom Survey in dry dock after delivery, thruster units are to be examined and confirmed in satisfactory condition including the followings.

(a) External examination including propeller, gear housing, bolting and their securing arrangements and for seal leakage.

(b) Internal gear train examination through inspection opening. Where inspection opening is not provided, at least one unit is to be opened for examination.

(c) Lubrication oil sample analysis.

(d) In addition, for controllable pitch propellers, blade seal leak check and functional test.

Where deemed necessary by the Surveyor, non-destructive testing may be required.

In case the first Bottom Survey in dry dock after delivery is the first Special Survey after delivery, the items specified in 3.4.3 below will also apply.

3.4.3 Special Surveys

In addition to the requirements of the Annual Survey specified in 3.4.1 above, complete performance tests are to be carried out to the Surveyor's satisfaction. The schedule of these tests is to be designed to demonstrate the level of redundancy established in the FMEA for **DPS-II** and **DPS-III**. In those cases where a Continuous DP Testing Program has been accepted in 3.4.3(d) below, this may be considered by the Surveyor for acceptance in lieu of conducting the complete performance test.

(a) Thrusters are to be surveyed as part of the Special Survey in accordance with 2.3.4 of this Part.

(b) Full power tests of thrusters and generators are to be conducted.

(c) The prime movers of thrusters are to be examined as applicable in accordance with 2.7.2 of this Part.

(d) Annual DP Testing Program

If the vessel is on Machinery Continuous Survey (MCS), the Owner may submit a Continuous DP Testing Program to conduct the required FMEA and performance testing throughout the survey cycle. The program may schedule approximately 20% of the FMEA and performance testing, along with the requirements specified in 3.4.1 above for the Annual Survey each year. This Annual DP Testing Program is to be submitted for review. The testing program shall be kept on board the vessel for reference at each Annual Survey.

## Appendix 2 Guidance for Inclining Test

*Paragraph A2.2.2(c) has been amended as follows:*

A2.2.2 Inclining test condition

(a) The ship is to be as near to completion in lightweight condition as possible. Equipment used by the yard on board is to be moved outboard as far as possible.

(b) Prior to the inclining test, lists of all items which are to be added, removed, or relocated are to be prepared. These weights and their locations are to be accurately recorded.

(c) The total value of missing weights is not to exceed 2 percent and surplus weights, excluding liquid ballast, fuel oil, diesel oil and fresh water, not exceed ~~2~~ 4 percent of the light ship displacement. For smaller ships, higher percentages may be allowed.

## Appendix 3 Procedure for Certification Firms Engaged in Thickness Measurement of Hull Structure

*Appendix 3 has been deleted as follows:*

## ~~Appendix 3~~

## ~~Procedure for Certification Firms Engaged in Thickness Measurement of Hull Structure~~

**~~A3.1 Application~~**

~~This guidance applies for certification of the firms which intended to engage in the thickness measurement of hull structure of the vessels.~~

## ~~A3.2 Procedures for Certification~~

~~A3.2.1 Submission of documents~~

~~The following documents are to be submission to the Society for approval:~~

~~(a) Outline of firms, e.g. organization and management structure.~~

~~(b) Experiences of the firms on thickness measurement inter alias of hull structures of the vessel.~~

~~(c) Technicians careers, i.e. experiences of technicians as thickness measurement operators, technical knowledge of hull structure etc. Operators, should be qualified according to a recognized industrial NDT Standard.~~

~~(d) Equipment used for thickness measurement such as ultra-sonic testing machines and its maintenance/ calibration procedure.~~

~~(e) A guide for thickness measurement operators.~~

~~(f) Training programmers of technicians for thickness measurement.~~

~~(g) Measurement record forms format in accordance with recommended procedures for thickness measurement.~~

~~A3.2.2 Auditing of Firms~~

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

~~A3.2.3 Certification is conditional on an onboard demonstration at thickness measurements as well as satisfactory reporting.~~

## ~~A3.3 Certification~~

~~A3.3.1 Upon satisfaction results of both the audit of the firm in A3.2.2 and the demonstration tests in A3.2.3 above, the Society will issue a Certificate of Approval as well as notice to the effect that the thickness measurement operation system of the firm has been certified by the Society.~~

~~A3.3.2 Renewal/endorsement of the Certificate is to be made at intervals not exceeding 3 years by verification that original condition are maintained.~~

## ~~A3.4 Information of any alteration to Certified Thickness Measurement Operation System~~

~~In case where any alteration to the certified thickness measurement operation system of the firm is made, such an alteration is to be immediately informed to the Society. Re-audit is made where deemed necessary by the society.~~

## ~~A3.5 Cancellation of Approval~~

~~Approval may be cancelled in the following cases:~~

~~A3.5.1 Where the measurements were improperly carried out or the results were improperly report.~~

~~A3.5.2 Where the Society's Surveyor found any deficiencies in the approved thickness measurement operation system of the firm.~~

~~A3.5.3 Where the firm failed to inform of any alteration in A3.4 above to the Society.~~

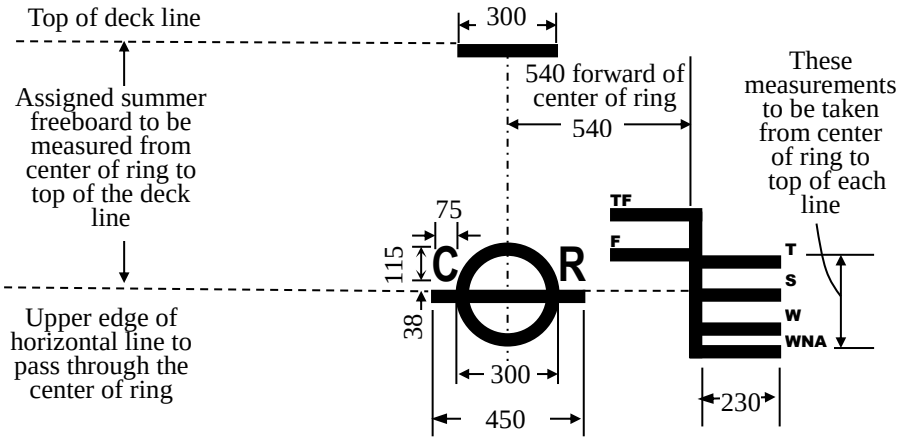
## Appendix 4 Load-Line Markings

*Appendix 4 has been renumbered as follows:*

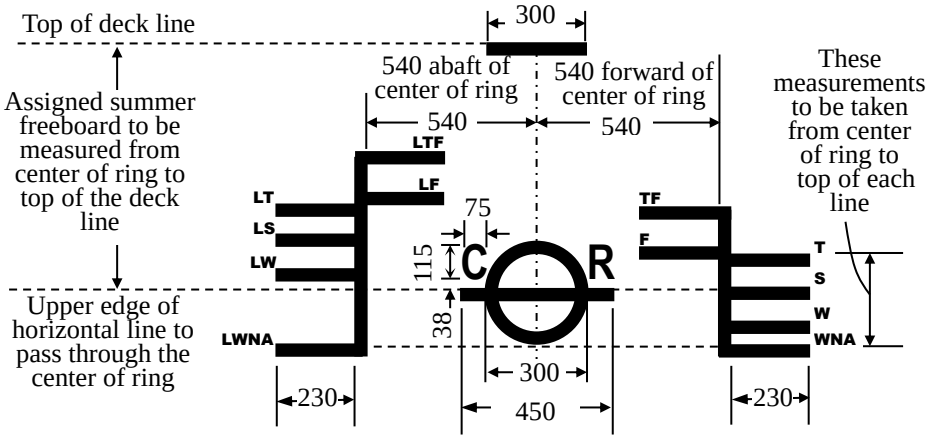
# Appendix 43

# Load-Line Markings

**For Ocean-going Ships**




**For Ocean-going Ships with Timber Freeboards**




Notes:

(1) The center of the ring is to be placed on each side of the vessel at the middle of the length as defined in the Load Line Regulations. The ring and lines are to be permanently marked, as by center punch, chisel cut or bead of weld.

(2) The thickness of all lines are 25 mm.

(3) The size of all letterings are 50 × 32 mm. except W 50 × 45 mm, unless otherwise noted.

AMENDMENT TO "THE RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2019"

# PART II HULL CONSTRUCTION AND EQUIPMENT

# List of major changes in Part II from 2019 edition

| | |
|---|---|
| 34.1 | Revised |
| 34.3 | New |
| Table II 34-2 | New |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

## Chapter 34 Noise ~~Levels~~ and Vibration on Board Ships

*Chapter 34 has been amended as follows:*

## Chapter 34 Noise ~~Levels~~ and Vibration on Board Ships

*Section 34.1 has been added as follows:*

### 34.1 General

34.1.1 Application

(a) The requirement in this chapter is intended to provide standards to prevent the occurrence of potentially hazardous noise ~~levels~~ and vibration on board ships and to provide acceptable standards for the applying ships~~an acceptable environment for seafarers~~.

(1) Ships which comply with the limits for noise levels of the code on noise levels on board ships (hereinafter referred to as "the Noise Code") adopted by resolution MSC.337(91), as given in Table II 34-1, will be assigned the notation **NR**. Where **NR** means the noise restricted by the noise level limits which quantify the comfort rating of noise for the vessel.

(2) Ships which comply with the limits for vibration of ISO 20283-5:2016, as given in Table II 34-2, will be assigned the notation **VR**. Where **VR** means the vibration restricted by values given in Table II 34-2.

(b) Ships not engaged on international voyages may apply **NR** notation voluntarily, except in case where specified by the Administration.

(c) The **VR** notation is applicable to ships applying vibration measurement and evalutation according to ISO 20283-5:2016.

34.1.2 Notation

(a) Ships of a gross tonnage of 1,600 and above but less than 10,000, which fulfill the requirements of 34.2.1 and 34.2.4 of this chapter and meet the limits for noise levels of Level I given in Table II 34-1, will be eligible to receive the notation **NR-I**.

(b) Ships of a gross tonnage of 10,000 and above, which fulfill the requirements of 34.2.1 and 34.2.4 of this chapter and meet the limits for noise levels of Level II given in Table II 34-1, will be eligible to receive the notation **NR-II**.

(c) Ships of a less gross tonnage than those categories given in (a) and (b) above may apply for a higher Level of noise limits at Owners' discretion.

(d) Ships affixed with **VR** notation comply with the requirements of 34.3 and meet the limits given in Table II 34-2.

34.1.3 Definitions

(a) Noise – Audible air pressure fluctuations generated by ship machinery, systems or structure, i.e. in the frequency range 20 to 20,000 Hz.

(b) dB(A) – A-weighted global value of the sound pressure level.

(c) Other noise related definitions are to be in accordance with the Section 1.4 Definitions of the Noise Code.

(d) Crew accommodation space – Space intended for crew recreational and administration use, namely cabins including day and sleeping rooms, hospitals, mess rooms, recreation rooms.
Note: Recreation rooms are lounges, smoke rooms, cinemas, gymnasiums, libraries, hobby rooms and game rooms.

(e) Work space – Area allocated for predominant manual work, namely workshops, laundries, galleys and laboratories, but except machinery spaces.

(f) Machinery space – Space which contains steam or internal-combustion machinery, pumps, air compressors, boilers, oil fuel units, major electrical machinery, oil filling stations, thrusters, refrigerating, stabilizing, steering gear, ventilation and air conditioning machinery, etc. and trunks to such spaces
Note: Machinery spaces are not meant for longer stay, hence they are not considered in ISO 20283-5:2016.

(g) Other vibration related definitions are to be in accordance with the Section 3 Terms and definitions of ISO 20283-5:2016.

*Section 34.3 has been added as follows:*

## 34.3 Vibration on Board ships

34.3.1 For the condition of assigning the notation **VR**, the provisions in the following Sections of the ISO 20283-5:2016 are to be conformed.

(a) Section 4 Instrumentation.

(b) Section 5 Measurement locations and directions.

(c) Section 6 Measurement conditions.

(d) Section 7 Measurement procedure.

(e) Section 8 Evaluation.

34.3.2 Criteria

The values given in Table II 34-2 are to be regarded as maximum acceptable vibration values.

34.3.3 Test report

(a) A test report containing the information and data specified in Section 9 of ISO 20283-5:2016, is to be provided.

(b) The format for the report is set out in Annex B of ISO 20283-5:2016.

*Table II 34-2 has been added as follows:*

**Table II 34-2**
**Values of Acceptable Vibration**

| **Type of occupied space** | **Value** | |
|---|---|---|
| | Velocity (mm/s) | Acceleration ($mm/s^2$) |
| **Crew spaces** | | |
| Crew accommodation | 3.5 | 125 |
| Work spaces | 6.0 | 214 |
| Offices | 4.5 | 161 |
| Navigation bridge and engine control room | 5.0 | 179 |
| Open-deck recreation spaces | 4.5 | 161 |
| **Passenger spaces** | | |
| Cabins and public spaces | 3.5 | 125 |
| Open-deck recreation spaces | 4.5 | 161 |

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# PART III SPECIAL SERVICE AND TYPE OF SHIPS

# List of major changes in Part III from 2019 edition

| | |
|---|---|
| 2A.3.3(e) | New |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

# Chapter 2A
# Double Hull Tankers

*Chapter 2A.3.3(e) has been amended as follows:*

## 2A.1 General

2A.1.1 This chapter applies primarily to the arrangements and scantlings within the cargo tank region of sea going tankers having integral cargo tanks, for the carriage of oil having a flash point not exceeding 60 °C (closed cup test) or other similar liquid cargoes.

2A.1.2 The requirements in this Chapter are framed for tankers with machinery aft having one or more longitudinal bulkheads and single deck with double bottom or with double hull structures or mid-deck.

2A.1.3 In case where the construction differs from that specified in 2A.1.2 and the requirements in this Chapter are considered to be not applicable. Matters are to be determined as deemed appropriate by the Society.

2A.1.4 As regards matters not specifically provided for in this Chapter, the general requirements for the construction and equipment of steel ships are to be applied.

2A.1.5 In addition to the requirements specified in 2A.1.4, the relevant requirements in Part IX of the Rules are to be applied to ships specified in 2A.1.1.

## 2A.2 Tank Arrangement

2A.2.1 Accidental oil outflow performance

## 2A.3 Location and Separation

2A.3.1 In cargo oil spaces, the standard arrangement of bulkheads is to be such that the interval between longitudinal bulkheads or transverse bulkheads does not exceed $1.2\sqrt{L}$, in m.

2A.3.2 Cofferdams are to be provided in accordance with followings:

(a) Cofferdams of air-tight construction with a sufficient width for access are to be provided at fore and aft terminations of cargo oil spaces and the space between cargo space and accommodation space.

(b) Cofferdams specified in (a) may be used as pump rooms.

(c) Fuel oil or ballast water tanks may be concurrently used as the cofferdams to be provided between cargo oil tanks and fuel oil or ballast water tanks, subject to the approval by the Society.

2A.3.3 Passageways leading to cargo areas are to be provided in accordance with followings:

(a) Access to cofferdams, ballast tanks, cargo oil tanks and other spaces in the cargo area are to be direct from the open deck and such as to ensure their complete inspection. Access to double bottom spaces may be through a cargo pump room, pump room, deep cofferdam, pipe tunnel or similar compartments, subject to consideration of ventilation aspect.

(b) For access through horizontal openings, hatches or manholes, the dimensions are to be sufficient to allow a person wearing a self-contained air breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also to provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening is 600 mm × 600 mm.

(c) For access through vertical openings, or man-holes providing passage through the length and breadth of the space, the minimum clear opening is to be 600 mm × 800 mm at a height of not more than 600 mm, unless gratings or other footholds are provided.

(d) For tankers of 5,000 tons deadweight and above, smaller dimensions of clear opening specified in (b) and (c) may be approved by the Society in special circumstances, if the ability to traverse such openings or to remove an injured person can be proved to the satisfaction of the Society.

(e) Access to pipe tunnels or duct keels

Where a pipe tunnel or duct keel is fitted, and access is normally required for operational purposes, provision is to be made for at least two exits to the open deck arranged at a maximum distance from each other. Access is not to be via the engine room. Where there is permanent access from a pipe tunnel to the pump room, a watertight door is to be fitted complying with the requirements of 14.3 of Part II of the Rules, and in addition with the following requirements:

(i) In addition to bridge operation, the watertight door is to be capable of being manually closed from outside the main pump-room entrance.

(ii) The watertight door shall be kept closed during normal operations of the ship except when access to the pipe tunnel is required.

Mechanical ventilation is to be provided and such spaces are to be adequately ventilated prior to entry. A notice-board is to be fitted at each entrance to the pipe tunnel stating that before any attempt is made to enter, the ventilating fan must have been in operation for an adequate period. In addition, the atmosphere in the tunnel is to be sampled by a reliable gas monitor, and where an inert gas system is fitted in cargo tanks, an oxygen monitor is to be provided. The suitable lighting system in pipe tunnels or duck keels is to be considered.

2A.3.4 All areas, where cargo oil pumps and cargo oil piping are provided, are to be segregated by an air-tight bulkhead from areas where boilers, propelling machinery, electric installations other than those of explosion-proof type or machinery where source of ignition is normally present.

2A.3.5 Ventilation inlets and outlets are to be arranged so as to minimize the possibilities of vapours of cargoes being admitted to an enclosed space containing a source of ignition, or collecting in the vicinity of deck machinery and equipment which may constitute an ignition hazard. Especially, openings of ventilation for machinery spaces are to be situated as far afterwards apart from the cargo spaces as practicable.

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# PART IV MACHINERY INSTALLATIONS－CONSTRUCTION AND SHAFTING

# List of major changes in Part IV from 2019 edition

| | | | |
|---|---|---|---|
| 3.6.2(c) | Revised | 4.6 | Renumbered |
| 3.12.8(d)(iii) | Revised | 7.2.1 | Revised |
| 4.1.5(a)(iv) | New | 9.2.3 & 9.2.4 | Revised |
| 4.2.11(e) | Revised | Table IV 9-1 | Revised |
| 4.2.16~4.2.19 | New | | |
| 4.6 | New | | |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

## Chapter 3 Diesel Engines

*Paragraph 3.6.2(c) has been amended as follows:*

3.6.2 Electric starting

(c) ~~The starting battery is not to be used for any purpose other than starting and running the engine. If it is also used for other purposes, the battery capacity is to be increased accordingly and the circuits are to be completely separated from the starting system.~~ The starting batteries (or set of batteries) are to be used for starting and for the engine's own control and monitoring purpose only. When the starting batteries are used for the engine's own control and monitoring purpose, the aggregate capacity of the batteries is to be sufficient for continued operation of such a system in addition to the required number of starting capacity. Requirements are to be made to continuously maintain the stored energy at all times.

*Paragraph 3.12.8(d)(iii) has been amended as follows:*

3.12.8 Stage B - witnessed tests

(d) The load points are:

(iii) Maximum permissible torque (at least and normally 110%) at 100% speed corresponding to load at point 3, or maximum permissible power (at least and normally 110%) and 103.2% speed according to the nominal propeller curve corresponding to load point 3a. Load point 3a applies to engines only driving fixed pitch propellers or ~~water jets~~waterjets. Load point 3 applies to all other purposes. Load point 3 (or 3a as applicable) is to be replaced with a load that corresponds to the specified overload and duration approved for intermittent use. This applies where such overload rating exceeds 110% of MCR. Where the approved intermittent overload rating is less than 110% of MCR, subject overload rating has to replace the load point at 100% of MCR. In such case the load point at 110% of MCR remains.

## Chapter 4 Deck Machinery and Essential Auxiliaries

*Paragraph 4.1.5(a)(iv) has been added as follows:*

4.1.5 Materials

(a) For steering gear

(i) All the steering gear components and the rudder stock are to be of sound reliable construction to the Surveyor's satisfaction.

(ii) All components transmitting mechanical forces to the rudder stock are to be tested according to the requirements of Part XI.

(iii) Ram cylinders, pressure housings of rotary vane type actuators, hydraulic power piping, valves, flanges and fittings; and all steering gear components transmitting mechanical forces to the rudder stock (such as tillers, quadrants, or similar components) are to be of steel or other approved ductile material, duly tested in accordance with the requirements of Part XI. In general, such material is to have an elongation of not less than 12 per cent nor a tensile strength in excess of 650 $N/mm^2$. Special consideration will be given to the acceptance of grey cast iron for valve bodies and redundant parts with low stress levels.

(iv) Grey cast iron may be accepted for redundant parts with low stress level, excluding cylinders, upon special consideration.

*Paragraph 4.2.11(e) has been amended as follows:*

4.2.11 Components and piping

(e) Relief valves for protecting any part of the hydraulic system which can be isolated, as required by 4.2.11(d) above are to comply with the following:

(i) The setting pressure is not to be less than 1.25 times the maximum working pressure.

(ii) The minimum discharge capacity of the relief valves(s) is not to be less than 110% of the total capacity of the pumps which can deliver through it (them). ~~Under such conditions the rise in pressure is not to exceed 10% of the setting pressure. In this regard, due consideration is to be given to extreme foreseen ambient conditions in respect of oil viscosity.~~

Under such conditions the rise in pressure is not to exceed 10% of the setting pressure. In this regard, due consideration is to be given to extreme foreseen ambient conditions in respect of oil viscosity.

*Paragraph 4.2.16~4.2.19 have been added as follows:*

4.2.16 Power piping arrangements

(a) The power piping for hydraulic steering gears is to be arranged so that transfer between units can be readily effected.

(b) For all ships with non-duplicated actuators, isolating valves are to be fitted at the connection of pipes to the actuator, and are to be directly fitted on the actuator.

(c) Arrangements for bleeding air from the hydraulic system are to be provided where necessary.

4.2.17 Design

(a) The construction should be such as to minimize local concentrations of stress.

(b) Welds

(i) The welding details and welding procedures should be approved.

(ii) All welded joints within the pressure boundary of a rudder actuator or connecting parts transmitting mechanical loads should be full penetration type or of equivalent strength.

(c) Oil seals

(i) Oil seals between non-moving parts, forming part of the external pressure boundary, should be of the metal upon metal type or of an equivalent type.

(ii) Oil seals between moving parts, forming part of the external pressure boundary, should be duplicated, so that the failure of one seal does not render the actuator inoperative. Alternative arrangements providing equivalent protection against leakage may be accepted at the discretion of the Society.

(d) All steering gear components transmitting mechanical forces to the rudder stock, which are not protected against overload by structural rudder stops or mechanical buffers, are to have a strength at least equivalent to that of the rudder stock in way of the tiller.

(e) Rudder actuators other than those covered by 4.2.15 and relating IMO Guidelines are to be designed in accordance with Group I pressure vessels (notwithstanding any exemptions for hydraulic cylinders).

(f) In application of such rules the permissible primary general membrance stress is not to exceed the lower of the following values:

$\frac{\sigma_B}{A}$ or

$\frac{\sigma_Y}{B}$

where:

$\sigma_B$ = Specified minimum tensile strength of material at ambient temperature

$\sigma_Y$ = Specified minimum yield stress or 0.2% proof stress of the material, at ambient temperature

A, B = A and B are as follows:

| | Steel | Cast steel | Nodular cast iron |
|---|---|---|---|
| A | 3.5 | 4 | 5 |
| B | 1.7 | 2 | 3 |

(g) The design pressure is to be at least equal to the greater of the following:

(i) 1.25 times the maximum working pressure,

(ii) the relief valve setting.

(h) Accumulators, if any, are to comply with requirements for pressure vessels in Part V of the Rules.

4.2.18 Dynamic loads for fatigue and fracture mechanic analysis

The dynamic loading to be assumed in the fatigue and fracture mechanics analysis considering SOLAS II-1/Reg. 29.2.2 and 29.17.1 and relating IMO Guidelines, is to be established at the discretion of the Society.

Both the case of high cycle and cumulative fatigue are to be considered.

4.2.19 Alternative source of power

(a) Where the rudder stock is required to be over 230 mm diameter in way of the tiller, excluding strengthening for navigation in ice, an alternative power supply, sufficient at least to supply the steering gear power unit which complies with the requirements of 4.2.3(b) and also its associated control system and the rudder angle indicator, is to be provided automatically, within 45 seconds, either from the emergency source of electrical power or from an independent source of power located in the steering gear compartment. This independent source of power shall be used only for this purpose. In every ship of 10,000 gross tonnage and upwards, the alternative power supply shall have a capacity for at least 30 minutes of continuous operation and in any other ship for at least 10 minutes.

(b) Where the alternative power source required by 4.2.20(a) above is a generator, or an engine driven pump, automatic starting arrangements are to comply with the requirements relating to the automatic starting arrangements of emergency generators.

*Section 4.6 has been amended as follows:*

## 4.6 Thrusters

4.6.1 General

(a) Application

The requirements of this section apply to maneuvering thrusters not intended to assist in propulsion, and to azimuthal and non-azimuthal thrusters (and to alternative propulsion and steering systems without a rudder, as applicable) intended for propulsion, maneuvering or dynamic positioning, or a combination of these duties.

Thrusters intended for propulsion, with or without combined duties for assisting in maneuvering or dynamic positioning, are to comply with appropriate requirements of this section in association with other relevant requirements of this Part.

Thruster types not provided for in this section, such as cycloidal propellers, pump or waterjet type thrusters, will be considered based on the manufacturer's submittal on design and engineering analyses.

Thrusters are to be constructed with sufficient strength, capacity and the necessary supporting systems to provide reliable propulsion and steering to the ship in all operating conditions. Special consideration will be given to the suitability of any essential component which is not duplicated.

For a ship fitted with multiple steering systems, each steering system is to be so arranged that the failure of one of them will not render the other one inoperative. Each of the steering systems is equipped with its own dedicated steering gear, provided that each of the steering systems is fulfilling the requirements for main steering gear (as given in 4.6.3(g)(i) below) and each of the steering systems is provided with an additional function for positioning and locking the failed steering system in a neutral position after a failure of its own power unit(s) and actuator(s).

(b) Definitions

For the purpose of this section the following definitions apply:

(i) Thruster

(1) General

Thrusters are devices capable of delivering side thrust or thrusts through 360° to improve the ship's maneuverability particularly in confined waters. There are three generic types of thrustproducing devices: the lateral or tunnel thruster, commonly known as " bow-thruster ", which consists of a propeller installed in a athwartship tunnel; jet type thruster, which consist of a pump taking suction from the keel and discharge to either side; and azimuthal thruster, which can be rotated through 360° so that thrust can be developed in any direction. Cycloidal propellers can be considered a type of azimuthal thruster.

(2) Propeller-type thruster

Regardless of whether they are normally used for propulsion, propellers intended to be operated for an extended period of time during service in a condition where the ship is not free running approximately along the direction of the thrust are to be considered thrusters for the purposes of this section.

(ii) Continuous duty thruster

A continuous duty thruster is a thruster designed for continuous operation, such as dynamic positioning thrusters, propulsion assist, or main propulsion units.

(iii) Intermittent duty thruster

An intermittent duty thruster is a thruster which is designed for operation at peak power or RPM levels, or both, for periods not exceeding 1 hour followed by periods at the continuous rating or less, with total running time not exceeding 8 hours in 20 hours. Generally such thrusters are not meant to operate more than 1,000 hours per year.

(iv) Permanent magnet thruster

A permanent magnet thruster is built around a permanent magnet motor supported on roller bearings directly connected to a propeller or other thrust-producing device.

The prime mover is integrated directly into the thruster's housing, so the permanent magnet thruster consists of an electrically-wound stationary ring that is integrated into the thruster housing to form the stator and permanent magnets attached to the shaft to serve as the rotor of an electric motor. The thrust-producing device is attached to the permanent magnet electric motor.

(v) Permanent magnet motor

A permanent magnet motor is a type of brushless electric motor that uses permanent magnets rather than windings in the rotor.

(vi) Declared operational limits

Declared steering angle limits and maximum rotational speed are operational limits in terms of maximum steering angle, and rotational speed, or equivalent, according declared guidelines for safe operation, also taking into account the ship's speed or propeller torque/speed or other limitation. The "declared steering angle limits" and "maximum rotational speed" are to be established by the ship's designer and shipbuilder based on the ship specific non-traditional steering means. Ships' maneuverability tests, such as IMO Standards for Ship Maneuverability, Resolution MSC.137(76) are to be carried out not exceeding the declared operational limits.

(vii) Steering gear power unit

For purposes of alternative propulsion and steering arrangements, the steering gear power units are to be considered as defined in 4.2.1(e)(iii) of this Chapter. For electric steering gears, the electric steering motor is to be considered as part of power unit and actuator.

(viii) Steering system

"Steering system" is ship's directional control system, including main steering gear, auxiliary steering gear, steering gear control system and rudder, if any.

(c) Plans and particulars to be submitted

The general arrangements of the thruster installation, its location of installation, along with its supporting auxiliary machinery and systems, fuel oil tanks, foundations, watertight boundary fittings, etc., are to be submitted. The rated power/rpm and the rated thrust are to be indicated. For azimuthal thrusters, the mechanical and control systems for rotating the thruster assembly or for positioning the direction of thrust are to be submitted. In addition, plans of each component and of the systems associated with the thruster are to be submitted as detailed in the applicable sections of the Rules. Typically, the following are applicable:

(i) Supporting structures

(ii) Diesel engine prime mover

(iii) Electric motor and controller

(iv) Gearing

(v) Shafting

(vi) Propellers

(vii) Piping system

(viii) Control and instrumentation

4.6.2 Materials

(a) General

Materials entered into the construction of the torque-transmitting components of the thruster are to be in accordance with the applicable requirements of this Part and Part VI of the Rules. For instance, material

requirements for propellers are to be in accordance with 7.1.3 of this Part; materials for gears, 5.1.3 of this Part; materials for shafting, 6.1.3 of this Part; materials for steering systems, 4.1.5(a) of this Chapter, etc. All material specifications are contained in Part XI of the Rules.

Where alternative material specifications are proposed, complete chemical composition and mechanical properties similar to the material required by the Rules are to be submitted for approval.

Materials used in the construction of the steering equipment components are to comply with the requirements of 24.1.2 of Part II of the Rules, as applicable.

(b) Material testing

(i) Testing by the Surveyor

The materials of the following components are to be tested in the presence of the Surveyor for verification of their compliance with the applicable requirements of Part XI of the Rules, or such other appropriate material specifications as may be approved in connection with a particular design.

(1) Shafts, shaft flanges, keys

(2) Gears (propulsion and steering)

(3) Propellers

(4) Impellers

(5) Couplings

(6) Coupling bolts

Bolts manufactured to a recognized standard and used as coupling bolts need not to be tested in the presence of the Surveyor.

4.6.3 Design

(a) Prime movers

(i) Diesel engines

Diesel engines used for driving thrusters are to comply with the design, construction, testing and certification requirements of Chapter 3 of this Part. Engine support systems are to be in accordance with Chapter 3 of this Part, except that standby pumps and similar redundancy specified for propulsion engines are not required for thruster engines.

(ii) Electric motors

Electric motors driving thrusters are to comply with the design, construction, testing and certification requirements of Chapter 4 of Part VII of the Rules. Power for thruster motors may be derived from ship service generators; except that precautions, such as interlock arrangements, are to be fitted to prevent starting except when there are enough generators on-line to support the starting and running of the thruster motor. All ship service generators may be put on line for this purpose, see 11.2 of Part VII of the Rules.

(iii) Hydraulic motors

Hydraulic motors delivering propulsion torque to thrusters are to be certified by the Surveyor at manufacturers' plants in accordance with the applicable requirements in 4.1, 4.5 and 4.7 of this Chapter. When applicable to notation **DPS**, in addition to the required test, hydraulic motors are to be designed based on applicable pressure vessel and piping standards for pressure retaining components, allowable stress for torque components, and recognized standard for seals. As an alternative to design review, mass produced motors may be accepted on the basis of specification review and a prototype test to 150% of the rated load, subject to agreement on design standards and manufacturing process.

(b) Propellers

The thruster propellers are to comply with the requirements of 7.2 of this Part.

(c) Gears

(i) Continuous duty gears

Gears for continuous duty thrusters are to meet the requirements of Chapter 5 of this Part.

(ii) Intermittent duty gears

Gears for intermittent duty thrusters as defined in 4.6.1(b)(iii) above are to be in accordance with a recognized standard and are to be submitted for consideration.

(d) Shafts

(i) Propeller and intermediate shafts

Shafting is to be in accordance with the requirements of Chapter 6 of this Part.

(ii) Coupling and coupling bolts

Shaft couplings, etc. are to be in accordance with the applicable requirements of 5.2.3, 5.2.4 and 6.6 of this Part.

(iii) Clutches

Clutches are to be in accordance with the requirements of a recognized standard.

(e) Anti-friction bearings

Full bearing identification and life calculations are to be submitted. Calculations are to include all gear forces, thrust vibratory loads at maximum continuous rating, etc. The minimum L10 life* is not to be less than the following:

(i) Continuous duty thrusters (propulsion and dynamic positioning): 20,000 hours

(ii) Intermittent duty thrusters: 5,000 hours

Shorter life may be considered in conjunction with an approved bearing inspection/replacement program reflecting calculated life.

*Note: L10 life means an expected time at which 10% of the population of a product will have failed.

(f) Steering systems for ship's directional control

Function of a steering mechanism is to rotate azimuthal thrusters for purpose of steering the ship at any horizontal angles. The steering mechanism is to be capable of rotating thrusters delivering the maximum torque under all conditions.

Steering components such as pinion gears are to meet the applicable requirements of Chapter 5, as applicable. Alternatively, consideration will be given to gears that are rated based on the recognized standards.

Hydraulic motors driving pinions for steering mechanisms are to be certified by the Surveyor at manufacturers' plants in accordance with 4.1, 4.5 and 4.7 of this Chapter.

Steering systems for azimuthal thrusters are to meet the requirements of 4.2 of this Part, as applicable, and the following requirements.

(i) Ships with only 1 azimuthal thruster

For ships that are arranged with only 1 azimuthal thruster as the only means of propulsion and steering, the thruster is to be provided with steering systems of a redundant design such that a single failure in one system does not affect the other system.

(ii) Cargo ships with 2 azimuthal thrusters

For cargo ships that are arranged with 2 azimuthal thrusters as the only means of propulsion and steering, each thruster is to be provided with at least one steering system. The steering system for each thruster is to be independent of the steering system for the other thruster.

(iii) Passenger ships with 2 azimuthal thrusters

For passenger ships that are arranged with 2 azimuthal thrusters as the only means of propulsion and steering, each thruster is to be provided with steering systems of a redundant design such that a single failure in one system does not affect any other system.

(g) Arrangements

(i) Arrangements

The main steering gear arrangements for ship's directional control is to be:

(1) of adequate strength and capable of steering the ship at maximum ahead service speed.

(2) capable of changing direction of the ship's directional control system from one side to the other at declared steering gear angle limits at an average rotational speed of not less than 2.3°/s with ship running ahead at maximum ahead service speed.

(3) operated by power

(4) reverse direction of thrust in sufficient time, and so to bring the ship to rest within a reasonable distance from maximum ahead service speed, shall be demonstrated and recorded.

(ii) Auxiliary steering gear arrangements

(1) The auxiliary steering arrangements for ship's directional control is to be:

a) of adequate strength and capable of steering the ship at navigable speed and of being brought quickly into action in an emergency;

b) capable of changing direction of the ship's directional control system from one side to the other at declared steering angle limits at an average rotational speed, of not less than 0.5°/s; with the ship running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater; and;

c) for all ships, operated by power where necessary to meet the requirements of 4.6.3(g)(ii)(1)b) above and in any ship having power of more than 2,500 kW propulsion power per thruster unit.

(2) In a ship fitted with multiple steering systems, such as but not limited to azimuthing thrusters or water jet propulsion systems, an auxiliary steering gear need not be fitted, provided that:

a) for a passenger ship, each of the steering systems, is capable of satisfying the requirements in 4.6.3(g)(i)(2) above while any one of the power units is out of operation;

b) for a cargo ship, each of the steering systems, is capable of satisfying the requirements in 4.6.3(g)(i)(2) above while operating with all power units;

c) each of the steering systems is arranged so that after a single failure in its piping or in one of the power units, ship's steering capability (but not individual steering system operation) can be maintained or speedily regained (e.g., by the possibility of positioning the failed steering system in a neutral position in an emergency, if needed). The above capacity requirements apply regardless whether the steering systems are arranged with common or dedicated power units.

(iii) Independent source of power

Where the propulsion power exceeds 2,500 kW per thruster unit, an alternative power supply, sufficient at least to supply the steering arrangements which complies with the requirements of 4.6.3(g)(ii)(1)b) above and also its associated control system and the steering system response indicator, is to be provided automatically, within 45 seconds, either from the emergency source of electrical power or from an independent source of power located in the steering gear compartment. This independent source of power is to be used only for this purpose. In every ship of 10,000 gross tonnage and upwards, the alternative power supply is to have a capacity for at least 30 minutes of continuous operation and in any other ship for at least 10 minutes.

(iv) Electric and electrohydraulic steering systems

For a ship fitted with multiple steering systems, the requirements in 2.3.4 through 2.3.8 of Part VII of the Rules are to be applied to each of the steering systems.

(h) Access for inspection

Adequate access covers are to be provided to permit inspection of gear train without disassembling thruster units.

(i) Permanent magnet thruster

(i) Plans to be submitted

General arrangement drawings indicating the key principal dimensions and detailed drawings and documents showing the following information are to be submitted:

(1) Design specifications for permanent magnet motor, stator, housing, bearing, blades, and cables

(2) Detailed material and welding connections

(3) Thruster rating (e.g., torque, power, thrust, RPM)

(4) Water sealing arrangements, (ingress of seawater or cooling water results in motor damage)

(5) Electrical drawing for power supply from the generators, switchboards, transformers, converters

(6) Design analysis of permanent magnet fixation and fastening procedure

(7) Operational characteristics, including conditions, limitations, and restrictions

(8) Blade material specifications in accordance with recognized standards, including chemical, mechanical, fatigue, thermal expansion properties/characteristics, and effects from continuous exposure to/operation in sea water

(9) Methodology and detailed calculations determining the maximum loading on the blades (e.g., CFD analysis, model tank testing)

(10) Assessment of the blade vibration characteristics while in service, including blade natural frequency

(11) Detailed fabrication of the blade material, quality assurance methodology/programs applied, along with inspection and testing carried out

(12) Method of attaching the blades to the rotor, including details of the endurance/operational tests the manufacturer has run

(13) Detailed service history experience data available from previous units that have been in Operation

(14) Any other information/arrangements/details that are considered necessary by the Society

(15) Test plan, See 4.6.3(i)(v) below

(ii) Structure

Structure is to be in accordance with a recognized standard. Structure requirements associated with azimuthing pods may be referred.

(iii) Permanent magnet materials standards

The permanent magnets are to be designed, constructed, and tested in accordance with a recognized code or standard.

(iv) Machinery and electrical systems

The requirements listed in 4.6.3(i) for machinery and electrical systems associated with the permanent magnet thruster are in addition to those listed in Part IV or Part VII of the Rules.

(1) Permanent magnet motor
Motors intended for essential services are to be designed, constructed, and tested in accordance with the requirements of Chapter 4 of Part VII of the Rules.

(2) Water seal system
The interface between the stator and rotor must maintain a water seal to prevent water leaking into the motor space resulting in motor failure.

(3) Lubricating system
Means are to be provided for preventing any damage/interruption of service lubricating carried in the water.

(4) Prevent rotation
The permanent magnet thruster is to be fitted with arrangements for stopping the rotor for safety, and to limit the risk of fires.

(5) Unusual design blade
Propellers of unusual design for permanent magnet thrusters are subject to special consideration based on the submittal of propeller load and stress analysis. See 4.6.3(b)(iii).

(6) Instrumentation
Alarms and instrumentation are to be provided in accordance with Table IV 4-1, as applicable.

(v) Testing and surveys

(1) Surveys
The permanent magnet motor is to be surveyed during manufacturing and testing in accordance with Chapter 4 of Part VII of the Rules, as applicable.

(2) Test plan.

A test plan is to be developed for each permanent magnet thruster and is to be submitted to the Society for performing the plan review at the start of the plan review process.

Copies of the test plan are to be submitted to the Society for witnessing the tests and trials for the ship, prior to performing any tests or trials. The test plan is to identify all equipment and systems and the recommended method of performing the tests or trials, taking into account that some tests or trials may have to occur earlier, since the equipment or system may not be completely accessible at the sea trials for the ship.

(3) Testing and trials

Testing is to be performed according to the test plan and as deemed necessary by the Surveyor responsible for witnessing the tests and trials for the ship. Testing is to be performed at plant of manufacture when possible, particularly when the equipment or system will not be easily accessible at the sea trials for the ship and is to be agreed to by the Surveyor responsible for witnessing the tests and trials for the ship. Certain tests may be performed by a different Surveyor, provided it is agreed to by the Surveyor responsible for witnessing the tests and trials for the ship.

4.6.4 Controls and instrumentation

(a) Control system

An effective means of controlling the thruster from the navigation bridge is to be provided. Control power is to be from the thruster motor controller or directly from the main switchboard. Propulsion thrusters are also to be fitted with local means of control.

(b) Instrumentation

Alarms and instrumentation are to be provided in accordance with Table IV 4-1 below, as applicable.

**Table IV 4-1**
**Instrumentation for Thrusters**

| Monitored Parameter | Navigating Bridge | Main Control Station(1), (2) |
|---|---|---|
| Engine low lubricating oil pressure alarm | x(1) | x |
| Engine coolant high temperature alarm | x(1) | x |
| Motor overload alarm | x(1) | x |
| Thruster RPM | x | x |
| Thrust direction (azimuthing type) | x | x |
| Thruster power supply failure alarm | x | x |
| Controllable pitch propellers hydraulic oil low pressure alarm | x(1) | x |
| Controllable pitch propellers hydraulic oil high pressure alarm | x(1) | x |
| Controllable pitch propellers hydraulic oil high temperature alarm | x(1) | x |
| Fire detection | x | x |
| Permanent Magnet Thruster stator high temperature alarm | x | x |
| Permanent Magnet Thruster earth fault | x | x |

Notes:

(1) Either an individual indication or a common trouble alarm may be fitted at this location, provided individual indication is installed at the equipment (or main control station)

(2) For ships not fitted with a main control station, the indication is to be installed at the equipment or other suitable location

(c) Failure detection and response

Notwithstanding 4.6.4(a) and 4.6.4(b) above, 2.3.13 and 4.2.8(c) of Part VII of the Rules for steering gear, apply.

4.6.5 Communications

A means of voice communication is to be provided between the navigation bridge, main propulsion control station and the thruster room.

4.6.6 Miscellaneous requirements for thruster rooms

(a) Ventilation

Thruster rooms are to be provided with suitable ventilation so as to allow simultaneously for crew attendance and for thruster machinery to operate at rated power in all weather conditions.

(b) Bilge system for thruster compartments

Thrusters installed in normally unattended spaces are to be arranged such that bilge pumping can be effected from outside the space. Alternatively, where bilge pumping can only be effected from within the space, a bilge alarm to warn of high bilge water level is to be fitted in a centralized control station, the navigation bridge, or other normally manned control station. For bilge systems in general, the following requirements are to apply:

(i) Bilge suctions for normally unmanned spaces

Normally unmanned spaces located below the waterline, such as bow thruster compartment, emergency fire pump room, etc., for which bilge pumping is required, are to be arranged such that bilge pumping can be effected from outside the space, or alternatively, a bilge alarm is to be provided.

Thrusters in enclosed modules (capsules) are to be provided with a high water level alarm. At least one pump capable of bilging the module is to be operable from outside the module.

(c) Fire fighting systems

In general, spaces where thrusters are located, including enclosed modules, are to be protected with firefighting system in accordance with Part IX of the Rules.

4.6.7 Certification and trial

(a) Survey at the shop of the manufacturer

Thrusters and associated equipment are to be inspected, tested and certified by the Society in accordance with the following requirements, as applicable:

(i) Diesel engines

(ii) Gas turbines

(iii) Electric motors

(iv) Gears

(v) Shafting

(vi) Propellers

(b) Sea trial

Upon completion of the installation, performance tests are to be carried out in the presence of the Surveyor in a sea trial. This is to include but not limited to running tests at intermittent or continuous rating and maneuvering tests not to exceed the declared operational limits.

(c) Sea trial results

The stopping times, ship headings and distances recorded on trials, together with the results of trials to determine the ability of ship's having multiple propulsion/steering arrangements to navigate and maneuver with one or more of these devices inoperative, are to be available on board for the use of the Master or designated personnel.

4.6.8 Notification of declared operational limits

At each position where the directional control system can be operated, the declared operational limits are to be permanently indicated by a placard.

*Section 4.6 has been renumbered as follows:*

## 4.~~6~~7 Tests and Inspections

4.~~6~~7.1 Hydraulic pressure tests

Hydraulic pressure tests on deck machinery and pump parts after machining are to be carried out in the presence of the Surveyor under the conditions specified in Table IV 4-1.

**Table IV 4-1**
**Hydraulic Test Pressure on Deck Machinery and Pump Parts**

| Parts to be Tested | Test Pressure, MPa |
|---|---|
| Steering gear: | |
| Steam reciprocating steering engine. | See 2.9.1 of this Part. |
| Hydraulic steering gear, pump case, cylinder etc. | 1.5 W or W + 7, whichever is smaller. |
| Windlass: | |
| Steam reciprocating windlass engine. | See 2.9.1 of this Part. |
| Diesel windlass engine. | See 3.10.1 of this Part. |
| Hydraulic pump and motor. | 1.5 W or W + 7, whichever is smaller. |
| Reciprocating compressors: | |
| Air Compressor: | |
| Cylinder, liner, cover, inter- and after-coolers. | |
| Compressed air side. | 1.5 W |
| Cooling water space. | 0.4 but not less than 1.5 W |
| Refrigerant compressor. | See Part X |
| Pump: | |
| Pump prime mover, steam or diesel engine. | See 2.9.1 and 3.10.1 of this Part. |
| Pump casing. | 0.4 but not less than 1.5 W. |
| Piping: | |
| Group-I and -II pipes and fittings. | See Part VI. |
| Where:<br>W = Design pressure and/or maximum working pressure for the respective parts, in MPa. | |

4.~~6~~7.2 Shop trials

(a) The following operational tests are to be carried out at the manufacturer's workshop in the presence of the Surveyor:

(i) For the steering gear: Characteristic tests of hydraulic pump units, if used. Running tests of steering gear. Adjustments and tests of safety devices and brake arrangements. Each new design power unit pump for steering gear is to be type tested before come into the market. The type test is to be for a duration of not less than 100 hours, the test arrangements are to be such that the pump may run in idling conditions, and at maximum delivery capacity at maximum working pressure. During the test, idling periods are to be alternated with periods at maximum delivery capacity at maximum working pressure. The passage from one condition to another is to occur at least as quickly as on board. During the whole test no abnormal heating, excessive vibration or other irregularities are permitted. After the test, the pump is to be disassembled and inspected. Type tests may be waived for a power unit which has been proven to be reliable in marine service.

(ii) For the athwartship thruster: Running tests of thruster. Adjustment and tests of the control and monitoring systems.

(iii) For the windlass, see 4.3.6 of this Part.

(iv) For the reciprocating compressor:

Running test for 2 hours and safety device test. Charging test for air compressor. Performance test for refrigerant compressor if deemed necessary by the Surveyor.

(v) For the pump: Characteristic tests with the pump running at designed condition.

(b) The overhaul inspection after shop trial is to be carried out in the presence of the Surveyor. The range and extent of inspection are subject to the discretion of the Surveyor.

4.~~6~~7.3 On-board trials

(a) For the steering gear: The steering gear is to be tried out on the trial trip in order to demonstrate to the Surveyor's satisfaction that the requirements of the Rules have been met. The trial is to include the operation of the following:

(i) The steering gear, including demonstration of the performances required by 4.2.2(b) and 4.2.3(b). For the main steering gear trial, the propeller pitch of controllable pitch propellers is to be at the maximum continuous ahead RPM. If the vessel cannot be tested at the deepest draught, alternative trial conditions may be specially considered. In this case, for the main steering gear trial, the speed of the ship corresponding to the maximum continuous revolutions of the main engine is to apply;

(ii) The steering gear power units, including transfer between steering gear power units;

(iii) The isolation of one power actuating system, checking the time for regaining steering capability;

(iv) The hydraulic fluid recharging system;

(v) The emergency power supply required by 2.3.10 of Part VII;

(vi) The steering gear controls, including transfer of control and local control;

(vii) The means of communication between the steering gear compartment and the wheelhouse, also the engine room, if applicable;

(viii) The alarms and indicators;

(ix) Where the steering gear is designed to avoid hydraulic locking this feature is to be demonstrated.

Test items (iv), (vii), (viii) & (ix) may be effected at the dockside.

(b) For the windlass, an anchoring test is to be carried out in the presence of the Surveyor to demonstrate that the windlass with brakes, etc., functions satisfactorily and that the lifting power specified by the Rules can be developed. See 4.3.6 of this Part.

(c) For the athwartship thruster, mooring winch and capstan, an on-board running under working condition, if available, is to be carried out in the presence of the Surveyor.

(d) For reciprocating compressor, the following on-board trials are normally to be carried out in the presence of the Surveyor:

(i) Running and charging.

(ii) Safety device adjusting and setting.

(e) For pumps, an on-board running under working condition is to be carried out in the presence of the Surveyor.

4.~~6~~7.4 Alternative proposals will be specially considered where any of the tests required by 4.~~6~~7.2 and 4.~~6~~7.3 above are considered impracticable.

# Chapter 7 Propellers

*Paragraph 7.2.1 has been amended as follows:*

7.2.1 Blades

(a) For propeller blade of conventional design ($\theta \leq 25°$), the required blade thickness is to comply with the following formula:

Note: The maximum skew angle of a propeller blade ($\theta$) is defined as the angle, in projected view of the blade, between a line drawn through the blade tip and the shaft centreline and a second line through the shaft centreline which acts as a tangent to the locus of the mid-points of the helical blade sections, see Fig. IV 7-1.

(b) Skewed propeller

~~(i) The maximum skew angle of a propeller blade is defined as the angle, in projected view of the blade, between a line drawn through the blade tip and the shaft centreline and a second line through the shaft centreline which acts as a tangent to the locus of the mid-points of the helical blade sections, see Fig. IV 7-1.~~

(i~~i~~) For propellers having a skew angle in excess of 25°or greater, but less than 50°, the blade thickness at the radius of 0.25 R and 0.6 R are not to be less than the values obtained by multiplying the value [t] calculated by the formula in 7.2.1(a) above, by the coefficients $K_{0.25}$ and $K_{0.6}$ respectively given in the formulas below:

$$K_{0.25} = 0.75(1+0.1\theta_S)^{0.25}$$
$$K_{0.6} = 0.54(1+0.1\theta_S)^{0.5}$$

Where $\theta_S$ =Proposed skew angle in degrees as defined in 7.2.1~~(b)(i)~~(a)

The thickness of the remaining radii are to be joined by a fair curve and the sections are to be of suitable aerofoil section.

(ii~~i~~) Results of detailed calculations where carried out, are to be submitted.

(iii~~iv~~) For propellers having a skew angle in excess of 50°, a detailed blade stress computation is to be submitted for special approval.

# Chapter 9 Special Requirements for Machinery Installed in Ship with Restricted Area of Service and Small Ships

*Paragraph 9.2.3 and 9.2.4 have been amended as follows:*

9.2.3 Bilge suction arrangement in machinery spaces

(a) For ships of less than 500 gross tonnage, the number of direct bilge suctions in 3.7.1~3.7.3 of Part VI may be changed to 1. The number of branch suction may be changed to 2.

For ships of less than 100 gross tonnage, the number of branch suction in 3.7.1~3.7.3 of Part VI may be changed to 1.

(b) For cargo ships of less than 500 gross tonnage or passenger ships of less than 100 gross tonnage not engaged on international voyage, emergency bilge suction as required in 3.7.4 of Part VI may be dispensed with.

9.2.4 Bilge pumps and bilge piping

(a) The number of power bilge pumps and drive modes for each ship as specified in 3.12 of Part VI may be required for the following ships:

(i) for passenger ships not engaged on international voyages of less than 100 gross tonnage, carrying not more than 100 passengers, 2 independent bilge pumps may be provided if navigation period is less than 4 hours;

(ii) for cargo ships of less than 100 gross tonnage, one of power driven type and one hand pump may be provided.

(b) For ships of 25 m or less in length, the internal diameter of branch bilge pipes as required in 3.11.1(d) of Part VI may be reduced to 40 mm.

(c) For ships of less than 500 gross tonnage, the capacity of bilge wells for cargo holds as specified in 3.6.2(c) of Part VI may be suitably reduced but not to be less than 0.1 $m^3$.

*Table IV 9-1 has been amended as follows:*

**Table IV 9-1**
**Specified Requirements are Not Necessary to Apply**

| | Machine or Equipment concerned | Stated in Rules Part/Section |
|---|---|---|
| a | An engineers' alarm | Part IV, 1.6.10(c) |
| b | Operating and maintenance Instruction for ship machinery and equipment | Part IV, 1.6.13 |
| c | An hydraulically pump or an air compressor for the operation of the clutch for main propelling purpose | Part IV, 5.2.3(b) |
| d | The hydraulically operated pitch selection mechanisms for controllable pitch propeller | Part IV, 7.3.2(b) |
| e | The air pipes for fuel oil service, settling and lubrication oil tanks | Part VI, 3.2.16 |
| f | Fuel oil service tanks for propulsion and generator systems | Part VI, 4.4.3(r)(i), (ii) and (iii) |
| g | Cargo oil tank venting, purging and gas-freeing | Part VI, 5.9.1(b)(iii) and 5.9.1(l) |

| | | |
|---|---|---|
| h | A low level alarm and a storage tank for hydraulic steering gear | Part IV, 4.2.11(g)(ii) and (iii) |
| i | Emergency electric power for steering gear | Part VII, 2.3.10 |
| j | Two exclusive circuits for electric or electrohydraulic steering gear arrangement | Part VII, 2.3.8 |
| k | Short circuit protection, and overload alarm for main and auxiliary motor circuit for steering gear | Part VII, 2.3.1 |
| l | A means of communication between the navigation bridge and steering gear compartment | Part VII, 2.5.9 |
| m | Electric control system for steering gear | Part VII, 2.3.11 |
| n | The buffer arrangements for the steering gear other than of hydraulic type may be omitted | Part IV, 4.2.11(b) |
| o | Scuppers and discharges draining from the space below the free board deck and etc. | Part II, 22.1.3 |
| p | All external high-pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors.<br>Arrangement for draining oil fuel leakage | Part IV, 3.8.1(b) & (e) |
| q | Requirements of starting system from dead ship condition | Part IV, 1.6.2 |

AMENDMENT TO "THE RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2019"

# PART VI PIPING AND PUMPING SYSTEMS

# List of major changes in Part VI from 2019 edition

| | |
|---|---|
| 2.1.4 | Deleted |
| 2.1.5 | Renumbered |
| 4.5.4 & 4.5.5 | Revised |
| 5.9.1(f) | Revised |
| Table VI 6-1 | Revised |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

## Chapter 2 Piping Design and Arrangements

*Paragraph 2.1.4 has been deleted as follows:*

~~2.1.4 Hydraulic fluid systems other than those for steering gear shall be specially considered by this Society.~~

*Paragraph 2.1.5 has been renumbered as follows:*

2.1.~~5~~4 These requirements do not apply to cargo piping systems of ships carrying chemicals in bulk and piping systems intended for liquefied gases(cargo and process).

## Chapter 4 Machinery Piping Systems

*Paragraph 4.5.4 and 4.5.5 have been amended as follows:*

4.5.4 Hydraulic systems

(a) The arrangements for ~~Group~~ Class I hydraulic piping systems are to be in accordance with the requirements of Chapter 2 in this Part. Plans showing clearly the arrangements and details are to be submitted for review.

(b) Hydraulic power cylinders

(i) General

Hydraulic cylinders subject to Classes I and II are to be designed, constructed and tested in accordance with a recognized standard for hydraulic power cylinders.

(ii) Non-compliance with a recognized standard

As an alternative to 4.5.4(b)(i) above, hydraulic cylinders subject to Classes I and II and which are not constructed to a recognized standard may be accepted based on the following:

(1) Regardless of diameter, the design of the cylinder is to be shown to comply with one of the following:

- A recognized pressure vessel code
- The requirements of Part V of the Rules

For instance, the cylinder is to have a wall thickness not less than that given by 3.1 of Part V of the Rules, and the cylinder ends are to meet the requirements of flat heads in 3.2 of Part V of the Rules.

- Verification through burst tests

Steel cylinders (other than cast steel) are to withstand not less than 4 times the maximum allowable working pressure, while cast steel, cast iron and nodular iron cylinders are to withstand not less than 5 times the maximum allowable working pressure.

Documentation in this regard is to be submitted for review.

(2) Each individual unit is to be hydrostatically tested to 1.5 times the maximum allowable working pressure (2 times, for cast iron and nodular iron cylinders) by the manufacturer. A test certificate is to be submitted.

(3) Each cylinder is to be affixed with a permanent nameplate or marking bearing the manufacturer's name or trademark and the maximum allowable working pressure and temperature.

(iii) Materials

The materials of hydraulic power cylinders addressed in 4.5.4(b)(i) and (ii) above are to comply with the following:

(1) The materials of the cylinders are to comply with the requirements of the standard or code to which they are designed and constructed.

(2) Ordinary cast iron having an elongation of less than 12% is not to be used for cylinders expected to be subjected to shock loading.

(3) Copies of certified mill test reports are to be made available to the Surveyor upon request.

(iv) Rudder actuators

Rudder actuators are to comply with the material requirements of 4.1.5(a) of Part IV of the Rules, be designed in accordance with 4.2.17 of Part IV of the Rules, and to be tested in accordance with 4.7 of Part IV of the Rules.

(v) Cylinders for Class III piping systems

Cylinders subject to Class III piping systems as defined in Table VI 1-1 may be used in accordance with the manufacturer's rating and verification of suitable for the intended service.

(vi) Exemptions

Hydraulic power cylinders that do not form part of the ship's piping systems, machinery or equipment covered in Part IV, Part V, Part VI of the Rules are exempt from the requirements of 4.5.4(b). However, those hydraulic power cylinders which are integrated into piping systems associated with optional classification notations are to comply with the requirements of 4.5.4(b).

4.5.5 Hydraulic system for essential services

Unless otherwise specified, the requirements in 4.5.5 apply to all hydraulic systems intended for essential services in accordance with Part IV 1.3 of the Rules.

(m) Where applicable, requirments for the hydraulic cylinders are to be in accordance with 4.5.4(b) above ~~Part IV, Chapter 4~~.

## Chapter 5 Oil Tankers Piping Systems

*Paragraph 5.9.1(f) has been amended as follows:*

5.9.1 Cargo oil tank venting

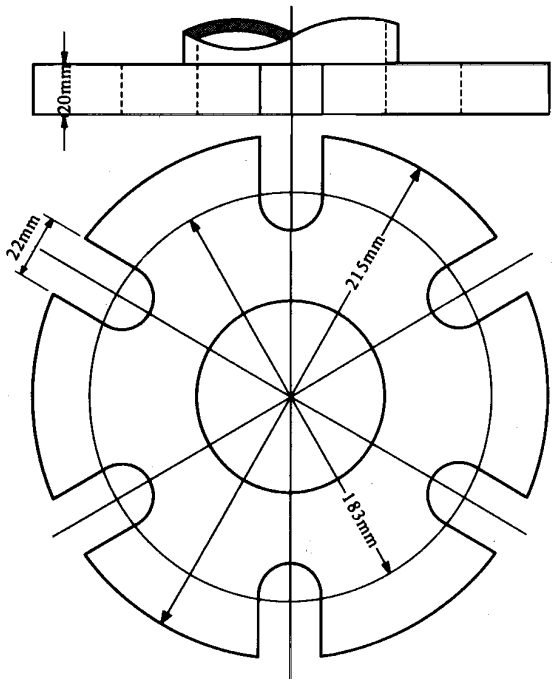
(f) ~~The venting system is to be provided with devices to prevent the passage of flame into the cargo oil tanks. The design, testing and locating of these devices is to comply with approved international requirements. Ullage openings are not to be used for pressure equalization. They are to be provided with self-closing and tightly sealing covers. Flame arresters and screens are not permitted in these openings.~~
Safety devices in venting systems are to comply with the requirements of 2.4.3(c) of Part IX of the Rules.

## Chapter 6 Equipment and Arrangement for Oil Pollution Prevention

*Table VI 6-1 has been amended as follows:*

**Table VI 6-1**
**Standard Dimensions of Flanges for Discharge Connections**

| Item | Requirements |
|---|---|
| External diameter | 215 mm |
| Internal diameter | A diameter reasonably corresponding to the outside diameter |
| Pitch circle diameter | 183 mm |
| Flange groove | Six 22 mm dia. holes are to be drilled on the above pitch circle dia. at equal angular intervals, and grooves of 22 mm wide from these holes reaching the outer periphery of the flange are to be machined. |
| Thickness of flange | 20 mm |
| Number and diameter of bolts and nuts with a proper length | 6 sets of 20 mm dia. |
| The flange is designed to accept pipes up to a maximum internal diameter of 125 mm and ~~Flanges are~~ is to be of steel or equivalent material with plain surfaces. This flange is to withstand a service pressure of 0.6 MPa when an oil-resistant gasket is inserted. | |



AMENDMENT TO "THE RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2019"

# PART VII ELECTRICAL INSTALLATIONS

# List of major changes in Part VII from 2019 edition

| | |
|---|---|
| 1.2.1 | Revised |
| 1.2.2(b)(i) & (ii) | New |
| 1.2.2(c)(i) & (ii) | New |
| 1.6.6 | New |
| 1.6.6~1.6.12 | Renumbered |
| 1.10.5~1.10.7 | Revised |
| 1.12 | Revised |
| 2.1.7 | Revised |
| 2.2.5. | Revised |
| 2.2.7(f), (g) | New |
| 2.5.12~2.5.14 | New |
| 3.3.8 | Revised |
| 3.6.2 | Revised |
| 3.8.6(a), (b) | Revised |
| 4.1.1 | Revised |
| 4.1.4 | Revised |
| 4.1.5 & 4.1.6 | New |
| 4.2.4(a), (e) | Revised |
| 5.1.6 | Revised |
| 5.2 | Revised |
| 9.3 | New |
| 9.3, 9.4 | Renumbered |
| 10.1.1.(e) | Revised |
| 10.3.4 | Revised |
| 10.3.5 | Deleted |
| 10.5 | Deleted |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

## Chapter 1 General

*Paragraph 1.2.1 and 1.2.2 have been amended as follows:*

1.2.1 The shipbuilder or manufacturer is to submit the following drawings and data for approval before the work commences:

(a) For propulsion machineries, generators and essential motors of 375 kW and over: – Complete rating, seating arrangements, assembly, shaft, stator and rotor details, electric propulsion coupling details, mass, main dimensions, main materials used, and data for calculation of critical speed.

(b) For generators ~~and essential motors~~ below 375 kW: – Complete rating, seating arrangements, type of enclosure and dimensional outline.

(c) For essential motors over 15 kW but below 375 kW: – Complete rating, seating arrangements, type of enclosure and dimensional outline.

(d~~c~~) For switchboards: – Arrangements and details, front view, installation arrangements and wiring diagram.

(e~~d~~) For wiring: – All wiring plans and circuit diagrams including load distribution, wire size, type of cable, maximum temperature rise of conductor and voltage drop, type of insulation, rating or setting of circuit breaker, rating of fuse and switch, and interrupting capacity of circuit breaker and fuse.

(f~~e~~) For arrangement: – General arrangement of electric equipment including details of the main cable runs.

1.2.2 The shipbuilder is to submit the following specification and data for approval before the work commences:

(a) Specifications and list of electrical equipment.

(b) Load analysis and protective device coordination study.

(i) This protective device coordination study is to be an organized time-current study of all protective devices, taken in series, from the utilization equipment to the source, under various conditions of short circuit. The time-current study is to indicate settings of long-time delay tripping, short-time delay tripping, and instantaneous tripping, as applicable. Where an overcurrent relay is provided in series and adjacent to the circuit protective devices, the operating and time-current characteristics of the relay are to be considered for coordination. Typical thermal withstanding capacity curves of the generators are to be included, as appropriate.

(ii) An electric-plant load analysis is to cover all operating conditions of the ship, such as conditions in normal sea going, cargo handling, harbor maneuver, emergency, and dynamic positioning operations.

(c) Calculations of short circuit currents at main, emergency and sub-switchboards including those fed from transformers.

(i) Maximum calculated short circuit current values, both symmetrical and asymmetrical values, available at the main and emergency switchboards and the downstream distribution boards.

(ii) Rated breaking and making capacities of the protective devices.

(d) Explanation of electric propulsion system.

(e) For tankers, ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk, drawings indicating hazardous areas and the list of electrical equipment installed in the hazardous areas.

(f) Maintenance schedule of batteries

*Paragraph 1.6.6 has been added as follows:*

## 1.6 Location and Construction

1.6.1 Electrical equipment is to be accessibly placed in well-ventilated and adequately lighted spaces where it is not exposed to risk of mechanical injury or damage arising from water, steam or oil. Where it is unavoidable to be exposed to such risks, the equipment is to be so constructed as to meet the conditions of the locations.

1.6.2 Bolts, nuts, pins, screws, terminals, studs, springs and such other small parts are to be made of corrosion resistant materials or steel suitably protected against corrosion.

1.6.3 Live parts are to be effectively shielded from any accidental contact when the voltage is above 250V D.C. or 150V, A.C.

1.6.4 All electrical apparatus are to be so constructed and so installed that it does not cause injury when handled or touched in the normal manner.

1.6.5 Insulating materials and insulated windings are to be resistant to moisture, sea air and oil vapour unless special precautions are taken to protect them.

1.6.6 Insulation Material

Insulating materials are to be classified by their maximum continuous operating temperatures in accordance with the following table:

| Class | Maximum Continuous Temperature (°C) |
|---|---|
| A | 105 |
| E | 120 |
| B | 130 |
| F | 155 |
| H | 180 |

Materials or combinations of materials which by experience or accepted tests can be shown to be capable of satisfactory operation at temperature over 180°C will also be considered. In this regard, supporting background information, reports, tests conducted, etc. ascertaining their suitability for the intended application and operating temperature are to be submitted for review.

*Paragraph 1.6.6~1.6.12 have been renumbered as follows:*

1.6.7~~6~~ Equipment is not to remain alive through the control circuits and/or pilot lamps when switched off by the control switch. This does not apply to synchronizing switches and/or plugs.

1.6.8~~7~~ The operation of all electrical equipment and the lubrication arrangements are to be efficient under such conditions of vibration and shock as arise in normal practice.

1.6.9~~8~~ All nuts and screws used in connection with current-carrying parts and working parts are to be effectively locked to prevent loosening due to vibration.

1.6.10~~9~~ No electrical equipment is to be installed in any space where flammable mixtures are liable to collect including those on board oil tankers or in compartments assigned principally to accumulator batteries, in paint lockers, acetylene stores or similar spaces, unless the Society is satisfied that such equipment is:

(a) essential for operational purposes;

(b) of a type which will not ignite the mixture concerned;

(c) appropriate to the space concerned; and

(d) appropriately certified for safe usage in the dusts, vapours or gases likely to be encountered.

1.6.11~~10~~Generators and motors are preferably to be placed with their axis of rotation in the fore and aft direction of the ship. Where a machine is installed athwartship, it is to be ensured that the design of the bearings and the arrangements for lubrication are satisfactory to withstand the ship's inclination specified in 1.4.

1.6.12~~11~~The electrical equipment exposed to the weather or located in spaces exposed to sea splashing or other severe moisture condition is to be of the waterproof type or protected by means of waterproof enclosure.

1.6.13~~12~~Conductors and equipment are to be placed at such a distance from the magnetic compass or all to be so screened that the interfering external magnetic field is negligible, even when circuits are switches on and off.

*Paragraph 1.10.5~1.10.7 have been amended as follows:*

1.10.5 Paint stores or enclosed spaces leading to paint stores

In principle, within the paint store; open deck area within 1 m from ventilation inlet and natural ventilation outlet; and open deck area within 3 m from power ventilation outlet are to be regarded as hazardous areas.

(a) Electrical equipment is to be installed in paint stores and in ventilation ducts serving such spaces only when it is essential for operational services. Certified safe type equipment specified in 1.10.2 of this chapter is acceptable.

(b) Electrical equipment for use in paint stores is to have minimum explosion group IIB and temperature class T3.

(c) In the areas on open deck within 1 m of inlet and exhaust ventilation openings of paint stores or 3 m of exhaust mechanical ventilation outlets of such spaces, following electrical equipment may be installed:

(i) Electrical equipment with the type of protection as permitted in paint stores.

(ii) Appliances which do not generate arcs in service and whose surface does not reach unacceptably high temperature.

(iii) Appliances with simplified pressurised enclosures or vapour proof enclosures (minimum class of protection IP55) whose surface does not reach unacceptably high temperature.

(iv) Cables of armoured type or installed in metallic conduit are to be used.

(d) Enclosed spaces giving access to paint stores may be considered as non-hazardous, provided that:

(i) The door to the paint store is a gastight door with self-closing devices without holding back arrangements.

(ii) The paint store is provided with an acceptable, independent, natural ventilation system ventilated from a safe area.

(iii) Warning notices are fitted adjacent to the paint store entrance stating that the store contains flammable liquids.

1.10.6 Battery room

In principle, within the battery room; open deck area within 1 m from natural ventilation outlet, and open area within 3 m from power ventilation outlet are to be regarded as hazardous areas.

(a) Electric ventilator motors are to be outside ventilation ducts and, if within 3 m of the exhaust end of the duct, they are to be of an explosion-proof safe type. The impeller of the fan is to be of the non-sparking type.

(b) Overcurrent protective devices are to be installed as close as possible to, but outside of, battery rooms.

(c) Electrical cables other than those pertaining to the equipment arranged in battery rooms are not permitted.

(d) Electrical equipment for use in battery rooms is to have minimum explosion group IIC and temperature class T1.

1.10.7 Welding gas (Oxygen-acetylene) storage room

In principle, within the storage room; open deck area within 1 m from natural ventilation outlet, open area within 3 m from power ventilation outlet; and the area within 3 m of the gas cylinders pressure relief device discharge outlet are to be regarded as hazardous areas.

(a) Electric ventilator motors are to be outside ventilation ducts and, if within 3 m of the exhaust end of the duct, they are to be of an explosion-proof safe type. The impeller of the fan is to be of the non-sparking type.

(b) Electrical equipment for use in oxygen-acetylene room is to have minimum explosion group IIC and temperature class T2.

*Section 1.12 has been amended as follows:*

## 1.12 Testing and Inspection

1.12.1 All generators, including emergency generators, motors, and other rotating machines for essential auxiliary services are to be tested in the presence of the Surveyor, preferably at the plant of the manufacturer.

1.12.2 Shop tests of generators are to be carried out in accordance with ~~3.8 of~~ Chapter 3 of ~~in~~ this Part ~~and mechanical check of end play setting, running balance, vibration and bearing temperature~~.

1.12.3 Shop tests of motors are to be carried out in accordance with ~~4.2 of~~ Chapter 4 of ~~in~~ this Part ~~and mechanical check of end play setting, running balance, vibration and bearing temperature~~.

1.12.4 Switchboards are to be inspected in the presence of the Surveyor at the plant of the manufacturer in accordance with ~~5.8 of~~ Chapter 5 of ~~in~~ this Part.

1.12.5 Motor controllers are to be inspected in the presence of the Surveyor at the plant of the manufacturer in accordance with ~~9.4 of~~ Chapter 9 of ~~in~~ this Part.

1.12.6 The shaft material of generators and motors of 375 kW and over is to be tested in accordance with the requirements of ~~in~~ Part XI. For the shaft material of machines below 375 kW the manufacturer's certificate of material test is to be acceptable in each case provided the test record submitted by the manufacturer is satisfactory.

1.12.7 Transformers are to be inspected in the presence of the Surveyor at the plant of the manufacturer in accrodance with ~~7.4 of~~ Chapter 7 of ~~in~~ this Part.

1.12.8 Cables are to be inspected in the presence of the Surveyor at the plant of the manufacturer in accordance with ~~8.14 of~~ Chapter 8 of ~~in~~ this Part

1.12.9 Semiconductor equipments are to be inspected in the presence of the Surveyor at the plant of the manufacturer in accordance with ~~15.2 of~~ Chapter 15 of ~~in~~ this Part.

1.12.10 Uninterruptible power systems are to be inspected in the presence of the Surveyor at the plant of the manufacturer in accordance with Chapter 18 of this Part.

1.12.11~~10~~ The electrical equipment for use in explosive gas atmospheres is to be approved and tested in the presence of the Surveyor.

## Chapter 2 System Design of Distribution and Circuit Protection

*Paragraph 2.1.7 has been amended as follows:*

2.1.7 Lighting circuits

(a) Lighting circuits are to be supplied by final sub-circuits separate from those for heating and power except cabin fans and electrical appliances for domestic use.

(b) For a lighting circuit suppplied by a final sub-circuit of rating 15 A or less, the connected load is not to exceed 80% of the overload protective device rating or setting.
~~The number of lighting points supplied by a final sub-circuit of rating 15 A or less is not to exceed:~~
~~10 for the circuits up to 55 V.~~
~~14 for the circuits over 55 V up to 127 V.~~
~~24 for the circuits over 127 V up to 250 V.~~

~~In case where the number of lighting points and total load current are invariable, more than the number of points specified above may be connected to final sub-circuit, provided that the aggregate load current does not exceed 80% of the rating of protective device in the circuit.~~

(c) In a final sub-circuit for panel lighting and electric signs, where lampholders are closely grouped, ~~the number of points supplied is unrestricted, provided that~~ the maximum operating current in the sub-circuit is ~~does~~ not to exceed 10 A.

*Paragraph 2.2.5 has been amended as follows:*

2.2.5 Protection of generators

(a) Overload protection

Generators are to be protected against ~~short- circuit and~~ overcurrent by circuit breakers ~~a multi-pole circuit-breaker~~ arranged to open simultaneously all insulated poles, or in the case of generators less than 25~~50~~ kW not arranged to run in parallel, may be protected by a multipole-linked switch with fuse or a circuit-breaker in each insulated pole. The overload protection is to be suitable to the thermal capacity of generators. The long-time delay overcurrent protection of the circuit breaker is not to exceed 15% above either the full-load rating of continuous-rated machines or the overload rating of special-rated machines. Where generators are operated in parallel and essential machinery is electrically driven, arrangements are to be made to disconnect automatically the excess non-essential load when the generators are overloaded. If required, this preference tripping may be carried out in one or more stages. See 11.2.2 of this Part.

(b) Short circuit protection

Generators are to be protected for short circuit by circuit breakers provided with short-time delay trips. For coordination with feeder circuit breakers, the short-time delay trips are to be set at the lowest values of current and time which will coordinate with the trip settings of feeder circuit breakers. The current setting of the short time delay trip is to be less than the steady state short circuit current of the generator.

(c) Instantaneous trip

Where two or more AC generators are arranged for parallel operation, each generator's circuit breaker is, in addition, to be provided with instantaneous trip set in excess of the maximum short circuit contribution of the individual generator.

(d) Reverse Power Protection

A reverse power protection device is to be provided for each generator arranged for parallel operation. The setting of the protective devices is to be in the range 2% to 6% of the rated power for turbines and in the range 8% to 15% of the rated power for diesel engines. A setting of less than 8% of the rated power of diesel engines may be allowed with a suitable time delay recommended by the diesel engine manufacturer.

(e) Undervoltage Protection

Generators arranged for parallel operation are to be provided with means to prevent the generator circuit breaker from closing if the generator is not generating, and to open the same when the generator voltage collapses. In the case of an undervoltage release provided for this purpose, the operation is to be instantaneous when preventing closure of the breaker, but is to be delayed for discrimination purposes when tripping a breaker.

~~(b) For D.C. generators arranged to operate in parallel, in addition to the requirement in (a), an instantaneous reverse current protection, operating at a fixed value of reverse current within the limits of 2% to 15% of the rated current of generators, is to be provided. This requirements, however, does not apply to the reverse current generated from load side, e.g. cargo winch motors, etc.~~

~~(e) For A.C. generators arranged to operate in parallel, in addition to the requirement in (a) a reverse-power protection, with time delay, selected and set within the limits of 2% to 15% of the full load to a value fixed in accordance with the characteristics of the prime mover, is to be provided.~~

~~(d) Where generators are operated in parallel and essential machinery is electrically driven, arrangements are to be made to disconnect automatically the excess non-essential load when the generators are overloaded. If required, this preference tripping may be carried out in one or more stages. See 11.2.2 of this Part.~~

*Paragraph 2.2.7(f), (g) have been added as follows:*

(f) Undervoltage Protection

Undervoltage protection is to be provided for motors of rating exceeding 0.5 kW to prevent undesired restarting upon restoration of the normal voltage, after a stoppage due to a low voltage condition or voltage failure condition.

(g) Undervoltage Release Protection

Undervoltage release is to be provided for the following motors unless the automatic restart upon restoration of the normal voltage will cause hazardous conditions:

(i) Essential services (See 1.3.2 of Part IV).

(ii) Essential services necessary for safety (See 1.3.3 of Part IV), such as:

(1) Fire pumps and other fire extinguishing medium pumps.

(2) Ventilating fans for engine and boiler rooms where their failure to restart may prevent the normal operation of the propulsion machinery. Undervoltage protection is to be provided for ventilation fans for engine and boiler room, which are supplied by an emergency source of power for the purpose of removing smoke from the space after a fire has been extinguished.

Special attention is to be paid to the starting currents due to a group of motors with undervoltage release controllers being restarted automatically upon restoration of the normal voltage. Means such as sequential starting is to be provided to limit excessive starting current, where necessary.

*Paragraph 2.5.12~2.5.14 have been added as follows:*

2.5.12 Engineers' Alarm

An engineers' alarm operable at the centralized propulsion machinery control station or the propulsion machinery local control position is to be provided. It is to be clearly audible in each engineer's cabin.

2.5.13 Refrigerated Space Alarm

Each refrigerated space is to be fitted with means to activate an alarm in a normally manned control station, operable from within such spaces for the protection of personnel.

2.5.14 Elevator's Alarm

Each elevator car is to be fitted with means to activate an alarm in a normally manned control station or with means of voice communication with that station.

## Chapter 3 Generators

*Paragraph 3.3.8 has been amended as follows:*

3.3.8 A provision is to be made for supplying the necessary amount of cool air and removing hot air, and to avoid as far as possible the admission of moisture or oil vapor. Where water cooling is used, the cooler is to be so arranged to avoid entry of water into the machine.

*Paragraph 3.6.2 has been amended as follows:*

### 3.6 Exciters

3.6.1 Excitation current for ship's service and emergency generators is to be provided by attached rotating exciters or by static exciters deriving their source of power from the machine being excited.

3.6.2 If a propulsion system contains only one generator and one motor and cannot be connected to another propulsion system, more than one exciter set is to be provided for each machine. The current derived from the ship's service power or lighting set may be taken as one means of excitation. However, this is not necessary for self-excited generators or for multi-propeller propulsion ships where any additional exciter set may be common for the ship.~~Propulsion generators are to be provided with at least two different means of excitation. The current derived from the ship's service power or lighting set may be taken as one means of excitation.~~

*Paragraph 3.8.6(a), (b) have been amended as follows:*

3.8.6 Other tests

(a) Overload test.~~A.C. generators are to be capable of carrying a momentary overload of 50% in current for 2 minutes, D.C. generator are to be capable of carrying a momentary overload of 50% in current for 15 seconds without injury.The test is to be carried out immediately after the temperature rise test as mentioned in 3.8.1 of this Part, and the voltage, revolutions and frequency of the generators are to be maintained as near the rated values as possible.~~

Generators are to withstand the following excess current tests by maintaining their voltage, revolutions , and frequency as near to their rated values as possible.

(i) A.C. generators : 150 % of rated current (not less than 30 seconds)

(ii) D.C. generators : 150 % of rated current (not less than 60 seconds)

(b) Overspeed test~~ Generators are to be capable of withstanding overspeed for two minutes according to the following requirements:~~

(i) A.C. generators: 120 % of the rated speed for 2 minutes.

(ii) D.C. generators: 120 % of the rated speed for 2 minutes.

~~Turbine driven — 115% of rated speed~~

~~Diesel driven — 120% of rated speed~~

~~All others — 125% of rated speed~~

# Chapter 4 Motors

*Section 4.1 has been amended as follows:*

## 4.1 General

4.1.1 The requirements for the design, construction, materials, insulation, and lubrication ~~and testing~~ of motors intended for essential services are the same as those for generators as specified in 3.1 and 3.3~~, 3.8.1, 3.8.2 and 3.8.3~~ of this Part except the means is to be provided for propulsion motors to prevent moisture condensation when motors are idle for appreciable periods. See 3.3.2 of this Part.

4.1.2 Motors for essential service when installed with their rotor shafts not in fore and aft direction, the lubrication will require special consideration.

4.1.3 All propulsion and essential service motors are to be of continuous rating except those for deck machinery which may be of non-continuous rating.

4.1.4 The standard application for types of enclosures of motors is to be in accordnace with 1.11 of this Part.~~as follows:~~

~~(a) In the engine room or spaces where motors are subject to mechanical injury, or dripping of oil or water are to have an enclosure of at least IP22 protection. Motors below the level of the floor plates are to have an enclosure of at least IP44 protection.~~

~~(b) In galleys, toilets, washing rooms and similar spaces, use an enclosure of at least IP44 protection.~~

~~(c) In the wheelhouse, the chart room, the radio room, the public saloon, offices, stores, living places passages and the pantry, use an enclosure of at least IP20 protection.~~

~~(d) On the weather deck, use a protection enclosure of IP56 or enclose motors in metal housing, giving the same protection.~~

*Paragraph 4.1.5 and 4.1.6 has been added as follows:*

4.1.5 Motors over 15 kW, intended for essential services, are to be tested and surveyed by the Surveyor during manufacture in accordnace with the requriement of 4.2 of this part.

4.1.6 Motors of 15 kW and below , intended for essential services, are to be tested by the manufacturer in accordnace with manufactuer's specification. The test reports are to be made aviablable when requested by the Surveyor. Acceptance of machines will be based on satisfactory performance after installation.

*Paragraph 4.2.4(a), (e) has been amended as follows:*

(a) Excess torque tests~~After the temperature rise test, motors of continuous ratings, except those of non-continuous ratings or special types, are to withstand the following excess torque test by maintaining the voltage, revolving speed and frequency as near their rated values as possible:~~

Motors, whatever their duty and construction, shall be capable of withstanding the following excess torque tests without either stalling or exhibiting an abrupt change of speed ( under gradual increase of torque). The voltage and frequency (for induction motors) shall be maintained at their rated values.

(i) D.C. motors : 160 % of rated torque for 15 seconds

(ii) Polyphase induction motors : 160 % of rated torque for 15 seconds

(iii) Polyphase synchronous motors:

(1) Synchronous (wound rotor) induction motors : 135 % of rated torque for 15 seconds

(2) Synchronous (cylindrical rotor) motors : 135 % of rated torque for 15 seconds

(3) Synchronous (salient pole) motors : 150 % of rated torque for 15 seconds

~~D.C. motors 50% 15 seconds~~
~~Synchronous motors 50% 15 seconds~~
~~Induction motors 60% 15 seconds~~

(b) Motors of non-continuous ratings or special types, the excess torque test is to be specially considered.

(c) The excess torque test for propulsion motors is to be specially considered for each installation.

(d) The commutation of motors is to be clear of any objectionable sparking when running under all conditions of load and field adjustment.

(e) Overspeed tests

Motors are to be capable of withstanding overspeed conditions for 2 minutes according to the following requirements:

(i) A.C. motors: 120 % of the rated speed.

(ii) D.C. motors:

(1) Shunt-wound and separately excited motors:
120 % of the highest rated speed or 115% of the corresponding no-load speed, whichever is greater

(2) Compound-wounded motors having speed regulation of 35% or less:
120 % of the highest rated speed or 115% of the corresponding no-load speed, whichever is greater, but not exceeding 150% of the highest rated speed

(3) Compound-wounded motors having speed regulation greater than 35% and series-wounded motors:
110 % of the maximum safe speed designated by the manufacturer

(4) Permanent-magnet excited motors:
In the case of series winding, (2) or (3) above is to be satisfied. In all other cases, (1) above is to be satisfied.

~~Motors are to be capable of withstanding overspeed for two minutes according to the following requirements:~~

~~Shunt-wound motors 125% of rated speed~~
~~Series-wound motors 200% of rated speed~~
~~Compound-wound motors 125% of no-load speed~~
~~Synchronous motors 125% of synchronous speed~~
~~Induction motors 125% of synchronous speed~~

# Chapter 5 Switchboards and Mounted Equipment

*Paragraph 5.1.6 has been amended as follows:*

5.1.6 The sides and the rear of the switchboard are to be suitably guarded or screened, and the front is to be fitted with insulating handrails. Non-conducting mats or gratings are to be provided at the front and the rear of switchboards where operations or maintenance are expected to protect the personnel from contacting the live part to the ground.

*Section 5.2 has been amended as follows:*

## 5.2 Construction

5.2.1 Enclosures and assemblies of a switchboard are to be constructed of steel or other suitable incombustible, moisture-resistant materials and reinforced as necessary to withstand the mechanical, electro-magnetic and thermal stresses which may be encountered under both normal and short-circuit fault conditions. Enclosures are to be of the closed type. The degree of the protection is to be in accordance with 1.11 of this Part. All wearing parts are to be accessible for inspection and be readily renewable.~~Switchboard panels are to be made of permanent high dielectric strength insulating materials of adequate strength such as impregnated ebony asbestos, laminated phenolic material or the equivalent~~. ~~They may be made of metal if all conducting parts are to be insulated from the panels with bushes and washers of mica or other non-absorbent insulating material.~~

~~5.2.2 No wood is to be used in the construction or installation of switchboards except the non-conducting handrails installed in front of the panels as required by 5.1.6 of this Part.~~

5.2.2~~3~~ Cable entries of a switchboard are to be so constructed that no ingress of water into the switchboard is permitted along the cables.

5.2.3~~4~~ Every live part is to be suitably spaced or shielded with non-ignitable insulating material that any arc cannot be maintained between the working parts or between such parts and earth.

5.2.4~~5~~ The apparatus, measuring instruments, circuit breakers, switches and operating handles are each to be provided with a name plate bearing a clear indelible indication for identification. The rating of the fuse, current rating of the circuit breaker and the cross sectional area of the cables which these devices protected are also to be marked on labels placed in suitable positions.

5.2.5~~6~~ Where the main source of electrical power is necessary for propulsion of the ship, the main busbar is to be subdivided into at least two parts which are normally to be connected by circuit breakers or other approved means; so far as are practicable, the connection of generating sets and other duplicated equipment is to be equally divided between the parts.

5.2.6~~7~~ Section and distribution boards are to be suitably enclosed unless they are installed in a cupboard or compartment to which only authorized persons have access, in which case the cupboard may serve as an enclosure.

5.2.7~~8~~ All enclosures are to be constructed of, or lined with, non-flammable and non-hygroscopic material, and are to be of robust construction.

# Chapter 9 Motor Controllers

*Section 9.3 has been added as follows:*

## 9.3 Magnetic Brakes

9.3.1 Electrical parts of magnetic brakes applied to watertight-type motors are to be watertight.

9.3.2 D.C. shunt-wound brakes are to satisfactorily release at 85 % of their rated voltage at maximum working temperatures, and d.c. compound-wound brakes under the same conditions as above are to satisfactorily release at 85 % of their starting currents.

9.3.3 D.C. series-wound brakes are to satisfactorily release at 40 % or more of their full-load currents and in every case at their starting current; furthermore, they are to satisfactorily dampen in cases where they are at 10 % or less of their full-load currents.

9.3.4 A.C. magnetic brakes are to comply with the following requirement:

(a) A.C. magnetic brakes are to satisfactorily release at 80 % of their rated voltages at working temperatures.

(b) A.C. magnetic brakes are not to be noisy due to any magnetic action under working conditions.

*Section 9.3, 9.4 have been renumbered as follows:*

## 9.4~~3~~ Temperature Rise

9.4~~3~~.1 The maximum permissible temperature rise limit to the principal parts of controllers is not to exceed the values given in Table VII 9-1.

9.4~~3~~.2 The contacts, magnet cores and other parts not mentioned above whether insulated or not, are not to reach a temperature which might injure themselves or cause damage to the adjacent parts or material.

9.4~~3~~.3 Where the temperature of any part of the enclosure is likely to exceed 60°C the apparatus is to be so located or guarded as to prevent it from being inadvertently touched.

## 9.5~~4~~ Tests

9.5~~4~~.1 The temperature rise test of controllers and their resistors is to be carried out under normal working condition, and the temperature rise of each is not to exceed the values given in 9.3 of this Part. However, the temperature rise test for controllers which are produced in series and identical to their type tested prototype unit may be omitted from the second unit onward subject to the Society's permission.

9.5~~4~~.2 Controllers and resistors are to be tested with high voltages applied between the current carrying part and the earthed frame or case, and between each circuit of different potentials with all covers in normal position at any frequency between 25 and 100 Hz maintained for 1 minute. The test voltage is to be as follows:

(a) The control gear rated at 60 V or less is to be tested at 500 V.

(b) The control gear rated above 60V is to be tested at twice the rated voltage plus 1,000 V, with a minimum of 1,500 V.

9.54.3 The operation test of the controller is to be carried out to confirm the requirements of 9.1.6, 9.2.3 and 9.2.4 of this Part.

9.54.4 Immediately after the completion of the dielectric test the insulation resistance of the control gear between poles, and between the current carrying part and the earthed frame or case is to be not less than 1 mega-ohm when tested with D.C. voltage of approximately 500 V tester.

## Chapter 10 Accessories and Lighting Equipment

*Paragraph 10.1.1(e) has been amended as follows:*

10.1.1 Accessory and lighting fittings are to be designed and constructed as follows:

(a) The passage for the insulated conductor is to be of ample size and free from rough projection sharp angles and bends.The outlet for cables is to have well rounded edges or be suitably bushed.

(b) Insulated conductors are so installed that the stress is not to be applied to terminals to which conductors are connected.

(c) Enclosures are to be made of metal with corrosion resistant finish or durable flame-retarding insulating materials. The inside of metallic enclosures is to be coated or painted with an insulating paint or compound.

(d) Live parts or their insulation are to be so fixed that dust and moisture cannot accumulate.

(e) Lighting fittings are to have a suitable degree of protection in accordnace with 1.11 of this Part. ~~Weatherproof or waterproof type is to be perfect water-tightness and capable of withstanding a hose test of 4,500 mm water head at 2,000 mm away for a period of 15 seconds.~~

(f) Means is to be provided to ground effectively the external metal parts which are liable to touch.

*Paragraph 10.3.4 has been amended as follows:*

~~10.3.4 Portable lighting fittings~~

~~(a) Portable lighting fittings for the illumination of decks, holds, the engine room and other similar spaces are to be provided with lamp holders enclosed in insulating materials or so protected by metal guards insulated from the holders that live parts cannot be touched.~~

~~(b) Portable lighting fittings are to be provided with a hook or ring or other suitable attachment to enable them to be hung up and so prevent strain on the connection.~~

~~(c) Switches are not to be incorporated in portable lighting fittings.~~

~~(d) Frames of portable lighting fittings are to be grounded by means of the earth continuity conductor of the cord.~~

10.3.4 Navigation lights are to be complied with Convention on the International Regulations for Preventing Collisions at Sea 1972 as amended and IMO Resolution - The performance standards for navigation lights, navigation light controllers and associated equipment as amended.

*Paragraph 10.3.5 has been deleted as follows:*

~~10.3.5 Navigation lights are to be of metal filament lamps of weather proof type. The lens and shapes are to be in accordance with the international maritime requirements.~~

*Section 10.5 has been deleted as follows:*

**~~10.5 Search Lights~~**

~~10.5.1 Search lights may be of either incandescent or arc type.~~

~~10.5.2 Arc lamps are not to be fitted in spaces in which inflammable goods are stored, or where explosive dust, vapor or gas is liable to accumulate, and the circuits are to be provided with a circuit breaker.~~

~~10.5.3 When series resistance is used with search lights, the control gear is to have a multi-pole switch with fuse, fitted on the supply lead to the resistance.~~

~~10.5.4 The frame of every search light supplied by a system having a voltage of 50 V or more is to be provided with a suitable terminal to which an earth conductor is to be connected.~~

AMENDMENT TO "THE RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2019"

# PART XI MATERIALS

# List of major changes in Part XI from 2019 edition

| | |
|---|---|
| 8.1~8.11 | Revised |
| 18.2 | Revised |
| Table XI 18-1 | New |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

## Chapter 8 Steel Forgings

*Section 8.1~8.11 has been amended as follows:*

### ~~8.1 General~~

~~8.1.1 This chapter gives the requirements for steel forgings intended to be used for important components in ship and machinery construction, and for low temperature service where the design temperature is less than 0℃. These requirements are also applicable to hot rolled machine steel bars used as a substitute for forgings.~~

~~8.1.2 The material grades of steel forgings specified in this chapter are designated as follows:~~

~~(a) 'F1-xxx' for carbon steel forgings.~~

~~(b) 'F2-xxx' for low alloy steel forgings.~~

~~(c) 'F3-xxx/-yy' for low temperature service carbon steel forgings.~~
~~Where 'xxx' is a figure to represent the specified minimum tensile strength in $N/mm^2$ of the design purpose.~~
~~Where '-yy' is a figure to represent the applicable design temperature in ℃.~~

~~(d) 'F4-1.5Ni', 'F4-3.5Ni', 'F4-5Ni' and 'F4-9Ni' for low temperature service nickel alloy steel forgings.~~

~~(e) Carbon steel and low alloy steel hot rolled machine bars used as the substitute of forgings are to affix with 'R' after the material grade, e.g. 'F1-xxxR', 'F2-xxxR'.~~

~~(f) Where carbon steel and low alloy steel forgings approved for welded construction in accordance with the requirements given in 8.3.5 of this Part, the material grade is to affix with 'W' after F1 or F2, e.g. "F1-W-xxx" or "F2W-xxx".~~

~~8.1.3 For other alloy steel forgings, the steelmaking processes, chemical compositions, heat treatments, mechanical properties, etc. are to comply with the requirements of the recognized national or international standards or of the special design specifications approved by the Society. For such materials, the grade marks designated by the standards or the approved design specifications are applicable.~~

~~8.1.4 Where steel forgings having characteristics differing from those prescribed in this chapter are used, the requirements in 1.1.2 and 1.1.3 of this Part are to be complied with.~~

### ~~8.2 Manufacture~~

~~8.2.1 All forgings and hot rolled carbon steel bars are to be made from killed steels. When forgings are made directly from ingots, or from blooms or billets forged from ingots, the ingots are to be cast in chill moulds with the wider ends up and with efficient feeder heads. Adequate discards are to be made from the top and bottom of each ingot to ensure freedom from piping and harmful segregations in the finished forgings.~~

8.2.2 The materials for forging, such as steel ingots, blooms, billets and rolled products, are to be manufactured at works or foundries which have been approved by the Society in compliance with the requirements given in 1.2 of this Part. Forgings are to be made at works which have been approved by the Society.

8.2.3 Steel forgings are to be gradually and uniformly hot worked by press or hammer and are to be formed as closely as possible to the finished shape and size. Where practicable, they are to be worked so as to cause metal flow in the most favorable direction having regard to the mode of stressing in service.

8.2.4 Forging reduction of area

(a) For forgings where the metal flow is mainly longitudinal, the forging reduction ratio is to be not less than that shown in Table XI 8-1.

(b) For disc type forgings made by upsetting, the thickness of any part of the disc is to be not more than1/2 of the length of the billet from which it was formed, provided that this billet has received an initial forging reduction ratio not less than 1.5. Where the forging piece used has been cut directly from an ingot, or where the billet has received an initial forging reduction ratio of less than 1.5, the thickness of any part of the disc is to be not more than 1/3 of the length of the original material piece.

(c) Rings and other hollow forgings are to be made from forging pieces cut from ingots or billets and which have been suitably punched, bored or trepanned prior to expanding or hollow forging. The wall thickness of the forging is to be not more than 1/2 of the thickness of the prepared hollow piece from which it was formed.

(d) Hot rolled machine steel bars are to be rolled to a rolling ratio not less than 6.

**Table XI 8-1**
**Minimum Forging Reduction Ratio**

| Method of Manufacture | Total Reduction Ratio ( min ) | |
|---|---|---|
| | L>D | L≤D |
| Made directly from Ingots or from forged Blooms or Billets | 3 | 1.5 |
| Made from rolled products | 4 | 2 |

Notes:

(1) The forging reduction ratio is to be calculated with the average cross-sectional area of the raw material to that of the forging under consideration.

(2) L and D are the length and diameter respectively of the part of the forging under consideration.

8.2.5 The shaping of forgings or rolled slabs and billets by flame cutting, scarfing or arc air gouging is to be undertaken in accordance with recognized good practice and is to be carried out before the final heat treatment unless otherwise approved.

8.2.6 Hot rolled machine steel bars may be accepted for making straight shafts, rudder stocks, and similar important parts in place of steel forgings. The surface layer is to be turned off to a depth sufficient to remove surface defects and decarburized material except where otherwise approved by the Society.

8.2.7 Steel forgings and hot rolled machine steel bars are to be of uniform quality and free from surface or internal defects.

## ~~8.3 Chemical Composition~~

~~8.3.1 For carbon steel forgings and hot rolled machine bars, the chemical composition of ladle samples is to comply with the following overall limits:~~

| | |
|---|---|
| ~~Carbon~~ | ~~0.65% max.~~ |
| ~~Silicon~~ | ~~0.45% max.~~ |
| ~~Manganese~~ | ~~0.30-1.50%~~ |
| ~~Sulphur~~ | ~~0.035% max.~~ |
| ~~Phosphorus~~ | ~~0.035% max.~~ |

~~Residual elements:~~

| | |
|---|---|
| ~~Copper~~ | ~~0.30% max.~~ |
| ~~Chromium~~ | ~~0.30% max.~~ |
| ~~Molybdenum~~ | ~~0.15% max.~~ |
| ~~Nickel~~ | ~~0.40% max.~~ |

~~8.3.2 For low alloy steel forgings and hot rolled machine bars, the chemical composition of ladle samples is to include the content of all alloying elements and is to comply with the requirements of the recognized national or international standards or of the approved specifications and the following overall limits:~~

| | |
|---|---|
| ~~Carbon~~ | ~~0.45% max.~~ |
| ~~Silicon~~ | ~~0.15 ~ 0.45%~~<br>~~Note: Where the special deoxidation practice is applied, the value of Si may be reduced approved by the Society.~~ |
| ~~Manganese~~ | ~~0.30 ~ 1.00%~~ |
| ~~Sulphur~~ | ~~0.03% max.~~ |
| ~~Phosphorus~~ | ~~0.03% max.~~ |

~~Residual elements: (Residual elements are not to be intentionally added to the steel.)~~

| | |
|---|---|
| ~~Copper~~ | ~~0.30% max.~~ |

~~In the following elements, one or more of the elements is to comply with the minimum content:~~

| | |
|---|---|
| ~~Chromium~~ | ~~0.40 ~ 3.50%~~ |
| ~~Molybdenum~~ | ~~0.15 ~ 0.70%~~ |
| ~~Nickel~~ | ~~0.40 ~ 3.50%~~ |

~~8.3.3 For low temperature service steel forgings, the chemical composition of ladle samples is to comply with the requirements given in Table XI 8-3.~~

~~8.3.4 Except where otherwise specified, suitable grain refining elements such as A1, Nb or V may be used at the discretion of the manufacturer.~~

~~8.3.5 Where carbon steel forgings intended for welded construction, the carbon content is to be 0.23% maximum and the total content of residual elements is to be 0.85% maximum. The carbon content may be increased above this level provided that the carbon equivalent (Ceq) is not more than 0.41%, calculated using the formula given in Note 2 of Table XI 3-4. Where low alloy steel forgings intended for welded construction, the proposed chemical composition is subject to approval by the Society.~~

## ~~8.4 Heat Treatment~~

~~8.4.1 At an appropriate stage of manufacture, after completion of all hot working operations, steel forgings are to be suitably annealed, normalized, normalized and tempered, quenched and tempered, or double normalized and tempered to refine the grain structure and to obtain the required mechanical properties.~~

~~8.4.2 Where steel forgings are to be quenched and tempered and cannot be hot worked close to size and shape, they are to be suitably rough machined or flame cut prior to being subjected to this heat treatment.~~

~~8.4.3 If a steel forging is subsequently heated for further hot working, it is to be re-heat treated.~~

~~8.4.4 If a steel forging is subjected to any cold work involving an excessive degree of straightening, it is to be stress relieved accordingly.~~

~~8.4.5 Hot rolled machine steel bars are to be heat treated properly after being rolled.~~

~~8.4.6 Where it is intended to surface harden forgings, full details of the proposed procedure and specifications are to be submitted for special consideration.~~

~~8.4.7 Heat treatment is to be carried out in properly constructed furnaces to comply with requirements given in 1.4.2 of this Part.~~

## ~~8.5 Mechanical Properties~~

~~8.5.1 Mechanical properties and test requirements for steel forgings and hot rolled carbon steel bars are to comply with the requirements given in Tables XI 8-2 and XI 8-4.~~

~~(a) Table XI 8-2 gives the minimum requirements for yield stress (or proof stress at 0.2% non-proportional elongation), elongation and reduction of area corresponding to different strength levels, and it is not intended that these are necessarily to be regarded as specific grades.~~

~~(b) Steel forgings may be supplied to any specified minimum tensile strength selected within the general limits detailed in Table XI 8-2.~~

~~8.5.2 Test samples~~

~~(a) Test samples, sufficient for the required tests and for possible retest purposes, are to be provided with a sectional area of not less than that part of the forging which it represents. Test samples are to be integral with each forging, except in the case of group forgings which are batch tested.~~

~~(b) Where a forging is subsequently divided into a number of components, all of which are heat treated simultaneously, this may be regarded as one forging and the number of test specimens required is to be related to the total length and mass of the original multiple forging.~~

~~(c) Except for components which are made by die forging processes or are to be carburized, test samples are generally not to be cut from the forgings until the heat treatment has been completed.~~

~~8.5.3 Test specimens~~

(a) Unless otherwise specified, test specimens for steel forgings are to be taken from the test samples in longitudinal to metal flow. In the case of special forms of forgings, they may be taken in transverse directions where deemed necessary.

(b) Selection of test specimens for steel forgings and hot rolled machine steel bars is to comply with the requirements given in Table XI 8-5.

**Table XI 8-2**
**Mechanical Properties for Acceptance Purposes and Test Requirements of Steel Forgings and Hot-Rolled Machine Steel Bars for Ship and Machinery Constructions**

| Material Grade | | Tensile Test (See Note 1) | | | | Hardness Test | No. of Test Specimens |
|---|---|---|---|---|---|---|---|
| | | Specified Minimum Tensile Strength (3) ($N/mm^2$) | Yield Stress min. ($N/mm^2$) | Elongation on $L=5.65\sqrt{A}$ min. (4) (%) | Reduction of Area min. (4) (%) | Hardness Brinell Numbers min. (5) (HBN) | |
| Carbon Steels (6) | F1 | 400 | 200 | 26 (19) | 50 (35) | 110~150 | See Table XI 8-5 |
| | | 440 | 220 | 24 (18) | 50 (35) | 125~160 | |
| | | 480 | 240 | 22 (16) | 45 (30) | 135~175 | |
| | | 520 | 260 | 21 (15) | 45 (30) | 150~185 | |
| | | 560 | 280 | 20(14) | 40 (27) | 160~200 | |
| | | 600 | 300 | 18 (13) | 40 (27) | 175~215 | |
| | | 640 | 320 | 17 (12) | 40 (27) | 185~230 | |
| | | 680 | 340 | 16 (12) | 35 (24) | 200~240 | |
| | | 720 | 360 | 15 (11) | 35 (24) | 210~250 | |
| | | 760 | 380 | 14 (10) | 35 (24) | 225~265 | |
| Low Alloy Steels (7) | F2 | 550 | 350 | 20(14) | 50 (35) | 160~200 | |
| | | 600 | 360 | 18 (14) | 50 (35) | 175-215 | |
| | | 650 | 390 | 17(12) | 50(35) | 190~230 | |
| | | 700 | 420 | 16 (12) | 45 (30) | 205-245 | |
| | | 800 | 480 | 14 (10) | 40 (27) | 235-275 | |
| | | 900 | 630 | 13 (9) | 40 (27) | 260-320 | |
| | | 1000 | 700 | 12 (8) | 35 (24) | 290-365 | |
| | | 1100 | 770 | 11 (7) | 35 (24) | 320-385 | |

Notes:

(1) Where it is proposed to use a steel forging with a specified minimum tensile strength intermediate to those given in the above Table, corresponding minimum values for the yield stress, elongation, reduction of area and absorbed energy of the impact test may be obtained by interpolation. In this case, the fractions below 0.5 of the figures are to be disregarded, and the figures of 0.5 and over are to be rounded up.

(2) For steel forgings intended to be used for the propeller shafts granted the notation **Ice Cla**ss and for elevated temperature service, the mechanical properties and test requirements are to be specially considered.

(3) The difference in tensile strength in cases where more than one tensile test specimen is taken from a forging is not to exceed 120 $N/mm^2$ for steel forgings not exceeding 600 $N/mm^2$ in specified minimum tensile strength, not to exceed 150 $N/mm^2$ for steel forgings exceeding 600 $N/mm^2$ in specified minimum tensile strength and not to exceed 200 $N/mm^2$ for steel forgings exceeding 900 $N/mm^2$ in specified minimum tensile strength, not to exceed 150 $N/mm^2$ for steel forgings not exceeding 900 $N/mm^2$ in specified minimum tensile strength.

(4) The values in parentheses of minimum elongation and reduction of area of tensile test are applicable to the test specimens taken transversely except specially specified in Note 3 of Table XI 8-7 for gear rim forgings.

(5) The hardness values are typical and are given for information purpose only.

(6) The requirements for carbon steel forgings or hot rolled carbon steel bars in the above Table are applicable to those annealed, normalized, normalized with tempered or quenched with tempered. For carbon steel forgings treated by other conditions, the mechanical properties are to be approved by the Society.

(7) The requirements for low alloy steel forgings in the above Table are applicable to those quenched and tempered. Where low alloy steel forgings are normalized or normalized and tempered, the mechanical properties are to be approved by the Society.

**Table XI 8-3**
**Chemical Composition of Low Temperature Service Steel Forgings**

| Material Grade | | Chemical Composition (%) (3) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | C (max.) | Si (max.) | Mn | P (max.) | S (max.) | Ni | Grain Refining Elements | Residual Elements |
| Carbon Steel Forgings | F3 xxx/ yy (1) | 0.18 (2) | 0.50 | 0.70 ~ 1.60 | 0.035 | 0.035 | 0.80 max. | To comply with the approved manufacturing specification | Cr 0.25max.<br>Mo 0.08 max.<br>Cu 0.35 max.<br>Total 0.60 max. |
| Nickel Alloy Steel Forgings | F4 1.5Ni | 0.18 | 0.35 | 0.30 ~ 1.50 | 0.025 | 0.020 | 1.30 ~ 1.70 | | |
| | F4 3.5Ni | 0.15 | | 0.30 ~ 0.90 | | | 3.20 ~ 3.80 | | |
| | F4 5Ni | 0.12 | | | | | 4.70 ~ 5.30 | | |
| | F4 9Ni | 0.10 | | | | | 8.50 ~ 10.00 | | |

Notes:

(1) Grade mark designation is defined in 8.1.2 of this Part.

(2) The maximum carbon content may be extended to 0.30% in case of carbon steel forgings not intended for welding.

(3) Certain variations in the specified chemical composition may be allowed or required in particular cases after consideration of the tensile strength, applying temperature, etc.

**Table XI 8-4**
**Mechanical Properties, Heat Treatment and Test Requirements of Low Temperature Service Steel Forgings**

| Material Grade | | Heat Treatment | Tensile Test | | | | Impact Test |
|---|---|---|---|---|---|---|---|
| | | | Tensile Strength min. ($N/mm^2$) | Yield Stress min. ($N/mm^2$) | Elongation on $L = 5.65\sqrt{A}$ min. (%) | Reduction of Area min. (%) | Absorbed Energy min. (J) |
| Carbon Steel Forgings | F3 xxx/ yy (2), (3) | Normalized or Normalized and Tempered | 410 | 240 | 24 | 50 | (4), (5) |
| | | | 460 | 270 | 22 | 45 | |
| | | | 490 | 300 | 20 | 45 | |
| Nickel Alloy Steel Forgings | F4 1.5Ni | Normalized, Normalized and Tempered or Quenched and Tempered | 470 | 270 | 22 | 35 | 41 (longitudinal) or 27 (transverse) |
| | F4 3.5Ni | | 470 | 340 | 22 | | |
| | F4 5Ni | | 570 | 380 | 21 | | |
| | F4 9Ni | Double Normalized and Tempered or Quenched and Tempered | 640 | 480 | 18 | | |

Notes:

(1) Selection and number of test specimens are to comply with the requirements given in Table XI 8-5.

(2) Grade mark designation is defined in 8.1.2 of this Part.

(3) Where it is proposed to use a carbon steel forging with a specified minimum tensile strength intermediate to those given in this table, corresponding minimum values for the yield stress, elongation and reduction of area may be obtained by interpolation.

(4) Impact test specimens are to be of Type N1 as given in Table XI 2-3.

(5) Applicable design temperature and impact test temperature for each grade of the low temperature service steel forgings are to comply with the followings:

| Material Grade | Applicable Design Temperature (°C) | Impact Test Temperature |
|---|---|---|
| F3 xxx/ yy | –55 | 5°C below design temperature or –20°C whichever is the lower |
| F4 1.5Ni | –60 | 10°C below design temperature or –65°C whichever is the lower |
| F4 3.5Ni | –90 | 10°C below design temperature or –95°C whichever is the lower |
| F4 5Ni | –105 | 10°C below design temperature or –110°C whichever is the lower |
| F4 9Ni | –165 | –196°C |

**Table XI 8-5**
**Selection of Test Specimens for Steel Forgings and Hot Rolled Carbon Steel Bars**

| Condition of Forgings | Size and mass of Forgings | Numbers and Locations of Test Specimens |
|---|---|---|
| Individual forgings as heat treated | $\omega \leq 4000$ | One set (from one end) |
| | $\omega > 4000$ | Two sets (one set each from both ends) |
| Group forgings of similar form and size made from the same ingot (or bloom) and heat treated simultaneously | $\omega < 250$ | One set (from each ingot or bloom) |
| | $250 \leq \omega < 500$ | One set (per three forgings or a fraction thereof) |
| Group of hot rolled machine steel bars of same diameter rolled from the same charge and heat treated simultaneously | – | One set (per W = 5000 or a fraction thereof, but need not exceed four sets) |
| Forgings of crankshaft, turbine rotor, turbine blade, reduction gear pinion and rim, etc. | See special requirements specified in 8.8 of this Part | |
| Where:<br>$\omega$ = Mass of individual forging as heat treated, in kg.<br>W = Total mass of group forgings or group of hot rolled carbon steel bars as heat treated, in kg. | | |

Notes:

(1) One set of test specimens specified in the above table means one tensile test specimen for carbon steel forgings or hot rolled machine steel bars intended for ship and machinery construction, and one tensile test specimen and one set of three impact test specimens for low alloy steel forgings intended for machinery construction and steel forgings intended for low temperature service.

(2) For sampling of test specimens of hot rolled machine steel bars, see 3.5.2(c) of this Part.

## 8.6 Non-Destructive Examination

8.6.1 When specified hereinafter, the non-destructive examination is to be carried out before acceptance. All such tests are to be carried out by competent operators using reliable and efficiently maintained equipment. The testing procedures used are to be agreed with the Surveyor.

8.6.2 Non-destructive examination is to be carried out by the manufacturer at an appropriate stage of the manufacturing process and the test reports are to be submitted to the Surveyor. Acceptance criteria for non-destructive testing shall be agreed with the Society. For hull forgings, IACS Recommendation No. 68 is regarded as an example of an acceptable standard.

8.6.3 The important parts of the following steel forgings are to be subjected to ultrasonic examination:

(a) Rudder stocks and pintles.

(b) Turbine rotors, discs and blades, etc. and also see 2.9.4 of Part IV.

(c) Steel forgings specified in Table IV 3-4.

(d) Thrust shafts, intermediate shafts and propeller shafts, etc.

(e) Reduction gears and gear shafts.

8.6.4 The important parts of the following steel forgings are to be subjected to magnetic particle or liquid penetrant test:

(a) Turbine rotors, discs and blades, etc. and also see 2.9.4 of Part IV.

(b) Steel forgings specified in Table IV 3.4.

(c) Propeller shafts.

(d) Reduction gears.

8.6.5 In place of the test methods specified above, the Society may accept the application of other nondestructive inspections considered adequate by the Society.

8.6.6 The welding parts of the steel forgings used for welded construction are to be subject to non-destructive examination considered adequate by the Society.

8.6.7 The Society may require non-destructive examination by radiographic test, ultrasonic test, magnetic particle test or penetrant test not only for the steel forgings specified above but also for the steel forgings deemed necessary by the Society.

## 8.7 Repair of Defects

8.7.1 In the event of finding unacceptable defects in the steel forgings, the defects may be removed by grinding or by chipping and grinding, etc.

8.7.2 After removing the defects, adequate non-destructive tests are to be carried out to ensure that all defects have been removed completely.

8.7.3 The employment of repaired forgings is to be approved by the Surveyor.

8.7.4 The grooves caused by removing the defects are not to be generally repaired by welding. However, special consideration will be given to weld repairs where the grooves are of a minor nature and in areas of low working stresses.

8.7.5 For hull forgings, the procedure of removal of defect and weld repair is to be in accordance with IACS Recommendation No. 68.

## 8.8 Special Requirements

8.8.1 For crankshafts

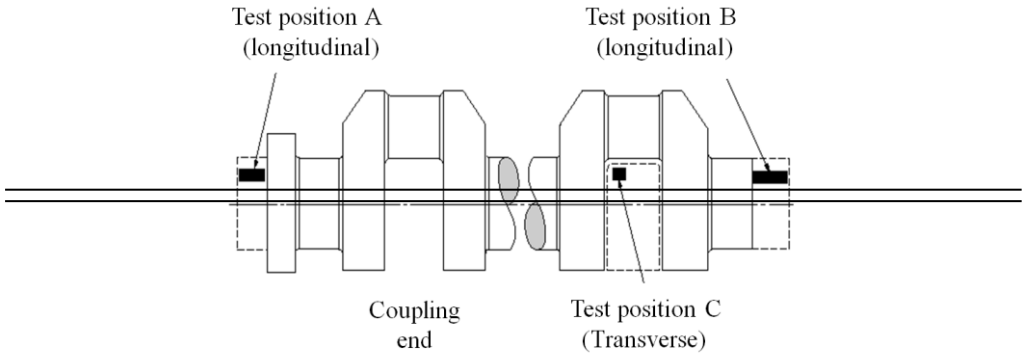
(a) Where a solid forged crankshaft of 250 mm and over in finished diameter is manufactured by free forging process, the heat treatment is normally to be carried out after crank parts are machined as nearly as possible to the finished shape. In this case, one set of test specimens is to be taken from each end of the crankshaft.

(b) For combined crank web and pin forgings, the proposed method of forging and selection of test specimens are to be submitted for approval by the Society.

(c) Where crank webs are flame cut from forged or rolled slabs, a depth of at least 7.5 mm is to be removed by machining from all flame cut surfaces.

(d) For continuous grain flow or die forged solid crankshaft forgings, where special manufacturing processes are adopted to allow K=1.05 for design purpose according to the requirements of 3.5.6 in Part IV, full details of the proposed method of manufacture are to be submitted for approval. In each case, tests are required to be demonstrated to ensure and obtain a satisfactory structure and grain flow.

~~(c) For solid open die forged crankshafts, one set of tests is to be taken in a longitudinal direction from the driving shaft end of each forging (test position A in Fig. XI 8-1). Where the mass (as heat treated but excluding test material) exceeds 3 t tests in a longitudinal direction are to be taken from each end (test positions A and B in Fig. XI 8-1). Where, however, the crankthrows are formed by machining or flame cutting, the second set of tests is to be taken in a transverse direction from material removed from the crankthrow at the end opposite the driving shaft end (test position C in Fig. XI 8-1).~~




**~~Fig. XI 8-1~~**
**~~Solid Forged Crankshaft~~**

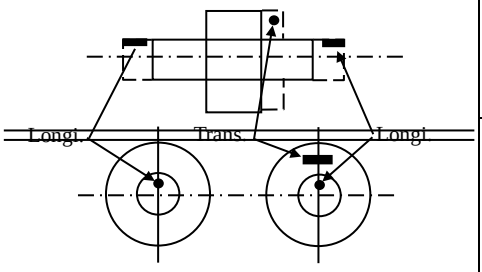
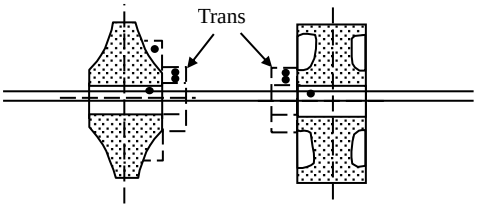
~~8.8.2 For turbine rotors, discs and blades~~

~~(a) The test specimens for turbine rotor and disc forging are to be selected in accordance with the requirements given in Table XI 8-6.~~

~~(b) Solid forged or welded rotors for main propelling turbines, which are subject to the inlet steam temperature over 400°C, are to be tested for axial stability by at least once of the thermal stability test. This test may be carried out at a suitable time after rough machining and heat treatment, or at any subsequent stage in the production. The method of thermal stability test is to be approved by the Society prior to the test.~~

~~(c) Turbine blade forgings are to be tested in accordance with the approved test specifications.~~

**Table XI 8-6**
**Selection of Test Specimens for Turbine Rotor and Disc Forgings**

| Forgings | Illustration | Mass of Forging (kg) | Test Specimens | | |
|---|---|---|---|---|---|
| | | | No. (set) | Location | Direction |
| Turbine Rotor Forgings |  | ≤ 3000 | 1 | Taken from one end of shaft | Longitudinal |
| | | | 1 | Taken from body | Transverse |
| | | ≥ 3000 | 2 | One set each taken from both ends of shaft | Longitudinal |
| | | | 1 | Taken from body | Transverse |
| Turbine Disc Forgings |  | All cases | 1 | Taken from boss, bore or body, any one location as illustrated | Transverse |

Note:

One set of test specimens specified in the above table means one tensile test specimen for carbon steel forgings, and one tensile test specimen and one set of three impact test specimens for low alloy steel forgings intended for machinery constructions.

8.8.3 For gear pinions and rims

(a) For pinion and rim forgings intended for reduction gears and camshaft driving gears of internal combustion engine, the test specimens are to be selected in accordance with the requirements given in Table XI 8-7.

(b) When the teeth of a gear pinion or rim are to be surface hardened, i.e. carburized, nitrided or induction hardened, the proposed specification together with details of the process and practice are to be submitted for approval before the work is commenced. In this case a preliminary test is to be carried out where deemed necessary by the Society.

(c) Hardness tests for gear forgings

(i) Non-surface hardened gears

Hardness tests are to be carried out after completion of heat treatment and prior to machining the gear teeth. The hardness is to be determined at 4 positions equally spaced around the circumference of the surface where gear teeth will subsequently be cut. Where the width of the toothed portion exceeds 500 mm, hardness tests are to be made at each end of the toothed portion of the forging. Where the finished diameter of the toothed portion exceeds 2500 mm, the number of test positions is to be increased to 8.

(ii) Surface Hardened gears

Hardness tests are to be made on the surface of gear teeth when surface hardening and grinding have been completed.

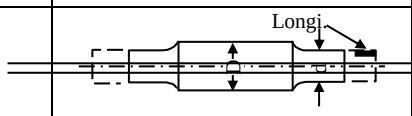
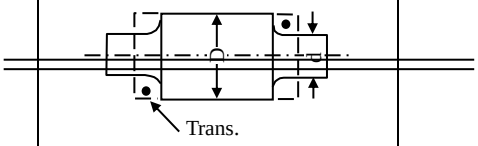
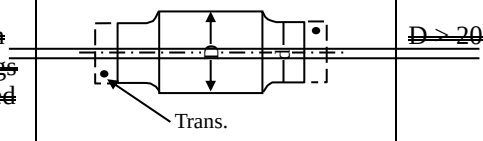
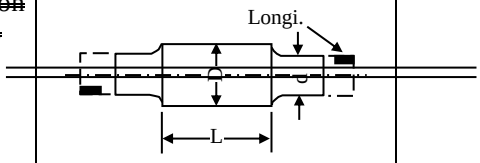
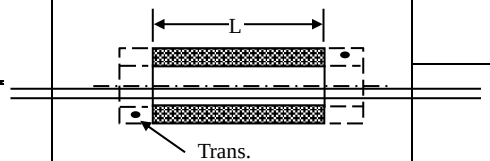
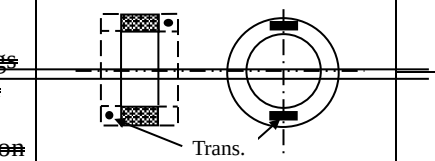
(iii) The results of hardness tests are to comply with the approved specification.

8.8.4 For surface hardening treatment

~~(a) Where surface hardening is to be carried out, the forgings are to be heat treated at an appropriate stage to a condition suitable for subsequent machining and surface hardening.~~

~~(b) Where the surface of steel forgings is to be hardened by induction hardening, nitriding, carburizing, cold rolling or other methods, details of the proposed hardening method are to be submitted for approval.~~

**~~Table XI 8-7~~**
**~~Selection of Test Specimens for Reduction Gear Pinion and Rim Forgings~~**

| ~~Forings~~ | ~~Illustration~~ | ~~Size and Mass of Forgings~~ | | | ~~Test Specimens~~ | | |
|---|---|---|---|---|---|---|---|
| | | | | | ~~No. (set)~~ | ~~Location~~ | ~~Direction~~ |
| ~~Gear Pinion Forgings intended for Reduction Gears~~ |  | ~~D ≤ 200~~ | | | ~~1~~ | ~~Taken from one end of journal~~ | ~~Longitudinal~~ |
| |  | ~~D > 200~~ | ~~D ≥ d~~ | ~~ω≤ 3,000~~ | ~~1~~ | ~~Taken from one end of body adjacent toothed portion~~ | ~~Transverse~~ |
| | | | | ~~ω> 3,000~~ | ~~2~~ | ~~One set each taken from both ends of body adjacent toothed portion~~ | |
| |  | | ~~D ≅ d~~ | ~~ω≤ 3,000~~ | ~~1~~ | ~~Taken from one end of journal~~ | ~~Transverse~~ |
| | | | | ~~ω> 3,000~~ | ~~2~~ | ~~One set each taken from both ends of journal~~ | |
| |  | | ~~d ≤ 200~~ ~~D ≅ d~~ | ~~ω≤ 3,000~~ | ~~1~~ | ~~Taken from one end of journal~~ | ~~Longitudinal~~ |
| | | | | ~~ω> 3,000~~ ~~or~~ ~~L > 1,250~~ | ~~2~~ | ~~One set each taken from both ends of journal~~ | |
| ~~ditto~~ |  | ~~L ≤ 1,250~~ | | | ~~1~~ | ~~Taken from one end of pinion sleeve~~ | ~~Transverse~~ |
| | | ~~L > 1,250~~ | | | ~~2~~ | ~~One set each taken from both ends of pinion sleeve~~ | |
| | ~~Group pinion forgings made from same ingot (or bloom) and heat treated simultaneously~~ | ~~ω≤ 250~~ | | | ~~1~~ | ~~Per two pinion forgings~~ | ~~Longitudinal~~ |
| ~~Gear Rim Forgings Intended for Reduction Gears and Camshaft Driving Gears~~ |  | ~~D ≤ 2,500 or ω≤ 3,000~~ | | | ~~1~~ | ~~Taken from one end of rim~~ | ~~Transverse(3)~~ |
| | | ~~D > 2,500 or ω> 3,000 (2)~~ | | | ~~2~~ | ~~One set each taken from both ends at diametrically opposed~~ | |
| | ~~Group rim forgings made from same ingot (or bloom) and heat treated simultaneously~~ | ~~ω≤ 250~~ | | | ~~1~~ | ~~Per two rim forgings~~ | |

~~Where: D = Finished diameter of toothed portion, in mm.~~
~~d = Finished diameter of journal portion, in mm.~~
~~L = Finished length of pinion sleeve, in mm.~~
~~ω = Mass of individual forging as heat treated, in kg.~~

~~Notes:~~

~~(1) One set of test specimens specified in the above table means one tensile test specimen for carbon steel forgings, and one tensile test specimen and one set of three impact test specimens for low alloy steel forgings intended for machinery construction.~~

~~(2) Where the finished width of the gear rim is not exceeding 1,000 mm, one set each of test specimens may be taken from either one end of the rim at the positions diametrically opposed.~~

~~(3) In the case of gear rim forgings having D > 2,500 mm or > 3,000 kg, the mechanical properties are to conform to the requirements for longitudinal test specimens.~~

## 8.1 Scope

8.1.1 Application

(a) The requirements of this Chapter are applicable to steel forgings intended for hull and machinery applications such as rudder stocks, pintles, propeller shafts, crankshafts, connecting rods, piston rods, gearing, and steel forgings intended for the construction of cargo tanks and process pressure vessels for liquefied gases, including forgings for the piping systems where the design temperature is below 0°C.

(b) Where relevant, the requirements of this Chapter are also applicable to material for forging stock and to rolled bars intended to be machined into components of simple shape.

8.1.2 Service temperature

(a) Ambient temperature service

The requirements from 8.2 to 8.10 of this Chapter are applicable to steel forgings where the design and acceptance tests are related to mechanical properties at ambient temperature.

(b) Low temperature service

For steel forgings intended for low temperature service, the requirements are specified in 8.11 which are supplementary to the requirements of 8.2 to 8.10 of this Chapter.

(c) Other applications

Additional requirements may be necessary especially when the forgings are intended for service elevated temperatures.

8.1.3 Forgings complying with other standards or specifications

Alternatively, forgings which comply with national or proprietary specifications may be accepted provided such specifications give reasonable equivalence to these requirements or are otherwise specially approved or required by the Society.

## 8.2 Manufacture

8.2.1 Approval

Forgings are to be made at works approved by the Society. Works approval is to be in accordance with the requirements given in 1.2 of this Part.

8.2.2 The steel used in the manufacture of forgings is to be made by a process approved by the Society.

8.2.3 Freedom from piping and harmful segregations

Adequate top and bottom discards are to be made to ensure freedom from piping and harmful segregations in the finished forgings.

8.2.4 Reduction ratio

The plastic deformation is to be such as to ensure soundness, uniformity of structure and satisfactory mechanical properties after heat treatment. The reduction ratio is to be calculated with reference to the average cross-sectional area of the cast material. Where the cast material is initially upset, this reference area may be taken as the average cross-sectional area after this operation. Unless otherwise approved the total reduction ratio is to be at least:

| Manufacture Method or Product | Total Reduction Ratio | |
|---|---|---|
| | L>D | L≤ D |
| Made from ingots or from forged blooms or billets | 3:1 | 1.5:1 |
| Made from rolled products | 4:1 | 2:1 |
| Rolled bars | 6:1 | |

Notes:

(1) For forgings made by upsetting, the length after upsetting is to be not more than one-third of the length before upsetting or, in the case of an initial forging reduction of at least 1.5:1, not more than one-half of the length before upsetting.

(2) L and D are the length and diameter respectively of the part of the forging under consideration.

8.2.5 For crankshafts, where grain flow is required in the most favourable direction having regard to the mode of stressing in service, the proposed method of manufacture may require special approval by the Society. In such cases, tests may be required to demonstrate that a satisfactory structure and grain flow are obtained.

8.2.6 Shaping

(a) The shaping of forgings or rolled slabs and billets by flame cutting, scarfing or arc-air gouging is to be undertaken in accordance with recognized good practice and, unless otherwise approved, is to be carried out before the final heat treatment. Preheating is to be employed when necessitated by the composition and/or thickness of the steel.

(b) For certain components, subsequent machining of all flame cut surfaces may be required.

8.2.7 When two or more forgings are joined by welding to form a composite component, the proposed welding procedure specification is to be submitted for approval. Welding procedure qualification tests may be required. Chapter 2 of Part XII of the Rules are to be referred.

8.2.8 Quality of forgings

All forgings are to be free from surface or internal defects which would be prejudicial to their proper application in service.

## 8.3 Chemical Composition

8.3.1 All forgings are to be made from killed steel and the chemical composition is to be appropriate for the type of steel, dimensions and required mechanical properties of the forgings being manufactured.

8.3.2 The chemical composition of each heat is to be determined by the manufacturer on a sample taken preferably during the pouring of the heat. When multiple heats are tapped into a common ladle, the ladle analysis shall apply.

8.3.3 The chemical composition is to comply with the overall limits given in Table XI 8-1 and Table XI 8-2 or, where applicable, the requirements of the approved specification.

8.3.4 At the option of the manufacturer, suitable grain refining elements such as aluminium, niobium or vanadium may be added. The content of such elements is to be reported.

8.3.5 Elements designated as residual elements in the individual specifications are not to be intentionally added to the steel. The content of such elements is to be reported.

**Table XI 8-1**
**Chemical Composition Limits for Hull Steel Forgings(1)(6)**

| Steel type | C | Si | Mn | P | S | Cr | Mo | Ni | Cu(4) | Total residuals |
|---|---|---|---|---|---|---|---|---|---|---|
| C, C-Mn | 0.23(2)(3) | 0.45 | 0.30 - 1.50 | 0.035 | 0.035 | 0.30(4) | 0.15(4) | 0.40(4) | 0.30 | 0.85 |
| Alloy | (5) | 0.45 | (5) | 0.035 | 0.035 | (5) | (5) | (5) | 0.30 | - |

Notes:

(1) Composition in percentage mass by mass maximum unless shown as a range.

(2) The carbon content may be increased above this level provided that the carbon equivalent ($C_{eq}$) is not more than 0.41%, calculated using the following formula:

$$C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \quad (\%)$$

(3) The carbon content of C and C-Mn steel forgings not intended for welded construction may be 0.65 maximum.

(4) Elements are considered as residual elements.

(5) Specification is to be submitted for approval.

(6) Rudder stocks and pintles should be of weldable quality.

**Table XI 8-2**
**Chemical Composition Limits for Machinery Steel Forgings(1)**

| Steel type | C | Si | Mn | P | S | Cr | Mo | Ni | Cu(3) | Total residuals |
|---|---|---|---|---|---|---|---|---|---|---|
| C, C-Mn | 0.65(2) | 0.45 | 0.30 - 1.50 | 0.035 | 0.035 | 0.30(3) | 0.15(3) | 0.40(3) | 0.30 | 0.85 |
| Alloy(4) | 0.45 | 0.45 | 0.30 - 1.00 | 0.035 | 0.035 | Min. 0.40(5) | Min. 0.15(5) | Min. 0.40(5) | 0.30 | - |

Notes:

(1) Composition in percentage mass by mass maximum unless shown as a range or as a minimum.

(2) The carbon content of C and C-Mn steel forgings intended for welded construction is to be 0.23 maximum. The carbon content may be increased above this level provided that the carbon equivalent ($C_{eq}$) is not more than 0.41%.

(3) Elements are considered as residual elements unless shown as a minimum.

(4) Where alloy steel forgings are intended for welded constructions, the proposed chemical composition is subject to approval by the Society.

(5) One or more of the elements is to comply with the minimum content.

## 8.4 Heat Treatment, Including Surface Hardening and Straightening

8.4.1 General

At an appropriate stage of manufacture, after completion of all hot working operations, forgings are to be suitably heat treated to refine the grain structure and to obtain the required mechanical properties.

8.4.2 Supply conditions

Except as provided in 8.4.6(b) and 8.4.6(c) forgings are to be supplied in one of the following conditions. For all types of steel the tempering temperature is to be not less than 550°C. Where forgings for gearing are not intended for surface hardening, lower tempering temperature may be allowed.

(a) Carbon and carbon-manganese steels

- Fully annealed

- Normalized
- Normalized and tempered
- Quenched and tempered

(b) Alloy steels
- Quenched and tempered

8.4.3 Alternatively, alloy steel forgings may be supplied in the normalized and tempered condition, in which case the specified mechanical properties are to be agreed with the Society.

8.4.4 Heat treatment furnace

(a) Heat treatment is to be carried out in properly constructed furnaces which are efficiently maintained and have adequate means for control and recording of temperature. The furnace dimensions are to be such as to allow the whole furnace charge to be uniformly heated to the necessary temperature. In the case of very large forgings alternative methods of heat treatment will be specially considered by the Society.

(b) Sufficient thermocouples are to be connected to the furnace charge to measure and record that its temperature is adequately uniform unless the temperature uniformity of the furnace is verified at regular intervals.

8.4.5 If for any reasons a forging is subsequently heated for further hot working, the forging is to be reheat treated.

8.4.6 Surface hardening

(a) Where it is intended to surface harden forgings, full details of the proposed procedure and specification are to be submitted for the approval of the Society. For the purposes of this approval, the manufacture may be required to demonstrate by test that the proposed procedure gives a uniform surface layer of the required hardness and depth and that it does not impair the soundness and properties of the steel.

(b) Where induction hardening or nitriding is to be carried out, forgings are to be heat treated at an appropriate stage to a condition suitable for this subsequent surface hardening.

(c) Where carburizing is to be carried out, forgings are to be heat treated at an appropriate stage (generally either by full annealing or by normalizing and tempering) to a condition suitable for subsequent machining and carburizing.

8.4.7 If a forging is locally reheated or any straightening operation is performed after the final heat treatment consideration is to be given to a subsequent stress relieving heat treatment.

8.4.8 The forge is to maintain records of heat treatment identifying the furnace used, furnace charge, date, temperature and time at temperature. The records are to be presented to the Surveyor on request.

## 8.5 Mechanical Tests

8.5.1 Test material, sufficient for the required tests and for possible retest purposes, is to be provided with a cross-sectional area of not less than that part of the forging which it represents. This test material is to be integral with each forging except as provided in 8.5.7 and 8.5.10. Where batch testing is permitted according to 8.5.10, the test material may alternatively be a production part or separately forged. Separately forged test material is to have a reduction ratio similar to that used for the forgings represented.

8.5.2 For the purpose of these requirements a set of tests is to consist of one tensile test specimen and, when required, three Charpy V-notch impact test specimens.

8.5.3 Test specimens are normally to be cut with their axes either mainly parallel (longitudinal test) or mainly tangential (tangential test) to the principal axial direction of each product.

8.5.4 Unless otherwise agreed, the longitudinal axis of test specimens is to be positioned as follows:

(a) for thickness or diameter up to maximum 50 mm, the axis is to be at the mid-thickness or the center of the cross section.

(b) for thickness or diameter greater than 50 mm, the axis is to be at one quarter thickness (mid-radius) or 80 mm, whichever is less, below any heat treated surface.

8.5.5 Except as provided in 8.5.10 the number and direction of tests is to be as follows.

(a) Hull components such as rudder stocks, pintles etc. and general machinery components such as shafting, connecting rods, etc.

One set of tests is to be taken from the end of each forging in a longitudinal direction except that, at the discretion of the manufacture, the alternative directions or positions as shown in Fig. XI 8-1, Fig. XI 8-2 and Fig. XI 8-3 may be used. Where a forging exceeds both 4 tonnes in mass and 3 m in length, one set of tests is to be taken from each end. These limits refer to the 'as forged' mass and length but excluding the test material.

(b) Pinions

Where the finished machined diameter of the toothed portion exceeds 200 mm one set of tests is to be taken from each forging in a tangential direction adjacent to the toothed portion (test position B in Fig. XI 8-4). Where the dimensions preclude the preparation of tests from this position, tests in a tangential direction are to be taken from the end of the journal (test position C in Fig. XI 8-4). If however, the journal diameter is 200 mm or less the tests are to be taken in a longitudinal direction (test position A in Fig. XI 8-4). Where the finished length of the toothed portion exceed 1.25 m, one set of tests is to be taken from each end.

(c) Small pinions

Where the finished diameter of the toothed portion is 200 mm or less one set of tests is to be taken in a longitudinal direction (test position A in Fig. XI 8-4).

(d) Gear wheels

One set of tests is to be taken from each forging in a tangential direction (test position A or B in Fig. XI 8-5).

(e) Gear wheel rims (made by expanding)

One set of tests is to be taken from each forging in a tangential direction (test position A or B in Fig. XI 8-6). Where the finished diameter exceeds 2.5 m or the mass (as heat treated excluding test material) exceeds 3 tonnes, two sets of tests are to be taken from diametrically opposite positions (test positions A and B in Fig. XI 8-6). The mechanical properties for longitudinal test are to be applied.

(f) Pinion sleeves

One set of tests is to be taken from each forging in a tangential direction (test position A or B in Fig. XI 8-7). Where the finished length exceeds 1.25 m one set of tests is to be taken from each end.

(g) Crankwebs

One set of tests is to be taken from each forging in a tangential direction.

(h) Solid open die forged crankshafts

One set of tests is to be taken in a longitudinal direction from the driving shaft end of each forging (test position A in Fig. XI 8-8).

Where the mass (as heat treated but excluding test material) exceeds 3 tonnes, tests in a longitudinal direction are to be taken from each end (test positions A and B in Fig. XI 8-8). Where, however, the crankthrows are formed by machining or flame cutting, the second set of tests is to be taken in a tangential direction from material removed from the crankthrow at the end opposite the driving shaft end (test position C in Fig. XI 8-8).

8.5.6 For closed die crankshaft forgings and crankshaft forgings where the method of manufacture has been specially approved in accordance with 8.2.5, the number and position of test specimens is to be agreed with the Society having regard to the method of manufacture employed.

8.5.7 When a forging is subsequently divided into a number of components, all of which are heat treated together in the same furnace charge, for test purposes this may be regarded as one forging and the number of tests required is to be related to the total length and mass of the original multiple forging.

8.5.8 Except for components which are to be carburized or for hollow forgings where the ends are to be subsequently closed, test material is not to be cut from a forging until all heat treatment has been completed.

8.5.9 Forgings to be carburized

(a) When forgings are to be carburized, sufficient test material is to be provided for both preliminary tests at the forge and for final tests after completion of carburizing. For this purpose duplicate sets of test material are to be taken from positions as detailed in 8.5.5, except that irrespective of the dimensions or mass of the forging, tests are required from one position only and, in the case of forgings with integral journals, are to be cut in a longitudinal direction.

(b) This test material is to be machined to a diameter of D/4 or 60 mm, whichever is less, where D is the finished diameter of the toothed portion.

(c) For preliminary tests at the forge, one set of test material is to be given a blank carburizing and heat treatment cycle simulating that which subsequently will be applied to the forging.

(d) For final acceptance tests, the second set of test material is to be blank carburized and heat treated along with the forgings which they represent.

(e) At the discretion of the forgemaster or gear manufacture test samples of larger cross section may be either carburized or blank carburized, but these are to be machined to the required diameter prior to the final quenching and tempering heat treatment.

(f) Alternative procedures for testing of forgings which are to be carburized may be specially agreed with the Society.

8.5.10 Normalized forgings with mass up to 1,000 kg each and quenched and tempered forgings with mass up to 500 kg each may be batch tested. A batch is to consist of forgings of similar shape and dimensions, made from the same heat of steel, heat treated in the same furnace charge and with a total mass not exceeding 6 tonnes for normalized forgings and 3 tonnes for quenched and tempered forgings, respectively.

8.5.11 A batch testing procedure may also be used for hot rolled bars. A batch is to consist of either:

(a) material from the same rolled ingot or bloom provided that where this is cut into individual lengths, these are all heat treated in the same furnace charge, or

(b) bars of the same diameter and heat, heat treated in the same furnace charge and with a total mass not exceeding 2.5 tonnes.

8.5.12 The preparation of test specimens and the procedures used for mechanical testing are to comply with the relevant requirements of Chapter 2 of this Part. Unless otherwise agreed, all tests are to be carried out in the presence of the Surveyor.

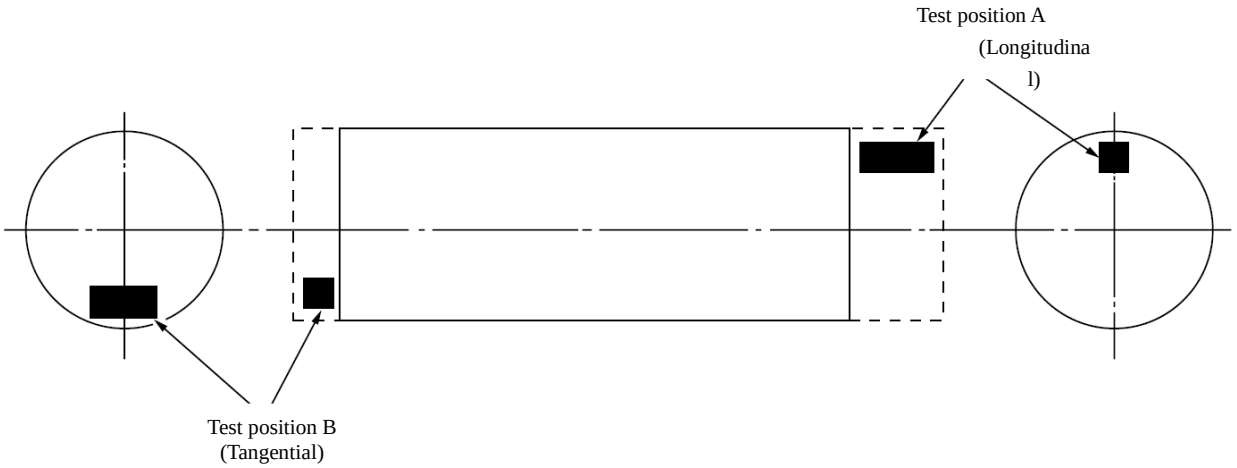



**Fig. XI 8-1**
**Plain Shaft**

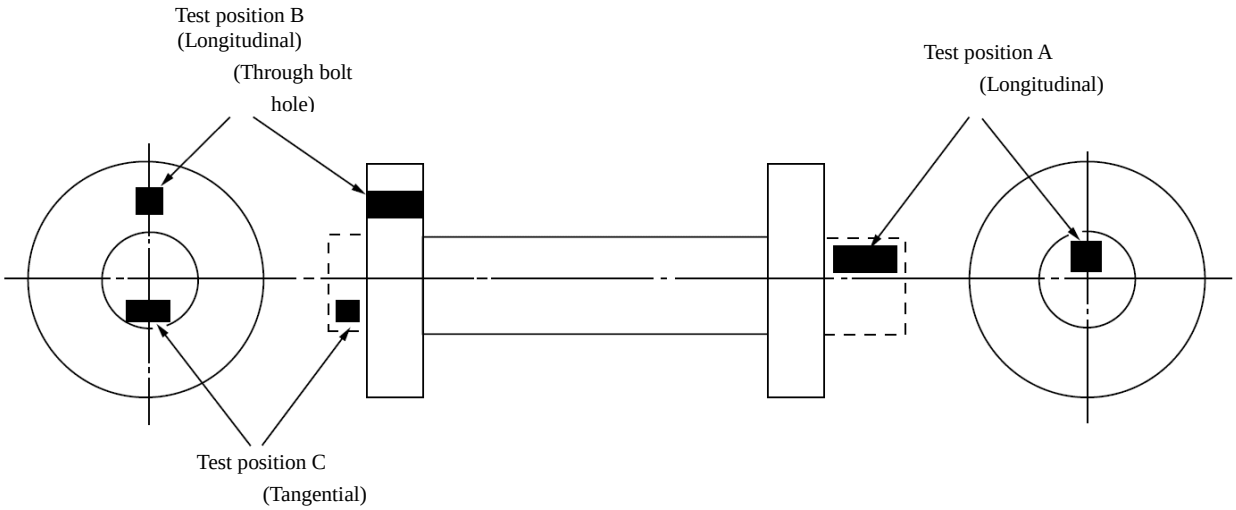



**Fig. XI 8-2**
**Flanged Shaft**

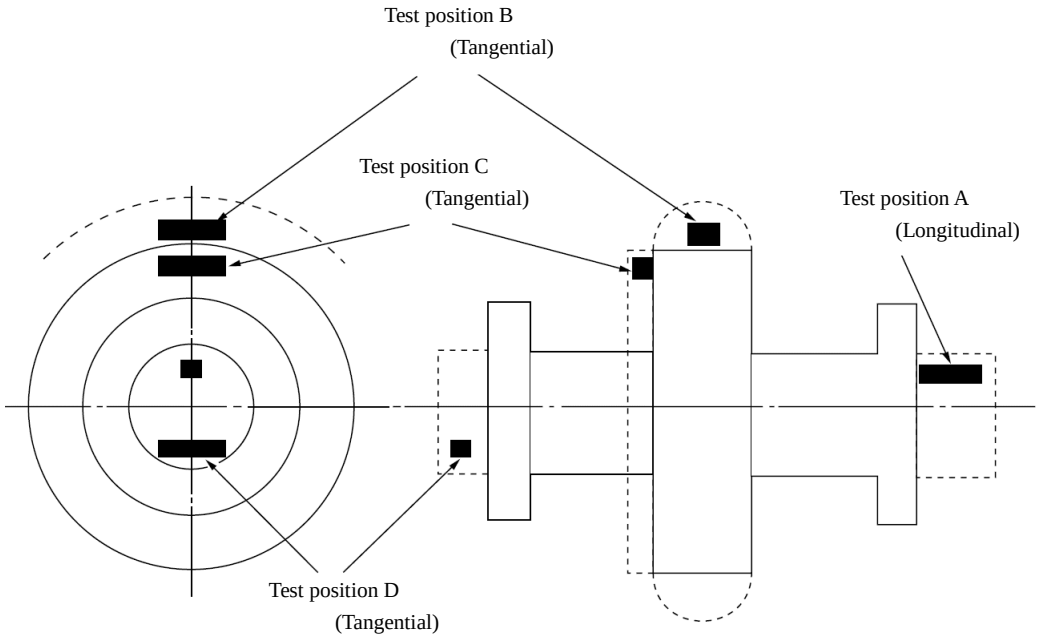
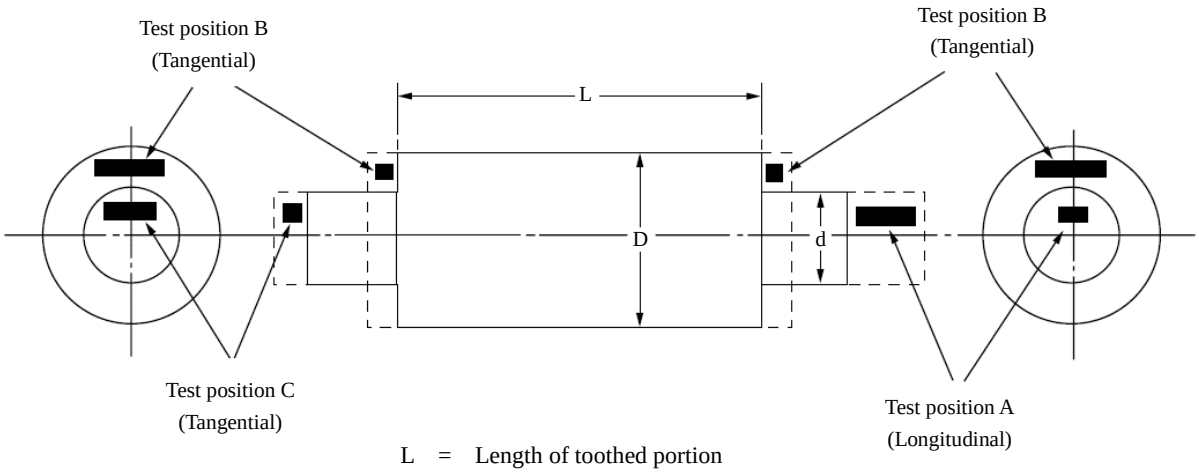



**Fig. XI 8-3**
**Flanged Shaft with Collar**




L = Length of toothed portion
D = Diameter of toothed portion
d = Journal diameter

**Fig. XI 8-4**
**Pinion**

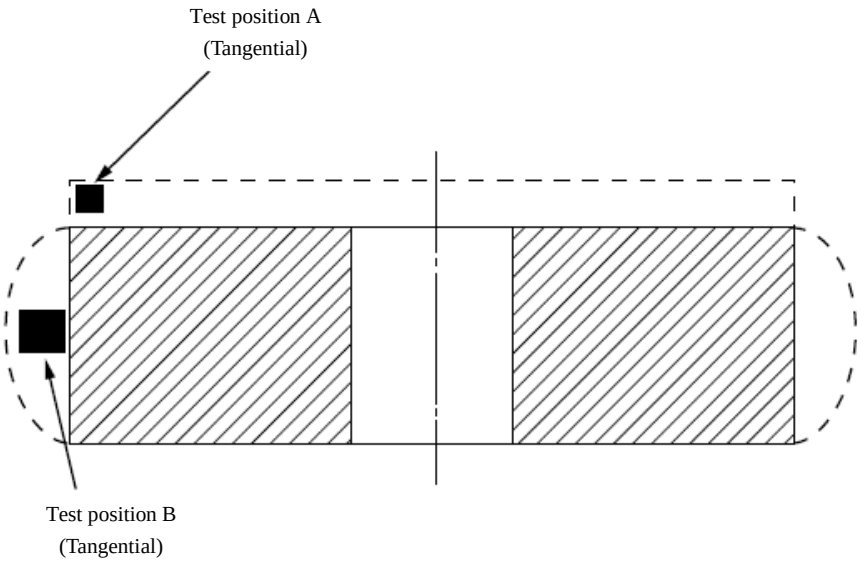



**Fig. XI 8-5**
**Gear Wheel**

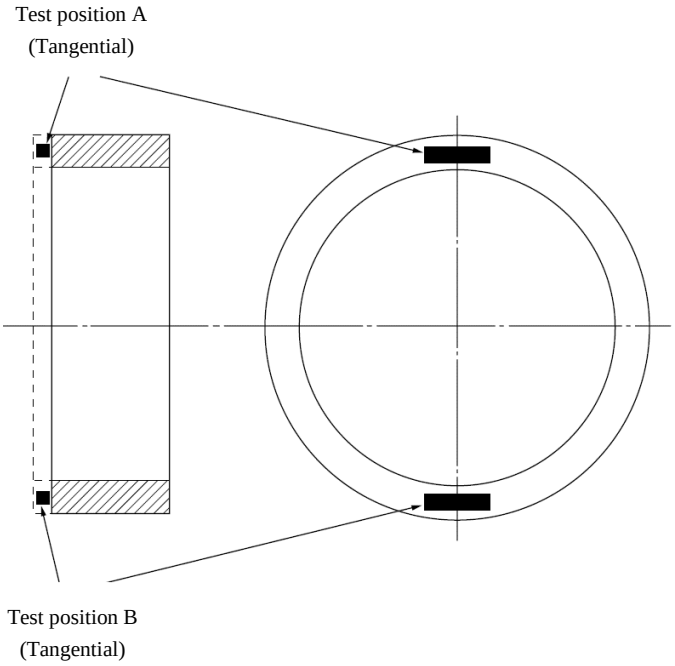



**Fig. XI 8-6**
**Gear Rim (Made by Expanding)**

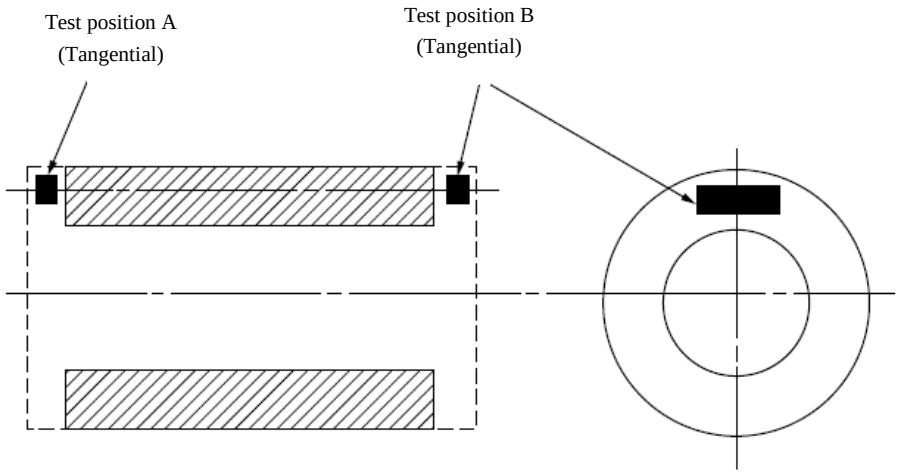



**Fig. XI 8-7**
**Pinion Sleeve**

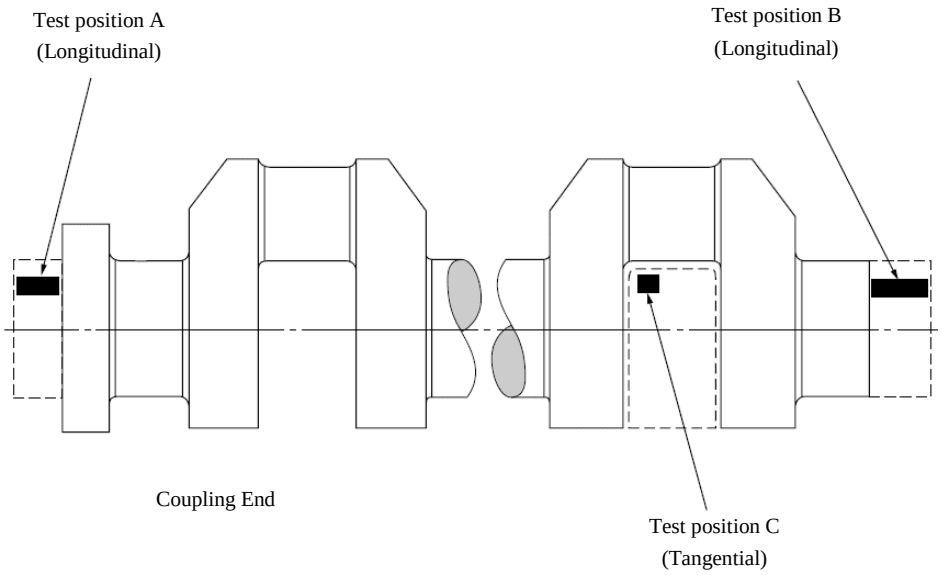



**Fig. XI 8-8**
**Solid Forged Crankshaft**

## 8.6 Mechanical Properties

8.6.1 Table XI 8-3 and Table XI 8-4 give the minimum requirements for yield stress, elongation, reduction of area and impact test energy values corresponding to different strength levels but it is not intended that these should necessarily be regarded as specific grades. Where it is proposed to use a steel with a specified minimum tensile strength intermediate to those given, corresponding minimum values for the other properties may be obtained by interpolation.

8.6.2 Forgings may be supplied to any specified minimum tensile strength selected within the general limits detailed in Table XI 8-3 or Table XI 8-4 but subject to any additional requirements of the relevant construction Rules.

8.6.3 The mechanical properties are to comply with the requirements of Table XI 8-3 or Table XI 8-4 appropriate to the specified minimum tensile strength or, where applicable, the requirements of the approved specification.

8.6.4 At the discretion of the Society hardness tests may be required on the following:

(a) Gear forgings after completion of heat treatment and prior to machining the gear teeth. The hardness is to be determined at four positions equally spaced around the circumference of the surface where teeth will subsequently be cut. Where the finished diameter of the toothed portion exceeds 2.5 m, the above number of test positions is to be increased to eight. Where the width of a gear wheel rim forging exceeds 1.25 m, the hardness is to be determined at eight positions at each end of the forging.

(b) Small crankshaft and gear forgings which have been batch tested. In such cases at least one hardness test is to be carried out on each forging.

The results of hardness tests are to be reported and, for information purposes, typical Brinell hardness values are given in Table XI 8-4.

8.6.5 Hardness tests may also be required on forgings which have been induction hardened, nitrided or carburized. For gear forgings these tests are to be carried out on the teeth after, where applicable, they have been ground to the finished profile. The results of such tests are to comply with the approved specifications (see 8.4.6(a)).

8.6.6 Re-test requirements for tensile tests are to be in accordance with Chapter 2 of this Part.

8.6.7 Re-test requirements for Charpy impact tests are to be in accordance with Chapter 2 of this Part.

8.6.8 The additional tests detailed in 8.6.6 and 8.6.7 are to be taken, preferably from material adjacent to the original tests, but alternatively from another test position or sample representative of the forging or batch of forgings.

8.6.9 At the option of the manufacturer, when a forging or a batch of forgings has failed to meet the test requirements, it may be reheat treated and re-submitted for acceptance tests.

**Table XI 8-3**
**Mechanical Properties for Hull Steel Forgings**

| Properties / Steel Type | Tensile Strength $R_m$[(1)] min. ($N/mm^2$) | Yield Stress $R_e$ min. ($N/mm^2$) | Elongation $A_5$ min. (%) | | Reduction of area Z min. (%) | |
|---|---|---|---|---|---|---|
| | | | Long. | Tran. | Long. | Tran. |
| C and C-Mn | 400 | 200 | 26 | 19 | 50 | 35 |
| | 440 | 220 | 24 | 18 | 50 | 35 |
| | 480 | 240 | 22 | 16 | 45 | 30 |
| | 520 | 260 | 21 | 15 | 45 | 30 |
| | 560 | 280 | 20 | 14 | 40 | 27 |
| | 600 | 300 | 18 | 13 | 40 | 27 |
| Alloy | 550 | 350 | 20 | 14 | 50 | 35 |
| | 600 | 400 | 18 | 13 | 50 | 35 |
| | 650 | 450 | 17 | 12 | 50 | 35 |

Notes:
(1) The following ranges for tensile strength may be additionally specified:
specified minimum tensile strength: < 600 $N/mm^2$ ≥ 600 $N/mm^2$
tensile strength range: 120 $N/mm^2$ 150 $N/mm^2$

**Table XI 8-4**
**Mechanical Properties for Machinery Steel Forgings[2]**

| Properties / Steel Type | Tensile Strength $R_m$[1] min. ($N/mm^2$) | Yield Stress $R_e$ min. ($N/mm^2$) | Elongation $A_5$ min. (%) | | Reduction of area Z min. (%) | | Brinell Hardness[3] |
|---|---|---|---|---|---|---|---|
| | | | Long. | Tran. | Long. | Tran. | |
| C and C-Mn | 400 | 200 | 26 | 19 | 50 | 35 | 110-150 |
| | 440 | 220 | 24 | 18 | 50 | 35 | 125-160 |
| | 480 | 240 | 22 | 16 | 45 | 30 | 135-175 |
| | 520 | 260 | 21 | 15 | 45 | 30 | 150-185 |
| | 560 | 280 | 20 | 14 | 40 | 27 | 160-200 |
| | 600 | 300 | 18 | 13 | 40 | 27 | 175-215 |
| | 640 | 320 | 17 | 12 | 40 | 27 | 185-230 |
| | 680 | 340 | 16 | 12 | 35 | 24 | 200-240 |
| | 720 | 360 | 15 | 11 | 35 | 24 | 210-250 |
| | 760 | 380 | 14 | 10 | 35 | 24 | 225-265 |
| Alloy | 600 | 360 | 18 | 14 | 50 | 35 | 175-215 |
| | 700 | 420 | 16 | 12 | 45 | 30 | 205-245 |
| | 800 | 480 | 14 | 10 | 40 | 27 | 235-275 |
| | 900 | 630 | 13 | 9 | 40 | 27 | 260-320 |
| | 1000 | 700 | 12 | 8 | 35 | 24 | 290-365 |
| | 1100 | 770 | 11 | 7 | 35 | 24 | 320-385 |

Notes:

(1) The following ranges for tensile strength may be additionally specified:

specified minimum tensile strength: < 900 N/mm ≥ 900 N/mm

tensile strength range: 150 N/mm 200 N/mm

(2) For propeller shafts intended for ships with **Ice Class** notation except the lowest one, Charpy V-notch impact testing is to be carried out for all steel types at –10°C and the average energy value is to be minimum 27 J (longitudinal test). One individual value may be less than the required average value provided that it is not less than 70% of this average value.

(3) The hardness values are typical and are given for information purposes only.

## 8.7 Inspection

8.7.1 Before acceptance, all forgings are to be presented to the Surveyor for visual examination. Where applicable, this is to include the examination of internal surfaces and bores. Unless otherwise agreed, the verification of dimensions is the responsibility of the manufacturer.

8.7.2 Non-destructive testing

(a) When required by the relevant construction Rules, or by the approved procedure for welded composite components (see 8.2.7), appropriate non-destructive testing is also to be carried out before acceptance and the results are to be reported by the manufacturer.

(b) The extent of testing and acceptance criteria are to be agreed with the Society. IACS Rec. No. 68 is regarded as an example of an acceptable standard.

8.7.3 When required by the conditions of approval for surface hardened forgings (8.4.6(a) refers) additional test samples are to be processed at the same time as the forgings which they represent. These test samples are subsequently to be sectioned in order to determine the hardness, shape and depth of the locally hardened zone and which are to comply with the requirements of the approved specification.

8.7.4 In the event of any forging proving defective during subsequent machining or testing, it is to be rejected notwithstanding any previous certification.

## 8.8 Rectification of Defective Forgings

8.8.1 Defects may be removed by grinding or chipping and grinding provided the component dimensions are acceptable. The resulting grooves are to have a bottom radius of approximately three times the groove depth and are to be blended into the surrounding surface so as to avoid any sharp contours. Complete elimination of the defective material is to be verified by magnetic particle testing or liquid penetrant testing.

8.8.2 Repair welding of forgings except crankshaft forgings may be permitted subject to prior approval of the Society. In such cases, full details of the extent and location of the repair, the proposed welding procedure, heat treatment and subsequent inspection procedures are to be submitted for the approval.

8.8.3 The forging manufacturer is to maintain records of repairs and subsequent inspections traceable to each forging repaired. The records are to be presented to the Surveyor on request.

## 8.9 Identification of Forgings

8.9.1 The manufacturer is to adopt a system of identification which will enable all finished forgings to be traced to the original cast and the Surveyor is to be given full facilities for so tracing the forgings when required.

8.9.2 Before acceptance, all forgings which have been tested and inspected with satisfactory results are to be clearly marked by the manufacturer. At the discretion of the Society, any of the following particulars may be required:

(a) Steel quality.

(b) Identification number, cast number or other marking which will enable the full history of the forging to be traced.

(c) Manufacturer's name or trade mark.

(d) The Society's mark .

(e) Abbreviated name of the Society's local office.

(f) Personal stamp of Surveyor responsible for inspection.

8.9.3 Where small forgings are manufactured in large numbers, modified arrangements for identification may be specially agreed with the Society.

## 8.10 Certification

8.10.1 The manufacturer is to provide the required type of inspection certificate giving the following particulars for each forging or batch of forgings which has been accepted:

(a) Purchaser's name and order number.

(b) Description of forgings and steel quality.

(c) Identification number.

(d) Steelmaking process, cast number and chemical analysis of ladle sample.

(e) Results of mechanical tests.

(f) Results of non-destructive tests, where applicable.

(g) Details of heat treatment, including temperature and holding times.

## 8.11 Ferritic Steel Forgings for Low Temperature Service

8.11.1 Scope

(a) The requirements of this Section apply to ferritic steel forgings intended for use in the construction of cargo tanks and process pressure vessels for liquefied gases, including forgings for the piping systems where the design temperature is below 0°C.

Provision is made for carbon and carbon-manganese steels and alloy steels with specified impact properties at temperatures down to –196°C.

(b) The requirements of this Section are supplementary to the requirements as specified in 8.2 ~ 8.10.

8.11.2 Chemical composition

(a) The chemical composition is to comply with the overall limits given in Table XI 8-5 or, where applicable, the requirements of the approved specification.

(b) Where carbon and carbon-manganese steel is fine grain treated with niobium, vanadium or titanium, either singly or in any combination, the content of Nb shall be within 0.01 to 0.05%, V shall be max. 0.05% and Ti shall be max. 0.02%.

8.11.3 Heat treatment

(a) Carbon and carbon-manganese steel forgings shall be supplied in one of the following conditions:

- Normalized
- Normalized and tempered at a temperature of not less than 550°C
- Quenched and tempered at a temperature of not less than 550°C
- Other delivery conditions may be accepted based on special approval.

(b) Alloy steel forgings shall be normalized and tempered, double normalized and tempered, or quenched and tempered at a temperature of not less than 550°C. Other delivery conditions may be accepted based on special approval.

8.11.4 Mechanical properties

(a) The mechanical properties shall comply with the values given in Table XI 8-6 as below or, where applicable, the requirements of the approved specification.

(b) For forgings which have been batch tested, hardness tests shall be made on each forging.

8.11.5 Inspection

(a) Quenched and tempered forgings are subject to magnetic particle testing (MT), see 8.7.2 of this Chapter.

(b) Normalized forgings with mass 1,000 kg or more and quenched and tempered forgings with mass 500 kg or more are subject to ultrasonic testing (UT).

8.11.6 Pressure testing

Pressure retaining forgings are to be tested after machining to the test pressure required by the relevant design and construction parts of the Rules. No leaks are permitted.

**Table XI 8-5**
**Chemical Composition Limits[(1)(2)] for Ferritic Steel Forgings for Low Temperature Service**

| Steel Type and Grade \ Elements | | C | Si | Mn | P | S | Cr | Mo | Ni | Cu | Al[(3)] | Total residuals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C and C-Mn | 450 | 0.16[(4)] | 0.1-0.5 | 0.7-1.6 | 0.025 | 0.025 | 0.25 | 0.08 | 0.8 | 0.35 | 0.02 | - |
| | 490 | | | | | | | | | | | |
| Nickel Alloy | 3.5Ni | 0.20 | 0.15-0.35 | 0.30-0.90 | 0.025 | 0.025 | 0.25 | 0.08 | 3.25-3.75 | 0.35 | 0.02-0.05 | - |
| | 5Ni | 0.12 | | | | | | | 4.70-5.30 | | | |
| | 9Ni | 0.10 | | | | | | | 8.50-10.0 | | | |

Notes:

(1) Given value is maximum content (percent, by weight) unless shown as a range or as a minimum

(2) Elements are considered as residual elements unless shown as a range or as a minimum

(3) Aluminium total content. Other grain refining elements may be used for carbon and carbon-manganese steel, see 8.11.2(a)

(4) By special agreement with the Society, the carbon content may be increased to 0.18% maximum, provided the design temperature is not lower than -40°C.

**Table XI 8-6**
**Mechanical Properties for Ferritic Steel Forgings for Low Temperature Service**

| Steel Type and Grade / Properties | | Tensile Strength $R_m$ min. ($N/mm^2$) | Yield Stress $R_e$ min. ($N/mm^2$) | Elongation $A_5$ min. (%) | Reduction of area Z min. (%) | Charpy V-notch Impact Test | |
|---|---|---|---|---|---|---|---|
| | | | | | | Test Temp. (°C) | Min. Aver. Energy (J) |
| C and C-Mn | 450 | 450-600 | 240 | 22 | 40 | -60(1) | 41 |
| | 490 | 490-640 | 275 | 20 | | | |
| Nickel Alloy | 3.5Ni | 490-640 | 275 | 20 | 35 | -95(3) | 41(2) |
| | 5Ni | 540-690 | 380 | 20 | | -110(3) | |
| | 9Ni | 640-790 | 480 | 18 | | -196(3) | |

Notes:

(1) Applicable for design temperature -55°C or higher. Corresponding to material thickness (t), test temperature may alternatively be:

| | |
|---|---|
| $t \le 25$ mm | 5°C below design temperature or –20°C, whichever is lower |
| 25 mm < $t \le 30$ mm | 10°C below design temperature or -20°C, whichever is lower |
| 30 mm < $t \le 35$ mm | 15°C below design temperature or -20°C, whichever is lower |
| 35 mm < $t \le 40$ mm | 20°C below design temperature |
| $t > 40$ mm | Test temperature is to be approved by the Society |

(2) Minimum average energy of 34J may be accepted subject to approval by the Society.

(3) The minimum design temperatures may be used as below:

| | $t \le 25$ mm | 25 mm < $t \le 40$ mm |
|---|---|---|
| 3.5Ni | -90°C | (t - 115) °C |
| 5Ni | -105°C | (t - 130) °C |
| 9Ni | -165°C | |

Special consideration is to be given to the use of thicknesses greater than 40 mm or to the use of design temperatures below –165°C.

# Chapter 18 Windows

*Section 18.2 has been amended as follows:*

## 18.2 Construction

18.2.1 Except otherwise specified as below, the ~~The~~ constructions and dimensions of the windows are to comply with ISO 3903 or other recognized standards accepted by the Society.

18.2.2 Design loads

(a) The design pressure for calculating the thickness of windows is to be in accordance with ISO 5779.

(b) The design pressure derived in 18.2.2(a) above is not to be less than the minimum design pressure ($P_{min}$) given below.

| | When L ≤ 250 m, $P_{min}$ | When L > 250 m, $P_{min}$ |
|---|---|---|
| Exposed front bulkhead of the first tier superstructure | $25+\frac{L}{10}$ (kPa) | 50 (kPa) |
| Other places | $12.5+\frac{L}{20}$ (kPa) | 25 (kPa) |

(c) If ship's length is less than 20 m, it may apply to a appropriate standard for approval when agreed by the Society.

18.2.3 Minimum glass thickness

The minimum glass thickness of windows is to be determined as follows:

$$t_w = \frac{b}{200}\sqrt{\beta P_w} \quad \text{mm}$$

where:

$t_w$ = The minimum thickness of glass, in mm

$P_w$ = Design load from 18.2.2, in kPa

$\beta$ = A non-dimensional coefficient as specifed in Table XI 18-1

b = The length of the shorter dimension of the window, in mm

**Table XI 18-1**
**Values for Factor β Based on Window Size Ratio K**

| Value of K(1) | 1.0 | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 | 0.4 | 0.3 | 0.2 | 0.1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| β | 0.287 | 0.330 | 0.393 | 0.478 | 0.545 | 0.612 | 0.668 | 0.704 | 0.730 | 0.745 | 0.750 |

Notes:

(1) K: window size ratio $= \frac{\text{Shorter dimension (mm)}}{\text{Larger dimension (mm)}}$

AMENDMENT TO "THE RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF STEEL SHIPS 2019"

# PART XIV GOAL-BASED SHIP CONSTRUCTION STANDARDS SHIPS

# List of major changes in Part XIV from 2019 edition

| | |
|---|---|
| 2.8 | Revised |
| 2.8.2 | New |
| 5.1.2 | Revised |
| 5.2.4(b) | Revised |
| 5.3.1, 5.3.2 | Revised |
| 6.1.2 | Revised |
| 6.1.3 | Deleted |

Rules for the Construction and Classification of Steel Ships 2019 have been partly amended as follows:

## Chapter 2 Complements to CSR-H

*Section 2.8 has been amended as follows:*

### 2.8 ~~Sloshing Impact Assessment~~ Direct Loads Assessment

2.8.1 The sloshing pressures defined in the CSR-H does not include the effect of impact pressures due to high velocity impacts with tank boundaries or internal structures. For tanks with a maximum effective sloshing breadth, $b_{slh}$, greater than 0.56 B or a maximum effective sloshing length, $l_{slh}$, greater than 0.13 L at any filling level from 0.05 $h_{max}$ to 0.95 $h_{max}$,a separate impact assessment is to be carried out in accordance with the Chapter 33 of Part II of the Rules. See CSR-H Part 1 Ch.4 Sec.6 for the definitions of the above-mentioned symbol.

*Paragraph 2.8.2 has been added as follows:*

2.8.2 Seakeeping design motions and loads assessment for hull forms outside the limits specified in CSR-H Part 1 Ch. 1 Sec. 2 [3] and Sec. 3 [6.2], CR Internal Guidance IG-RES-XIV-002 is to be applied for seakeeping motions and loads assessment.

## Chapter 5 Construction Quality Procedures

*Paragraph 5.1.2 has been amended as follows:*

### 5.1 General

5.1.1 Ships are to be built in accordance with controlled and transparent quality production standards with due regard to intellectual property rights. The ship construction quality procedures are to include, but not be limited to, specifications for material, manufacturing, alignment, assembling, joining and welding procedures, surface preparation and coating.

~~5.1.2 All of the industrial standards employed are to be recognized, for example, CNS, ISO, JIS, JSQS, DIN, AWS, IACS Rec.47, etc.~~

5.1.2 IACS Rec.47 Part A is to be applied as the minimum standard for hull new construction activities. Where the Builder/Fabricator proposes to use national and/or local standards, these are to be confirmed equivalent to, or of a higher standard than Rec.47 Part A accordingly to the procedure provided in IACS UR Z23.

*Paragraph 5.2.4(b) has been amended as follows:*

5.2.4 Procedures followed when the "as built" is different than "design"

(a) When the dimension and the grade of materials are changed, the relevant “as built” drawings are to be submitted for review. Nevertheless, in the situations of increasing in the scantling or the material grade deemed satisfactory by the Surveyor, the review may be waived.

(b) The review includes the re-evaluation of the strength and/or fatigue life for both net and gross scantlings where ~~appropriate~~ found necessary according to IACS Rec. 165.

*Paragraph 5.3.1 and 5.3.2 have been amended as follows:*

## 5.3 Continual Improvement

5.3.1 When any deviation occurs during implementation of the construction quality procedures, the experience ~~may~~ is to be fed back by the shipbuilder, the owner or the Surveyor for possible rule improvement. Actions ~~would~~ are to be ~~took~~ taken according the internal procedure of Quality Manual of this Society.

5.3.2 ~~Any~~ Major experience from new construction and in-service ~~may~~ is to be fed back by the shipbuilder, the owner or the Surveyor to update the Rules according to the internal procedure of Quality Manual of this Society.

*Paragraph 6.1.2 has been amended as follows:*

6.1.2 The shipbuilder is to submit a construction survey plan to the Surveyor during the initial kick-off meeting for review. The Surveyor is to carry out inspections according to the plan in order to meet ~~an acceptable~~ the minimum construction quality level as provided in 5.1.2.

*Paragraph 6.1.3 has been deleted as follows:*

~~6.1.3 All of the industrial standards employed are to be recognized, for example, CNS, ISO, JIS, JSQS, DIN, AWS, IACS Rec.47, etc.~~

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