Rules for Maintenance and Survey for Existing Ships

CLASSIFICATION OF STEEL SHIPS

“CLASS SURVEYS”

ClassPMDS
PANAMA MARITIME DOCUMENTATION SERVICES
Rules for Maintenance and Survey for Existing Ships

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CHAPTER 1 GENERAL

Section 1 Classification and Registry of Ship

1.1. Application

1.1.1. The Rule for Maintenance and Survey for Existing Ships, scopes and schedule of surveys of items of technical supervision for various purpose ships to verify that ships comply with the rules of ClassPMDS of Shipping and the normative technical documents regarding the possibility to assign, retain and confirm the Register class according to their purpose, safety of human life at sea, safe carriage of cargoes, as well as for other functions of technical supervision.

1.1.2. The present Rules are applied by the Register during technical supervision of ships in service with the purpose of their classification and verification of class conditions. Classification surveys carried out in due dates and scope are mandatory for a ship classification ClassPMDS.

1.1.3. The present Rules are mandatory for all ship owners, organizations, firms and individuals involved in operation of ships. The above mentioned organizations, firms and individuals ensure the fulfilment of the Rules requirements, performance of the Register technical supervision, submission of the necessary documentation to the Register surveyors and the fulfillment of the requirements of the Register surveyors issued upon the survey results.

1.1.4. The Register classification activities do not preclude the set activities of other state supervision bodies, ship owners, flag state maritime administrations and port administrations.

1.1.5. Steel ship surveyed in accordance with the Rules for Maintenance and Survey for existing Ships and Classification of Steel Ships (hereinafter referred to as the Rules) published by Class PMDS or alternatives found to represent an overall safety standard equivalent to that of the Rules will be assigned a class in the Register of Ships and will continue to be classed so long as they are found, upon examination at the prescribed surveys, to be maintained in a fit and efficient condition and in accordance with the requirements of the Rules.

1.1.6. The Rules do not cover certain technical characteristics, such as stability, trim, hull vibration, etc., but the Society is willing to advice on such matters although it cannot assume responsibility for them.

1.2. Equivalence

The Society may consider the acceptance of alternatives to the Rules, provided that they are deemed to be equivalent to the Rules to the satisfaction to the Society.

1.3. Special considerations for the application to Bulk Carriers and Oil Tankers

1.3.1. Bulk carriers with unrestricted international navigation, having length of 90 m or above and contracted for construction on or after 1 April 2006, are to comply with Appendix 1 (CSR-B). Issues other than those specified in Appendix 1 (CSR-B) are to comply with the provisions of other Parts of the Rules, with appropriate consideration to related provisions of Appendix 1 (CSR-B).
1.3.2. Double hull oil tankers with unrestricted international navigation, having length of 150 m or above and contracted for construction on or after 1 April 2006, are to comply with Appendix 2 (CSR-T). Issues other than those specified in Appendix 2 (CSR-T) are to comply with the provisions of other Parts of the Rules, with appropriate consideration to related provisions of Appendix 2 (CSR-T).

1.3.3. For the provisions of 1.3.1 and 1.3.2 above, the following definitions are to apply.

1.3.3.1. Length of ship is the distance, in meters, measured on the summer load waterline, from the forward side of the stem to the after side of the rudder post, or to the centre of the rudder stock where there is no rudder post. This length is to be not less than 96% and need not exceed 97% of the extreme length on the summer load waterline.

1.3.3.2. Bulk carrier means a sea going self-propelled ship which is constructed generally with single deck, double bottom, hopper side tanks and topside tanks, and with single or double side skin construction in cargo length area; and intended primarily to carry dry cargoes in bulk, excluding ore carriers and combination carriers.

1.3.3.3. Oil tanker means a ship constructed or adapted primarily to carry oil in bulk in its cargo spaces and including combination carriers and any chemical tanker when it is carrying a cargo or part cargo of oil in bulk. Double hull oil tanker means an oil tanker 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.

1.3.4. Notwithstanding the provisions of 1.3.1, above, ships which have at least one cargo hold constructed with hopper tanks and topside tanks as specified in 1.3.3.2 above, apply Appendix 1 (CSR-B). In this case, the structural strength of members in holds constructed with hopper tank and/or topside tank is to comply with the strength criteria specified in Appendix 1 (CSR-B).

Section 2 Period of Validity

2.1. Period of validity of the Certificate of class is normally not longer than 5 (five) years.

2.2. When the Renewal survey is completed:

2.2.1. Within 3 (three) months before the expiry date of the existing Certificate of class, the new Certificate of class shall be valid from the date of completion of the Renewal survey to a date not exceeding allowable period of validity of the Certificate of class counting from the date of expiry of the existing certificate.

2.2.2. After the expiry date of the existing Certificate of class, the new Certificate of class shall be valid from the date of completion of the Renewal survey to a date not exceeding allowable period of validity of the Certificate of class counting from the date of expiry of the existing Certificate of class.

2.2.3 More than 3 (three) months before the expiry date of the existing Certificate of class, the new Certificate of class shall be valid from the date of completion of the renewal survey to a date not
exceeding allowable period of validity of the Certificate of class counting from the date of completion of the Renewal survey.

2.3. Annual Survey
2.3.1. Shall be carried out between special surveys (or between initial and special survey) within three months before or after each anniversary date of the Classification Certificate. In case whereas any annual survey is due and not completed in time, within any given window period, PMDS Technical Committee will decide upon validating an “Occasional survey equivalent to an Annual Survey”, on a case-by-case basis.

2.3.2. If an annual or intermediate survey is completed before the beginning of a specified survey window (early survey), a new anniversary date shall be stated in the Classification Certificate, and the subsequent annual or intermediate surveys shall be completed at the intervals prescribed by these Rules using the new anniversary date. A new anniversary date shall be fixed not later than 3 months after the survey completion date, and a new survey window shall be prescribed (+3months), respectively. Thus, the validity date of the Classification Certificate may be changed accordingly, namely, the completion of annual or intermediate survey before the beginning of a specified survey window (early survey) may lead to the reduction of current Classification Certificate validity period.

2.3.3. Annual surveys of a ship consist mainly of an external examination of items and their operational testing.

2.4. Intermediate Survey
2.4.1. Intermediate Survey is to be carried out within 3 months before or after the second or third anniversary date from the completion date of the initial Classification Survey or of the previous Special Survey. However, for passenger ships, submersibles, nuclear ships, hydrofoils, air cushion vehicles, high speed crafts, Intermediate Survey is to be carried out within 3 months before or after each anniversary date.

2.4.2. Intermediate Survey may be carried out in advance even if it is not due, upon application by an Owner. However, if Intermediate Survey is carried out more than 3 months earlier than the anniversary date, the anniversary date will be newly assigned to the date of 3 months later than the date on which the survey was completed. The subsequent Intermediate Survey shall be completed at the interval which will correspond to the new anniversary date.

2.5. Special Survey
2.5.1. Special survey for class renewal is intended for determining whether the ship's technical condition and structural and composition modifications of its items comply with the requirements of the Rules.

2.5.2. Special survey shall include survey of the outside of the ship's bottom in dry dock.

2.5.3. At special survey the ship owner shall submit technical documentation and ship documentation (documents of classification and other competent supervisory bodies, manufacturer's certificates, etc.) in
the scope required for verification of compliance with the technical requirements, parameters and characteristics, regulated by the Rules, also the ship owner shall provide necessary conditions for survey and testing of the items.

2.5.4. Special survey shall be carried out at 5 years intervals to renew the class in compliance with the requirements of the rules.

2.5.5. The first special survey shall be completed within 5 years from the date of the initial survey after construction and thereafter 5 years from the credited date of the previous special survey. In exceptional circumstances, an extension of class of 3 month maximum beyond the 5th year can be granted. In this case, the next period of class will start from the expiry date of special survey before the extension was granted.

2.6. Propeller Shaft Survey, are to be held according to:

2.6.1. Saturated steam pipes, and superheated steam pipes where the temperature of the steam at the super heater outlet does not exceed 450°C are to be surveyed ten years from the date of build (or installation) and thereafter at five year intervals.

2.6.2. Superheated steam pipes where the temperature of the steam at the super heater outlet is over 450°C are to be surveyed five years from the date of build (or installation) and thereafter at five-year intervals.

2.6.3. At ten years from the date of build (or installation) and thereafter at five year intervals, all copper or copper alloy steam pipes over 75 mm external diameter supplying steam for essential services at sea, are to be hydraulically tested to twice the working pressure.

2.7. Boiler Survey

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

2.7.2. 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 this rule. All studs fastening directly to boiler shells or heads, if provided, are to be examined.

2.7.3. 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.

2.7.4. 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.
2.7.5. Automatic combustion control devices, if provided, are to be tested under working condition.

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

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

2.7.8. At each annual survey, general examination is to be carried out.

2.8. Docking Survey
2.8.1. Survey of the outside of the ship's bottom is carried out in order to periodically check the technical condition of the underwater hull bottom, openings, bottom and side valves, external underwater parts of rudder and steering gear, propulsion plant and navigational equipment.

2.8.2. There shall be a minimum of two surveys of the outside of the ship's bottom and related items during each five-year special survey period.
One such examination shall be carried out in conjunction with the special survey, which may begin not earlier than 15 months prior to the due date of the special. In all cases the interval between these two surveys shall not exceed 36 months.
Extension of survey of the outside of the ship's bottom of 3 months beyond the due date may be granted in exceptional circumstances (documented evidence of unavailability of dry-docking facilities; unavailability of repair facilities; unavailability of essential materials, equipment or spare parts; or delays incurred by action taken to avoid severe weather conditions). In this case, it shall be noted that the requirements of the SOLAS-74/78 do not permit extension of surveys of the outside of the ship's bottom, if the interval between such two surveys exceeds 36 months, therefore three month extension beyond the due interval may be applied only to the ships not covered by the SOLAS-74/78 requirements.

2.8.3. Generally, survey of the outside of the ship's bottom and related items shall be carried out in dry dock.

Section 3 Class Notations
3.1. H
This class notation is to be assigned to the ship’s hull which in all their parts complies with the Rules for the draught required.

3.2. M
This class notation is to be assigned to the machinery including propelling and essential auxiliary machinery and all other equipment covered by the classification which complies with the Rules.
3.3.
For ships complying with additional requirements and/or those exempted from requirements related to the subjects specified in the following paragraphs in accordance with the provisions of these Rules, an appropriate notation is affixed to the Classification Characters in accordance with the provisions of structural materials for main hull as follows:

3.3.1. **Restricted services**
For ships classed to be engaged in restricted services, an appropriate notation is affixed to the Classification Characters as follows:

3.3.1.1.
Area I means an area in open seas in which the ship in the course of navigation is not more than 200 miles from a place of refuge, the permissible distance between places of refuge not exceeding 400 miles.

Area II means an area in open seas in which the ship in the course of navigation is not more than 50 miles from a place of refuge, the permissible distance between places of refuge not exceeding 100 miles.

Area III Coastal navigation up to 25 miles from a shelter place and a distance between two shelter places up to 50 miles.

For ships engaged in service restricted to only coastal areas within generally 20 miles from the nearest land or areas deemed equivalent by the Society (hereinafter, referred to as smooth water service):

**Coasting Service (Abbreviated to CS)**

3.3.1.2. For ships engaged in service restricted to only calm water areas generally sheltered from the open sea by land or areas deemed equivalent by the Society (hereinafter, referred to as smooth water service):

**Smooth Water Service (abbreviated to SWS)**

3.3.1.3. For Ships that are classed on their relationship with shore support facilities and that are engaged in service within a specific sea area where the aforementioned shore support can reach; or ships operated when moored or positioned in a specific sea area:

**Designated Service Area (abbreviated to DSA)**

3.3.1.4. For ships other than those specified above that are engaged in restricted service where the Rules deemed necessary by the Society are applied, an appropriate notation may be affixed.

3.3.2. **Structural Materials for Main Hull**
For ships that use materials other than steel as the structural material for the main hull in accordance with the provisions, materials other than steels complying with IACS Rules (Materials) are used for the main hull structure, the use of such materials and corresponding scantlings are to be at the discretion of the
Society or with the exception of the requirements *, the construction and scantlings where high tensile steels are used are to be at the discretion of Society.

* The section modulus of the transverse sections of the hull is not to be less than the value obtained by multiplying the following coefficient. Moreover, the extent of high tensile steel use is to be in accordance with the discretion of the Society.

- 0.78: where high tensile steels AH32, DH32, EH32 and FH32 are used
- 0.72: where high tensile steels AH36, DH36, EH36 and FH36 are used
- 0.68: where high tensile steels AH40, DH40, EH40 and FH40 are used

3.3.2.1. For ships made of aluminum alloy:

**Aluminium Alloy (abbreviated to AL)**

3.3.2.2. For ships other than those specified in 3.3.2, a notation deemed appropriate by the Society may be affixed.

3.3.2.3. For ships made of Glass reinforced plastics:

**Glass reinforced plastics (abbreviated to GRP)**

3.3.3. **Hull construction and equipment**

3.3.3.1. For ships intended for the carriage of liquid cargoes in tank(s) integrated with their hull structures and complying with the provisions of **TANKERS** of the Rules as appropriate, the notation of Tanker is affixed to the Classification Characters. For such ships intended for carriage of flammable liquid cargoes (except those specified in 3.3.3.2 or 3.3.3.3 below) and complying with the appropriate requirements of the Rules, an additional notation corresponding to the flashpoints of the cargoes is affixed as follows.

3.3.3.1.1. For ships intended for the carriage of liquid cargoes having a flash point on and below 60°C other than oils:

**Tanker, flammable liquid-flash point on and below 60°C (abbreviated to TFLB)**

3.3.3.1.2. For ships intended for the carriage of liquid cargoes having a flash point above 60°C other than oils:

**Tanker, flammable liquid-flash point above 60°C (abbreviated to TFLA)**

3.3.3.1.3. For ships intended for the carriage of oils having a flash point on and below 60°C:

**Tanker, oils-flash point on and below 60°C (abbreviated to TOB)**

3.3.3.1.4. For ships intended for the carriage of oils having a flash point above 60°C:

**Tanker, oils-flash point above 60°C (abbreviated to TOA)**

3.3.3.2. Notwithstanding the provisions specified in 3.3.3.1, for ships carrying dangerous chemicals in bulk, an appropriate notation corresponding to the type of ships Chemical Tankers is affixed to the Classification Characters as follows.
3.3.3.2.1. For Type I ships: A type I ship is a chemical tanker intended to transport chapter 17 (IBC CODE) products with very severe environmental and safety hazards which require maximum preventive measures to preclude an escape of such cargo.

*Chemical Tanker Type I (abbreviated to CT I)*

3.3.3.2.2. For type II ships: A type II ship is a chemical tanker intended to transport products listed in chapter 17 (IBC CODE) with appreciably severe environmental and safety hazards which require significant preventive measures to preclude an escape of such cargo.

*Chemical Tanker Type II (abbreviated to CT II)*

3.3.3.2.3. For type III ships: A type III ship is a chemical tanker intended to transport products listed in chapter 17 (IBC CODE) with sufficiently severe environmental and safety hazards which require a moderate degree of containment to increase survival capability in a damaged condition.

*Chemical Tanker Type III (abbreviated to CT III)*

3.3.3.2.4. For ships complying with the requirements for both type II and type III ships:

*Chemical Tanker Types II & III (abbreviated to CT II&III)*

3.3.3.3. For ships carrying liquefied gases in bulk, an appropriate notation corresponding to the type of ships is affixed to the Classification Characters as follows:

3.3.3.3.1. For type 1G ships: is a gas carrier intended to transport products indicated in IGC Code which require maximum preventive measures to preclude the escape of such cargo.

*Liquefied Gas Carrier Type 1G (abbreviated to LGC 1G)*

3.3.3.3.2. For type 2G ships: is a gas carrier intended to transport products indicated in IGC Code which require significant preventive measures to preclude the escape of such cargo.

*Liquefied Gas Carrier Type 2G (abbreviated to LGC 2G)*

3.3.3.3.3. For type 2PG ships: is a gas carrier of 150m in length or less intended to transport products indicated in IGC Code which require significant preventive measures to preclude escape of such cargo, and where the products are carried in independent type C tanks for a MARVS of at least 0.7 MPa gauge and a cargo containment system design temperature of -55oC or above. Note that a ship of this description but over 150m in length is to be considered a type 2G ship.

*Liquefied Gas Carrier Type 2PG (abbreviated to LGC 2PG)*

3.3.3.3.4. For type 3G ships: is a gas carrier intended to carry products indicated in IGC Code which require moderate preventive measures to preclude the escape of such cargo;

*Liquefied Gas Carrier Type 3G (abbreviated to LGC 3G)*

3.3.3.4. For ships intended for the carriage of liquid cargoes in independent tank(s) (except those specified in 3.3.3.2 or 3.3.3.3 above), the notation of Tank Carrier (abbreviated to TC) is affixed to the Classification Characters. In this case, an additional notation corresponding to its cargoes may be affixed in the same manner as specified in 3.3.3.1 above.
3.3.3.5. For ships intended for the carriage of ore cargoes or similar cargoes having equivalent high density, generally having two longitudinal watertight bulkheads and a double bottom throughout the cargo spaces, the notation of Ore Carrier (abbreviated to OC) is affixed to the Classification Characters.

3.3.3.6. For ships intended for the carriage of dry cargoes in bulk, generally having a single deck, a double bottom, bilge hopper tanks and topside tanks in cargo spaces, the notation of Bulk Carrier (abbreviated to BC) is affixed to the Classification Characters. For such ships which have not been subject to the requirements for loading and/or unloading in multiple ports, the additional notation of No Multi-port loading/unloading (abbreviated to NO MP) is affixed to the notation specified in a) to c) below.

a) For ships of BC-A: Bulk Carrier-Type A (abbreviated to BC-A):
BC-A: Bulk carriers designed to carry bulk cargoes with a bulk cargo density of 1.0 t/m³ and above with specified holds empty at designed maximum load draught (hereinafter referred to as alternately loaded condition) and with all ballast tanks empty.

b) For ships of BC-B: Bulk Carrier-Type B (abbreviated to BC-B)
BC-B: Bulk carriers designed to carry bulk cargoes with a bulk cargo density of 1.0 t/m³ and above in a homogeneously loaded condition at designed maximum load draught with all ballast tanks empty.

c) For ships of BC-C: Bulk Carrier-Type C (abbreviated to BC-C)
BC-C: Bulk carriers designed to carry bulk cargoes with a bulk cargo density of less than 1.0 t/m³ in a homogeneously loaded condition at designed maximum load draught with all ballast tanks empty.

3.3.3.7. For Bulk carrier means a ship which is intended primarily to carry dry cargo in bulk, including such types as ore carriers and combination carriers the notation of BC-XII is affixed to the Classification Characters.

3.3.3.8. For ships intended for the carriage of containers, generally having a double bottom in cargo spaces, the notation of Container Carrier (abbreviated to CNC) is affixed to the Classification Characters.

3.3.3.9. For ships having cargo spaces not normally subdivided in any way and normally extending to either a substantial length or the entire length of the ship in which cargoes can be loaded and unloaded normally in a horizontal direction, the notation of Roll on-Roll off (abbreviated to RORO) is affixed to the Classification Characters.

3.3.3.10. For ships which are engaged in designated operations such as dredging, lifting heavy loads, firefighting, offshore supply, towing, etc. (hereinafter, referred to as work-ships), an appropriate notation is affixed to the Classification characters.

3.3.3.11. For structures positioned for a long period of time or semi-permanently at a specified sea area, a notation deemed appropriate by the Society may be affixed.
3.3.3.12. For floating offshore facilities which are not primarily intended for the transport of cargo and are positioned at specific oil producing sea areas for long periods of time or semi-permanently, which are also fitted with crude oil/petroleum gas production, storage and offloading systems, a notation deemed appropriate by the society may be affixed.

3.3.3.13. For floating structures intended for the carriage of cargoes in cargo holds, on decks and/or in tanks integrated with hull structures, not propelled by mechanical means (hereinafter referred to as barges), the notation of Barge (abbreviated to B) is affixed to the Classification Characters. Additional notation corresponding to hull structure and type of cargo is affixed as follows:

a) For barges of pontoon type intended for the carriage of cargoes only on upper decks:
   **Barge, Pontoon Type (abbreviated to BP)**

b) For barges intended for the carriage of liquid cargoes in tank(s) integrated with their hull structures. In this case, an additional notation corresponding to cargoes is affixed in the same manner as specified in 3.3.3.1 or 3.3.3.2, as appropriate:
   **Barge, Tanker (abbreviated to BT)**

c) For barges carrying liquefied gases in bulk. In this case, an additional notation corresponding to cargoes is affixed in the same manner as specified in 3.3.3.3:
   **Barge, Liquefied Gas Carrier (abbreviated to BLGC)**

3.3.3.14. For ships equipped for the carriage of dangerous goods (refer to Dangerous goods are those goods referred to in the IMDG Code, as defined in Chapter VII, Regulation 1.1 of the International Convention for Safety of Life at Sea 1974 (hereinafter, referred to as SOLAS), as amended.), the notation of Equipped for Carriage of Dangerous Goods (abbreviated to EQ C DG) is affixed to the Classification Characters.

3.3.3.15. For ships equipped for the carriage of motor vehicles with fuel in their tanks, the notation of Equipped for Carriage of Vehicles (abbreviated to EQ C V) is affixed to the Classification Characters.

3.3.3.16. For ships equipped for the carriage of coal, the notation of Equipped for Carriage of Coal (abbreviated to EQ C C) is affixed to the Classification Characters.

3.3.3.17. For ships equipped for the carriage of lumber cargoes, the notation of Equipped for Carriage of Lumber (abbreviated to EQ C LB) is affixed to the Classification Characters.

3.3.3.18. For ships strengthened for cargo operations with the use of a grab deemed as appropriate by the Society, the notation of GRAB is affixed to the Classification Characters.

3.3.3.19. For all ships dedicated seawater ballast tanks of all type of ships of not less than 500 gross tonnage engaged on international voyages and double-side skin spaces arranged in bulk carriers and Tankers engaged on international voyages of 150m in length and upwards (IMO Performance Standard
for Protective Coatings for Seawater Ballast tanks, etc. / / IMO resolution MEPC.215(82) as may be amended), the notation of *Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in All Types of Ships and Double-side Skin Spaces of Bulk Carriers and Tankers (abbreviated to PSPC-WBT)* is affixed to the Classification Characters.

3.3.3.20. Unless otherwise specified above, for ships deemed necessary by the Society, an appropriate notation may be affixed to the Classification Characters.

3.3.4. **Polar Class Ships and Ice Class Ships**

3.3.4.1. The following notation corresponding to the polar classes, is affixed to the Classification character

<table>
<thead>
<tr>
<th>Polar Class</th>
<th>Symbol</th>
<th>Ice Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar Class 1</td>
<td>PC1</td>
<td>Year round operation in all Polar waters</td>
</tr>
<tr>
<td>Polar Class 2</td>
<td>PC2</td>
<td>Year round operation in moderate multiyear ice condition</td>
</tr>
<tr>
<td>Polar Class 3</td>
<td>PC3</td>
<td>Year round operation in 2nd year ice which may include multiyear ice inclusion</td>
</tr>
<tr>
<td>Polar Class 4</td>
<td>PC4</td>
<td>Year round operation in 1st year ice which may include multiyear and/or 2nd year ice inclusion</td>
</tr>
<tr>
<td>Polar Class 5</td>
<td>PC5</td>
<td>Year round operation in medium 1st year ice which may include multiyear and/or 2nd year ice inclusion</td>
</tr>
<tr>
<td>Polar Class 6</td>
<td>PC6</td>
<td>Summer/autumn operation in medium 1st year ice which may include multiyear and/or 2nd year ice inclusion</td>
</tr>
<tr>
<td>Polar Class 7</td>
<td>PC7</td>
<td>Summer/autumn operation in thin 1st year ice which may include multiyear and/or 2nd year ice inclusion.</td>
</tr>
</tbody>
</table>

3.3.4.2. The following notation corresponding to the ice classes, is affixed to the Classification Characters

a) IA Super: Class IA Super Ice Strengthening (*abbreviated to IA SUPER IS*)

b) IA: Class IA Ice Strengthening (*abbreviated to IA IS*)

c) IB: Class IB Ice Strengthening (*abbreviated to IB IS*)

d) IC: Class IC Ice Strengthening (*abbreviated to IC IS*)

e) ID: Class ID Ice Strengthening (*abbreviated to ID IS*)

*Note: Ice Class is classified into the following five classes. It is the responsibility of the Owner to determine which class is most suitable for his requirements.*

3.3.5. **Application of Special Survey Scheme**
3.3.5.1. For oil tankers, chemical tankers and bulk carriers, for which enhanced surveys are carried out in class maintenance surveys, the notation of “Enhanced Survey Programme” (abbreviated to ESP) is affixed to the Classification Characters.

3.3.5.2. For ships approved for In-water Surveys, the notation of “In Water Survey” (abbreviated to IWS) is affixed to the Classification Characters.

3.3.5.3. For ships for which surveys based on the preventive maintenance system are carried out on the propeller shaft, the notation of “Propeller Shaft Condition Monitoring System” (abbreviated to PSCM) is affixed to the Classification Character.

3.4. Continuous Machinery Survey (CMS)
The Survey consists of open-up examinations of machinery and equipment specified in this rule which are to be carried out systematically, continuously and sequentially so that each survey interval for all CMS items does not exceed five years.

3.5. IGS, this notation will be assigned when a ship intended for the carriage of oil in bulk, or for the carriage of liquid chemicals in bulk, is fitted with an approved system for producing gas for inerting the cargo tanks.

3.6. UMS, this notation may be assigned when the arrangements are such that the ship can be operated with the machinery spaces unattended. It denotes that the control engineering equipment has been arranged, installed and tested.

3.7. CCS, this notation may be assigned when the arrangements are such that the machinery may be operated with continuous supervision from a centralized control station. It denotes that the control engineering equipment has been arranged, installed and tested.

3.8. IFP, this additional notation may be assigned where an integrated fire protection system is fitted to provide control and monitoring of all active fire protection and fixed fire extinguishing systems from a centralized fire-control station. It denotes that the integrated fire protection system has been arranged, installed and tested.

Section 4 Preparation for Survey

4.1 Notification
When a ship is to be surveyed in accordance with the Rules, it is the responsibility of the owners to notify the Surveyor at the place where they wish to undergo the survey. The Surveyor is to be advised of the survey a reasonable time in advance so that the survey can be carried out at the proper time.

4.2 Preparation for Surveys
4.2.1 All such preparations as required for classification, periodical and other surveys and thickness measurements specified in this part as well as those which may be required as necessary by the Surveyor in accordance with the provisions in this Rule are to be made by the Owners or their representatives at their responsibilities. The preparations are to include provisions of an easy and safe access, necessary facilities, certificates and records for the execution of the survey and thickness measurements, open-up examinations of equipment, removal of obstructions and cleaning. Inspection, measuring and test equipment, which Surveyors rely on to make decisions affecting classification are to be individually identified and calibrated to a standard deemed appropriate by the Society. However, the Surveyor may accept simple measuring equipment (e.g. rulers, measuring tapes, weld gauges) without individual identification or confirmation of calibration, provided they are of standard commercial design, properly maintained and periodically compared with other similar equipment or test pieces. The Surveyor may also accept equipment fitted on board a ship and used in examination of shipboard equipment (e.g. pressure, temperature or rpm gauges and meters) based either on calibration records or comparison of readings with multiple instruments.

4.2.2 An applicant is to submit a Survey Programme that details survey items as part of the preparation for the Special Survey of oil tankers, bulk carriers and ships carrying dangerous chemicals in bulk with integral tanks and for the Intermediate Surveys of bulk carriers, oil tankers and ships carrying dangerous chemicals in bulk with integral tanks over 10 years of age. To ships which do not engage in international voyage and classed for restricted service, such as having the class notation Coasting Service, Smooth Water Service, etc., this requirement need not apply.

4.2.3 An applicant for survey(s) is to arrange a supervisor (hereinafter referred to as owners representative) who is well conversant with the intended survey items for the preparation of the survey in order to provide the necessary assistance to the Surveyor according to his requests during the surveys.

4.2.4 Prior to the commencement of survey and measurement, a survey planning meeting is to be held by the surveyor(s), the owner s representative, the thickness measurement company representative, where involved, and the master of the ship or an appropriately qualified officer of the ship appointed by the master, ship owner or Company so as to ensure the safe and efficient conduct of the survey and measurement work to be carried out.

Section 5 Suspension of Class

5.1. Classification is automatically suspended and Certificate of class shall become invalid in the following cases:
5.1.1. When the Renewal survey has not been completed or is not under attendance for completion prior to resuming trading, by the due date.

5.1.2. When the Annual survey has not been completed within 3 (three) months of the due date of the annual survey, unless the vessel is under attendance for completion of the Annual survey.
5.1.3. When the Intermediate survey has not been completed within 3 (three) months of the due date of the third annual survey in each periodic survey cycle, unless the vessel is under attendance for completion of the Intermediate survey.

In above mentioned cases classification will be reinstated upon satisfactory completion of the surveys due.

Such surveys are to be credited from the date originally due.

However, the ship is disclassed from the date of suspension until the date class is reinstated.

Additionally, classification is automatically suspended and Certificate of class shall become invalid in the following cases also:

5.1.4. When conversions or alternations are carried out without the approval of Class PMDS.

5.1.5. If Class PMDS has not been informed when the ship sustains damage or defect

5.1.6. If the ship is not loaded and operated to the conditions or limitations stated in the Certificate of class and other pertinent documents (e.g. draught, area of navigation, sea state condition, type of cargo, main engine power output).

5.1.7. The ship’s class will be subject to a suspension procedure in following cases:

5.1.7.1. When Continuous survey items due or overdue at time of Annual or Intermediate survey, have not been dealt with or postponed by agreement.

5.1.7.2. When recommendations or conditions of class have not been dealt with, or postponed by agreement.

5.1.7.3. When non-payment of fees occurs.

In above mentioned cases classification will be reinstated upon verification that the overdue conditions of class and/or additional requirements of Class PMDS have satisfactorily been dealt up with. However, the ship is to be disclassed from the date of suspension until the date class is reinstated.

5.1.8. Vessels laid-up: In accordance with the Class PMDS prior to surveys coming due vessel need not be suspended when surveys addressed above become overdue.

However, vessels which are laid-up after being suspended as a result of surveys going overdue, remain suspended until the overdue surveys are completed.

5.1.9. Force Majeure: If, due to circumstances reasonably beyond the Owner (Company) or the control of the Register (limited to such cases as: damage to the ship, unforeseen inability of Class PMDS to attend the ship due to the governmental restrictions on right of access or movement of personnel, unforeseeable
delays in port or inability to discharge cargo due to unusually lengthy periods of severe weather, strikes, civil strife, acts of war, or other cases of force majeure) the ship is not in a port where the overdue surveys can be completed at the expiry of the periods allowed above, the Class PMDS may allow the ship to sail in class, directly to an agreed discharge port and, if necessary, hence, in ballast, to an agreed port at which the survey will be completed, provided that the Class PMDS:

5.1.9.1. Exams the ship’s records.

5.1.9.2. Carries out the due and/or overdue surveys and examination of conditions of class at the first port of call when there is an unforeseen inability of Class PMDS to attend the vessel in the present port, and

5.1.9.3. Has satisfied itself that the vessel is in condition to sail for one trip to a discharge port and subsequent ballast voyage to a repair facility if necessary. (Where there is unforeseen inability of the Class PMDS to attend the vessel in the present port, the master is to confirm that his ship is in condition to sail to the nearest port of call). If class has already been automatically suspended in such cases, it may be reinstated subject to the previously prescribed conditions.

5.1.10. When a vessel is intended for a demolition voyage with any periodical survey overdue, the vessel’s class suspension may be held in abeyance and consideration may be given to allow the vessel to proceed on a single direct ballast voyage from the lay up or final discharge port to the demolition yard. In such cases a short term Certificate of class with conditions for the voyage noted may be issued provided the attending surveyor finds the vessel in satisfactory condition to proceed for the intended voyage.

Section 6 Definitions

6.1. Ship
A floating unit intended for sea-going service with length greater than 12 meters and with gross tonnage greater than 15, or which carries more than 12 passengers.
The term ship comprises the following: passenger ships, cargo ships, technical floating units, fishing vessels, ships used by Authorities and research ships. The present definition does not apply to ships of war and troopships.

6.2. Register
Steel ships with their class approved by the Society are to be recorded in the Register. The Register is to be printed annually and is to contain the names of ships and other useful items of information such as class notations, owners, shipbuilders, dimensions, machinery particulars, the date of build, etc.

6.3. Anniversary Date
Means the day and month of each year which corresponds to the date of expiry of the relevant certificate;

6.4. Date of build
6.4.1. The date of build is normally to be the date of completion of the classification initial survey during construction of ships built under the inspection.
6.4.2. If the period between launching and completion or putting a ship to use is unduly made longer than usual, the date of launching may be additionally indicated in the Register.

6.4.3. If a ship is not immediately put into service after completion, but is laid up for a period, the ship is to be dry-docked for examination by the Surveyor of the Society (hereinafter referred to as the Surveyor) before proceeding to sea, and the subsequent special survey is based on the date of such an examination provided that the result of such survey is satisfactory in all respects.

6.5. Damage, repairs and alternations
Any damage, defect, breakdown or grounding, which could invalidate the conditions for which a class has been assigned, is to be reported to the Society without delay.

6.6. Length of ship (L)
Is the Length as defined in the International Convention on Load Lines in force.

6.7. Length of Freeboard
Length means 96% of the total length on a waterline at 85% of the least moulded depth measured from the top of the keel, or the length from the fore side of the stem to the axis of the rudder stock on that waterline, if that be greater. In ships designed with a rake of keel the waterline on which this length is measured shall be parallel to the designed waterline.

6.8. Breadth of Ship
The breadth of ship (B) is the greatest moulded breadth of the ship at or below the deepest subdivision draught.

6.9. Moulded Breadth
The breadth for freeboard is the maximum horizontal distance in metres from outside of frame to outside of frame measured at the middle.

6.10. Depth of Ship
The depth of ship (D) is the vertical distance in metres, measured at the middle of L, from the top of the keel to the top of the freeboard deck beam at side.

6.11. Moulded Depth
6.11.1. The vertical distance measured from the top the keel to the top of the freeboard deck beam at side. In wood and composite ships the distance is measured from the lower edge of the keel rabbet. Where the form at the lower part of the amidships section is of a hollow character, or where thick garboards are fitted, the distance is measured from the point where the line of the flat of the bottom continued inwards cuts the side of keel;

6.11.2. in ships having rounded gunwales, it shall be measured to the point of intersection of the molded lines of the deck and side shell plating, the lines extending as though the gunwale were of angular design;
6.11.3. where the freeboard deck is stepped and raised part of the deck extends over the point at which the molded depth is to be determined, it should be measured to a line of reference extending from the lower part of the deck along a line parallel with the raised part;

6.12. Gross tonnage
Means the tonnage as measured in accordance with the International Tonnage Convention, 1969, and for ships of less than 24 m in length in accordance with the relevant national rule;

6.13. Freeboard deck
Means, normally, the uppermost complete deck exposed to weather and sea, which has permanent means of closing all openings in the weather part thereof, and below which all openings in the sides of ship are fitted with permanent means of watertight closing, In a ship having a continuous freeboard deck, the lowest line of the deck and the continuation of that line parallel to the upper part of the deck is taken as the freeboard deck. At the option of the owner and subject to the approval of the Administration, a lower deck may be designated as the freeboard deck provided it is a complete and permanent deck. At the option of the owner and subject to the approval of the Administration, a lower deck may be designated as the freeboard deck, than part of the is taken as the freeboard deck. When o lower deck us designated as the freeboard deck, that part of the hull which extends above the freeboard deck is treated as a superstructure so far as concerns the application of the conditions of assignment and the calculation of freeboard. It is from this deck that the freeboard is calculated.

A horizontal plane which crosses amidships the top of a flat keel or the intersection of the inner surface of the plating with the bar keel.

6.15. Midship
The midship of ship is the part 0.4L amidships unless otherwise specified.

6.16. Amidships
Is at the middle of the length (L).

6.17. End Parts of Ship
The end parts of ship are the parts 0.1L from each end of the ship.

6.18. Cargo length area
That part of the ship, which contains cargo holds, cargo tanks, slop tanks and cargo pump-rooms, including other pump rooms, cofferdams, ballast and void spaces adjacent to cargo holds and cargo tanks and also deck areas throughout the entire length and breadth of the part of the ship over the above mentioned spaces.
6.19. Perpendiculars
Means the forward and after perpendiculars taken at the forward and after ends of the length (L). The forward perpendicular shall coincide with the foreshide of the stem on the waterline on which the length is measured;

6.20. Full Load Displacement
Full load displacement is the moulded displacement in tons corresponding to the full load condition

6.21. Block Coefficient
Is given by formula: \( C_b = \frac{V}{L \cdot B \cdot T} \); where
- \( V \) is the volume of the moulded displacement of the ship, excluding bossing, in a ship with a metal shell, and is the volume of displacement to the outer surface of the hull in a ship with a shell of any other material, both taken at a molded draught of \( T \); and where
- \( T \) is 85 percent of the least molded depth;
- \( L \) is the length as defined in this rule;

6.22. Freeboard Deck
The uppermost deck officially considered to be watertight: used as the level from which the Plimsoll marks are measured. (On a cargo vessel)

6.23. Bulkhead deck
Is the uppermost deck up to which transverse watertight bulkheads are carried.

6.24. Spaces
Separate compartments, including holds and tanks.

6.25. Special Consideration
Close up inspection and thickness measurements which are sufficient to confirm the actual average condition of the structure under the coating.

6.26. Superstructures
Any construction built above the main deck of a vessel as an upward continuation of the sides.

6.27. Enclosed Superstructures
The enclosed superstructure is the superstructure complying with the following conditions:
6.27.1. Access openings in the end bulkheads of the superstructure are provided with doors.

6.27.2. All other openings in side or end bulkheads of the superstructure are provided with efficient weathertight means of closing.
6.28. Classification cycle
A cyclical period starting from the date of completion of the Initial Survey for Assignment of Class, performed after the ship's construction completion or from the date of Class Renewal Survey completion, equal to class validity period (in general 5 years) and covering all due Periodical Surveys.

6.29. Class of a ship
Compliance of the ship’s structure, workmanship and condition (the condition of hull, machinery, installations, equipment) with the relevant requirements of the Rules, confirmed by assignment of class and the issue of the Certificate of Class.

6.30. Coating condition
Is defined as follows:
6.30.1. GOOD
Condition with only minor spot rusting;

6.30.2. FAIR
Condition with local breakdown at edges of stiffeners and weld connections or light rusting over 20% or more of the area under consideration, but less than defined as POOR condition;

6.30.3. POOR
Condition is general breakdown of coating over 20% or more of the area or hard scale at 10% or more of the area under consideration.

6.31. Maximum Continuous Output of Engine
Maximum continuous output of engine is the maximum output at which the engine can run safely and continuously in the design condition (the full load running condition for a main engine)

6.32. Deadweight Tonnage
Is the difference in tons between full load displacement and light weight.

6.33. Light Weight
Light Weight is the displacement in tons excluding cargoes, fuel oil, lubricating oil, ballast and fresh water in tanks, stored goods, and passengers and crew and their effects.

6.34. Machinery Space
Machinery spaces are all machinery spaces of category A and all other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces.

6.35. Cargo Space
Cargo spaces are all spaces used for cargo (including cargo oil tanks) and trunks to such spaces.
6.36. Cargo Area
Cargo area is that part of the ship that contains cargo tanks, slop tanks and cargo pump rooms including pump rooms, cofferdams, ballast and void spaces adjacent to cargo tanks and also deck areas throughout the entire length and breadth of the part of the ship over the aforementioned spaces.

6.37. Accommodation Space
Accommodation spaces are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobby rooms, barber shops, pantries containing no cooking appliances and similar spaces.

6.38. Watertight
Watertight means having scantlings and arrangements capable of preventing the passage of water in any direction under the head of water that is likely to occur in intact and damaged conditions. In the damaged condition, including intermediate stages of flooding, the head of water is to be considered in the worst situation at equilibrium.

6.39. Weathertight
Weathertight means that in any sea conditions water will not penetrate into the ship.

6.40. Low flame spread
Means that the surface thus described will adequately restrict the spread of flame, this being determined to the satisfaction of the Administration by an established test procedure.

6.41. Main steering gear
Is the machinery, rudder actuators, steering gear power units, if any, and ancillary equipment and the means of applying torque to the rudder stock (e.g. tiller or quadrant) necessary for effecting movement of the rudder for the purpose of steering the ship under normal service conditions;

6.42. Keel line
Keel line is a line parallel to the slope of the keel passing amidships through the top of the keel at the centerline or at the line of intersection of the inside of a shell plating with the keel if a bar keel extends below that line, on a ship with a metal shell.

6.43. 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. Surveyor will be normally within the reach of hand

6.44. Tanker
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).

The ship type notation CHEMICAL TANKER, or equivalent, and the notation ESP are assigned to sea-going self-propelled ships, which are constructed generally with integral tanks and intended primarily to carry chemicals in bulk.
These type notations are assigned to tankers of both single and double hull construction, as well as tankers with alternative structural arrangements. Typical midship sections:

The ship type notation **ORE CARRIER/CRUDE OIL TANKER**, or equivalent, and the notation **ESP** are assigned to sea-going self-propelled ships which are constructed generally with single deck, two longitudinal bulkheads and a double bottom throughout the cargo length area and intended primarily to carry ore cargoes in the centre holds or of oil cargoes in centre holds and wing tanks. Typical midship sections:

The ship type notation **OIL/BULK/ORE CARRIER**, or equivalent, and the notation **ESP** are assigned to sea-going self-propelled ships which are constructed generally with single deck, double bottom, hopper side tanks and topside tanks, and with single or double side skin construction in the cargo length area, and intended primarily to carry oil or dry cargoes, including ore, in bulk.

6.45. A general dry cargo ship

Is a cargo ship carrying solid cargoes other than bulk carriers, dedicated container carriers, dedicated forest product carriers (not timber or log carriers), ro-ro cargo ships, refrigerated cargo ships, dedicated wood chip carriers and dedicated cement carriers.
6.46. A bulk carrier

Is a ship which is constructed generally with hopper side tanks and topside tanks in cargo spaces and intended primarily to carry dry cargo in bulk. It includes a vessel of such type as ore carrier or combination carrier.

The ship type notation BULK CARRIER, or equivalent, and the notation ESP are assigned to sea-going self-propelled ships which are constructed generally with single deck, double bottom, hopper side tanks and topside tanks and with single or double side skin construction in cargo length area and intended primarily to carry dry cargoes in bulk.

6.47. Non convention sized vessel

This means a ship or barge not covered by the international conventions.

6.48. Exiting ship

This means a ship which is not a new ship.

6.49. A transverse section

This includes all longitudinal members such as plating, longitudinal and girders at the deck, side, bottom, inner bottom and hopper side plating, longitudinal bulkhead and bottom plating in top wing tanks.

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

6.51. A ballast tank

Is a tank which is being used solely for water ballast, or a tank which is used for both bulk cargo and ballast will be treated as a ballast tank when Substantial Corrosion has been found in that tank.

6.52. 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.
6.53. 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.

6.54. Main source of electrical power
Is a source intended to supply electrical power to the main switchboard for distribution to all services necessary for maintaining the ship in normal operational and habitable condition.

6.55. Emergency source of electrical power is a source of electrical power, intended to supply the emergency sw.

6.56. Main switch board
Is a switchboard which is directly supplied by the main source of electrical power and is intended to distribute electrical energy to the ship' services.

6.57. Margin line
Is a line drawn at least 76 mm below the upper surface of the bulkhead deck at side.

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

6.59. Substantial corrosion:
Is an extent of corrosion such that assessment of corrosion pattern indicates wastage in excess of 75% of allowable margins, but within acceptable limits. Notwithstanding the above, for the following 6.59.1 to 6.59.3, substantial corrosion is an extent of corrosion such that the assessment of the corrosion pattern indicates a gauged (or measured) thickness which is within the range of 0.5 mm to the renewal thickness stipulated in this rule. Renewal thickness refers to the minimum allowable thickness below which the renewal of structural members is to be carried out.
6.59.1. For ships complying with the provisions of this rule.

6.59.2. For hatch covers and hatch coamings for cargo holds of the ships stipulated otherwise by the society.

6.59.3. For transverse watertight bulkheads in cargo hold complying with the provision of this rule.

6.60. Pitting corrosion is defined as scattered corrosion spots/areas with local material reductions which are greater than the general corrosion in the surrounding area. Pitting intensity is defined in Fig. 6.60.1.

6.61. Edge corrosion is defined as local corrosion at the free edges of plates, stiffeners, primary support members as well as around openings. An example of edge corrosion is shown in Fig. 6.61.1.
6.62. Grooving corrosion is defined as local corrosion adjacent to weld joints along abutting stiffeners or at stiffener or plate butts or seams. An example of grooving corrosion is shown in Fig. 6.62.1.

Fig. 6.60.1 Pitting intensity diagram

5% Scattered

20% Scattered

10% Scattered

25% Scattered

15% Scattered

Fig. 6.60.2 Edge corrosion

Attached plating

Flatbar stiffener

0.25\(d_{eq}\)

Attached plating

Inverted angle or built-up stiffener

0.25\(d_{eq}\)
Fig. 6.60.3 Grooving corrosión
Section 1 Bulk Carriers

1. General

1.1. The present requirements apply to all self-propelled bulk carriers.

1.2. This Chapter applies to ships classed in accordance with the provisions in this Chapter and built for the purpose of carrying bulk. Where the ship is specifically reinforced for the carriage of heavy density cargoes and/or special loading arrangements, it is to be distinguished in the classification symbol and the Register with an additional notation describing which cargo holds may be empty and if required what kind of cargo is intended to be carried. Full particulars of the loading conditions and the maximum density of the cargo to be intended for are to be specified on the basic construction drawings.

1.3. The requirements contain the minimum extent of examination, thickness measurement and tank testing. The survey should be extended when Substantial Corrosion and/or structural defects are found and include additional Close-Up Survey when necessary.
1.4. Bulk carriers to which freeboards are assigned based on the subdivision requirements of the International Convention on Load Lines, 1996, are to comply with those regulations.

2. Annual Surveys

2.1. General

The survey shall 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. The satisfactory condition of hatch coaming plating and their stiffener should be checked.

2.2. Hull Examinations

2.2.1. Examination of the hull plating and its closing appliances as far as can be seen.

2.2.2. Examination of watertight penetrations as far as practicable.

2.2.3. External examination of all air pipe heads.

2.3. Examination of weather decks, hatch covers and coamings

2.3.1. 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:

2.3.1.1. Stowage and securing in open condition;

2.3.1.2. Proper fit and efficiency of sealing in closed condition; and

2.3.1.3. 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.

2.3.2. If there are indications of difficulty in operating and securing hatch covers, additional sets above those required by 2.3.1, at the discretion of the surveyor, are to be tested in operation.

2.3.3. Where the cargo hatch securing system does not function properly, repairs are to be carried out under the supervision of the Society.

2.3.4. For each cargo hatch cover set, at each annual survey, the following items are to be surveyed:

2.3.4.1. Cover panels, including side plates, and stiffener attachments that may be accessible in the open position by close-up survey (for corrosion, cracks, deformation);
2.3.4.2. 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);

2.3.4.3. Clamping devices, retaining bars, cleating (for wastage, adjustment, and condition of rubber components);

2.3.4.4. Wires, chains, tensioners, and gypsies;

2.3.4.5. Closed cover locating devices (for distortion and attachment);

2.3.4.6. Stoppers

2.3.4.7. Guide rails and track wheels;

2.3.4.8. Guides;

2.3.4.9. End and interpanel hinges pins and stools where fitted;

2.3.4.10. Hydraulic system, electrical safety devices and interlocks; and

2.3.4.11. Chain or rope pulleys.

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

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

2.3.7. Where portable covers, wooden or steel pontoons are fitted, the satisfactory condition of the following should be confirmed:

2.3.7.1. Wooden covers and portable beams, carriers or sockets for the portable beam, and their securing devices;

2.3.7.2. Steel pontoons, including close up survey of hatch cover plating;

2.3.7.3. Tarpaulins;

2.3.7.4. Cleats, battens and wedges;
2.3.7.5. hatch securing bars and their securing devices;

2.3.7.6. Loading pads/bars and the side plate edge;

2.3.7.7. guide plates and chocks;

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

2.3.8. Examination of flame screens on vents to all bunker tanks.

2.3.9. The satisfactory condition of hatch coaming plating and their stiffener should be checked, including close-up survey.

2.3.10. Random checking of the satisfactory operation of mechanically operated hatch covers should be made, including:
2.3.10.1. Stowage and securing in open condition

2.3.10.2. Proper fit and efficiency of sealing in closed condition

2.3.10.3. Operational testing of hydraulic and power components, wires, chains, and link drives.

2.3.10.4. Examinations of flame screens on vents to all bunker tanks.

2.3.10.5. Examinations of bunker and vent piping systems, including ventilators.

2.3.11. Examination of bunker and vent piping systems, including ventilators.

2.4. Examination of cargo holds
2.4.1. Bulk carriers 10-15 years of age, the following is to apply:
2.4.1.1. Overall survey of all cargo holds.

2.4.1.2. 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 than 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

2.4.1.3. When considered necessary by the surveyor, 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 should be increased in accordance with Table 1. 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.

2.4.1.4. 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.

2.4.1.5. All piping and penetrations in cargo holds, including overboard piping, are to be examined.

Table 1: Bulk carriers - Extent of thickness measurements at areas of substantial corrosion (to be continued)

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of measurement</th>
<th>Pattern of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shell Structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Bottom and side shell plating</td>
<td>Suspect plate, plus four adjacent plates</td>
<td>5 point pattern for each panel between longitudinals</td>
</tr>
<tr>
<td></td>
<td>See other tables for particulars on gauging in way tanks and cargo holds</td>
<td></td>
</tr>
<tr>
<td>2. Bottom / side shell longitudinals</td>
<td>Minimum of three longitudinals in way of suspect areas</td>
<td>3 measurements in line across web</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 measurements on flange</td>
</tr>
<tr>
<td><strong>Transverse bulkheads in cargo holds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Lower stool</td>
<td>Transverse band within 25mm of welded connection to inner bottom.</td>
<td>5 point between stiffeners over 1m length</td>
</tr>
<tr>
<td></td>
<td>Transverse band within 25mm of welded connection to shelf plate.</td>
<td>5 point between stiffeners over 1m length</td>
</tr>
<tr>
<td>2. Transverse bulkhead</td>
<td>Transverse band at mid – height</td>
<td>5 point pattern over 1m$^2$ of plating</td>
</tr>
<tr>
<td></td>
<td>Transverse band at part of bulkhead adjacent to upper deck or below upper stool shelf plate (for those ships fitted with upper stools)</td>
<td>5 point pattern over 1m$^2$ of plating</td>
</tr>
</tbody>
</table>

2.4.2. Bulk carriers over 15 years of age, the following is to apply:

2.4.2.1. Overall survey of all cargo holds.

2.4.2.2. Close-up examination of sufficient extent, minimum 25% of frames, to establish the condition of the lower region of the shell frames including approximately lower than 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;
2.4.2.3. When considered necessary by the surveyor, or where extensive corrosion exists, thickness measurement should be carried out. If the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements should be increased in accordance with Table 2. 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.

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

2.4.2.5. All piping and penetrations in cargo holds, including overboard piping.

**Table 2: Bulk carriers - Extent of thickness measurements at areas of substantial corrosion**

*(To be continued)*

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of measurement</th>
<th>Pattern of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck Structure including cross strips, main cargo hatchways, hatch covers, coamings and topside tanks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cross deck strip plating</td>
<td>Suspect cross deck strip plating</td>
<td>5 point pattern between underdeck stiffeners over 1m length</td>
</tr>
<tr>
<td>2. Under deck stiffeners</td>
<td>Transverse members</td>
<td>5 point pattern at each end and mid-span</td>
</tr>
<tr>
<td></td>
<td>Longitudinal member</td>
<td>5 point pattern on both web and flange</td>
</tr>
<tr>
<td>3. Hatch Covers</td>
<td>Side and end skirts, each 3 locations</td>
<td>5 point pattern at each location</td>
</tr>
<tr>
<td></td>
<td>3 longitudinal bands, outboard strakes (2) and centerline strake (1)</td>
<td>5 point measurement each band</td>
</tr>
<tr>
<td>4. Hatch coamings</td>
<td>Each side and end of coaming, one band lower 1/3, one band upper 2/3 of coaming</td>
<td>5 point measurement each band</td>
</tr>
<tr>
<td>5. Topside water ballast tanks</td>
<td>Watertight transverse bulkheads: Lower 1/3 of bulkhead, Upper 2/3 of bulkhead, Stiffeners</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>2 representative swash transverse bulkheads: Lower 1/3 of bulkhead, Upper 2/3 of bulkhead, Stiffeners</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>3 representative bays of slope plating: Lower 1/3 of tank, Upper 2/3 of tank</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>Longitudinals, suspect and adjacent</td>
<td>5 point pattern over 1m²</td>
</tr>
<tr>
<td>6. Main deck plating</td>
<td>Suspect plates and adjacent</td>
<td>5 point pattern over 1m²</td>
</tr>
<tr>
<td>7. Main deck longitudinals</td>
<td>Minimum of 3 longitudinals where plating measured</td>
<td>5 point pattern on both web and flange over 1m length</td>
</tr>
<tr>
<td>8. Web frames / Transverses</td>
<td>Suspect plates</td>
<td>5 point pattern over 1m²</td>
</tr>
</tbody>
</table>
### (Conclusion)

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent Measurement</th>
<th>Pattern of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Double bottom and Hopper structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Inner/Double bottom plating</td>
<td>Suspect plate plus all adjacent plates</td>
<td>5 point pattern for each panel between longitudinals over 1m length</td>
</tr>
<tr>
<td>2. Inner/Double bottom longitudinals</td>
<td>3 longitudinals where plates measured</td>
<td>3 measurements inline across web, and 3 measurements on flange</td>
</tr>
<tr>
<td>3. Longitudinal girders or transverse floors</td>
<td>Suspect plate</td>
<td>5 point pattern over about 1m²</td>
</tr>
<tr>
<td>4. Watertight bulkheads (WT floors)</td>
<td>• Lower 1/3 of tank • Upper 2/3 of tank</td>
<td>5 point pattern over 1m² of plating 5 point pattern alternate plates over 1m² of plating</td>
</tr>
<tr>
<td>5. Web frames</td>
<td>Suspect plates</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td>6. Bottom / side longitudinals</td>
<td>Minimum of three longitudinals in way of suspect areas</td>
<td>3 measurements in line across web 3 measurements on flange</td>
</tr>
</tbody>
</table>

| Cargo Holds | | |
| 1. Side shell frames | Suspect frame and each adjacent | At each end and midspan: 5 point pattern of both web and flange. 5 point pattern within 25 mm of welded attachment to both shell and lower slope plate |

2.5. Examinations of ballast tanks

Examination of ballast tanks should be carried out 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, 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 should be increased in accordance with Table 2. 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.

2.6. Additional annual survey requirements for the foremost cargo hold of ships subject to SOLAS XII/9.1

2.6.1. Ships subject to SOLAS XII/9.1 are those meeting all the following conditions:

2.6.1.1. Bulk Carriers of 150 m in length and upwards of single side skin construction

2.6.1.2. Carrying solid bulk cargoes having a density of 1780 kg/m³ and above,

2.6.1.3. Contracted for construction before 1 July 1999, and

2.6.1.4. 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.
2.6.2. In accordance with SOLAS XII/9.1, for the foremost cargo hold of such ships, the additional survey requirements listed below shall apply.

2.6.3. Extent of Survey: (IACS UR Z10.2 ANNEX IV (Rev. 26 Nov. 2007))

2.6.3.1. For bulk carriers of 5 – 15 years of age:
2.6.3.1.1. 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:
   2.6.3.1.1.1. Shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads.

   2.6.3.1.2. Areas found suspect according to the previous Special Survey.

   2.6.3.1.2. Where considered necessary by the surveyor as a result of the Overall and Close-up Survey as described in (2.7.3.1.1) above, the survey is to be extended to include a Close-up Survey of all of the shell frames and adjacent shell plating of the cargo hold.

2.6.3.2. For bulk carriers exceeding 15 years of age:
2.6.3.2.1. An Overall Survey of the foremost cargo hold, including Close-up Survey is to be carried out to establish the condition of:
   2.6.3.2.1.1. All shell frames including their upper and lower end attachments, adjacent shell plating, and transverse bulkheads.

   2.6.3.2.1.2. Areas found suspect according to the previous Special Survey.

2.7. Extent of Thickness Measurement:
2.7.1. 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 (3.1.1) and (3.1.3) above. The minimum requirement for thickness measurements is areas found to be Suspect Areas according to the previous Special Survey. Where Substantial Corrosion is found, the extent of thickness measurements should be increased in accordance with the requirements of Table 2.

2.7.2. 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.

2.8. Special Consideration
Where the protective coating in the foremost cargo hold, is found to be in GOOD condition, the extent of close-up surveys and thickness measurements may be specially considered.

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 a surveyor.
2.9. Additional annual survey requirements after determining compliance with SOLAS XII/12 and XII/13

2.9.1. 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.

2.9.2. 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.

3. Intermediate Survey

3.1. General

3.1.1. At each intermediate survey for hull, in addition to all the requirements for annual survey in point 2, the following additional applicable requirements in 2.6. are also to be complied with depending on the type of ship.

3.1.2. Additional hull requirements for ships other than tankers, combination carriers and bulk carriers, Ships of age over 5 years and up to 10 years:
An internal general 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:
3.1.2.1. If such inspections reveal no visible structural defects, the examination may be limited to verification that the coatings remain efficient.

3.1.2.2. Where no protective coating, soft coating or Poor coating condition without dealing with is found, the examination is to be extended to other ballast spaces of the same type.

3.1.2.3. In ballast tanks, where no protective coating, soft 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.

3.2. Ships over 10 years of age:
An internal general examination of all sea water ballast tanks is to be carried out as follows:
3.2.1. If such inspection reveals no visible structural defects, the examination may be limited to verification that the coatings remain efficient.

3.2.2. In ballast spaces other than double bottom tanks, where no protective coating, soft 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.

3.2.3. Also in case of double bottom tanks, annual surveys may have to carry out.
3.2.4. In addition to the requirements in (3.2.1) and (3.2.2) 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.

3.3. Additional ESP hull requirements for bulk carriers

3.3.1. For bulk carriers of 5< Ages10

3.3.1.1. Ballast tanks

3.3.1.1.1. 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 verification that the coating remains effective.

3.3.1.1.2. 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.

3.3.1.1.3. 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 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.

3.3.1.1.4. In addition to the requirements in (3.3.1.1.1) to (3.3.1.1.3) above, areas found to be Suspect Areas at the previous special survey are to be overall and close-up surveyed.

3.4. Cargo holds

3.4.1. 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.

3.4.2. Where considered necessary by the Surveyor as a result of the overall and close-up survey, as described in 3.4.1 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.

3.5. Extent of thickness measurements

3.5.1. 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 1.1 and 1.2, 302. The minimum
requirements for thickness measurements at the intermediate enhanced survey are areas found to be Suspect Areas at the previous special survey.

3.5.2. Where Substantial Corrosion is found, the extent of thickness measurements is to be increased in accordance with the requirements of Table 3.

Table 3 Requirements for Extent of Thickness Measurement in way of Substantial Corrosion
At Hull Special Survey of Bulk Carriers within the Cargo Area (1/2)

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of measurement</th>
<th>Pattern of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shell Structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Bottom and side shell plating</td>
<td>Suspect plate, plus four adjacent plates</td>
<td>5 point pattern for each panel between longitudinals</td>
</tr>
<tr>
<td></td>
<td>See other tables for particulars on gauging in way tanks and cargo holds</td>
<td></td>
</tr>
<tr>
<td>2. Bottom / side shell longitudinals</td>
<td>Minimum of three longitudinals in way of suspect areas</td>
<td>3 measurements in line across web 3 measurements on flange</td>
</tr>
<tr>
<td><strong>Transverse bulkheads in cargo holds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Lower stool</td>
<td>Transverse band within 25mm of welded connection to inner bottom.</td>
<td>5 point between stiffeners over 1m length</td>
</tr>
<tr>
<td></td>
<td>Transverse band within 25mm of welded connection to shell plate.</td>
<td>5 point between stiffeners over 1m length</td>
</tr>
<tr>
<td>2. Transverse bulkhead</td>
<td>Transverse band at mid – height</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>Transverse band at part of bulkhead adjacent to upper deck or below upper stool shell plate (for those ships fitted with upper stools)</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td><strong>Deck Structure including cross strips, main cargo hatchways, hatch covers, coamings and topside tanks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cross deck strip plating</td>
<td>Suspect cross deck strip plating</td>
<td>5 point pattern between underdeck stiffeners over 1m length</td>
</tr>
<tr>
<td>2. Under deck stiffeners</td>
<td>Transverse members</td>
<td>5 point pattern at each end and mid-span</td>
</tr>
<tr>
<td></td>
<td>Longitudinal member</td>
<td>5 point pattern on both web and flange</td>
</tr>
<tr>
<td>3. Hatch Covers</td>
<td>Side and end skirts, each 3 locations</td>
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<td>3 longitudinal bands, outboard strakes (2) and centerline strake (1)</td>
<td>5 point measurement each band</td>
</tr>
<tr>
<td>4. Hatch coamings</td>
<td>Each side and end of coaming, one band lower 1/3, one band upper 2/3 of coaming</td>
<td>5 point measurement each band</td>
</tr>
<tr>
<td>5. Topside water ballast tanks</td>
<td>Watertight transverse bulkheads: Lower 1/3 of bulkhead Upper 2/3 of bulkhead Stiffeners</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>2 representative swash transverse bulkheads: Lower 1/3 of bulkhead Upper 2/3 of bulkhead Stiffeners</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>3 representative bays of slope plating: Lower 1/3 of tank Upper 2/3 of tank Longitudinals, suspect and adjacent</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>Suspect plates and adjacent</td>
<td>5 point pattern over 1m²</td>
</tr>
</tbody>
</table>
### Table 3 Requirements for Extent of Thickness Measurement in way of Substantial Corrosion

**At Hull Special Survey of Bulk Carriers within the Cargo Area (2/2)**

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent Measurement</th>
<th>Pattern of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Double bottom and Hopper structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Inner/Double bottom plating</td>
<td>Suspect plate plus all adjacent plates</td>
<td>5 point pattern for each panel between longitudinals over 1m length</td>
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<td>3 longitudinals where plates measured</td>
<td>3 measurements inline across web, and 3 measurements on flange</td>
</tr>
<tr>
<td>3. Longitudinal girders or transverse floors</td>
<td>Suspect plate</td>
<td>5 point pattern over about 1m²</td>
</tr>
</tbody>
</table>
| 4. Watertight bulkheads (WT floors) | • Lower 1/3 of tank  
• Upper 2/3 of tank  
Suspect plates | 5 point pattern over 1m² of plating  
5 point pattern alternate plates over 1m²  
5 point pattern over 1m² of plating |
| 5. Web frames | Minimum of three longitudinals in way of suspect areas | 3 measurements in line across web  
3 measurements on flange |
| 6. Bottom / side longitudinals | | |
| **Cargo Holds** | | |
| 1. Side shell frames | Suspect frame and each adjacent | At each end and midspan: 5 point pattern of both web and flange  
5 point pattern within 25 mm of welded attachment to both shell and lower slope plate |

3.5.3. 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.

3.5.4. 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.

3.6. For bulk carriers 10 < age ≤ 15

3.6.1. Ballast tanks

3.6.1.1. For bulk carriers:

All salt water ballast tanks are to be examined If such inspections reveal no visible structural defects, the examination may be limited to a verification that the protective coating remains efficient.

3.6.2. Cargo holds

3.6.2.1. 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:
3.6.2.1.1. Shell frames including their upper and lower and attachments, adjacent shell plating, and transverse bulkheads of all cargo holds; and
3.6.2.1.2. Areas found to be Suspect Areas at the previous special survey.
3.6.2.2. Where considered necessary by the Surveyor as a result of the overall and close-up survey, as described in 3.6.2.1 above, the survey is to be extended to include a close-up survey of all of the shell frames and adjacent plating of all cargo holds.

3.6.3. Extent of thickness measurement
3.6.3.1. 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 3.6.2.1 and 3.6.2.2. The minimum requirements for thickness measurements at the intermediate enhanced survey are areas found to be Suspect Areas at the previous special survey.

3.6.3.2. In addition, the requirements described in 3.3.1.1.1 to 3.3.1.1.4 apply.

3.7. For bulk carriers of age >15
3.7.1. The requirements of the intermediate enhanced survey are to be to the same extent as the previous special survey required in this rules. However, pressure testing of tanks and cargo holds used for ballast is not required unless deemed necessary by the attending Surveyor.

3.7.2. In application of 3.7.1 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.

3.8. Survey planning
For ships age > 10 years, survey planning is to be carried out.

3.9 Dry-docking requirements
For ships age > 15 years, the ship is to be placed in a dry dock or upon a slipway and all items 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.

3.10. 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.

4. Special Survey
4.1. General
4.1.1. The special survey shall include, in addition to the requirements of the annual survey, examination, tests, and checks of sufficient extent to ensure that the hull and related piping as required in 4.1.3, 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.

4.1.2. All cargo holds, ballast tanks, including double bottom tanks, pipe tunnels, cofferdams and void spaces bounding cargo holds, decks and outer hull shall be examined, and this examination shall be supplemented by thickness measurements and testing as required in 406 and 407, to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

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

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

4.2. Dry dock survey
4.2.1. A survey in dry dock shall 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 shall be carried out in accordance with the applicable requirements for special surveys, if not already performed.

*Note. Lower portions of the cargo holds and ballast tanks are considered to be the parts of the hull below light ballast waterline.*

4.3. Tank protection
4.3.1. Where provided, the condition of the corrosion prevention system of ballast tanks shall be examined. For ballast tanks, excluding double bottom tanks, where a hard protective coating is found in POOR condition 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 shall be examined at annual intervals. Thickness measurements shall be carried out as deemed necessary by the surveyor.

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

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

4.4. Hatch covers and coamings
The hatch covers and comings shall be surveyed as follows.
4.4.1. A thorough inspection of the items listed in this rule.

4.4.2. Satisfactory operations of all mechanically operated hatch covers shall be checked, including:
4.4.2.1. Stowage and securing in open condition;
4.4.2.2. Proper fit and efficiency of sealing in closed condition;
4.4.2.3. Operational testing of hydraulic and power components, wires, chains and link drives.

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

4.4.4. Thickness measurements of the hatch cover and coamings plating and stiffeners shall be carried out as given in Table 6.

4.5. Scope of overall and close-up surveys.
4.5.1. An overall survey of all tanks and spaces shall be carried out at each special survey. Fuel oil tanks in the cargo length area shall be surveyed in accordance with Table 4

Table 4 Overall surveys of fuel oil tanks in the cargo area at special surveys of bulk carriers

<table>
<thead>
<tr>
<th>Special survey No. 1 Age ≤ 5</th>
<th>Special survey No. 2 5 ≤ age ≤ 10</th>
<th>Special survey No. 3 10 ≤ age ≤ 15</th>
<th>Special survey No.4 and subsequent Age ≥ 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>One</td>
<td>Two</td>
<td>Half, minimum two</td>
</tr>
</tbody>
</table>

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 shall be examined at each special survey on a rotational basis.
3. Peak tanks (all uses) shall be subject to internal examination at each special survey.
4. At special survey No.3 and subsequent special surveys, one deep tank for fuel oil in the cargo area shall be included, if fitted.

4.5.2. The minimum requirements for close-up surveys at special survey are given in Table 5.

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

4.5.4. For areas in spaces where hard protective coatings are found to be in a GOOD condition, the scope of close-up surveys according to Table 5 may be specially considered (refer also to 403.2).

4.6. Extent of thickness measurements
4.6.1. The minimum requirements to thickness measurements at special survey are given in Table 6 for additional thickness measurement guidelines applicable to the vertically corrugated transverse bulkhead between cargos hold Nos.1 and 2 on ships subject to compliance with the requirements of this rule.
For additional thickness measurement guidelines are applicable to the side shell frames and brackets on ships subject to the compliance with the requirements of this rule.

4.6.2. Provisions for extended measurements for areas with substantial corrosion are given in Table 7 and may be additionally specified in the Survey Programme. These extended thickness measurements shall be carried out before the survey is credited as completed. Suspected areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken. For ships built under the Common Structural Rules for Bulk Carriers, the identified substantial corrosion areas may be: protected by coating applied in accordance with the coating manufacturer’s requirements and examined at annual intervals to confirm the coating is still in good condition; or alternatively required to be measured at annual intervals.

### Table 5 Minimum requirements to close-up survey at special hull surveys of bulk carriers

<table>
<thead>
<tr>
<th>Special survey No. 1 Age ≤ 5</th>
<th>Special survey No. 2 5 ≤ age ≤ 10</th>
<th>Special survey No. 3 10 ≤ age ≤ 15</th>
<th>Special survey No.4 and subsequent Age ≥ 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 25 per cent of shell frames in the forward cargo hold at representatives positions.</td>
<td>a) All shell frames in the forward cargo hold and 25 per cent of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating. For bulk carriers 100,000 deadweight and above, all shell frames in the foremost cargo hold and 50 per cent of shell frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating.</td>
<td>a) all shell frames in the forward and one other selected cargo hold and 50 per cent of frames in each of the remaining cargo holds, including upper and lower end attachments and adjacent shell plating.</td>
<td>A) All shell frames in all cargo holds, including upper and lower end attachments and adjacent shell plating.</td>
</tr>
<tr>
<td>b) One transverse web with associated plating and longitudinals in two representative water ballast tanks of each type (i.e. topside or hopper side tank).</td>
<td>b) One transverse web with associated plating and longitudinals in each ballast tank.</td>
<td>b) All transverse webs with associated plating and longitudinals in each ballast tank.</td>
<td>B) Areas B – E as for special survey No. 3</td>
</tr>
<tr>
<td>c) Two selected cargo hold transverse bulkheads, including internal structure of upper and lower stois, where fitted.</td>
<td>c) All cargo holds transverse bulkheads, including internal structure of upper and lower stois, where fitted.</td>
<td>c) all transverse bulkheads in ballast tanks, including stiffening system.</td>
<td></td>
</tr>
<tr>
<td>d) All cargo hold hatch covers and coamings (plating and stiffeners)</td>
<td>d) All cargo hold hatch covers and coamings (plating and stiffeners)</td>
<td>d) All deck plating and under deck structure inside line of hatch openings between all cargo hold hatches</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. A – E – Areas of close up, including:
   - A – Cargo holds transverse frames;
   - B – transverse web frame or watertight transverse bulkhead in ballast tanks;
   - C – Cargo Hold transverse bulkheads plating, stiffeners and girders;
   - D – Cargo Hold hatch covers and coamings;
   - E – Deck plating and under deck structure inside line of hatch openings between cargo hold hatches.
2. Refer to sketches in Fig. 5.2.3.2-1 for the areas corresponding to (A) – (E) at close-up survey of bulk and combination carriers.
3. Also refer to sketches in Fig. 5.2.3.2-2 for areas of side shell frames in cargo holds.
4. Criteria for evaluating the condition of hatch covers and coamings of cargo holds (for ships constructed on or after 1 January 2004) are given in Appendix 5.2.1.
5. Close-up survey transverse bulkheads shall be carried at four levels, sketches of which are given in Figs. 5.2.3.2-3 and 5.2.3.2-4;
6. level a – immediately above the inner bottom and immediately above the line of gussets (if fitted) and shedders for ships without lower stois;
   - level b – immediately above and below the lower stois (for those ships fitted with lower stois), and immediately above the line of shedders plates;
   - level c – about mid-height of the bulkhead;
   - level d – immediately below the upper plating and immediately adjacent to the upper wing tank, and immediately below the upper stois of ships with upper stois), or immediately below the topside tanks.
   - level e – below the side shell frames.
Typical transverse section of cargo hold, Areas A, B and D for close up survey

Typical transverse bulkhead of cargo holds Area C for close up survey

Typical areas of deck plating and under deck structure inside line of hatch openings between cargo hold hatches Area E for Close up survey

Areas A, B, C, D and E for close up survey of bulk carriers
Lower parts and areas A, B, C and D of frames in cargo holds of bulk carriers

Levels a, c and d for close up surveys of transverse bulkheads having no upper and lower stools in cargo holds of bulk carriers

Levels b, c and d for close up surveys of transverse bulkheads having upper and lower stools in cargo holds of bulk carriers
### Table 6 Minimum requirements to thickness measurements at special surveys of bulk carriers

<table>
<thead>
<tr>
<th>Special Survey No. 1</th>
<th>Special Survey No. 2</th>
<th>Special Survey No. 3</th>
<th>Special Survey No. 4 and subsequent Age ≥ 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 5</td>
<td>5 ≤ age ≤ 10</td>
<td>10 ≤ age ≤ 15</td>
<td></td>
</tr>
<tr>
<td>1. Suspect areas.</td>
<td>1. Suspect areas.</td>
<td>1. Suspect areas.</td>
<td>1. Suspect areas.</td>
</tr>
<tr>
<td>2. Within the cargo length area:</td>
<td>2. Within the cargo length area:</td>
<td>2. Within the cargo length area:</td>
<td>2. Within the cargo length area:</td>
</tr>
<tr>
<td>2.1 Two transverse sections of deck plating outside line of cargo hatch openings.</td>
<td>2.1 Each deck plate outside line of cargo hatch openings;</td>
<td>2.1 Each deck plate outside line of cargo hatch openings;</td>
<td>2.1 Each deck plate outside line of cargo hatch openings;</td>
</tr>
<tr>
<td>2.2 Two transverse sections beyond the line cargo hatch openings, of which one is in the midship area;</td>
<td>2.2 Two transverse sections beyond the line cargo hatch openings, of which one is in the midship area;</td>
<td>2.2 Three transverse sections beyond the line of cargo hatch openings, of which one is in the midship area;</td>
<td>2.2 Three transverse sections beyond the line of cargo hatch openings, of which one is in the midship area;</td>
</tr>
<tr>
<td>2.3 All wind and water strakes.</td>
<td>2.3 All wind and water strakes.</td>
<td>2.3 Each bottom plate.</td>
<td>2.3 Each bottom plate.</td>
</tr>
<tr>
<td>3. Wind and water strakes in way of the two transverse sections considered above. Selected wind and water strakes outside the cargo length area.</td>
<td>3. Selected wind and water strakes outside the cargo length area.</td>
<td>3. All wind and water strakes, full length.</td>
<td></td>
</tr>
<tr>
<td>4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 5.</td>
<td>4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 5.</td>
<td>4. Measurements, for general assessment and recording of corrosion pattern, of those structural members subject to close-up survey according to Table 5.</td>
<td></td>
</tr>
<tr>
<td>5. For additional thickness measurement guidelines applicable to the side shell frames and brackets on ships</td>
<td>5. For additional thickness measurement guidelines applicable to the vertically corrugated transverse watertight bulkheads between cargos hold Nos. 1 and 2 on bulk carriers.</td>
<td>5. For additional thickness measurement guidelines applicable to the vertically corrugated transverse watertight bulkheads between cargos hold Nos. 1 and 2 on bulk carriers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6. For additional thickness measurement guidelines applicable to the side shell frames and brackets on bulk carriers.</td>
</tr>
</tbody>
</table>
## Table 7 Requirements for extent of thickness measurements in areas of substantial corrosion within cargo area at special survey of bulk carriers

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of measurement</th>
<th>Pattern of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Shell structures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Bottom and side shell plating.</td>
<td>a) Suspect plate, plus four adjacent plates.</td>
<td>e) 5 point pattern for each panel between longitudinals.</td>
</tr>
<tr>
<td></td>
<td>b) Refer to other items of tables for particulars on ganging in way tanks and cargo holds.</td>
<td></td>
</tr>
<tr>
<td>1.2 Bottom and side shell longitudinals.</td>
<td>Minimum of three longitudinals in way of suspect areas.</td>
<td></td>
</tr>
<tr>
<td>2. Transverse bulkheads in cargo hold.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Lower stool</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Transverse band within 25mm of welded connection to inner bottom.</td>
<td>a) 5 points between stiffeners over 1 m length.</td>
</tr>
<tr>
<td></td>
<td>b) Transverse band within 25 mm of welded connection to shelf plate.</td>
<td>b) 5 points between stiffeners over 1 m length</td>
</tr>
<tr>
<td>2.2 Transverse bulkhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Transverse band at approximately mid height.</td>
<td>a) 5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>b) Transverse band at part of bulkhead adjacent to upper deck or below upper stool shell plate (for those ships fitted with upper stools).</td>
<td>b) 5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td>3. Deck structures including cross strips, main cargo hatchways, hatch covers, coamings and topside tanks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Cross deck strip plating</td>
<td>a) Suspect cross deck strip plating</td>
<td>a) 5 point pattern between under deck stiffeners over 1m length</td>
</tr>
<tr>
<td>3.2 Under deck stiffeners</td>
<td>a) Transverse member</td>
<td>a) 5 point pattern at each end and mid span.</td>
</tr>
<tr>
<td></td>
<td>b) Longitudinal member.</td>
<td>b) 5 point pattern on both web and flange.</td>
</tr>
<tr>
<td>3.3 Hatch covers</td>
<td>a) Side and end skirts, each 3 locations.</td>
<td>a) 5 point pattern at each location</td>
</tr>
<tr>
<td></td>
<td>b) 3 Longitudinal bands, two outboard strakes and one centerline strakes.</td>
<td>b) 5 point measurements each band</td>
</tr>
<tr>
<td></td>
<td>Each side and end of coamings, one band lower 1/3, and one band upper 2/3 of coamings.</td>
<td>5 point measurement each band, i.e. end or side coamings.</td>
</tr>
<tr>
<td>3.4 Hatch coamings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 Topside ballast tanks.</td>
<td>a) Watertight transverse bulkheads; lower 1/3 of bulkhead; upper 2/3; stiffeners.</td>
<td>5 point pattern over 1 m² of plating</td>
</tr>
<tr>
<td></td>
<td>b) 2 representative swash transverse bulkheads; lower 1/3 of bulkhead; upper 2/3 of bulkhead; Stiffeners.</td>
<td>5 point pattern over 1 m² of plating</td>
</tr>
<tr>
<td></td>
<td>c) 3 representative bays of slope plating; lower 1/3 of tank; upper 2/3 of tank.</td>
<td>5 point pattern over 1 m² of plating</td>
</tr>
<tr>
<td></td>
<td>d) Longitudinals, suspect and adjacent.</td>
<td>5 point pattern both web and flange over 1 meter length.</td>
</tr>
<tr>
<td></td>
<td>Suspect plates and four adjacent. Minimum of 3 longitudinals where plating measured.</td>
<td>5 point pattern on both web and flange over 1 meter length.</td>
</tr>
<tr>
<td>3.6 Main deck plating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.7 Main deck longitudinals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.8 Web frames/transverse.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suspect plate plus all adjacent plates.</td>
<td>5 point pattern for each panel between longitudinals over 1m length.</td>
</tr>
<tr>
<td>4. Double bottom and hopper structure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Inner/double bottom plating.</td>
<td>Three longitudinals where plates measured.</td>
<td>3 measurements in line across web and three measurements on flange.</td>
</tr>
<tr>
<td>4.2 Inner/double bottom longitudinals</td>
<td>a) Lower 1/3 of tank</td>
<td>a) 5 point pattern over 1m² of plating.</td>
</tr>
<tr>
<td>4.3</td>
<td>Longitudinals girders or transverse floors.</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Watertight bulkheads (watertight floors)</td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>Web frames</td>
<td></td>
</tr>
<tr>
<td>4.6</td>
<td>Bottom / side shell longitudinals.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Cargo holds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.1 side shell frames</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b)</td>
<td>Upper 2/3 of tank Suspect plates.</td>
</tr>
<tr>
<td></td>
<td>Minimum of three longitudinals in way of suspect areas.</td>
</tr>
<tr>
<td></td>
<td>Suspect frame and each adjacent</td>
</tr>
<tr>
<td>b)</td>
<td>5 point pattern over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>5 point pattern plates over 1m² of plating</td>
</tr>
<tr>
<td></td>
<td>3 measurements in line across web and 3 measurements on flange.</td>
</tr>
<tr>
<td></td>
<td>At each end and mid span:</td>
</tr>
<tr>
<td></td>
<td>a) 5 point pattern of both web and flange;</td>
</tr>
<tr>
<td></td>
<td>b) 5 point pattern within 25mm of welded attachment to both shell and lower slope plate.</td>
</tr>
</tbody>
</table>

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

4.6.4. For areas in tanks where hard protective coatings are found to be in a GOOD condition, the extent of thickness measurements according to Table 6 may be specially considered (refer also to 4.3.2).

4.6.5. Transverse sections shall be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements, one of which shall be in the amidships area.

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

4.7. Extent of tank testing

4.7.1. All boundaries of ballast tanks, deep tanks and cargo holds used for water ballast within the cargo length areas, as well as representative fuel oil tanks shall be pressure tested.

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

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

4.7.4. Boundaries of cargo holds for water ballast shall be tested with a head of liquid to near the top of cargo hatches.

4.7.5. Boundaries of fuel oil tanks shall be tested with a head of liquid to the highest point that liquid will rise under service conditions. Tank testing of fuel oil tanks may be specially considered based on a satisfactory external examination of the tank boundaries, and a confirmation from the master stating that the pressure testing has been carried out according to the requirements with satisfactory results.
4.7.6. The testing of double bottom tanks and other spaces not designed for the carriage of liquid may be omitted, provided a satisfactory internal examination together with an examination of the tank top is carried out.

4.8. Additional special survey requirements after determining compliance with SOLAS XII/12 and XII/13

4.8.1. For ships complying with the requirements of SOLAS XD/12 for hold, ballast and dry space water detectors, the special survey shall include an examination and a test of the water ingress detection system and of their alarms.

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

4.8.3. For bulk carriers timing of compliance with the requirements of SOLAS XII/12 and XII/13 is specified in this rule.

4.9. Double Skin Bulk Carrier

A Double Skin Bulk Carrier is a ship which is constructed generally with single deck, top-side tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk, including such types as ore carriers and combination carriers, in which all cargo holds are bounded by a double-side skin (regardless of the width of the wing space).

4.9.1. Annual Survey

4.9.1.1. Internal Examinations of Spaces and Tanks

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements for Double Skin Bulk Carriers</td>
<td></td>
</tr>
<tr>
<td>1 Engine room and boiler room</td>
<td>• An internal examination is to be carried out</td>
</tr>
<tr>
<td>2 Ballast tanks</td>
<td>• For bulk carriers over 5 years of age, an internal examination of the tank(s), of which an internal examination is required as a consequence of the last Intermediate Survey or Special Survey, is to be carried out.</td>
</tr>
<tr>
<td>3 Cargo Holds</td>
<td>• For bulk carriers over 10 years and up to 15 years of age, an internal examination of two selected cargo holds is to be carried out.</td>
</tr>
<tr>
<td></td>
<td>• For bulk carriers over 15 years of age, an internal examination of all cargo holds is to be carried out.</td>
</tr>
</tbody>
</table>

4.9.1.2. Close-up Surveys - Requirements for Double Skin Bulk Carriers

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hatch covers and hatch coamings</td>
<td>• Close-up survey of hatch cover plating and hatch coaming plating and their stiffeners is to be carried out.</td>
</tr>
</tbody>
</table>
4.9.2. Intermediate Survey

4.9.2.1. Close-up Surveys - Requirements for Double Skin Bulk Carriers

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hatch covers and hatch coamings</td>
<td>Close-up survey of hatch cover plating and hatch coaming plating and their stiffeners is to be carried out.</td>
</tr>
<tr>
<td>2 Structural members in cargo holds</td>
<td>Where considered necessary by the Surveyor as a result of the internal examination required in the internal examination of spaces and tanks in Bulk Carrier, a close-up survey is to be carried out.</td>
</tr>
</tbody>
</table>

4.9.3. Special Survey

4.9.3.1 Close-up Surveys - Requirements for Surveys for Double Skin Bulk Carriers

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Structural members subject to Close-up Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special survey for ships up to 5 years of age (Special Survey No.1)</td>
<td>1. Two selected cargo hold transverse bulkheads and lower part of remaining transverse bulkheads (including stiffeners and girders) (C)</td>
</tr>
<tr>
<td></td>
<td>2. One transverse web with associated plating and longitudinals in two representative ballast tanks of each type (this is to include the foremost topside and double side ballast tanks on either side) (B)</td>
</tr>
<tr>
<td></td>
<td>3. Air pipes and sounding pipes in cargo holds in way of tank top</td>
</tr>
<tr>
<td>Special survey for ships over 5 years and up to 10 years of age (Special Survey No.2)</td>
<td>1. One transverse bulkhead in each cargo hold and lower part of remaining transverse bulkheads (including stiffeners and girders) (C)</td>
</tr>
<tr>
<td></td>
<td>2. About half of transverse webs with associated plating and longitudinals in a representative ballast tank of each type (topside, bilge hopper or side tank) (B)</td>
</tr>
<tr>
<td></td>
<td>3. One transverse web with associated plating and longitudinals in each of the remaining ballast tanks (B)</td>
</tr>
<tr>
<td></td>
<td>4. Both forward and aft transverse bulkheads (including stiffeners and girders) in a transverse section including topside, bilge hopper and double side ballast tanks (B)</td>
</tr>
<tr>
<td></td>
<td>5. A sufficient number (at least 1/4 of total number) of stiffeners on side shell and longitudinal bulkhead at forward, middle, and aft parts on both sides of the foremost double side tanks (A)</td>
</tr>
<tr>
<td></td>
<td>6. All deck plating and under deck structure inside the line of hatch openings between cargo hold hatches</td>
</tr>
<tr>
<td></td>
<td>7. All piping arrangements in cargo holds. If the surveyor considers it necessary, airtight tests are to be carried out.</td>
</tr>
<tr>
<td>Special survey for ships over 10 years and up to 15 years of age (Special Survey No.3)</td>
<td>1. All transverse bulkheads (including stiffeners and girders) in all cargo holds (C)</td>
</tr>
<tr>
<td></td>
<td>2. All transverse webs with associated plating and longitudinals and all transverse bulkheads (including stiffeners and girders) in each ballast tank (B)</td>
</tr>
<tr>
<td></td>
<td>3. A sufficient number (at least 1/4 of total number) of stiffeners on side shell and longitudinal bulkhead at forward, middle, and aft parts on both sides of all double side tanks (A)</td>
</tr>
<tr>
<td></td>
<td>4. Structural members specified in 6. and 7. of Special Survey No.2 above</td>
</tr>
<tr>
<td>Special survey for ships over 15 years of age (Special Survey No.4 and subsequent Special Survey)</td>
<td>1. All stiffeners on side shell and longitudinal bulkhead in all double side tanks (A)</td>
</tr>
<tr>
<td></td>
<td>2. Structural members specified in 1., 2. and 4. of Special Survey No.3 above</td>
</tr>
</tbody>
</table>

Notes:

1) Letters in this table mean:
   (A) Cargo hold transverse frames, or stiffeners on side shell or longitudinal bulkhead in double side
   (B) Transverse web frame ring or watertight transverse bulkhead in fore and aft peak, topside, bilge hopper and double side ballast tanks including adjacent structural members
   (C) Including plating and internal structures of lower and upper stowls, where fitted

2) Close-up Surveys of transverse bulkheads are to be carried out at least at four levels as specified as follows:
   i. Immediately above the inner bottom and immediately above the line of gussets (if fitted) and sheds for ships without lower stoil.
   ii. Immediately above and below the lower stoil shelf plate (for those ships fitted with lower stowls), and immediately above the line of the shedder plates.
   iii. About mid-height of the bulkhead.
   iv. Immediately below the upper deck plating and immediately adjacent to the upper wing tank, and immediately below the upper stoil shelf plate for those ships fitted with upper stowls, or immediately below the topside tanks.

3) A double side tank of double skin bulk carriers is to be considered as a separate tank even if it is in connection to either the topside tank or the bilge hopper tank.
### 4.9.3.2 Requirements of Thickness Measurements for Bulk Carriers (Structures in Double Side Skin Spaces including Wing Void Spaces in Ore Carriers)

<table>
<thead>
<tr>
<th>Structural member</th>
<th>Extent of Measurement</th>
<th>Pattern of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For cargo holds of double side skin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Side shell and inner plating:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Upper strake and strakes in way of horizontal girders</td>
<td>Plating between each pair of transverse frames or longitudinals in a minimum of three bays (along the tank)</td>
<td>Single measurement</td>
</tr>
<tr>
<td>• All other strakes</td>
<td>Plating between every third pair of longitudinals in same three bays</td>
<td>Single measurement</td>
</tr>
<tr>
<td>2. Side shell and inner side transverse frames / longitudinals on:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Upper strake</td>
<td>Each transverse frame / longitudinal in same three bays</td>
<td>Three measurements across web and 1 measurement on flange</td>
</tr>
<tr>
<td>• All other strakes</td>
<td>Every third transverse frame / longitudinal in same three bays</td>
<td>Three measurements across web and 1 measurement on flange</td>
</tr>
<tr>
<td>3. Transverse frames / longitudinals - brackets</td>
<td>Minimum of three areas at top, middle and bottom of tank in same three bays</td>
<td>Five-point pattern over area of bracket</td>
</tr>
<tr>
<td>4. Vertical web and transverse bulkheads:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Strakes in a way of horizontal girders</td>
<td>Minimum of two webs and both transverse bulkheads</td>
<td>Five-point pattern over approx. two square meter area</td>
</tr>
<tr>
<td>• Other strakes</td>
<td>Minimum of two webs and both transverse bulkheads</td>
<td>Two measurements between each pair of vertical stiffeners</td>
</tr>
<tr>
<td>5. Horizontal girders</td>
<td>Plating on each girder in a minimum of three bays</td>
<td>Two measurements between each pair of longitudinal girder stiffeners</td>
</tr>
<tr>
<td>6. Panel stiffening</td>
<td>Where applicable</td>
<td>Single measurements</td>
</tr>
</tbody>
</table>
4.9.3.3 Requirements of Additional Thickness Measurements for Bulk Carriers (Bottom, Inner Bottom and Hopper Structure)

<table>
<thead>
<tr>
<th>Structural member</th>
<th>Extent of Measurement</th>
<th>Pattern of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>For cargo holds of double side skin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Bottom, inner bottom and hopper structure plating</td>
<td>Minimum of three bays across double bottom tank, including aft bay</td>
<td>Five-point pattern for each panel between longitudinals and floors</td>
</tr>
<tr>
<td></td>
<td>Measurements around and under all suction bell mouths</td>
<td></td>
</tr>
<tr>
<td>2. Bottom, inner bottom and hopper structure longitudinals</td>
<td>Minimum of three longitudinals in each bay where bottom plating measured</td>
<td>Three measurements in line across flange and three measurements on the vertical web</td>
</tr>
<tr>
<td>3. Bottom girders, including the watertight ones</td>
<td>At fore and aft watertight floors and in centre of tanks</td>
<td>Vertical line of single measurements on girder plating with one measurement between each panel stiffener, or a minimum of three measurements</td>
</tr>
<tr>
<td>4. Bottom floors, including the watertight ones</td>
<td>Three floors in the bays where bottom plating measured, with measurements at both ends and middle</td>
<td>Five-point pattern over 2 sq. metre area</td>
</tr>
<tr>
<td>5. Hopper structure web frame ring</td>
<td>Three floors in bays where bottom plating measured</td>
<td>Five-point pattern over 1 sq. metre of plating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single measurements on flange</td>
</tr>
<tr>
<td>6. Hopper structure transverse watertight bulkhead or</td>
<td>Lower 1/3 of bulkhead</td>
<td>five-point pattern over 1 sq. metre of plating</td>
</tr>
<tr>
<td>swash bulkhead or swash bulkhead</td>
<td>upper 2/3 of bulkhead</td>
<td>five-point pattern over 2 sq. metre of plating</td>
</tr>
<tr>
<td></td>
<td>stiffeners (minimum of three)</td>
<td>For web, five-point pattern over span (two measurements across web at each end and one at centre of span). For flange, single measurements at each end and centre of span</td>
</tr>
<tr>
<td>7. Panel stiffening</td>
<td>Where applicable</td>
<td>Single measurements</td>
</tr>
</tbody>
</table>

Section 2 Other Cargo Ships and Dry Cargo Ships Types

2.1. General

This section gives the requirements for periodical surveys of all ship types other than bulk carriers, oil tankers, chemical tankers and liquefied gas carriers. The requirements for general dry cargo ships are also included.

General Dry Cargo ships are ships constructed or converted to carry solid cargoes other than:

- Bulk Carrier
- Container carrier
- Dedicated forest product carriers (except for ships carrying timber cargoes)
- Ro-ro cargo ships
- Car carriers
- Refrigerated cargo ships
- Dedicated wood chip carrier and
- Dedicated cement carriers
Notes: Ships carrying timber cargoes are a cargo ship which belongs to general dry cargo ships specified in the above and which marked timber load lines and primarily carrying log cargoes

Structure and terminology of typical General Dry Cargo Ships

General Cargo

2.2. Annual Survey

Annual Surveys are to be carried out within 3 months before or after the anniversary date each year. These should be held concurrently with statutory annual or other relevant statutory Surveys, where practicable.

At Annual Surveys, the Surveyor is to examine the hull and machinery, so far as necessary and practicable, in order to be satisfied as to their general condition.

2.2.1. Hull – General

The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull, equipment, hatch coamings, hatch covers including their securing arrangement, other closing appliances and related piping are maintained in satisfactory/efficient condition.

a) Weather deck, shipside plating above waterline.

b) Hatchways on freeboard and superstructure decks; exposed casings; skylights; deck houses; companionways and superstructure bulkheads; side, bow and stern doors; side scuttles and dead lights; flush deck scuttles; ash shoots and other openings.

c) Weld connection between air pipes and deck plating, air pipe heads on exposed decks (external examination), flame screens on vents to all bunker tanks; ventilators and closing devices.

d) Scuppers and sanitary discharges as far as practicable together with valves and their controls.
e) Guard rails, bulwarks, freeing ports, gangways, walkways and life lines, fittings and appliances for timber deck cargo.

f) Watertight bulkheads and their penetrations as far as practicable.

2.2.1.1. Cargo hatch covers and coamings are to be examined to ensure that no alterations have been made to the approved arrangements:

a) Mechanically operated hatch covers are to be examined for satisfactory condition of:
   - Hatch covers;
   - Tightness devices of longitudinal,
   - Transverse and intermediate cross
   - Junctions, gaskets, gasket lips,
   - Compression bars, drainage channels;
   - Clamping devices, retaining bars,
   - Cleating;
   - Chain or rope pulleys;
   - Guides;
   - Guide rails and track wheels;
   - Stoppers, etc.;
   - Wires, chains, gypsies, tensioning
   - Devices;
   - Hydraulic system essential to closing and securing;
   - Safety locks and retaining devices.

b) Cargo hatch covers of the portable type (i.e. wood or steel pontoons) are to be examined to confirm the satisfactory condition of:
   - Wooden covers and portable beams,
   - Carriers or sockets for the portable
   - Beams and their securing devices;
   - Steel pontoons;
   - Tarpaulins;
   - Cleats, battens and wedges;
   - Hatch securing bars and their securing devices;
   - Loading pads/bars and the side plate edge;
   - Guide plates and chocks;
   - Compression bars, drainage channels
   - And drain pipes, if any.

c) Checking the satisfactory condition of hatch coamings plating and their stiffeners.

d) Random checking of the satisfactory operation of mechanically operated hatch covers:
   - Stowage and securing in open position;
- Proper fit, locking and efficiency of sealing in closed condition;
- Operational testing of hydraulic and power components, wires, chains and link drives.

Hatch covers / steel pontoons of general dry cargo ships, a close-up survey of hatch cover plating is to be carried out.

2.2.1.2. All watertight doors in watertight bulkheads, to be examined and tested (locally and remotely) as far as practicable.

2.2.1.3. Anchoring and mooring equipment is to be examined as far as is practicable.

2.2.1.4. Where applicable Surveyor should satisfy himself regarding the freeboard marks on the ship's side.

2.2.1.5. Suspect areas identified at previous special or intermediate surveys are to be close up surveyed. Thickness measurements are to be taken in the area of substantial corrosion identified at previous surveys.

2.2.1.6. Examination of Ballast Tanks when required as a consequence of the results of the Special Survey or Intermediate Survey. When extensive corrosion is found, thickness measurement is to be carried out. If the results of these thickness measurements indicate substantial corrosion then the extent of thickness measurements are to be increased to determine the extent of areas of substantial corrosion.

2.2.1.7. Accommodation ladders are to be examined at annual surveys. Satisfactory condition of the following items is to be checked, in particular:
   a) Steps;
   b) Platforms;
   c) All support points such as pivots, rollers, etc.;
   d) All suspension points such as lugs, brackets, etc.;
   e) Stanchions, rigid handrails, hand ropes and turntables;
   f) Davit structure, wire and sheaves, etc.

2.2.1.8. Gangways are to be examined at annual surveys. Satisfactory condition of the following items is to be checked, in particular:
   a) Treads;
   b) Side stringers, cross-members, decking, deck plates, etc.;
   c) All support points such as wheel, roller, etc.;
   d) Stanchions, rigid handrails, hand ropes.

2.2.1.9. Winches of accommodation ladders and gangways are to be examined to verify the satisfactory condition of the following items:
   a) Brake mechanism including condition of brake pads and band brake, if fitted;
b) Remote control system, and

c) Power supply system for electric motor.

2.2.1.10. Davits and fittings on the ship’s deck associated with accommodation ladders and gangways are to be examined for satisfactory condition at annual surveys. Fittings or structures for means of access to deck such as handholds in a gateway or bulwark ladder and stanchions are also to be examined.

2.2.1.11. The maintenance and inspection records of accommodation ladders and gangways are to be verified. It is to be confirmed that supporting wires are being renewed at intervals not exceeding 5 years.

2.2.2. Examination of cargo holds of general dry cargo ships.

2.2.2.1. For cargo ships of 10 – 15 years of age:

a) Overall survey of one forward and one after cargo hold and their associated tween deck spaces.

b) 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 substantial corrosion, then the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion.

2.2.2.2. For cargo ships over 15 years of age:

a) Overall survey of all cargo holds and tween deck spaces.

b) In a forward lower cargo hold and one other selected lower cargo hold:

- 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, side frame end attachment and the adjacent shell plating.

- 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).

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 substantial corrosion, then the numbers of thickness measurements are to be increased to determine the extent of substantial corrosion.

d) Where the protective coating in cargo holds, as applicable, is found to be in a GOOD condition, the extent of close-up surveys may be specially considered.

e) All piping and penetrations in cargo holds, including overboard piping are to be examined.
2.3. Tables

### 2.3.1. Examinations of Plans and Documents

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Loading Manual</td>
<td>For ships required to have the manual on board, confirmation that the manual is kept on board is to be made.</td>
</tr>
<tr>
<td>2 Stability Information Booklet</td>
<td>Confirmation as to whether the booklet is kept on board is to be made.</td>
</tr>
<tr>
<td>3 Damage Control Plan and Booklet</td>
<td>For ships required to have the damage control plan on board, confirmation that the approved plan is exhibited and the booklet containing the information shown in the plan is kept on board is to be made.</td>
</tr>
<tr>
<td>4 Fire Control Plan</td>
<td>Confirmation that the fire control plan is exhibited and properly stored is to be made.</td>
</tr>
<tr>
<td>5 Operating and Maintenance Manual for the door and inner door and notices indicating procedures for closing and securing</td>
<td>For the ships required to have the manual and notices on board, and confirmation that the manual is kept on board is to be made and confirmation that the board is exhibited is to be made.</td>
</tr>
<tr>
<td>6 Towing and Moorings fitting Arrangement Plan</td>
<td>Confirmation that the Towing and Moorings fitting Arrangement Plan is kept on board is to be made.</td>
</tr>
</tbody>
</table>

### 2.3.2 General Examination

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Shell Plating</td>
<td>Confirmation that the areas visible above the load waterline are in good condition.</td>
</tr>
<tr>
<td>2 Weather deck plating</td>
<td>Confirmation that the areas visible above the load waterline are in good condition.</td>
</tr>
<tr>
<td>3 Opening on deck and outside the hull</td>
<td>Confirmation that the following are in good condition: coamings and closing appliances of hatchways and flush deck openings on the exposed deck and within unenclosed superstructures; gangway ports, cargo ports and coal ports; and side scuttles below the freeboard or superstructure deck.</td>
</tr>
<tr>
<td>4 Casing of engine room</td>
<td>Confirmation that the following are in good condition: exposed engine casings and their openings; skylights of the engine room and boiler room and their closing appliances.</td>
</tr>
<tr>
<td>5 Ventilators</td>
<td>Confirmation that coamings and closing appliances pf ventilators to spaces below the freeboard deck or within enclosed superstructures are in good condition.</td>
</tr>
<tr>
<td>6 Air pipes</td>
<td>Confirmation that the air pipes on weather deck and their closing appliances are in good condition.</td>
</tr>
<tr>
<td>7 Watertight bulkhead and superstructure end bulkhead</td>
<td>Confirmation that watertight doors, penetrations and stop valves on watertight bulkheads, and closing appliances of openings in superstructure end bulkheads are in good condition.</td>
</tr>
<tr>
<td>8 Load line marks</td>
<td>Confirmation that deck line and load line markings are appropriate.</td>
</tr>
<tr>
<td>9 Bulwark</td>
<td>Confirmation that bulwark and the shutters of its freeing port; and hinges and guard rails are in good condition.</td>
</tr>
<tr>
<td>10 Means of access</td>
<td>Confirmation that permanent gangway or other means of access are in good condition.</td>
</tr>
<tr>
<td>11 Scuppers, inlets, other discharge pipes and valves</td>
<td>Confirmation that all areas which can be examined are in good condition.</td>
</tr>
<tr>
<td>12 Anchoring and mooring arrangement</td>
<td>Confirmation that the anchoring and mooring arrangements including their accessories are in good condition as far as can be seen.</td>
</tr>
<tr>
<td>13 Fire extinguishing arrangement</td>
<td>Confirmation that the fire extinguishing arrangement is in good condition and the fixed fire extinguishing system, semi-portable and portable fire extinguishers and fireman’s outfits are maintained in good order.</td>
</tr>
<tr>
<td>14 Fire protection arrangement and means of escape</td>
<td>Confirmation that no alteration has been made to these arrangements since the last survey.</td>
</tr>
<tr>
<td>15 Emergency towing arrangement</td>
<td>Confirmation that the emergency towing arrangement of ships required to have one, is in good condition.</td>
</tr>
<tr>
<td>16 Ships Identification Number</td>
<td>Confirmations that the markings of the ship’s identification number for ships required to be so marked are in good condition.</td>
</tr>
</tbody>
</table>
2.3.3 Performance Tests

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Weathertight hatch cover</td>
<td>• Hose test (when deemed necessary by the surveyor)</td>
</tr>
<tr>
<td></td>
<td>• Random checking of the satisfactory operation of mechanically operated hatch covers.</td>
</tr>
<tr>
<td>2 Closing appliances of watertight door on watertight bulkhead and</td>
<td>• Checking whether the appliances work in good order is to be made as deemed necessary by the surveyor.</td>
</tr>
<tr>
<td>openings on superstructure en bulkhead</td>
<td></td>
</tr>
<tr>
<td>3 Appliances related to fire protection and escape</td>
<td>• Checking whether the appliances work in good order is to be carried out.</td>
</tr>
<tr>
<td>4 Fire detection system and fire alarm system including manually</td>
<td>• Checking whether the system work in good order (including proper operation of malfunction indicator) is to be made.</td>
</tr>
<tr>
<td>operated call points</td>
<td></td>
</tr>
<tr>
<td>5 Fire pumps (including emergency fire pumps) piping, hydrants,</td>
<td>• Performance test of the fire fighting system composed of fire pump, hydrants, etc. is to be carried out. For ships</td>
</tr>
<tr>
<td>hoses, nozzles etc.</td>
<td>with pumps in periodically unattended machinery spaces, an operation test of the remote control system or automatic</td>
</tr>
<tr>
<td></td>
<td>operation system of one pump is to be carried out.</td>
</tr>
<tr>
<td>6 Ventilation system</td>
<td>• Checking whether the system works in good order is to be carried out.</td>
</tr>
</tbody>
</table>

2.3.4 Internal Examination of Spaces and Tanks

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements for cargo ships except when specified otherwise</td>
<td></td>
</tr>
<tr>
<td>1 Engine room and boiler room</td>
<td>• An internal examination is to be carried out.</td>
</tr>
<tr>
<td>2 Ballast tanks</td>
<td>• For ships over 5 years of age, an internal examination of the tank(s), of which and internal examination is required as consequence of the last Intermediate Survey or Special Survey, is to be carried out.</td>
</tr>
</tbody>
</table>

2.3.4.1 Requirements for General Dry Cargo Ships of not less than 500 gross tonnage

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Engine room and boiler room</td>
<td>• An internal examination is to be carried out.</td>
</tr>
<tr>
<td>2 Ballast tanks</td>
<td>• For General dry cargo ships over 5 years of age, an internal examination of the tank(s), of which and internal examination is required as consequence of the last Intermediate Survey or Special Survey, is to be carried out.</td>
</tr>
<tr>
<td>3 Cargo holds</td>
<td>• For general dry cargo ships carrying timber cargoes over 5 years and up to 10 years of age, an internal examination of all cargo holds is to be carried out to check the condition of lower part of hold frames, lower brackets and lower part of transverse bulkheads.</td>
</tr>
<tr>
<td></td>
<td>• For general dry cargo ships over 10 years and up to 15 years of age, an internal examination of one forward and one after cargo hold (all cargo holds for ships carrying timber cargoes) and their associated tween decks spaces is to be carried out.</td>
</tr>
<tr>
<td></td>
<td>• For general dry cargo ships over 15 years of age, an internal examination of all cargo holds and their associated tween deck spaces is to be carried out.</td>
</tr>
</tbody>
</table>
2.3.6 Close-up Surveys

2.3.6.1 Requirements for General Dry cargo Ships of not less than 500 gross tonnage

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hatch covers and hatch coamings</td>
<td>• Close-up survey of hatch cover plating and hatch coaming plating and their stiffeners is to be carried out.</td>
</tr>
</tbody>
</table>
| 2 Cargo Hold frames                               | • For general dry cargo ships carrying timber cargoes over 5 years and up to 15 years of age, the extend of survey is to be increased to the satisfaction of the Surveyor where deemed necessary by the surveyor as a consequence of the survey carried out in accordance with Table 2.3.4 and 2.3.4.1  
  • For general dry cargo ships over 15 years of age, a close-up survey of sufficient extent (i.e. minimum of 25% of the frames) is to be carried out, to establish the condition of the lower region of the shell frames including approximately the lower one third length of the frames at side shell and side frame end attachment and the adjacent shell plating in the forward lower cargo hold and one selected lower cargo hold.  
  • When 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 of all remaining cargo holds and tween deck spaces (as applicable). |

2.3.7 Thickness Measurements

<table>
<thead>
<tr>
<th>Items</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements for cargo ships except when specified otherwise</td>
<td></td>
</tr>
<tr>
<td>1 Structural members in ballast tanks</td>
<td>• When extensive corrosion is found in the examination specified in Table 2.3.4 and Table 2.3.4.1 which is required for ships over 5 years of age, thickness measurements are to be carried out to the satisfaction of the Surveyor. Where substantial corrosion is found, additional thickness measurements are to be carried out. Thickness measurements are to be carried out 12 months prior to completion of the survey in question under the attendance of the surveyor by the firm approved by the class.</td>
</tr>
<tr>
<td>2 Hatch covers and hatch coamings</td>
<td>• When deemed necessary by the Surveyor as a consequence of the close-up survey required in Table 2.3.6 thickness measurements are to be carried out to the satisfaction of the Surveyor. Where substantial corrosion is found, additional thickness measurements are to be carried out. Thickness measurements of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys.</td>
</tr>
<tr>
<td>3 Structural members in cargo holds</td>
<td>• For general dry cargo ships over 10 years of age, when deemed necessary by the surveyor as a consequence of the internal examination required in Table 2.3.4 and 2.3.4.1 and the close-up required in Table 2.3.6, thickness measurements are to be carried out to the satisfaction of the Surveyor. Where substantial corrosion is found, additional thickness measurements are to be carried out. Thickness measurements of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys.</td>
</tr>
</tbody>
</table>
2.4. Intermediate Surveys
Intermediate surveys are to be carried out at or between the second or third Annual Survey. Those items which are additional to the requirements of annual survey may be examined at or between the second and third annual survey.

2.4.1. Hull – General
The following requirements are applicable for vessels over five years of age. For vessels below 5 years of age additional examination over and above the requirements of Annual survey may be required at the discretion of the Surveyors.
Prior to the commencement of any part of the intermediate survey, a survey planning meeting is to be held between the attending Surveyor(s), the owner’s representative in attendance and where involved, the thickness measurement company representative and the master of ship or an appropriately qualified representative appointed by the master or Company for the purpose to ascertain that all the arrangements envisaged in the survey programmed are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out.
Concurrent crediting to both Intermediate survey and Special survey for surveys and thickness measurements of spaces is not acceptable.

2.4.2. Vessels of age between 5 and 10 years
2.4.2.1. Ballast tanks:
   a) An internal general examination of representative ballast tanks is to be carried out as required by (c) and (d). When extensive corrosion is found, thickness measurements are to be carried out. If such examination reveals no visible structural defects, the examination may be limited to verification that the corrosion prevention system remains efficient.

   b) Where POOR coating condition, corrosion or other defects are found in ballast spaces or where hard protective coating was not applied from the time of construction, the examination is to be extended to other ballast spaces of the same type.

   c) For ballast tanks, other than double bottom tanks, where a protective coating is found to be in POOR condition and 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 tank(s) in question are to be examined at subsequent annual surveys.

   d) For double bottom ballast tanks, where a protective coating is found to be in POOR condition and 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 tank(s) in question may be examined at subsequent Annual surveys.

2.4.2.2. Cargo hold of general dry cargo ships
   a) An overall survey of one forward and one after cargo hold and their associated tween deck spaces.
PART I

2.4.3. Vessels of age between 10 and 15 years

2.4.3.1. Ballast tanks:

a) An overall survey of all ballast tanks is to be carried out. When extensive corrosion is found, thickness measurements are to be carried out. If such examination reveals no visible structural defects, the examination may be limited to verification that the corrosion prevention system remains efficient.

b) For ballast tanks, other than double bottom tanks, where a protective coating is found to be in POOR condition and 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 tank(s) in question are to be examined at subsequent annual surveys.

c) For double bottom ballast tanks, where a protective coating is found to be in POOR condition and 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 tank(s) in question may be examined at subsequent Annual surveys.

2.4.4. Cargo holds of general dry cargo ships:

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 2.2.1.5.

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 substantial corrosion, then the extent of thickness measurements are to be increased to determine the extent of areas of substantial corrosion.

2.4.5. Vessels of age more than 15 years

a) For vessels other than general dry cargo ships, in addition to the requirements given in 2.4.3, an internal examination of selected cargo holds is to be carried out.

b) For general dry cargo ships, the requirements of the intermediate survey is to be to the same extent as the previous special survey as required for hull structure and piping systems in way of the cargo holds, cofferdams, pipe tunnels, void spaces and fuel oil tanks in the cargo area and all ballast tanks. However, tank testing, survey of automatic air pipe heads and internal examination of fuel oil, lub.oil and freshwater tanks need not be carried out unless deemed necessary by the Surveyor. In water survey complying with the requirements established may be accepted in lieu of docking survey. Thickness measurement is to be carried out in accordance with the requirements established.
The intermediate survey may be commenced at the second annual survey and be progressed with a view to completion at the third annual survey.

2.5. Tables

2.5.1. Examination of Plans and Documents

At Intermediate Surveys, the management conditions of plans and documents specified in Table 2.3.1 are to be examined.

2.5.2. General Examination

At Intermediate Surveys, examination of hull, equipment, fire-extinction and fittings specified in Table 2.3.2 are to be carried out. In addition, conditions of spare parts for fire-extinguishing systems are to be generally examined.

2.5.3. Performance Test

<table>
<thead>
<tr>
<th>Items</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Equipment or installations of items in Table 2.3.3 (except item 2)</td>
<td>Test for each item specified in Table 2.3.3 are to be carried out.</td>
</tr>
<tr>
<td>2 Doors on watertight bulkhead and closing appliances on superstructure end bulkheads</td>
<td>Confirmation that the doors and closing appliances work in order is to be made.</td>
</tr>
<tr>
<td>3 Drainage, mooring and anchoring arrangements and their accessories.</td>
<td>Confirmation that the arrangements work in order to be made. This check may be dispensed with at the discretion of the Surveyor.</td>
</tr>
<tr>
<td>4 Fixed dry-chemical powder fire fighting system</td>
<td>Confirmation that the piping is maintained in good condition is made by delivering air through the pipes. Confirmation that monitors and hoses, and the remote control system and related automatic valves work in order is to be made. Confirmation of quantity of starting or pressuring gases is to be made.</td>
</tr>
<tr>
<td>5 Water spray system</td>
<td>Checking whether the system works in order is to be made by delivering water through the system. Checking of quantity of delivered water may be dispensed with.</td>
</tr>
<tr>
<td>6 Carbon dioxide extinguishing medium halon extinguishing medium and dry chemical powder extinguishing medium</td>
<td>Confirmation of quantity of media is to be made.</td>
</tr>
<tr>
<td>7 Fixed carbon dioxide fire fighting system and fixed halon fire fighting system</td>
<td>Confirmation that piping is maintained in good condition is made by delivering air through the pipes. Confirmation that system alarm works in order is to be made.</td>
</tr>
<tr>
<td>8 Fixed foam fire fighting system and fixed high expansion foam fire fighting system</td>
<td>Confirmation that piping is maintained in good condition is to be carried out by delivering water through the pipes.</td>
</tr>
<tr>
<td>9 Fixed pressure water spraying fire fighting system</td>
<td>Confirmation that the system works in order is to be made by delivering water through the system.</td>
</tr>
<tr>
<td>10 Automatic sprinkler system</td>
<td>Confirmation that the delivery alarm and pump work in order is to be made while fire detection system is in operation.</td>
</tr>
<tr>
<td>11 Closing appliances of openings related to fire fighting in way of cargo holds</td>
<td>Confirmation that closing appliances work is to be made.</td>
</tr>
</tbody>
</table>
### 2.5.4. Internal Examination of Spaces and Tanks

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Requirements for cargo ships except when specified otherwise</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Engine room and boiler room</td>
<td>- An internal examination is to be carried out on all aspects.</td>
</tr>
</tbody>
</table>
| **2** Ballast tanks | - For ships over 5 years and up to 10 years of age, an internal examination of representative ballast tanks is to be carried out. Where poor coating condition, corrosion or other defects are found in a ballast tank or where a protective coating has not been applied from the time of construction, the examination is to be extended to other ballast tanks of the same type.  
- For ships over 10 years of age, an internal examination of all ballast tanks is to be carried out.  
- If such examinations reveal no visible structural defects, the examination may be limited to verification that the corrosion prevention system remains effective.  
- 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 tank, an internal examination is to be carried out at annual intervals. For double bottom ballast tanks in this condition, where considered necessary by the Surveyor, an internal examination is to be carried out at annual intervals. |
| **3** Cargo holds | - For cargo ships over 10 years of age, excluding ships solely carrying dry cargoes, an intervals examination of selected cargo holds is to be carried out |

**Note**
"Representative ballast tanks” means ballast tanks which include, at least, fore and aft peak tank and two deep tanks within the cargo length area.

### 2.5.5. Requirement for General Dry Cargo Ships of not less than 500 gross tonnage

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Engine room and boiler room</td>
<td>- An internal examination is to be carried out on all aspects.</td>
</tr>
<tr>
<td><strong>2</strong> Ballast tanks</td>
<td>- Same as those for cargo ships</td>
</tr>
</tbody>
</table>
| **3** Cargo holds | - For General dry cargo ships over 5 years and up to 10 years of age, an internal examination of one forward and one after cargo hold (all cargo holds for ships carrying timber cargoes) and their associated tween deck spaces is to be carried out.  
- For general dry cargo ships over 10 years of age, an internal examination of all cargo holds and their associated tween deck spaces is to be carried out. |

**Note**
"Representative ballast tanks” means ballast tanks which include, at least, fore and aft peak tank and two deep tanks within the cargo length area.

### 2.5.6. Close-up Survey

<table>
<thead>
<tr>
<th>Items</th>
<th>Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Requirements for General Dry Cargo Ships of not less than 500 gross tonnage</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1</strong> Hatch covers and hatch coamings</td>
<td>- Close-up survey of hatch cover plating and hatch coaming plating and their stiffeners is to be carried out.</td>
</tr>
</tbody>
</table>
| **2** Structural members in cargo holds | - For ships carrying timber cargoes over 5 years of age, a close-up survey of structures listed in the left column is to be carried out in all cargo holds.  
1. Lower part of shell frames and their lower end brackets  
2. Lower parts of transverse bulkhead  
3. Lower parts (located on inner bottom plating) of pipes that pass through cargo holds such as air pipes, sounding pipes, etc. |
### 2.5.7. Thickness measurements

<table>
<thead>
<tr>
<th>Items</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements for Cargo Ships over 5 years except those specified in the followings</td>
<td></td>
</tr>
</tbody>
</table>
| 1 Structural members in ballast tanks | ● Where considered necessary by the Surveyor as a result of the survey specified in Tables 2.5.4 and 2.5.6, thickness measurements are to be carried out at the discretion of the Surveyor, where a poor coating condition, corrosion or other defects are found in a ballast tank or where a protective coating has not been applied from the time of construction  
    ● Where substantial corrosion is found, additional thickness measurements are to be carried out. Thickness measurements are to be carried out 12 months prior to completion of the survey in question under the attendance of the surveyor by the firm approved by the class. |

### 2.5.8. Requirements for General Dry Cargo ships of not less than 500 gross tonnage

<table>
<thead>
<tr>
<th>Items</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements for Cargo Ships over 5 years except those specified in the followings</td>
<td></td>
</tr>
</tbody>
</table>
| 1 Structural members in ballast tanks | ● Where considered necessary by the Surveyor as a result of the survey specified in Tables 2.5.4 and 2.5.6, thickness measurement are to be carried out at the discretion of the Surveyor, where a poor coating condition, corrosion or other defects are found in a ballast tank or where a protective coating has not been applied from the time of construction  
    ● If the results of thickness measurements indicated that substantial corrosion is found, the extent of thickness measurements is to be carried out. Thickness measurements of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys. |
| 2 Hatch covers and hatch coaminings | ● When deemed necessary by the Surveyor as a consequence of the close-up survey required in Table 2.5.5, thickness measurements are to be carried out to the satisfaction of the Surveyor. Where substantial corrosion is found, additional thickness measurements are to be carried out. Thickness measurements of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys. |
| 3 Structural members in cargo holds | 1. For ships carrying timber cargoes over 5 years of age  
   ● Thickness measurements of structural members that were subject to close-up in all cargo holds is to be carried out to the same extent as the previous Special Survey  
   ● The thickness measurements may be dispensed with provided the Surveyor is satisfied by the results of the close-up survey: that there is no structural diminution and the protective coating remains effective.  
   2. For general dry cargo ships over 10 years of age (excluding ships carrying timber cargoes)  
   ● When deemed necessary by the Surveyor as a consequence of the internal examination required in Table 2.5.4 and 2.5.6, thickness measurements are to be carried out to the satisfaction of the Surveyor. Where substantial corrosion is found, additional thickness measurements are to be carried out. Thickness measurements of structures in areas where close-up surveys are required are to be carried out simultaneously with close-up surveys. |

### 2.6. Special Surveys

All ships classed with PMDS are to undergo Special Surveys at 5 yearly intervals. The first Special Survey is to be completed within 5 years from the date of the initial classification survey and thereafter 5 years from the assigned date of the previous Special Survey. However, an extension of class of 3 months maximum beyond the 5th year may be granted in exceptional circumstances. In such cases, the next period of class will start from the expiry date of the Special Survey before extension was granted.
2.6.1 General (Hull)
For surveys completed within 3 months before the expiry date of the Special Survey, the next period of class will start from the expiry date of the Special Survey. For surveys completed more than 3 months before the expiry date of the Special Survey, the period of class will start from the survey completion date.

The Special Survey may be commenced at the 4th Annual Survey and be progressed with a view to completion by the 5th anniversary date. When the special survey is commenced prior to the fourth annual survey, the entire survey is to be completed within 15 months if such work is to be credited to the special survey and in this case the next period of class will start from the survey completion date.

Concurrent crediting to both Intermediate survey and Special survey for surveys and thickness measurements of spaces is not acceptable. For the purpose of special survey, results of thickness measurement carried out during or after the fourth annual survey only would be considered. Record of Special Survey will not be assigned until the Machinery Survey has been completed or postponed in agreement with ClassPMDS.

The special survey is to include, in addition to the requirements of the Annual Survey, examination, tests and checks of sufficient extent to ensure that the hull, equipment and related piping as required are in satisfactory condition and that the ship is fit for its intended purpose for the new period of class of five years to be assigned subject to proper maintenance and operation and the periodical surveys being carried out at the due dates.

The examinations of the hull are to be supplemented by thickness measurements and testing as deemed necessary, 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.

A Docking Survey in accordance with the requirements is to be carried out as part of the Special Survey. Any remaining work in respect of the overall and close-up surveys and thickness measurements, as applicable, of the lower portions of cargo holds and ballast tanks (i.e. parts below light ballast water line) are to be completed in dry dock.

2.6.2. Preparation for survey
The ship is to be prepared for overall survey in accordance with the requirements of Table 2.6.2.1. The preparation is to be of sufficient extent to facilitate an examination to ascertain any excessive corrosion, deformation, fractures, damages and other structural deterioration.
2.6.2.1 Table of survey Preparation

<table>
<thead>
<tr>
<th>Special Survey No. I</th>
<th>Special Survey No. II</th>
<th>Special Survey No. III</th>
<th>Special Survey No. IV and subsequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 5</td>
<td>5 &lt; Age ≤ 10</td>
<td>10 &lt; Age ≤ 15</td>
<td>Age ≥ 15</td>
</tr>
<tr>
<td>1) The holds, tween decks, deep tanks, peaks, bilges and drain wells, engine and boiler spaces, coal bunkers and other spaces are to be cleared out and cleaned as necessary for examination. Floor plates in engine and boiler spaces are to be lifted as may be necessary for examination of the structure underneath. Where necessary ceiling, lining, casings and loose insulation are to be removed as required by the Surveyor for examination of the structure. Compositions on the plating are to be examined and sounded, but need not be disturbed if found satisfactorily adhering to the plating.</td>
<td>1) Requirements of Special Survey I to be complied with</td>
<td>1) Requirements of Special Survey II to be complied with</td>
<td>1) Requirements of Special Survey III to be complied with</td>
</tr>
</tbody>
</table>

Table 2.6.2.1 : (Contd.)

2) In ships with single bottom, a sufficient amount of close ceiling is to be lifted to enable examination of the structure below. The ceilings to be lifted is to comprise of at least two strakes on each side of centreline fore and ait and one of these strakes is to be in way of the bilges. | 2) In ships having a single bottom, a sufficient amount of ceiling is to be lifted to allow the examination of the structure underneath. The lifting of the ceiling is to comprise of at least three strakes all fore and aft on each side and one such strake one each side to be in way of the bilges. Where the ceiling is fitted in hatches, the whole of the hatches and at least one strake of planks in way of the bilges on each side are to be lifted. If the Surveyor considers it necessary the whole of the ceiling and the limber boards are to be lifted. | 2) Ceiling in the holds is to be removed in order to ascertain that the steel work is in good condition, free from rust and coated. If the Surveyor is satisfied, after removal of portions of the ceiling, than it need not all be removed | 2) Where holds are insulated for the purpose of carrying refrigerated cargoes, limbers and hatches are to be lifted and a sufficient additional amount of insulation is to be removed in each compartment to enable the Surveyor to ascertain the condition of the structure in way and to enable the thickness of the shell platting to be ascertained |

3) In ships having double bottom, a sufficient amount of ceiling is to be lifted from the tank top and the bilges to enable the condition of plating underneath to be ascertain. If the condition of the plating is found to be satisfactory, lifting of the remainder of the ceiling may be dispensed with. All bilges are to be cleaned for examination. Where the inner bottom plating is covered with cement or asphalt the removal of such covering may be dispensed with provided it is found to be adhering properly to the plating when carefully examined by hammering and chipping | 3) In ships with double bottom, a sufficient amount of ceiling in the holds and other spaces is to be removed from the bilges and the inner bottom to enable the condition of the structure in the bilges, the inner bottom plating, pillar feet and the bottom plating of bulkheads and tunnel sides to be examined. If the Surveyor considers it necessary, the whole of the ceiling is to be removed | 3) Portions of wood sheathing, or other covering, on steel decks are to be removed, as considered necessary by the Surveyor, in order to ascertain the condition of the plating | |

4) Where holds are insulated for the carriage of refrigerated cargoes and the hull in way was examined by PMDS Surveyors prior to the fitting of the insulation, it will be sufficient to remove the limbers and hatches | 4) The chain locker is to be cleaned internally. The chain cables are to be ranged for inspection. The anchors are to be cleaned and placed in an accessible position for | 4) Where the holds are insulated for the purpose of carrying refrigerated cargoes, the limbers and hatches are to be lifted and sufficient insulation is to be removed in each of the chambers to | |
for examination of the structure in way. In all other cases additional insulation will require to be removed as considered necessary to enable the Surveyor to satisfy himself regarding condition of the structure.

5) The steel work is to be exposed and cleaned as may be required for its proper examination by the Surveyor and close attention is to be paid to the parts of the structure which are particularly liable to excessive corrosion or to deterioration due to other causes.

6) All tanks are to be cleaned as necessary to permit examination.

7) Casings or covers of air, sounding, steam and other pipes, spar ceiling and lining in way of the side scuttles are to be removed, as required by the Surveyor.

Table 2.6.2.1 : (Contd.)

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

2.6.2.2 Survey Planning
Prior to commencement of any part of the special survey, a survey planning meeting is to be held between the attending surveyor(s), the owner’s representative in attendance, the thickness measurement company representative and the master of the ship or an appropriately qualified representative appointed by the master or Company for the purpose to ascertain that all the arrangements envisaged in the survey programme are in place, so as to ensure the safe and efficient conduct of the survey work to be carried out.

2.6.2.3 Space Protection
For ballast tanks, excluding 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, space in question is to be internally...
examined at annual surveys. Thickness measurements are to be carried out as deemed necessary by the Surveyor.

For double bottom ballast tanks where a hard protective coating is found in POOR condition and it has not been 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 spaces in question may be examined at Annual Surveys. When considered necessary by the surveyor, thickness measurements are to be carried out.

2.7. Tables
2.7.1. Examination of Plans and Documents
At Special Surveys, the management conditions of plans and documents specified in Table 2.3.1 are to be examined.

2.7.2. General Examination
At Special Surveys, all bilges and ballast piping systems in addition to hull, equipment, fire extinction and fittings specified in 2.5.2 are to be carried out carefully. Automatic air pipes heads which are located on the exposed deck are also examined carefully.

2.7.3. Performance Test
2.7.3.1. At Special Survey performance tests specified in 2.5.3 are to be carried out.

2.7.3.2. In addition to 2.7.3.1. Above, the performance tests and operation tests specified in 2.7.3.2.1 to 2.7.3.2.2 below are to be carried out.
2.7.3.2.1. Operation tests for all mechanically operated hatch covers
2.7.3.2.2. Hose tests (Shell plating, watertight decks, watertight bulkheads, shaft tunnels and other watertight tunnels, and hatchways with weathertight steel covers)

2.7.4. Internal Examinations of Spaces and Tanks
2.7.4.1. At Special Surveys, examinations of structures and fittings such as piping in tanks and spaces are to be carried out carefully paying due attention to items 2.7.4.1.1 to 2.7.4.1.7) below
2.7.4.1.1. Areas sensitive to corrosion (on parts such as structural members, piping, and hatch covers) in cargo holds where cargoes highly corrosive to steel such as logs, salt, coal, and sulphide ore have been loaded)
2.7.4.1.2. Areas sensitive to deterioration by heat such as planting under boilers
2.7.4.1.3. Structural discontinuous portions such as corners of hatchway openings on deck, openings (including side scuttles), cargo port, etc, on shell
2.7.4.1.4. Condition of coating and corrosion prevention system if applied
2.7.4.1.5. Condition of striking plates under sounding pipes
2.7.4.1.6. Condition of deck covering (e.g. cement)

2.7.4.1.7. Locations on which defects such as cracking, buckling, and corrosion have been found in similar ships or similar structures.

2.7.4.2. At Special Surveys, internal examinations of tanks or spaces listed in 2.7.4.1 below.

2.7.4.3. **Internal Examinations of Spaces and Tanks**

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Tanks and spaces subject to examination</th>
<th>Note</th>
</tr>
</thead>
</table>
| Special survey for ships up to 5 years of age (Special Survey No.1) | • Cargo holds  
• Cofferdams  
• Water tanks (tanks used for fresh or sea water)  
• Fuel oil tanks other than those of double bottom  
• Cargo tanks  
• Machinery spaces and other spaces | • Internal examination of the deep fuel oil tanks (except both peak tanks) may be omitted provided, after an external examination, the Surveyor is satisfied with the condition of the tanks.  
• Ballast tanks (excluding double bottom tanks) where the protective coating is found in poor condition and it is not renewed or where a protective coating has not been applied, internal examinations are to be carried out at annual intervals  
For double bottom tanks in this condition, internal examinations are to be carried out at annual intervals where considered necessary by the Surveyor |
| Special survey for ships over 5 years and up to 10 years of age (Special Survey No.2) | • Tanks and spaces subject to examination carried out at Special Survey No.1  
• Fuel oil tanks in double bottom | • If the fuel oil tanks (excluding both peak tanks) have had external examinations and the Surveyor is satisfied that they are in good condition, the scope of internal examinations may be reduced to just one forward and aft double bottom tank and one selected deep tank. If tanks are located in the cargo area, at least one of these tanks is to be examined. |
| Special survey for ships over 10 years of age (Special Survey No.3 and subsequent Special Survey) | • Tanks and spaces subject to examination carried out at Special Survey No.2  
• Lubricating oil tanks | • If the fuel oil tanks (excluding both peak tanks) have had external examinations and the Surveyor is satisfied that they are in good condition, the scope of internal examinations may be reduced to just one forward, aft and amidship double bottom tank and half of the deep tanks. If tanks are located in the cargo area, at least two of these tanks (including one deep tank) are to be examined. Also, at least one tank located in the engine room is to be examined.  
• However, internal examinations of fuel oil tanks and lubricating oil tanks for ships over 15 years of age may not be omitted |

2.7.4.4. **Additional requirements of internal examinations for general dry cargo ships of not less than 500 gross tonnage**

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Tanks and spaces subject to examination</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Special Surveys</td>
<td>1. All cargo holds</td>
<td></td>
</tr>
</tbody>
</table>
| 2. All ballast tanks and all tanks and spaces adjacent to cargo holds (pipe tunnels, cofferdams and void spaces) | • For ballast tanks where the protective coating is found in poor condition, and is not renewed or where a protective coating has not been applied, excluding double bottom tank, an internal examination is to be carried out at annual intervals. For double bottom ballast tanks in this condition, and internal examination is to be carried out at annual intervals where considered necessary by the Surveyor.  
• Ballast tanks converted to void spaces are to be examined applying the provisions for ballast tanks. |

2.7.5. Close-up Surveys

2.7.5.1. At Special Surveys, Close-up Surveys are to be carried out for portions 1) to 3) below:
2.7.5.1.1. Lower part of shell frames, tank side brackets and transverse bulkheads

2.7.5.1.2. Lower parts of air pipes and sounding pipes located on top of inner bottom plating

2.7.5.1.3. All hatch cover plating, hatch coaming plating and stiffeners

2.7.5.2. At Special Survey for general dry cargo ships of not less than 500 gross tonnage, in addition to the provisions of 2.7.5.1. Above, a Close-up Survey is to be carried out for structural members listed in Table 2.7.5.1

2.7.5.3. Requirements of Close-up Surveys for General Dry cargo ships of not less than 500 gross tonnage

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Structural members subject to Close-up Survey</th>
</tr>
</thead>
</table>
| Special survey for ships up to 5 years of age (Special Survey No.1) | 4. Selected shell frames in one forward and one after cargo holds and associated tween deck spaces and lower part of remaining shell frames including their end attachment and adjacent shell plating  
5. Lower parts of shell frames in remaining cargo holds including their end attachments and adjacent shell plating  
6. One selected transverse bulkhead and lower part of remaining transverse bulkheads (including stiffeners and girders)  
7. Air pipes and sounding pipes in cargo holds in way of tank top |
| Special survey for ships over 5 years and up to 10 years of age (Special Survey No.2) | 8. Selected shell frames in all cargo holds and associated tween deck spaces and lower part of remaining shell frames including their end attachments and adjacent shell plating.  
9. One transverse bulkhead and lower part of the remaining transverse bulkhead in each cargo hold (including stiffeners and girders)  
10. Both forward and aft bulkhead (including stiffeners and girders) in one side ballast tank  
11. One transverse web with associated plating and longitudinals in two representative ballast tanks of each type (topside, bilge hopper, side tank or double bottom tank)  
12. Selected area of deck plating and under deck structure inside the line of hatch openings between cargo holds (1)  
13. Selected area of inner bottom plating  
14. Air pipes and sounding pipes in cargo holds in way of tank top |
| Special survey for ships over 10 years and up to 15 years of age (Special Survey No.3) | 5. All shell frames in the forward lower cargo hold, and 25% of frames in each of the remaining cargo holds and tween deck spaces, and lower part of remaining shell frames including their end attachments and adjacent shell plating  
6. All transverse bulkheads (including stiffeners and girders) in all cargo holds  
7. All transverse webs with associated plating and longitudinal in each ballast tank (topside, bilge hopper, side tank or double bottom tank)  
8. All deck plating and under deck structure inside the line of hatch openings between cargo hold hatches (1)  
10. All area o inner bottom plating  
11. Air pipes and sounding pipes in cargo holds in way of tank top. |
| Special survey for ships over 15 years of age (Special Survey No.4 and subsequent Special Survey) | 3. All shell frames in all cargo holds and associated tween deck spaces including their end attachments and adjacent shell plating  
4. Structural members specified in 2 to 7 of Special Survey No. 3 above. |

Note: (1) Deck plating under deck structure inside the line of hatch openings between cargo holds hatches

2.7.6. Thickness Measurements

2.7.6.1. At Special Surveys, Thickness measurements are to be carried out in accordance with 2.7.6.1.1 through 2.7.6.1.5 below:

2.7.6.1.1. Thickness measurements are to be carried out using appropriate ultra-sonic gauging machines or other approved means. The Surveyor may request that the accuracy of the equipment be demonstrated.

2.7.6.1.2. Thickness measurements are to be carried out within 12 months prior to completion of the survey in question under the attendance of the Surveyor by the firm approved by the Class
PART I

2.7.6.1.3. Additional thickness measurements are to be carried out before the completion of the survey

2.7.6.1.4. A thickness measurement record is to be prepared and submitted to the Class

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

2.7.6.1.6. Lower parts of air pipes and sounding pipes located on top of inner bottom plating

2.7.6.1.7. All hatch cover plating, hatch coaming plating and stiffeners

2.7.6.2. At Special Surveys thickness measurements are to be carried out according to 2.7.6.1.1 above for structural members listed in Table 2.7.6.3 below. Where substantial corrosion is found as a result of such thickness measurements, additional thickness measurements are to be taken in accordance with Table 2.7.6.5.

2.7.6.3. Requirements for Thickness Measurements for Cargo Ships

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Structural members subject to thickness measurement</th>
</tr>
</thead>
</table>
| Special survey for ships up to 5 years of age (Special Survey No.1) | 1. Suspect areas  
2. All bow doors, inner doors, side shell doors and stern doors when deemed necessary by the Surveyor (plating and stiffeners) |
| Special survey for ships over 5 years and up to 10 years of age (Special Survey No.2) | 1. Suspect areas  
2. Each plate in one section of the strength deck plating for the full beam of the ship within 0.5L amidships  
3. All bow doors, inner doors, side shell doors and stern doors when deemed necessary by the Surveyor (plating and stiffeners) |
| Special survey for ships over 10 years and up to 15 years of age (Special Survey No.3) | 1. Suspect areas  
2. Each plate and member in two transverse sections within 0.5L amidships. (in way of two different cargo spaces, if applicable)  
3. Internals in fore and aft. peak tank  
4. Both ends and middle part of each hatch side and end coaming (plating and stiffeners)  
5. All cargo hold hatch covers (plating and stiffeners)  
6. All bow doors, inner doors, side shell doors and stern doors when deemed necessary by the Surveyor (plating and stiffeners) |
| Special survey for ships over 15 years and up to 20 years of age (Special Survey No.4) | 1. Suspect areas  
2. Following portions of structural members:  
1) All exposed main deck plates, full length  
2) Each plate and member in three transverse sections of cargo areas within 0.5L amidships  
3) All wind and water strakes, port and starboard, full length  
3. Representative exposed superstructure deck plating (poop, bridge and forecastle deck)  
4. All keel plates, full length, and an appropriate number of bottom plates in way of cofferdams, machinery spaces and aft end of tanks  
5. Plating of sea chests, and shell plating in way of overboard discharges (as deemed necessary by the Surveyor)  
6. In all cargo holds, all lowest strakes and strakes in way of tween decks of all watertight transverse bulkheads in cargo spaces together with internals in way  
7. Structural members specified in 3. to 5. of Special Survey No.3 |
| Special survey for ships over 20 years of age (Special Survey No.5 and subsequent Special Surveys) | 1. Suspect areas  
2. Following portions of structural members  
1) All exposed main deck plates, full length  
2) Each plate and member in three transverse sections, one in the midship area, within 0.5L amidships.  
3) Each bottom plate within cargo length area, including lower turn of bilge  
4) Duct keel or pipe tunnel plating and internals within cargo length area  
3. All wind and water strakes  
4. At least the following structural members for general assessment and recording of corrosion pattern:  
1) Structural members subject to close-up survey |
2.7.6.4. **Requirements of Thickness Measurements for General Dry Cargo Ships of not less than 500 gross tonnage**

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Structural members subject to thickness measurement</th>
</tr>
</thead>
</table>
| **Special survey for ships up to 5 years of age (Special Survey No.1)** | 1. Suspect areas  
2. At least the following structural members for general assessment and recording of corrosion pattern:  
1) In cargo holds where cargoes highly corrosive to steel such as logs, salt, coal, and sulfide ore have been loaded: lower parts of web (thinnest parts of web in case of built-up type frame) and their lower end brackets of at least three hold frames at forward, middle, and aft parts on both sides of each cargo hold  
2) At least one plate of lowest strake and strakes in way of tween decks of all watertight transverse bulkheads in cargo spaces specified in 1) above together with internals in way  
3) For top side tanks, bilge hopper tanks and deep tanks used as ballast tanks: both ends and middle part (including face plate) of one transverse ring or corresponding main structural members in one tank selected arbitrarily from each type  |
| **Special survey for ships over 5 years and up to 10 years of age (Special Survey No.2)** | 1. Suspect areas  
2. Following portions of structural members within 0.5L amidships:  
1) Each plate in one section of the strength deck plating for the full beam of the ship  
2) Each strength deck plate in way of water ballast tanks, if any  
3) Each strength deck plate on or underneath which log cargoes or other cargoes that are prone to accelerate corrosion have been carried  
3. At least the following structural members for general assessment and recording of corrosion pattern:  
1) In cargo holds specified in 2. 1) of Special Survey No.1 above: lower and upper parts of web (thinnest parts of web in case of built-up type frame) and their end brackets of a sufficient number (at least 1/3 of total number) of frames at forward, middle, and aft parts on both sides of each cargo hold  
2) All plates of lowest strake and strakes in way of tween decks of all watertight transverse bulkheads in cargo spaces specified in 1) above together with internals in way  
3) In cargo holds other than 1) above, structural members specified in 2. 1) and 2) of Special Survey No.1 above.  
4) For top side tanks, bilge hopper tanks and deep tanks used as ballast tanks: both ends and middle part (including face plate) of approximately half the number of transverse rings or corresponding main structural members and at least one plate of upper and lower ends of each bulkhead in one tank selected arbitrarily from each type  
5) For remaining top side tanks, bilge hopper tanks and deep tanks used as ballast tanks: both ends and middle part of one transverse ring or corresponding main structural members (including face plate)  
6) Other structural members subject to close-up survey  
4. All cargo hold hatch coamings (plating and stiffeners)  
5. All cargo hold hatch covers (plating and stiffeners)  |
| **Special survey for ships over 10 years and up to 15 years of age (Special Survey No.3)** | 1. Suspect areas  
2. Structural members within the cargo length area:  
1) Each deck plating outside the line of cargo hatch openings  
2) Each deck plating inside the line of cargo hatch openings within 0.5L amidships  
3) Each plate and member in two transverse sections, one in the midship area, within 0.5L amidships.  
4) All wind and water strakes  
3. Selected wind and water strakes outside the cargo length area  
4. At least the following structural members for general assessment and recording of corrosion pattern:  
1) Lower and upper parts of web (thinnest parts of web in case of built-up type frame) and their end brackets of a sufficient number (at least 1/3 of total number) of frames at forward, middle, and aft parts on both sides of each cargo hold  
2) Other structural members subject to close-up survey  
5. Internals in fore and aft peak tank  
6. All cargo hold hatch coamings (plating and stiffeners)  
7. All cargo hold hatch covers (plating & stiffeners)  |
| **Special survey for ships over 15 years of age (Special Survey No.4 and subsequent Special Surveys)** | 1. Suspect areas  
2. Following portions of structural members:  
1) All exposed main deck plating, full length  
2) Each plate and member in three transverse sections of cargo areas within 0.5L amidships  
3) Each bottom plate within cargo length area, including lower turn of bilge  
4) Duct keel or pipe tunnel plating and internals within cargo length area  
3. All wind and water strakes, port and starboard, full length  
4. Representative exposed superstructure deck plating (poop, bridge and forecastle deck)  
5. All keel plates, full length, and an appropriate number of bottom plates in way of cofferdams,
machinery spaces and aft end of tanks
6. Plating of sea chests, and shell plating in way of overboard discharges (as deemed necessary by the Surveyor)
7. In all cargo holds, all lowest strakes and strakes in way of tween decks of all watertight transverse bulkheads in cargo spaces together with internals in way
8. Structural members specified in 3. to 5. of Special Survey No.3

2.7.6.5. Requirements of Additional thickness Measurements for Cargo Ships in Way of Substantial Corrosion

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of Measurement</th>
<th>Pattern of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Plating</td>
<td>Suspect areas and adjacent plates</td>
<td>5 point pattern over 1 square metre</td>
</tr>
<tr>
<td>2. Girders</td>
<td>Suspect areas</td>
<td>5 point pattern over 1 square metre</td>
</tr>
<tr>
<td>3. Stiffeners</td>
<td>Suspect areas</td>
<td>3 measurements in line across web</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 measurements on flange</td>
</tr>
</tbody>
</table>

2.8. Pressure Tests

2.8.1. At Special Surveys, a pressure test of tanks is to be carried out according to 2.8.1.1 through 2.8.1.3 below:

2.8.1.1. A pressure test is to be carried out under the pressure specified below:
   a) For tanks: the pressure corresponding to the maximum head that can be experienced in service
   b) For piping: the working pressure

2.8.1.2. A pressure test of tanks may be carried out when the ship is afloat, provided that an internal examination of the bottoms of the tanks has also been carried out while afloat.

2.8.1.2.1. At Special Surveys for ships having many water tanks and oil tanks, some of the tank may be exempted from a pressure test where deemed appropriate by the Surveyor taking into account the ship’s present condition, age and interval from the previous test.

2.8.1.3. At Special Survey for cargo ships, a pressure test is to be carried out according to 2.8.1.1 above for tanks listed in 2.8.1.

2.8.1.4. At Special survey for dry cargo ships of not less than 500 gross tonnage, notwithstanding the provisions of 2.8.1.2 above a pressure test is to be carried out according to 2.8.1.1 above for tanks listed in 2.8.2.

2.8.2. Requirement of Pressure Test for Cargo Ships

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Tanks subject to pressure test</th>
</tr>
</thead>
</table>
| All Special Survey   | 1. All water tanks including cargo holds used for ballast and all cargo tanks
|                      | Pressure tests of fresh water tanks may be specially considered when deemed appropriate by the Society. |
|                      | 2. All fuel oil tanks
|                      | Pressure tests may be specially considered when deemed appropriate by the Society.            |
|                      | 3. All lubrication oil tanks
|                      | Pressure tests may be specially considered when deemed appropriate by the Society.            |
2.8.3. **Requirements of Pressure Tests for General Dry Cargo Ships of not less than 500 gross tonnage**

<table>
<thead>
<tr>
<th>Special Survey</th>
<th>Tanks subject to pressure test</th>
</tr>
</thead>
</table>
| All Special Survey | 1. All boundaries of ballast tanks, deep tanks and cargo holds used for ballast within the cargo length area  
                      | 2. Representative fuel oil tanks within the cargo length area. When deemed appropriate by the Society, pressure tests may be specially considered.  
                      | 3. All water tanks  
                      | Pressure tests of fresh water tanks may be specially considered when deemed appropriate by the Society.  
                      | 4. All fuel oil tanks outside the cargo length area  
                      | Pressure tests may be specially considered when deemed appropriate by the Society.  
                      | 5. All lubrication oil tanks  
                      | Pressure tests may be specially considered when deemed appropriate by the Society                                                                 |

**Section 3 Oil (Chemical) Tankers**

3.1 General

3.1.1. These requirements apply to all self-propelled ships with integral tanks (chemical tankers) carrying chemicals in bulk, ships with the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk regulated by the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk. If a chemical tanker is constructed with both integral and independent tanks, these requirements are applicable only to that portion of the cargo length containing integral tanks. Combination carriers for the carriage of liquefied gases and chemicals (gas carriers / chemical tankers) with independent tanks within the hull, shall be surveyed as gas carriers.
3.1.2. The requirements apply to surveys of hull structures and piping systems in way of cargo tanks, pump rooms, cofferdams, pipe tunnels, void spaces within the cargo area and all ballast tanks. The requirements are not applicable to independent tanks on deck. The requirements also apply to the survey of mechanical, electrical equipment and systems.

3.1.3. These 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.

3.2. Annual Survey
3.2.1. General
3.2.1.1. The survey shall consist of an examination for the purpose of ensuring, as far as practicable, that the hull, piping, mechanical and electrical equipment, as well as systems are maintained in a satisfactory condition.
3.2.2. Survey of the hull includes:
3.2.2.1. Examination of the hull plating and its closing appliances as far as can be seen;
3.2.2.2. Examination of deck and bulkhead sockets in watertight structures as far as practicable.

3.2.3. Survey of the weather deck includes:
3.2.3.1. Examination of all cargo tank openings including gaskets, covers, coamings and flame screens;
3.2.3.2. Examination of vacuum/pressure valves of vent systems, flame screens and flame-arresting fittings;
3.2.3.3. Examination of flame screens on air pipes of fuel and oil tanks;
3.2.3.4. Examination of cargo, bunker, ventilating and vent piping systems, including vent masts and headers;
3.2.3.5. Examination of electrical connections of pipeline sections and their earthings.

3.2.4. Survey of cargo pump rooms and pipe tunnels, if any, includes:
3.2.4.1. Examination of vent systems, including an interlock of cargo pump room lighting and a check of mechanical ventilating system operation.
3.2.4.2. Examination of all pump room bulkheads for signs of dangerous chemical leakage or fractures and, in particular, the sealing arrangements of pump shafts and bulkhead sockets;
3.2.4.3. Examination of electrical connections of pipeline sections and their earthings;
3.2.4.4. Examination of the condition of all piping systems;
3.2.5. Survey of ballast tanks.

3.2.5.1. Examination of ballast tanks where required as a consequence of the results of the special survey or intermediate survey shall be carried out. When considered necessary by the surveyor, or when extensive corrosion exists, thickness measurements shall be carried out and if the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements shall be increased in accordance with Table 17. These extended thickness measurements shall be carried out before the survey is credited as completed.

Suspense areas identified at previous surveys shall be examined. Areas of substantial corrosion identified at previous surveys shall have thickness measurements taken.

Table 17 Requirements for extent of thickness measurements in areas of substantial corrosion within the cargo tank length at special survey of chemical tankers

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extend of measurements</th>
<th>Pattern of measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Bottom, inner bottom and hopper structure</strong></td>
<td>Minimum of three bays across tank, including aft spacing. Measurements around and under all suction bell mouths. Minimum of three longitudinals in each section where bottom plating measured. At fore and aft watertight floors and in centre of tanks.</td>
<td>5 point pattern for each panel between longitudinals and floors. Three measurements in line across the face plate and three measurements between each stiffener, or a minimum of three measurements.</td>
</tr>
<tr>
<td>1.1 Bottom inner bottom and hopper structure plating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Bottom inner bottom and hopper structure longitudinals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Central ad bottom girders, including the watertight ones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Floors including the watertight ones</td>
<td>Three floors in section where bottom plating measured, with measurements at both ends and middle. Three web frame rings in sections where bottom plating measured. - Lower 1/3 of bulkhead. - Upper 2/3 of bulkhead. - Stiffeners (minimum of three).</td>
<td>Two measurements across flange where fitted. 5 point pattern over two square meter. 5 point pattern over one square meter of plating. Single measurements on flange. 5 point pattern over one square meter of plating. For web. 5 point pattern over span (two measurements across web at each end and center of span single measurements).</td>
</tr>
<tr>
<td>1.5 Hopper structure web frame ring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Hopper structure transverse watertight bulkhead or swash bulkhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.7 Stiffeners</td>
<td>Where applicable.</td>
<td>2. Deck structure</td>
</tr>
<tr>
<td><strong>2.1 Deck plating</strong></td>
<td>Two transverse sections across tank.</td>
<td>Minimum of three measurements per plate per section. Three measurements in line vertically on webs and two measurements on face plate (if fitted). Vertical line of single measurements on girder plating with one measurement between each stiffener, or a minimum of three measurements. Two measurements across flange. 5 point pattern on deck girders/bulkheads/bulkheads brackets. 5 point pattern over one square meter area. Single measurements on flange. 5 point pattern over one square meter area.</td>
</tr>
<tr>
<td><strong>2.2 Deck longitudinals</strong></td>
<td>Every third longitudinal in each of two strakes with a minimum of one longitudinal. At fore and aft transverse bulkhead, bracket toes and in center of tanks.</td>
<td></td>
</tr>
<tr>
<td><strong>2.3 Deck girders and brackets.</strong></td>
<td>Minimum of two webs, with measurements at both ends and middle of span. Minimum of two web frame rings, and both transverse bulkheads.</td>
<td></td>
</tr>
<tr>
<td><strong>2.4 Deck transverse webs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.5 Vertical web frame rings and transverse bulkheads in wing ballast tank for double skin chemical tanker (two meters from deck)</strong></td>
<td>Where applicable.</td>
<td></td>
</tr>
<tr>
<td><strong>2.6 stiffeners</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Side shell and longitudinals bulkheads structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.1 side shell and longitudinal bulkhead plating:</strong></td>
<td>Plating between each pair of longitudinals in a minimum of three sections (along the tank). Plating between every third pair of</td>
<td>Single measurement.</td>
</tr>
<tr>
<td>3.1.1 deck head and bottom strakes in way of horizontal girders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1.2 all other strakes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2 side and longitudinal bulkhead longitudinals on:
3.2.1 deckhead and bottom strakes, and strakes in way of horizontal girders
3.2.2 All other strakes
3.3 longitu
dinals brackets
3.4 Vertical web frame rings and transverse bulkheads of double side tanks (excluding deck area):
3.4.1 strakes in way of horizontal girders
3.4.2 other strakes
3.5. Web frame rings and cross ties for other tanks than double side tanks
3.6. Horizontal girders
3.7. Stiffeners

| 3.2 | side and longitudinal bulkhead longitudinals on: | longitu
dinals in same three sections |
|     | 3.2.1 deckhead and bottom strakes, and strakes in way of horizontal girders | Each longitudinals in same three sections |
|     | 3.2.2 All other strakes | Every third longitudinal in same three sections |
| 3.3 | longitu
dinals brackets | Minimum of three at top, middle and bottom of tank in same three sections |
| 3.4 | Vertical web frame rings and transverse bulkheads of double side tanks (excluding deck area): | Minimum of two web frame rings and both transverse bulkheads |
|     | 3.4.1 strakes in way of horizontal girders | Minimum of two web frame rings and both transverse bulkheads |
|     | 3.4.2 other strakes | Three web frame rings with minimum of three locations on each lower end bracket |
|     | 3.5. Web frame rings and cross ties for other tanks than double side tanks | Plating on each girder in a minimum of three section |
|     | 3.6. Horizontal girders | Where applicable |
| 3.7. | Stiffeners | 3 measurements across web and 1 measurement on face plate |
|     | | 3 measurements across web and 1 measurement on face plate |
|     | | 5 point pattern over area of bracket |

4. Transverse watertight bulkheads and swash bulkheads

| 4.1. Upper and lower stool, where fitted | Transverse strakes within 25 mm of welded connection to inner bottom/deck plating |
| 4.2. Deckhead and bottom strakes, and strakes in way of horizontal girders | Plating between pair of stiffeners at three locations: approximately 1/4, 1/2 and 3/4 within of tank |
| 4.3. All other strakes | Plating between pair of stiffeners at middle location |
| 4.4. Strakes in corrugated bulkheads | Plating for each change of scantling at center of web and flange of corrugation |
| 4.5. Stiffeners | Minimum of three typical stiffeners |
| 4.6. Brackets | Minimum of three at top, middle and bottom of tank |
| 4.7. Horizontal girders | All girders with measurements at both ends and middle |
| 4.8. Deep webs | Measurements at toe bracket and at center of span |

| 4.1. Upper and lower stool, where fitted | 5 point pattern between stiffeners over one meter length |
| 4.2. Deckhead and bottom strakes, and strakes in way of horizontal girders | 5 point pattern between stiffeners over one meter length |
| 4.3. All other strakes | 5 point pattern over about one square meter of plating |
| 4.4. Strakes in corrugated bulkheads | Single measurement |
| 4.5. Stiffeners | 5 point pattern over about one square meter of plating |
| 4.6. Brackets | For web, 5 point pattern over span between bracket connections (two measurements across web at each bracket connection and one at center of span) |
| 4.7. Horizontal girders | For face plate, single measurements at each bracket toe and at center of span |
| 4.8. Deep webs | For web, 5 point pattern over about 1 square meter |

3.2.6. Survey of mechanical, electrical equipment and systems.
2.6.1. Pumps, fans with their drive motors, control systems, instrumentation, safety devices and other equipment of the following systems, as far as practicable, are subject to examination and operational testing:
3.2.6.1.1. Automated cargo control system; hydrocarbon gas concentration control system in pump rooms;
3.2.6.1.2. Cargo heating system in cargo tanks;
3.2.6.1.3. Cargo and stripping system;

3.2.6.1.4. Ballast system.

3.2.6.2. Survey shall be carried out to confirm that potential sources of fire in pump rooms or nearby are missing and ladders for access are in fit condition and that all the electrical equipment in pump rooms is in fit condition.

3.2.6.3. During examination confirmation shall be made that all the electrical equipment in pump rooms is in fit condition and properly maintained.

3.2.7. Survey of inert gas system is carried out, which includes:

3.2.7.1. Examination to confirm that all piping and their components are in fit condition and free of signs of corrosion, or gas or liquid leakage;

3.2.7.2. Check of a deck water seal for automatic filling and draining, and for being free of water carry-over;

3.2.7.3. Check of a non-return valve condition;

3.2.7.4. Examination to confirm that both inert gas blowers are properly operated;

3.2.7.5. Operational testing of a scrubber room ventilating system;

3.2.7.6. Operational testing of soot blowers interlocking;

3.2.7.7. Operational testing of all remotely operated and automatically controlled valves including inert gas shut-off valves;

3.2.7.8. Check, as far as practicable, including simulation of conditions, when necessary, of the following alarm and safety devices of the inert gas system:

3.2.7.8.1. High oxygen content of the inert gas in the inert gas supply main;

3.2.7.8.2. Low pressure or low velocity of water flow;

3.2.7.8.3. Low pressure in the pipeline feeding the deck water seal;

3.2.7.8.4. High water level in scrubber;

3.2.7.8.5. Low pressure in the inert gas supply main;
3.2.7.8.6. High gas temperature in the inert gas supply main;

3.2.7.8.7. Discontinuance of inert gas blowers operation;

3.2.7.8.8. Failure of power supply to the automatic control system for the gas regulating valve and to continuously indicating and permanently recording devices for monitoring pressure and oxygen content in the inert gas supply main;

3.2.7.8.9. High gas pressure in the inert gas supply main;

3.2.7.9. Check of an accuracy of portable and fixed equipment for measurements of an oxygen concentration with use of a calibrating gas;

3.2.7.10. Check, if practicable, of the proper functioning of the inert gas system after the completion of the above checks.

3.2.8. Survey of piping and fittings of a fixed foam fire extinguishing system on deck and in pump rooms shall be carried out.

3.2.9. Survey and operational testing of spark arresters of exhaust systems of main, auxiliary and emergency engines, steam boilers and fire extinguishing means for silencers, if fitted, shall be carried out.

3.3. Intermediate Survey

3.3.1. General

3.3.1.1. The survey extent is dependent on the age of the vessel.

3.3.1.2. 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.

3.3.1.3. Those items which are additional to the requirements of the Annual Surveys may be surveyed either at or between the 2nd and 3rd Annual Survey.

3.3.2. Chemical Tankers between 5 and 10 years of age

3.3.2.1. For ballast tanks used, 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.

3.3.2.2. A Ballast Tank is to be examined at subsequent annual intervals where:

3.3.2.2.1. A hard protective coating has not been applied from the time of construction, or
3.3.2.2. A soft coating has been applied, or

3.3.2.3. Substantial corrosion is found within the tank, or

3.3.2.4. 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.

3.3.2.3. In addition to the requirements above, suspect areas identified at previous surveys are to be examined.

3.3.3. Chemical Tankers between 10 and 15 years of age
3.3.3.1. The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey as required in this rules. However, pressure testing of cargo and ballast tanks is not required unless deemed necessary by the attending Surveyor.

3.3.3.2. In application of 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.

3.3.3.3. In application of an underwater survey may be considered in lieu of the requirements of Dry Dock Survey.

3.3.4. Chemical Tankers over 15 years of age
3.3.4.1. The requirements of the Intermediate Survey are to be to the same extent as the previous Special Survey. However, pressure testing of cargo and ballast tanks is not required unless deemed necessary by the attending surveyor.

3.3.4.2. 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.

3.3.4.3. 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 surveyed 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.

3.3.5. Dry-dock Survey
3.3.5.1. A 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 are to be carried out in accordance with the applicable requirements for special surveys, if not already performed. Lower portions of the cargo and ballast tanks are considered to be the parts below light ballast water line.
3.3.6. In-water survey
3.3.6.1. For ships of less than 15 years of age, alternate inspections of the ship’s bottom not conducted in conjunction with the enhanced survey during the Special Survey may be carried out with the ship afloat. Inspection of the ship afloat should only be carried out when the conditions are satisfactory and the proper equipment and suitably qualified staff is available.

3.3.6.2. For ships of 15 years of age and over, inspection of the outside of the ship's bottom should be carried out with the ship in dry dock.

3.3.7. Special Survey
3.3.7.1. In addition to the applicable requirements of this rule, the following items are to be surveyed:
3.3.7.1.1. The internal examination including close-up survey and pressure testing of all tanks and spaces are to be carried out according to Table 18, Table 19 and Table 20

<table>
<thead>
<tr>
<th>Table 18 Additional Requirements of Internal Examinations for Oil Tankers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special Survey</td>
</tr>
<tr>
<td>All special survey</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Table 19 Minimum Requirements for Close-up Surveys at Hull Special Survey of Chemical Carriers

<table>
<thead>
<tr>
<th>SS No.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 5</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1. One transverse section&quot;1 in a ballast wing tank or ballast double</td>
</tr>
<tr>
<td>2. One deck transverse*2 in a cargo tank or on deck</td>
</tr>
<tr>
<td>3. One transverse bulkhead*4</td>
</tr>
<tr>
<td>a) In a ballast tank</td>
</tr>
<tr>
<td>b) In a cargo wing tank</td>
</tr>
<tr>
<td>c) In a cargo center tank</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 10</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1. All plating and internal structure*5 in a ballast wing tank or ballast double hull tank</td>
</tr>
<tr>
<td>2. One deck transverse*2,</td>
</tr>
<tr>
<td>a) In each remaining ballast tank or on deck</td>
</tr>
<tr>
<td>b) In a cargo wing tank or on deck</td>
</tr>
<tr>
<td>c) In two cargo center tanks or on deck</td>
</tr>
<tr>
<td>3. Both transverse bulkhead*6 – in a ballast wing tank or ballast double hull tank</td>
</tr>
<tr>
<td>4. One transverse bulkhead*7,</td>
</tr>
<tr>
<td>a) In each remaining ballast tank</td>
</tr>
<tr>
<td>b) In a cargo wing tank</td>
</tr>
<tr>
<td>c) In two cargo center tanks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 15</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1. All plating and internal structure*5 – in all ballast tanks</td>
</tr>
<tr>
<td>2. All plating and internal structure*5 in a cargo wing tank.</td>
</tr>
<tr>
<td>3. One transverse section*1 in each remaining ballast tank</td>
</tr>
<tr>
<td>4. All transverse bulkheads*7, in all cargo tanks</td>
</tr>
</tbody>
</table>

*1. Complete transverse web frame ring including adjacent structural members.  
*2. Deck transverse including adjacent deck structural members.  
*3. Transverse bulkhead complete – including girder system and adjacent members.  
*4. Transverse bulkhead lower part – including girder  
*5. Complete tank – including all tank boundaries and internal structure, and external structure on deck in way of the tank.  
*6. Double hull tank – including double bottom and side tank even though these tanks are separate.

### Table 20 Minimum Requirements to Tank Testing at Hull Special Survey of Chemical Carriers

<table>
<thead>
<tr>
<th>SS No.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 5</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1. All ballast tank boundaries</td>
</tr>
<tr>
<td>2. Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, representative fuel oil tanks, pump-rooms or cofferdams</td>
</tr>
<tr>
<td>3. All cargo tank bulkheads which form the boundaries of segregated cargoes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 10</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1. All ballast tank boundaries</td>
</tr>
<tr>
<td>2. Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, representative fuel oil tanks, pump-rooms or cofferdams</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 15</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1. All ballast tank boundaries</td>
</tr>
<tr>
<td>2. Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, representative fuel oil tanks, pump – rooms or cofferdams</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No. ≥ 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 15</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>1. As special survey No. 3</td>
</tr>
<tr>
<td>2. Cargo tank boundaries facing ballast tanks, void spaces, pipe tunnels, representative fuel oil tanks, pump-rooms or cofferdams</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SS No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 15</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>3. All remaining cargo tank bulkheads</td>
</tr>
</tbody>
</table>

3.3.7.1.2. The minimum requirements for thickness measurements are given in Table 21. The extent of thickness measurement in way of Substantial Corrosion is given in Table 22.
Table 21 Minimum Requirements for Thickness Measurements at Hull Special Survey of Chemical Carriers

<table>
<thead>
<tr>
<th>SS No. 1 Age ≤ 5</th>
<th>SS No. 2 5 ≤ Age ≤ 10</th>
<th>SS No. 3 10 ≤ Age ≤ 15</th>
<th>SS No. ≥ 4 Age ≤ 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. One section of deck plating for the full beam of the ship within the cargo area (in way of a ballast tank used primarily for water ballast)</td>
<td>1. Within the cargo area: a. Each deck plate b. One transverse section</td>
<td>1. Within the cargo area: a. Each plate b. Two transverse sections</td>
<td>1. Within the cargo area: a. Each deck plate b. Three transverse sections c. each bottom plate</td>
</tr>
<tr>
<td>2. Measurements of structural members subject to close-up survey according to Table I 2-6, for general assessment and recording of corrosion pattern</td>
<td>2. Measurements of structural members subject to close-up survey according to Table I 2-6, for general assessment and recording of corrosion pattern</td>
<td>2. Measurements of structural members subject to close-up survey according to Table I 2-6, for general assessment and recording of corrosion pattern</td>
<td>2. Measurements of structural members subject to close-up survey according to Table I 2-6, for general assessment and recording of corrosion pattern</td>
</tr>
<tr>
<td>4. selected wind and water strakes outside the cargo area</td>
<td>4. selected wind and water strakes outside the cargo area</td>
<td>4. selected wind and water strakes outside the cargo area</td>
<td>5. All wind and water strakes within the cargo area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. All wind and water strakes within the cargo area</td>
<td></td>
</tr>
</tbody>
</table>
### Table 22 Requirements for Extent of Thickness Measurement in way of Substantial Corrosion at Hull Special Survey of Chemical Carriers within the Cargo Tank Length (1/2)

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of measurement</th>
<th>Pattern of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Double bottom and hopper structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. inner bottom and bottom plating</td>
<td>Suspect plate plus adjacent plates Measurements around and under all bell mouths and pump wells</td>
<td>5 point pattern for each panel between longitudinals over 1 meter length</td>
</tr>
<tr>
<td>2. Inner bottom and bottom longitudinal</td>
<td>Three longitudinals where plates measured</td>
<td>3 measurements in line across flange and 3 measurements on vertical web</td>
</tr>
<tr>
<td>3. Longitudinals girders or transverse floors</td>
<td>Suspect plates</td>
<td>5 point pattern over about 1 m²</td>
</tr>
</tbody>
</table>
| 4. Watertight bulkheads (WT floors) | a. lower 1/3 of tank  
  b. 2/3 of tank                                                                            | a. 5 point pattern over about 1 m²  
  b. 5 point pattern alternate plates over 1 m² of plating                             |
| 5. Web frames                      | Suspect plate                                                                          | 5 point pattern                                                                        |

**Deck Structure**

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of measurement</th>
<th>Pattern of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. deck plating</td>
<td>Two bands across tank</td>
<td>Minimum of three measurements per plate per band</td>
</tr>
<tr>
<td>2. Deck longitudinals</td>
<td>Minimum of 3 longitudinals in each of two bays</td>
<td>3 measurements in line vertically on webs, and 2 measurements on flange (if fitted)</td>
</tr>
<tr>
<td>3. Deck girders and brackets</td>
<td>At fore and aft transverse bulkhead, bracket toes and in center of tanks.</td>
<td>Vertical line of single measurements on web plating with one measurement between each panel stiffeners, or a minimum of three measurements two measurements across face flat 5 point pattern on girders/bhd brackets</td>
</tr>
<tr>
<td>4. Deck transverse webs</td>
<td>Minimum of two webs with measurements at middle and both ends of span</td>
<td>5 points pattern over about 2 m² areas. Single measurements on face flat</td>
</tr>
<tr>
<td>5. Panel stiffening</td>
<td>Where provided</td>
<td>Single measurements</td>
</tr>
</tbody>
</table>

**NOTE:** For tanks where substantial Corrosion covers more than 20% of the deck surface, the whole deck structure including longitudinal web frames above the tank is to be thickness measured in accordance with above

**Deck structure side shell and longitudinal bulkheads**

<table>
<thead>
<tr>
<th>Structural Member</th>
<th>Extent of measurement</th>
<th>Pattern of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Deckhead and bottom strakes, and strakes in way of stringer platforms</td>
<td>Plating between each pair of longitudinals in a minimum of 3 bays</td>
<td>Single measurement</td>
</tr>
<tr>
<td>2. All other strakes</td>
<td>Plating between every 3rd pair longitudinals in a minimum of 3 bays</td>
<td>Single measurement</td>
</tr>
<tr>
<td>3. Longitudinals-deckhead and bottom strakes</td>
<td>Each longitudinal in same 3 bays</td>
<td>3 measurements across web and 1 measurement on flange</td>
</tr>
<tr>
<td>4. Longitudinals – all others</td>
<td>Every third longitudinal in same 3 bays</td>
<td>3 measurements across web and 1 measurement on flange</td>
</tr>
<tr>
<td>5. Longitudinals - bracket</td>
<td>Minimum of three at top middle and bottom of tank in same 3 bays</td>
<td>5 point pattern over area of bracket</td>
</tr>
<tr>
<td>6. Web frames and across ties</td>
<td>3 webs with minimum of three locations on each web, including in way of cross tie connections</td>
<td>5 point pattern over about 2 m² area, plus single measurements on web frame and cross tie face flats</td>
</tr>
</tbody>
</table>
3.3.8. Special survey - cargo area equipment
In addition to the requirements of the cargo system and pertinent safety devices, the following items are to be examined:

3.3.8.1. 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.

3.3.8.2. All ventilation systems in cargo areas, including portable fans, are to be examined and function tested.

3.3.8.3. 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.

3.3.8.4. The bilge systems of pump rooms are to be examined and tested.

3.3.8.5. Cargo tank heating systems are to be examined and pressure tested to 1.5 times the operating pressure.

3.3.8.6. Tank venting systems are to be examined. Flame arresters are to be opened up as far as necessary, and cleaned.

3.3.8.7. Cargo stripping and ballast pumps are to be examined. Pressure relief valves of pumps are to be function tested.

3.3.8.8. The following equipment is to be function tested:

3.3.8.8.1. Remote control systems of cargo pumps.

3.3.8.8.2. Overflow controls

3.3.8.8.3. Liquid level alarms.

3.3.8.8.4. Sampling arrangements for cargo tanks, if fitted.

3.3.8.8.5. Level indicators of cargo tanks.

3.3.8.8.6. Pressure and temperature alarms.

Section 4 Liquefied Gas Carriers
4.1. General
4.1.1. When a survey becomes due or any damage or alterations which may affect the technical fitness or the class to the hull or machinery of the ship occurred, the owner or his representative is to apply in time for a survey to be made without waiting for notice from the Society.
4.1.2. The Surveyor is to have free access at any time in order to examine a classed ship and to make sure of her good condition.

4.1.3. Though the survey of a certain part of the ship, the Surveyor may, if deemed necessary, make an additional survey of such a part. The Head Office of the Society also reserve the rights to perform an occasional survey whenever reasonable necessity exists.

4.1.4. In the case of any disagreement or dispute between the owner and the Surveyor or other officers regarding the inspection, examination and survey work, an appeal in writing for re-survey or explanation may be made to the Society.

4.2. Annual Survey
4.2.1. General
4.2.1.1. The survey is to consist of an examination for the purpose of ensuring, as far as practicable, that the hull and piping are maintained in a satisfactory condition.

4.2.2. Examination of the hull
4.2.2.1. Examination of the hull plating and its closing appliances as far as can be seen.

4.2.2.2. Examination of watertight penetrations as far as practicable.

4.2.3. Examination of weather deck
4.2.3.1. Examination of flame screens on the open ends of air pipes to all bunker tanks.

4.2.3.2. Examination of bunker and vent piping systems.

4.2.4. Examination of cargo pump rooms and compressor rooms and, as far as practicable, pipe tunnels if fitted
4.2.4.1. Examination of all pump room and compressor room bulkheads for signs of leakage or fractures and, in particular, the sealing arrangements of all penetrations of pump room and compressor room bulkheads.

4.2.4.2. Examination of the condition of all piping systems.

4.2.5. Suspect areas
Suspect areas identified at previous surveys are to be examined. Thickness measurements are to be taken of the areas of substantial corrosion and the extent of thickness measurements is to be increased to determine the extent of areas of substantial corrosion. Table 16 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.
4.2.6. Examination of ballast tanks
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 the extent of areas of substantial corrosion. Table 16 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.

4.3. Intermediate Survey
4.3.1. General
4.3.1.1. The due range of Intermediate Survey is to be in accordance with the requirements of IMO.

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

4.3.1.3. At each Intermediate Survey, in addition to the requirements of the Annual Survey, the following items are to be surveyed. Those items which are additional to the requirements of the Annual Survey may be surveyed either at or between the 2nd and 3rd Annual Survey. The additional requirements are to be surveyed as follows, as far as practicable. This survey is preferably to be carried out with the ship in a gas-free conditions. The extent of the testing required for this survey will normally be such that the survey cannot be carried out during a loading or discharging operation, and then testing cargo handling installations with related automatic control, alarm and safety systems for correct functioning.

4.3.1.4. Confirmation, where applicable, that pipelines and independent cargo tanks are electrically bonded to the hull.

4.3.1.5. Generally examining the electrical equipment and cables in dangerous zones such as cargo pump rooms and areas adjacent to cargo tanks to check for defective equipment, fixtures and wiring. The insulation resistance of the circuits should be tested and in cases where a proper record of testing is maintained, consideration should be given to accepting recent readings.

4.3.1.6. Confirmation that spares are provided for cargo area mechanical ventilation fans.

4.3.1.7. Confirming that the heating arrangements, if any, for steel structures are satisfactory.

4.3.1.8. The instrumentation of the cargo installation with regard to pressure, temperature and liquid level is to be visually examined and to be tested by changing the pressure, temperature and level as applicable and comparing with test instruments. Simulated testing may be accepted for sensors which are not accessible or for sensors located within cargo tanks or inerted hold spaces. The testing is to include testing of alarm and safety function.
4.3.1.9. The piping of the gas detection system is to be visually inspected for corrosion and damage as far as practicable. The integrity of the suction lines between suction points and analyzing units is to be verified as far as possible. Gas Detectors are to be calibrated or verified with sample gases.

4.3.2. Examination of ballast tanks

4.3.2.1. The minimum requirements for Close-up Survey of ballast tanks in Intermediate Survey is to be in accordance with the follows.

<table>
<thead>
<tr>
<th>10 years ≤ age ≤ 15 years</th>
<th>15 years ≤ age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close – up of:</td>
<td></td>
</tr>
<tr>
<td>1. All web frames and both transverse bulkheads in a representatives ballast tank (*1) and (*2)</td>
<td>1. all web frames and both transverse bulkheads in two representative ballast tanks (*1) and (*2)</td>
</tr>
<tr>
<td>2. the upper part of one web frame in another representative ballast tank</td>
<td></td>
</tr>
<tr>
<td>3. one transverse bulkhead in another representative ballast tank(*2)</td>
<td></td>
</tr>
</tbody>
</table>

(NOTES)
1) (*1) and (*2) mean as follows;
   (*1) : Complete transverse web frame including adjacent structural members
   (*2) : Transverse bulkhead complete, including girder system and adjacent structural members, and adjacent longitudinal bulkhead structure.
2) Ballast tanks include topside, double hull side, double bottom, hopper side, or any combined arrangement of the aforementioned, and peak tanks were fitted.
3) For areas in tanks where protective coatings are found to be in GOOD condition, the extent of Close-up Surveys may be specially considered by the Society.
4) For ships having independent tanks type C, with a midship section similar to that of a general cargo ship, the extent of Close – up Surveys may be specially considered by the Society.
5) 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:
   - 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.

4.3.2.2. The Overall Survey of ballast tanks in Intermediate Survey is to be in accordance with the follows.

<table>
<thead>
<tr>
<th>5 years ≤ age ≤ 10 years  1), 2), 3)</th>
<th>10 years ≤ age  1), 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Survey of representative ballast tanks</td>
<td>Overall Survey of all ballast tanks</td>
</tr>
</tbody>
</table>

(NOTES)
1) If such examinations reveal no visible structural defects, the examination may be limited to verification that the corrosion prevention system remains efficient.
2) 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 tanks of the same type.
3) For ballast tanks, excluding double bottom ballast tanks, if there is no hard protective coating, soft or semi-hard coating POOR coating condition audit is not renewed, and the tanks in question are to be internally examined at annual intervals.
4) When such conditions as above 3) are found in double bottom ballast tanks, the tanks in question may be internally examined at annual intervals.
4.4. Special Survey

4.4.1. General

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

4.4.1.2. The due range of Special Survey is to be in accordance with the requirements of this rule.

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

4.4.1.4. All piping systems within the spaces specified in (7) above are to be examined and operationally tested to working pressure to attending Surveyor's satisfaction to ensure that tightness and condition remain satisfactory.

4.4.1.5. A 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 are to be carried out in accordance with the applicable requirements for Special Surveys, if not already performed.

4.4.1.6. The Special Survey is to include, in addition to the requirements of the Annual Surveys, examination, tests and checks of sufficient extent to ensure that the hull and related piping, as required in 4.4.14, are in a satisfactory condition and is 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.

4.4.1.7. 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, to ensure that the structural integrity remains effective. The aim of the examination is to discover substantial corrosion, significant deformation, fractures, damages or other structural deterioration, that may be present.

4.4.2. Tank protection

4.4.2.1. Where the hard protective coating in spaces is found to be in a GOOD condition, the extent of Close-up Surveys and thickness measurements may be specially considered.

4.4.2.2. When such breakdown of hard protective coating is found in double bottom ballast tanks and it is not renewed, where a soft or semi-hard coating has been applied, or where a hard protective coating was not applied from the time of construction, the tanks in question may be examined at annual intervals. When considered necessary by the Surveyor, or where extensive corrosion exists, thickness measurements are to be carried out.

4.4.2.3. Where provided, the condition of the corrosion prevention system of ballast tanks is to be examined. For ballast tanks, excluding double bottom ballast tanks, where a hard 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 hard protective coating was not 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.

4.4.3. Hatch covers and coamings
In addition to the requirement of the Annual Survey, the following items are to be surveyed.

4.4.3.1. Thickness measurement of the hatch cover and coaming plating and stiffeners is to be carried out as given in Table 12.

4.4.3.2. Checking the effectiveness of sealing arrangements of all hatch covers by hose testing or equivalent is to be carried out.

4.4.3.3. Checking of the satisfactory operation of all mechanically operated hatch covers is to be made, including:

4.4.3.3.1. Operational testing of hydraulic and power components, wires, chains and link drives

4.4.3.3.2. Stowage and securing in open condition

4.4.3.3.3. Proper fit and efficiency of sealing in closed condition

4.4.4. Extent of Overall and Close-up Survey

4.4.4.1. For areas in spaces where hard protective coatings are found in a GOOD condition, the extent of Close-up Surveys according to Table 13 may be specially considered.

Note: For examination of automatic air pipe heads, reference is to be made to Table 15.

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

4.4.4.3. The minimum requirements for Close-up Surveys at Special Surveys are given in Table 13.

4.4.4.4. 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 14

4.4.5. Extent of thickness measurement

4.4.5.1. The minimum requirements for thickness measurements at Special Survey are given in Table 12.

4.4.5.2. The Surveyor may extend the thickness measurements as deemed necessary. When thickness measurements indicate substantial corrosion, the extent of thickness measurements is to be increased to
determine the extent of areas of substantial corrosion. Table 6 may be used as guidance for these additional thickness measurements.

4.4.5.3. For areas in tanks where hard protective coatings are found to be in a GOOD condition, the extent of thickness measurement according to Table 12 may be specially considered.

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

4.4.5.5. 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 measurements may be dispensed with provided the Surveyor is satisfied by the Close-up Survey, that there is no structural diminution, and the hard protective coating where applied remains efficient.

4.4.6. Extent of tank testing

4.4.6.1. 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 spatially considered based on a satisfactory external examination of the tank boundaries, and a confirmation from the Master stating that the pressure testing has been carried out according to the requirements with satisfactory results.

4.4.6.2. The Surveyor may extend the tank testing as deemed necessary.

4.4.6.3. All boundaries of ballast tanks and deep tanks used for water ballast within the cargo length area are to be pressure tested. For fuel oil tanks within the cargo length area, representative tanks are to be pressure tested.

4.4.7. Additional Special Survey requirements for single hold cargo ships after determining compliance with SOLAS II-1/23-3 and II-1/25

For ships complying with the requirements of SOLAS II-1/23-3 and II-1/25 for hold water level detectors, the Special Survey is to include an examination and a test of the all water ingress detection system and of their alarms.
Section 1 General

1. Confirming that the machinery, boilers and other pressure vessels, associated piping systems and fittings are installed and protected as to reduce to a minimum any danger to persons on board, due regard being given to moving parts, hot surfaces and other hazards.

1.2. Confirming that the normal operation of the propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative.

1.3. Confirming that means are provided so that the machinery can be brought into operation from the dead ship condition without external aid.

1.4. Carrying out a general examination of the machinery, the boilers, all steam, hydraulic, pneumatic and other systems and their associated fittings to see whether they are being properly maintained and with particular attention to the fire and explosion hazards.

1.5. Examining and testing the operation of main and auxiliary steering arrangements, including their associated equipment and control system.

1.6. Confirming that the means of communication between the navigating bridge and the steering gear compartment and the means of indicating the angular position of the rudder are operating satisfactorily.

1.7. Confirming that with ships having emergency steering positions there are means of relaying heading information and, when appropriate, supply visual compass reading to the emergency steering position.

1.8. Confirming that various alarms required for hydraulic power-operated, electric and electro-hydraulic steering gears are operating satisfactorily and that the re-charging arrangements for hydraulic power-operated steering gears are being maintained.

1.9. Examining the means for the operation of the main and auxiliary machinery essential for propulsion and the safety of the ship, including, when applicable, the means of remotely controlling the propulsion machinery from the navigating bridge (including the control, monitoring, reporting, alert and safety actions) and the arrangements to operate the main and other machinery from a machinery control room.

1.10. Confirming the operation of the ventilation for the machinery spaces.

1.11. Examining, as far as practicable, visually and in operation, the electrical installations, including the main source of power and the lighting systems.
1.12. Confirming, as far as practicable, the operation of the emergency sources of electrical power including their staring arrangements, the systems supplied and, when appropriate, their automatic operation.

1.13. Confirming that the engine room telegraph, the second means of communication between the navigating bridge and the machinery space and the means of communication with any other positions from which the engines are controlled are operating satisfactorily.

1.14. Confirming that the engineer's alarm is clearly audible in the engineer's accommodation.

1.15. Examining, in general, that the precautions provided against shock, fire and other hazards of electrical origin are being maintained.

1.16. Examining visually the condition of any expansion joints in sea water systems.

1.17. The surveys for water jet propulsion systems and azimuth or rotatable thruster are to be carried out in accordance with the Rules.

1.18. Examining the arrangements for gaseous fuel for domestic purpose.

1.19. Confirming that the means of escape from accommodation, machinery and other spaces are satisfactory.

1.20. The surveys for additional installations(cargo refrigerating installations, cargo handling appliances, centralized monitoring and control system for main propulsion and essential auxiliary machinery, operating systems for periodically unattended machinery spaces, automation equipment, dynamic positioning system, navigation bridge systems and hull monitoring systems, etc.) are to be carried out in accordance with the requirements specified in the rules.

1.21. Survey of electrical equipment of the ship shall be carried out in the scope of special survey.

Section 2 Annual Surveys
At each annual survey, the following requirements are to be complied with:
2.1. Machinery installation, together with the machinery, systems, electrical equipment, arrangements, automation, signaling and monitoring equipment by which it is served, shall be inspected to verify whether any modifications have been introduced to the list of items of technical supervision, their design, arrangement and installation on board, equipment of machinery spaces, as well as to assess their technical condition.

2.2. Main and auxiliary machinery, emergency power sources and systems, by which they are served, shall be examined and operationally tested.
2.3. For the purpose of the main and auxiliary machinery operational testing, its availability for service is checked, as well as the serviceability of manoeuvring and starting devices, remote control, regulating and protection devices, machinery driven by the main engine and driving machinery, as well as of gear and couplings. It is not necessary for the machinery to achieve a specific speed, load or other parameters.

2.4. Diesel generators, pumps, turbochargers, ejectors, separators, compressors, ventilators in dangerous spaces, and boiler blowers shall be examined and operationally tested.

2.5. Speed governors and over speed devices (only where the main machinery driving main generators or driving a propeller through a release gear, as well as diesel generators with power output of 220 kW and above) shall be operationally tested.

2.6. Shafting and stern tube arrangement shall be examined. The control systems and pitch-control units, as well as the cooling and lubricating system of propeller shaft bearings, shall be examined and operationally tested.

2.7. Steam boilers shall be internally surveyed between the second and third annual surveys for ships between 0 and 5 years of age, at intermediate surveys of ships between 5 and 10 years of age, at each special survey, but after the second special survey at each annual survey. Internal examination of the boiler, performed at annual survey of the ship, may be carried out by the crewmembers within the period not more than 3 months before the ship survey. The materials of internal examination carried out by the crewmembers, namely, the ship's report and photographs, shall be submitted to the surveyor. On the basis of the results of the submitted materials review or on the basis of external examination, the surveyor may require repeat performance of the internal examination in his presence.

Measurements shall be carried out of diameters of fire-tube and water-tube boiler furnaces. Where two or more main water-tube boilers are fitted on board, the intervals between internal examinations of such boilers after the second special survey of the ship are not changed.

Hydraulic tests of steam water-tube and fire-tube boilers with service life over 10 years shall be carried out at the surveyor's decision taking into consideration the results of the internal examination and after major repair.

External examination of steam boilers, including testing of safety valves and protective devices, as well as testing of safety valves with their drives, shall be carried out annually within the terms of annual survey of the ship.

Safety valves of waste heat boilers shall be checked by the chief engineer at sea within the specified terms of annual survey. An entry on such testing shall be made in the ship's log (engine log) for checking by the surveyor to be considered at annual survey of machinery installation.
Instructions on check and adjustment of safety valves and on internal examination and hydraulic testing of steam boilers, air receivers and pressure vessels are set out for instructions of Head Office.

2.8. Systems and fittings, remotely driven fittings included, as well as bottom-and-side fittings, shall be examined and operationally tested.

2.9. Heat exchangers, air receivers and other pressure vessels, filters and their safety devices shall be examined and checked together with the check of the systems.

2.10. Communication systems, telegraphs, audible and visual signal devices shall be examined and operationally tested.

2.11. 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.

2.12. 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.

2.13. 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.

2.14. Parts which are opened up for maintenance at Owner’s option are to be examined as necessary.

2.15. The main auxiliary and emergency electrical machinery, the switchgear and other electrical equipment are to be generally examined under operating conditions so far as is practicable. Earth bonding straps are to be examined where fitted.

Section 3 Intermediate Survey

3.1. At each intermediate survey, all the requirements for annual survey and General are to be complied with.

3.2. 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.

3.3. 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 A997(25) – 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.
3.4. Liquefied gas carrier

3.4.1 Cargo systems and tanks are to be examined as follows:

3.4.1.1. The piping system in cargo tanks is to be examined. Bonding of tanks and pipes is to be controlled.

3.4.1.2. 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.

3.4.1.3. Weather deck: Piping systems essential for operation of the ship, e.g. cargo transfer, bunkering and ballast lines, are to be examined.

3.4.1.4. On ships of 10 years of age and over, which have carried products other than those listed in the IMO-Certificate of Fitness; two selected cargo tanks if of the integral type and selected double bottom or ballast spaces, if any, are to be internally inspected.

3.4.2. Cargo containment venting systems are to be examined as follows:

3.4.2.1. The drainage arrangements of venting systems are to be examined.

3.4.2.2. 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 nonmetallic membranes are renewed at intervals not exceeding 3 years.

3.4.3. Instrumentation and safety systems are to be examined as follows:

3.4.3.1. 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.

3.4.3.2. 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.

3.4.3.3. 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.

3.4.4. 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:

3.4.4.1. Protective earthing (spot check).
3.4.4.2. Integrity of certified safe-type equipment.

3.4.4.3. Damage to outer sheath of cables.

3.4.4.4. Function testing of pressurized equipment, and of associated alarms.

3.4.4.5. 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.

3.4.4.6. 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.

3.4.4.7. When the ship is in gas free condition, it is to be verified that the cargo tanks are electrically bonded to the hull.

3.5. Chemical carrier
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.

3.5.1 In the case of chemical tankers aged 10 years or over, at least two selected cargo tanks are to be internally inspected for such as piping, valves and fittings, instrumentation, etc. is to be inspected.

3.5.2 All important piping systems in the cargo area are to be examined, e.g.:
3.5.2.1. Cargo, tank cleaning, bunkering, ballast and steam piping.
3.5.2.2. Provisions for drainage of cargo tank vent lines.
3.5.2.3. Bonding devices of all piping systems and independent cargo tanks.
3.5.2.4. Cargo cooling systems.
3.5.2.5. Cargo hoses.
3.5.2.6. Tank heating systems.
3.5.2.7. Spare parts for mechanical ventilation systems.

3.5.3. The electrical equipment in gas dangerous spaces and zones is to be surveyed with respect to the following:
3.5.3.1. Protective earthing (spot checks).
3.5.3.2. Integrity of certified safe type equipment.
3.5.3.3. Damage to the outer sheet of cables.

3.5.3.4. Function testing of pressurized equipment, and of associated alarms.

3.5.3.5. 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.

3.6. General dry cargo ships
3.6.1. Each intermediate survey, the surveyors check the requirements of Section 1 and 2.

3.7. At intermediate survey, in addition to the scope of annual survey mentioned in Section 2 of this chapter, measurements of insulation resistance of generators and electric motors of essential equipment, including cables and switches, shall be carried out.

In oil tankers, gas carriers and chemical tankers, the electrical equipment, cables and earthing of dangerous zones shall be inspected, for instance, in cargo pump rooms and areas adjacent to cargo tanks, and the insulation resistance of electric circuits shall be measured.

Where ship's logs are kept properly, approval of the latest measured data may be considered.

Section 4 Special Survey
4.1. When the vessel is in dry dock all openings to the sea including sanitary and overboard discharges with the valves and cocks and their fastenings in the machinery and pump room spaces are to be examined.

4.2. The Surveyor is to satisfy himself concerning the efficient condition of the following:
4.2.1. Shafts thrust blocks, shaft line and bearings.

4.2.2. Reduction gears, pinions, wheels with their shafts' bearings and clutch arrangements.

4.2.3. Auxiliary engines, air compressors, oil separators, coolers, filters and all pumps and components used for essential services.

4.2.4. Main and emergency steering arrangements.

4.2.5. Windlass and mooring winches.

4.2.6. Holding down bolts and chocks of main engines and diesel generators.

4.2.7. Evaporators and their safety devices.
4.2.8. Air receivers, their mountings, valves and safety devices are to be cleaned internally and thoroughly examined. In case internal examination of air receivers is unpractical they are to be hydraulically tested at 1.5 times the working pressure.

4.2.9. The bilge system including valves, cocks, strainers, emergency bilge suction valve, pumps, remote reach rods and level alarms, if fitted, are to be opened up, examined and tested under working conditions.

4.2.10. The oil fuel, feed, lubricating oil, cooking water and ballast systems and blanking arrangements to deep tanks which may carry cargoes, liquid or dry, as well as pressure filters, heaters, coolers and their safety devices used for essential services are to be examined and tested as considered necessary by the Surveyor.

4.2.11. Fuel tanks not forming part of the ship’s structure are to be examined externally one at the first survey and internally and externally at each Special Survey thereafter and tested to the pressure specified for new tanks. Mountings, fittings and remote controls are also to be examined.

4.2.12. Automatic and remote controls if fitted for essential machinery are to be tested under working conditions.

4.3. 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.

4.4. As far as practicable, the following equipment is to be examined for satisfactory condition:

4.4.1. Main and emergency switchboards.

4.4.1.1. The fittings on switchboards, section boards and distribution boards are to be examined. Over current protective devices and fuses are to be inspected to verify that they provide suitable protection for their respective circuits.

4.4.2. Generators.

4.4.3. Distribution boards.

4.4.4. Motor starters.

4.4.5. Electrical motors.

4.4.6. Converters (e.g. transformers, rectifiers, chargers).

4.4.7. Cable installations.

4.4.7.1. The electric cables are to be examined as far as is practicable without undue disturbance of fixtures.
4.4.8. Enclosures for electrical equipment.

4.4.9. Lighting equipment.

4.4.10. Heating equipment.

4.4.11. Battery installation.

4.4.12. The following are to be tested to the extent deemed necessary by the Surveyor to ascertain the proper functioning of the equipment:
   4.4.12.2. Generator parallel operation.
   4.4.12.3. Generator protection relays.
   4.4.12.4. Generator remote speed control.
   4.4.12.5. Generator synchronizing equipment.
   4.4.12.6. Power plant interlocking systems.

4.4.13. Insulation resistance indicating device.
   4.4.13.1. The insulation resistance of generators, switchboards, motors, heaters, lighting fittings and cables is to be tested and adjusted as necessary.


4.4.15. Battery chargers.

4.4.16. Mechanical ventilation of battery rooms / lockers.

4.4.17. Navigation lights, with controllers including alarms.
   4.4.17.1. Navigation light indicators and all the means of communication between the navigating bridge and the machinery control positions as well as the bridge and the alternative steering position, if fitted, are to be tested to ascertain that they function satisfactorily. Where considered necessary by the Surveyor, emergency stopping means of motors for fuel oil pumps, ventilating fans and similar loads, interlocking devices for safety operation of electrical equipment, and motors and their control gears for essential services are to be tested to ascertain that they are in good working order.
4.4.18 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:

<table>
<thead>
<tr>
<th>Part to be tested</th>
<th>Insulation resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchboard with all out-going circuit breakers and switches opened, and control</td>
<td>Between each busbar, and busbar to hull</td>
</tr>
<tr>
<td>and measuring instrument disconnected</td>
<td>1 mega ohm</td>
</tr>
<tr>
<td>Generator and motor</td>
<td>Each generator or motor to hull</td>
</tr>
<tr>
<td></td>
<td>1,000 times the rated voltage of the machine in ohms</td>
</tr>
<tr>
<td>All wiring measured from switchboard with circuit breakers and protective devices</td>
<td>Between each conductor and conductor to hull</td>
</tr>
<tr>
<td>closed, except those of the generator</td>
<td>100.00 ohms</td>
</tr>
</tbody>
</table>

4.4.19. Tests of emergency stopping means of all oil transfer systems, and boiler and engine room ventilations are to be performed.

4.4.20. 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.

4.4.21. The emergency source of power and its associated equipment are to be tested to demonstrate that the whole system is in good working order, and if they are automatic, in the automatic mode.

Section 5 Additional requirements to ship types
5.1. Chemical Tankers
The additional requirements are to be surveyed as follows, as far as practicable. Where considered necessary by the Surveyor, the performance test and overhauling may be required.
5.1.1. Confirming, when appropriate, that the requisite arrangements to regain steering capability in the event of the prescribed single failure are being maintained.

5.1.2. Examining the cargo tank openings, including gaskets, covers, coamings and screens.

5.1.3. Examining the cargo tank pressure/vacuum valves and devices to prevent the passage of flame.

5.1.4. Examining flame screens on the open ends of air pipes to all bunker tanks, ballast tanks adjacent to cargo tanks, slop tanks and void spaces adjacent to cargo tanks.

5.1.5 Examining the cargo tank venting, cargo tank purging and gas-freeing and other ventilation systems.

5.1.6. Examining the cargo, tank cleaning, ballast and stripping systems both on deck and in the cargo pump-rooms and the bunker system on deck.
5.1.7. Examining, as far as practicable, the cargo, bilge, ballast and stripping pumps for undue gland seal leakage. Verification of the proper operation of electrical and mechanical remote operating and shutdown devices and operation of cargo pump-room bilge system, and checking that pump foundations are intact.

5.1.8. Confirming that the pump-room ventilation system is operational, ducting is intact, dampers are operational and screens are clean.

5.1.9. Verifying that installed pressure gauges on cargo discharge lines and level indicator systems are operational.

5.1.10. Confirming that wheelhouse doors and windows, side scuttles and windows in superstructure and deckhouse ends facing the cargo area are in a satisfactory condition.

5.1.11. Confirming that removable pipe lengths or other approved equipment necessary for cargo separation are available in the pump room and are in a satisfactory condition.

5.1.12. Examining all pump room bulkheads for signs of cargo leakage or fractures and, in particular, the sealing arrangements of all penetrations of pump room bulkheads.

5.1.13. Examining the bilge and ballast arrangements and confirming that pumps and pipelines are identified.

5.1.14. Examining the cargo transfer arrangements and confirming that any hoses are suitable for their intended purpose and, where appropriate, type-approved or marked with date of testing.

5.1.15. Examining, as far as practicable, the cargo heating or cooling systems, including any sampling arrangements, and confirming that the means for measuring the temperature and associated alarms are operating satisfactorily.

5.1.16. Examining, as far as practicable, the cargo tank vent systems, including the pressure/vacuum valves and secondary means to prevent over or under pressure and flame screens.

5.1.17. Examining the gauging devices, high-level alarms and valves associated with overflow control.

5.1.18. Confirming that arrangements for sufficient gas to be carried or generated to compensate for normal losses and that the means provided for monitoring ullage spaces are satisfactory.

5.1.19. Confirming that arrangements are made for sufficient medium to be carried where drying agents are used on air inlets to cargo tanks.

5.1.20. Examining the fixed fire-fighting system for the cargo pump room and the deck foam system for the cargo area and confirming that their means of operation are clearly marked.
5.1.21. Confirming that the condition of the portable fire extinguishing equipment for the cargoes to be carried in the cargo area is satisfactory.

5.1.22. Examining, as far as practicable, and confirming the satisfactory operation of, the arrangements for the ventilation of spaces normally entered during cargo handling operations and other spaces in the cargo area.

5.1.23. Examining the equipment for personal protection and in particular that:
5.1.23.1. The protective clothing for crew engaged in loading and discharging operation and its stowage is in a satisfactory condition;

5.1.23.2. The required safety equipment and associated breathing apparatus and associated air supplies and, when appropriate, emergency-escape respiratory and eye protection are in a satisfactory condition and are properly stowed;

5.1.23.3. Medical first-aid equipment, including stretchers and oxygen resuscitation equipment are in a satisfactory condition;

5.1.23.4. Arrangements have been made for the antidotes for the cargoes actually carried to be on board;

5.1.23.5. Decontamination arrangements and eyewashes are operational;

5.1.23.6. The required gas detection instruction is on board and that arrangements have been made for the supply of the appropriate vapor detection tubes;

5.1.23.7. The arrangements for the stowage of cargo samples are satisfactory;

5.1.24. Confirming that the system for continuous monitoring of the concentration of flammable vapours which is installed in cargo pump room is satisfactory. And, confirming that sampling points or detector heads are located in suitable positions in order that potentially dangerous leakages are readily detected.

5.1.25. Examining externally and confirming that the pumping and piping systems, including a stripping system if fitted, and associated equipment remain as approved.

5.1.26. Examining externally the tank washing piping and confirming that the type, capacity, number, and arrangement of the tank washing machine are as approved.

5.1.27. Examining externally the wash water heating system.

5.1.28. Examining externally, as far as practicable, the underwater discharge arrangements.

5.1.29. Confirming that the means of controlling the rate of discharge of the residue is as approved.
5.1.30. Confirming that the flow rate indicating device is operable.

5.1.31. Confirming that the ventilation equipment for residue removal is as approved.

5.1.32. Examining externally, as far as it is accessible, the heating system required for solidifying and high viscosity substances.

5.1.33. Confirming that any cargo tank high-level alarms are operable.

5.1.34. Examining any additional requirements for the carriage of cargoes listed on the relevant Certificate.

5.1.35. Examining access to bow arrangement.

5.1.36. Examining the towing arrangement for tankers of not less than 20,000 tonnes deadweight.

5.1.37. All electrical equipment and cables in dangerous zones on weather decks and cargo pump rooms.

5.1.38. Confirming that potential sources of ignition in or near the cargo pump-room are eliminated, such as loose gear, combustible materials, etc., that there are no signs of undue leakage and that access ladders are in good condition.

5.1.39. Electrical and mechanical remote operating and shutdown devices including operation tests in cargo pump rooms.

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

5.1.41. Confirming, when applicable, that the bow or stern loading and unloading arrangements are in order and testing the means of communication and the remote shut down for the cargo pumps.

5.1.42. Confirming that all electrical equipments in dangerous zones is suitable for such locations, is in satisfactory condition and has been properly maintained.

5.1.43. Examining, as far as practicable, that the intrinsically safe systems and circuits used for measurement, monitoring, control and communication purposes in all hazardous locations are being properly maintained.

5.1.44. Examining the emergency lighting in all cargo pump rooms of tanker constructed after 1 July 2002.
5.2. Liquefied Gas Carriers
The additional requirements are to be surveyed as follows, as far as practicable, during a loading or discharging operation. Access for cargo tanks or inerted hold spaces, however, need not be surveyed unless otherwise specially required by the Surveyor. Where considered necessary by the Surveyor, the performance test and overhauling may be required.

5.2.1. Confirming, when appropriate, that the requisite arrangements to regain steering capability in the event of the prescribed single failure are being maintained.

5.2.2. Examining the cargo tank openings, including gaskets, covers, coamings and screens.

5.2.3. Examining flame screens on the open ends of air pipes to all bunker tanks, ballast tanks adjacent to cargo tanks and spaces adjacent to cargo tanks.

5.2.4. Examining the cargo tank venting, cargo tank purging and gas-freeing and other ventilation systems.

5.2.5. Examining the cargo piping systems both on deck and in the cargo compressor-rooms and the bunker system on deck.

5.2.6. Examining all cargo compressor-room bulkheads for signs of oil leakage or fractures and, in particular, the sealing arrangements of all penetrations of cargo compressor-room bulkheads.

5.2.7. Confirming that the compressor-room ventilation system is operational, ducting is intact, dampers are operational and screens are clean.

5.2.8. Verifying that installed pressure gauges on cargo discharge lines and level indicator systems are operational.

5.2.9. Confirming that special arrangements to survive conditions of damage are in order.

5.2.10. Confirming that wheelhouse doors and windows, side scuttles and windows in superstructure and deckhouse ends in the cargo area are in a satisfactory condition.

5.2.11. Examining the cargo pump rooms and cargo compressor rooms

5.2.12. Confirming the manually operated emergency shutdown system together with the automatic shutdown of the cargo pumps and compressors are satisfactory.

5.2.13. Examining the cargo control room.

5.2.14. Examining the gas detection arrangements for cargo control rooms and measures taken to exclude ignition sources where such spaces are not gas-safe.
5.2.15. Confirming the arrangements for the air locks are being properly maintained.

5.2.16. Examining, as far as practicable, the bilge, ballast and oil fuel arrangements.

5.2.17. Confirming that the sealing arrangements at gas domes are satisfactory

5.2.18. Confirming that portable or fixed drip tray of deck insulation for cargo leakage is in order.

5.2.19. Examining the cargo and process piping, including the expansion arrangements, insulation from the hull structure, pressure relief and drainage arrangements.

5.2.20. Confirming that the cargo tank and inter-barrier space pressure and relief valves, including safety systems and alarms, are satisfactory.

5.2.21. Confirming that the any liquid and vapor hoses are suitable for their intended purpose and, where appropriate, type-approved or marked with date of testing.

5.2.22. Examining the arrangements for the cargo pressure/temperature control including, when fitted, any refrigeration system and confirming that any associated alarms are satisfactory.

5.2.23. Examining the cargo, bunker, ballast and vent piping systems, including vent masters and flame screens, as far as practicable.

5.2.24. Confirming that arrangements are made for sufficient inert gas to be carried to compensate for normal losses and that means are provided for monitoring the spaces.

5.2.25. Confirming that the use of inert gas has not increased beyond that needed to compensate for normal losses by examining records of inert gas usage.

5.2.26. Confirming that any air-drying system and any inter-barrier and hold space purging inert gas system are satisfactory.

5.2.27. Examining the arrangements for the fire protection and fire extinction and testing the remote means of starting one main fire pump.

5.2.28. Examining the fixed fire-fighting system for the cargo pump room and confirming that its means of operation is clearly marked.

5.2.29. Examining the water spray system for cooling, fire protection and crew protection and confirming that its means of operation is clearly marked.

5.2.30. Examining the dry chemical powder fire-extinguishing system for the cargo area and confirming that its means of operation is clearly marked.
5.2.31. Examining the fixed installation for the gas-dangerous spaces and confirming its means of operation is clearly marked.

5.2.32. Examining, as far as practicable, and confirming the satisfactory operation of, the arrangements for the mechanical ventilation of spaces in the cargo area normally entered during cargo handling operations.

5.2.33. Examining, and confirming the satisfactory operation of, the arrangements for the mechanical ventilation of spaces normally entered other than those covered by (36) above.

5.2.34. Examining, and testing as appropriate and as far as practicable, the liquid level indicators, overflow control, pressure gauges, high pressure and, when applicable, low pressure alarms, and temperature indicating devices for the cargo tanks.

5.2.35. Examining, and testing as appropriate, the gas detection equipment.

5.2.36. Confirming that two sets of portable gas detection equipment suitable for the cargoes to be carried and a suitable instrument for measuring oxygen levels have been provided.

5.2.37. Checking the provision of equipment for personal protection and in particular that:
5.2.37.1. Two complete sets of safety equipment each permitting personnel to enter and work in a gas-filled space are provided and are properly stowed;

5.2.37.2. The requisite supply of compressed air is provided and examining, when applicable, the arrangements for any special air compressor and low-pressure air line system.

5.2.37.3. Medical first-aid equipment, including stretchers and oxygen resuscitation equipment and antidotes, when available, for the products to be carried are provided.

5.2.37.4. Respiratory and eye protection suitable for emergency escape purposes are provided.

5.2.37.5. Examining when applicable, the arrangements to protect personnel against the effects of major cargo release by a special suitably designed and equipped space within the accommodation area;

5.2.37.6. Examining, when applicable, the arrangements for the use of cargo as fuel and testing, as far as practicable, that the gas supply to the machinery space is cut off should the exhaust ventilation not be functioning correctly and that master gas fuel valve may be remotely closed from within the machinery space.

5.2.38. The log books are to examined with regard to correct functioning of the cargo containment and cargo handling systems. The hours per day of the re-liquefaction plants or the boil-off rate is to be considered.
5.2.39. All accessible gas-tight bulkhead penetrations including gas-tight shaft sealings are to be visually examined.

5.2.40. The means for accomplishing gas tightness of the wheelhouse doors and windows is to be examined. All windows and side scuttles within the area required to be of the fixed type (non-opening) are to be examined for gas tightness. The closing devices for all air intakes and openings into accommodation spaces, service spaces, machinery spaces, control stations and approved openings in superstructures and deckhouses facing the cargo area or bow and stern loading/unloading arrangements, are to be examined.

5.2.41. Cargo handling systems; the cargo handling piping and machinery, e.g. cargo and process piping, cargo heat exchangers, vaporizers, pumps, compressors and cargo hoses are in general to be visually examined, as far as possible, during operation.

5.2.42. Cargo containment venting systems; venting systems, including protection screens if provided, for the cargo tanks, interbarrier spaces and hold spaces are to be visually examined externally. It is to be verified that the cargo tank relief valves are sealed and that the certificate for the relief valves opening/closing pressure is on board.

5.2.43. Instrumentation and safety systems
5.2.43.1. The instrumentation of the cargo installations with regard to pressure, temperature and liquid level is to be verified in good working order by one or more of the following methods:
5.2.43.1.1. Visual external examination
5.2.43.1.2. Comparing of readouts from different indicators
5.2.43.1.3. Consideration of readouts with regard to the actual cargo and/or actual condition
5.2.43.1.4. Examination of maintenance records with reference to cargo plant instrumentation maintenance manual
5.2.43.1.5. Verification of calibration status of the measuring instruments
5.2.43.2. The logbooks are to be examined for confirmation that the emergency shutdown system has been tested.

5.2.44. Environmental control for cargo containment systems
5.2.44.1. Inert gas/dry air installations including the means for prevention of backflow of cargo vapour to gas-safe spaces are to be verified as being in satisfactory operating condition.
5.2.44.2. For membrane containment systems normal operation of the nitrogen control system for insulation and interbarrier spaces shall be confirmed to the Surveyor by the Master.

5.2.45. Miscellaneous
5.2.45.1. It is to be verified that all accessible cargo piping systems are electrically bonded to the hull.

5.2.45.2. Arrangements for burning methane boil-off are to be visually examined as far as practicable. The instrumentation and safety systems are to be verified as being in good working order in accordance with (5.2.43.1) above.

5.2.45.3. The relevant instruction and information material such as cargo handling plans, filling limit information, cooling down procedures etc. are to be verified as being onboard.

5.2.45.4. Mechanical ventilation fans in gas dangerous spaces are to be visually examined.

5.2.46. Examining access to bow arrangement.

5.2.47. Examining the towing arrangement for tankers of not less than 20,000 tonnes deadweight. The additional requirements are to be surveyed as follows, as far as practicable, during a loading or discharging operation. Access for cargo tanks or inerted hold spaces, however, need not be surveyed unless otherwise specially required by the Surveyor. Where considered necessary by the Surveyor, the performance test and overhauling may be required.

5.2.48. Confirming that all electrical equipment in dangerous zones is suitable for such locations, is in good condition and has been properly maintained.

5.2.49. Confirming that potential sources of ignition in or near the cargo compressor-room are eliminated, such as loose gear, combustible materials, etc., that there are no signs of undue leakage and that access ladders are in good condition.

5.2.50. Examining, when applicable, the bow or stern loading and unloading arrangements with particular reference to the electrical equipment, fire-fighting arrangements and means of communication between cargos control room and the shore location.

5.2.51. Confirming that electrical equipments in gas-dangerous spaces and zones is in a satisfactory condition and is being properly maintained.

5.2.52. Examining the emergency lighting in all cargo pump rooms of tanker constructed after 1 July 2002.

5.3. Oil tankers (including tankers):
The additional requirements are to be surveyed as follows, as far as practicable. Where considered necessary by the Surveyor, the performance test and overhauling may be required.
5.3.1 Checking the deck foam system, including the supplies of foam concentrate and testing that the minimum required number of jets of water at the required pressure in the fire main is obtained when the system is in operation.

5.3.2. Examining the inert gas system, and in particular:
5.3.2.1. Examining externally for any sign of gas or effluent leakage.
5.3.2.2. Confirming the proper operation of both inert gas blowers.
5.3.2.3. Observing the operation of the scrubber room ventilation system.
5.3.2.4. Checking the deck water seal for automatic filling and draining.
5.3.2.5. Examining the operation of all remotely operated or automatically controlled valves and, in particular, the flue gas isolating valves.
5.3.2.6. Observing a test of the interlocking feature of soot blowers.
5.3.2.7. Observing that the gas pressure regulating valve automatically closes when the inert gas blowers are secured.
5.3.2.8. Checking, as far as practicable, the following alarms and safety devices of the inert gas system using simulated condition where necessary.
5.3.2.8.1. High oxygen content of gas in the inert gas main.
5.3.2.8.2. Low gas pressure in the inert gas main.
5.3.2.8.3. Low pressure in the supply to the deck water seal.
5.3.2.8.4. High temperature of gas in the inert gas main.
5.3.2.8.5. Low water pressure or low water-flow rate.
5.3.2.8.6. Accuracy of portable and fixed oxygen-measuring equipment by means of calibration gas.
5.3.2.8.7. High water level in the scrubber.
5.3.2.8.8. Failure of the inert gas blower.
5.3.2.8.9. Failure of the power supply to the automatic control system for the gas regulating valve and to the instrumentation for continuous indication and permanent recording of pressure and oxygen content in the inert gas main.
5.3.2.8.10. High pressure of gas in the inert gas main.

5.3.3. Checking, when practicable, the proper operation of the inert gas system on completion of the checks listed above. And then the inert gas systems using stored carbon dioxide, oil fuel combustion type systems, etc. except those using flue gases, are to be tested to ascertain that they are in good working order.

5.3.4. Examining the fixed fire-fighting system for cargo pump rooms, and confirming, as far as practicable, the operation of the remote means for closing the various openings.

5.3.5. Checking protection of cargo pump room and in particular:
5.3.5.1. Checking temperature sensing devices for bulkhead gland and alarms.
5.3.5.2. Checking interlock between lighting and ventilation.
5.3.5.3. Checking gas detection system.
5.3.5.4. Checking bilge level monitoring devices and alarms.

5.3.6. Confirming, when appropriate, that the requisite arrangements to regain steering capability in the event of the prescribed single failure are being maintained.

5.3.7. Examining the cargo tank openings, including gaskets, covers, coamings and screens.

5.3.8. Examining the cargo tank pressure/vacuum valves and devices to prevent the passage of flame.

5.3.9. Examining flame screens on the open ends of air pipes to all bunker tanks, ballast tanks adjacent to cargo oil tanks, slop tanks and void spaces adjacent to cargo oil tanks.

5.3.10. Examining the cargo tank venting, cargo tank purging and gas-freeing and other ventilation systems.

5.3.11. Examining the cargo, crude oil washing, ballast and stripping systems both on deck and in the cargo pump-rooms and the bunker system on deck.

5.3.12. Examining all pump-room bulkheads for signs of oil leakage or fractures and, in particular, the sealing arrangements of all penetrations of cargo pump-room bulkheads.

5.3.13. Confirming that the pump-room ventilation system is operational, ducting is intact, dampers are operational and screens are clean.

5.3.14. Verifying that installed pressure gauges on cargo discharge lines and level indicator systems are operational.
5.3.15. Examining access to bow arrangement.

5.3.16. Examining the towing arrangement for tankers of not less than 20,000 tonnes deadweight.

The additional requirements are to be surveyed as follows, as far as practicable. Where considered necessary by the Surveyor, the performance test and overhauling may be required.

5.3.17. Confirming that all electrical equipment in dangerous zones is suitable for such locations, is in good condition and is being properly maintained.

5.3.18. Confirming that potential sources of ignition in or near the cargo pump-room are eliminated, such as loose gear, combustible materials, etc., that there are no signs of undue leakage and that access ladders are in good condition.

5.3.19. Examining, as far as practicable, the cargo, bilge, ballast and stripping pumps for undue gland seal leakage. Verifying the proper operation of electrical and mechanical remote operating and shutdown devices and operation of cargo pump-room bilge system, and checking that pump foundations are intact.

5.3.20. Examining the emergency lighting in all cargo pump rooms of tanker constructed after 1 July 2002.

5.3.21. Oil tankers over 5 years of age but not more than 10 years: General examination of the electrical equipment and cables in dangerous zones such as cargo pump rooms, and areas adjacent to cargo tanks for defective explosion-proof lights and fixtures, improperly installed wiring, non-approved lighting and fixtures and dead end wiring and a testing of the insulation resistance of the circuits. In cases where a proper record of testing is maintained, consideration may be given to accepting recent readings. If any of the readings are marginal or if the condition of the cables, fixtures or equipment appears defective in any way, verification measurements may be required.

These measurements are not to be attempted until the ship is in a gas free condition and are to be carried out within an acceptable time period.

Section 6 Continuous Survey
6.1. At the ship owner’s request the Register establishes the Continuous Survey System of the Ships (CSS): hull, arrangements, machinery, electrical equipment, refrigerating plant.
6.2. CSS does not apply to the hull of ships.
6.3. Continuous survey consists of the distribution of survey scope corresponding to the scope of special survey for class renewal between separate surveys, and the whole cycle of survey shall be conducted within the period, for which the class is assigned or renewed.
6.4. Application of CSS to the ship (hull, arrangements, machinery, electric equipment and refrigerating plant) is certified by an appropriate entry in the Classification Certificate and the Continuous Survey List attached thereto, containing the list of items of technical supervision, brief description of survey and submission dates planned.

6.5. Surveys, which are permitted to be carried out by the ship's chief engineer, are credited after the confirming survey performed by the surveyor to the Register.

If during survey of an item, the surveyor finds out wear, damages or failures affecting the item fitness for service or he has some doubt in proper technical condition of the item, he may require repeated or additional survey, as well elimination of the revealed defect immediately or at a stated time.

6.6. In case of authorization of a Chief Engineer for carrying out surveys in the context of the Continuous Survey Program only the following items of machinery may be accepted for examination by the Chief Engineer:

6.6.1. Main engine cylinder covers

6.6.2. Main engine cylinder liners

6.6.3. Main engine valves and valve gears

6.6.4. Main engine pistons and piston rods

6.6.5. Main engine top end connecting rod bearings, cross-heads and relevant slides and guides

6.6.6. Main engine fuel-oil injection and booster pumps

6.6.7. Scavenge pumps, except for the case where only one such pump is provided

6.6.8. Pumps driven by the main engine, such as bilge, lubricating oil and cooling water pumps

6.6.9. Independently driven pumps, such as bilge, ballast, fire, fresh and sea cooling water, lubricating oil and fuel oil transfer pumps

6.6.10. Engine water and oil coolers, except for the case where only one such cooler for each service is provided

6.6.11. Low Pressure coolers employed in heavy fuel-oil systems of main propulsion internal combustion engines

6.6.12. Air compressors

6.6.13. Fans and relevant prime movers for forced and induced ventilation
6.6.14. Steam and internal combustion auxiliary machinery, with relevant coolers and pumps, provided that their number is such that all essential services for the propulsion and safety of the ship, as well as for the preservation of the cargo, may be effectively ensured with any machinery out of service for survey.

Section 7 Planned Maintenance Scheme (PMS) for Machinery

7.1. Application.
7.1.1. These requirements apply to an approved Planned Maintenance Scheme for Machinery (PMS) as an alternative to CSS.

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

7.1.3. This Scheme is limited to components and systems covered by CSS.

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

7.2. Maintenance intervals.
7.2.1. The intervals for PMS shall not exceed those specified for CSS.

7.2.2. However, if an approved condition monitoring system is applied, the machinery survey intervals based on the PMS cycle may be extended.

7.3. Onboard Responsibility
7.3.1. The chief engineer shall be the responsible person on board in charge of PMS.

7.3.2. Documentation on overhauls (maintenance operations) of items covered by PMS shall be reported and signed by the chief engineer and submitted to the Register.

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

7.4. Documentation and information
7.4.1. The following documentation shall be submitted for the approval of the scheme:
7.4.1.1. Organization chart identifying areas of responsibility;

7.4.1.2. Documentation filling procedures;
7.4.1.3. Listing of equipment to be considered by classification in PMS;

7.4.1.4. Machinery identification procedure;

7.4.1.5. Preventive maintenance sheet(s) for each machine to be considered;
7.4.1.6. Listing and specifications of condition monitoring equipment;

7.4.1.7. Baseline data for equipment with condition monitoring,

7.4.1.8. Listing and schedule of preventive maintenance procedures.

7.4.2. In addition to the above documentation the following information shall be available on board:
7.4.2.1. All clauses in 7.4.1 above in an up-to-date fashion;
7.4.2.2. Maintenance instructions (manufacturer’s and shipyard’s);
7.4.2.3. Condition monitoring data including all data since last opening of the machine and the original base line data;
7.4.2.4. Reference documentation (trend investigation procedures etc.),
7.4.2.5. Records of maintenance including repairs and renewals carried out.

7.5. Surveys
7.5.1. Implementation Survey
7.5.1.1. The Implementation Survey shall be carried out by the Society’s surveyor within one year from the date of approval.
7.5.1.2. During the implementation survey the following shall be verified by a surveyor to ensure:
7.5.1.2.1. The PMS is implemented according to the approval documentation and is adapted to the type and complexity of the components/system on board;
7.5.1.2.2. 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;
7.5.1.2.3. The onboard personnel is familiar with the PMS.
7.5.1.3. When this survey is carried out and the implementation is found in order, a report describing the system shall be submitted to the Society and the system may be put into service.

7.6. Annual Audit
7.6.1. An annual audit of the PMS shall be carried out by a Society’s surveyor and preferably concurrently with the annual survey of machinery.
7.6.2. The surveyor shall review the annual report or verify that it has been reviewed by the Society.
7.6.3. 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.
7.6.4. 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.

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

7.6.6. 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 a Society’s Surveyor.

7.6.7. At the discretion of the surveyor, function tests, confirmatory surveys and random check readings, where condition monitoring equipment is in use, shall be carried out as far as practicable and reasonable.

7.6.8. Upon satisfactory completion of the above requirements, the Society shall retain the PMS.
Chapter 4 PROPELLER SHAFTS AND TUBE SHAFT SURVEYS

Section 1 General
1.1. Propeller shafts Kind 1 (including stern tube shafts, etc.) are to be surveyed with an interval of 5 years from the completion date of the previous survey.

1.2. Propeller shafts Kind 2 (including stern tube shafts, etc.) are to be surveyed with an interval not exceeding 30 months from the completion date of the previous survey.

1.3. The surveys for water jet propulsion systems and azimuth or rotatable thruster are to be carried out in accordance with the Guidance relating to the Rules.

1.4. Upon the request of the Owner, the survey of propeller shaft (including stern tube shaft, etc.) may be postponed for a period not exceeding 6 months from the due date.

Section 2 Ordinary survey items
2.1. After drawn out the propeller shaft from the stern tube bearings, parts of the propeller shaft, sleeves, fillets of coupling flange connected to the intermediate shaft and the coupling bolts are to be examined.

2.2. The stern tube bearings are to be examined and bearing wear down is to be measured.

2.3. Major parts of the stern tube sealing devices are to be opened and examined.

2.4. After the propeller is removed, the following examination for the propeller shaft, in way of the propeller fitting area, is to be carried out:
2.4.1. For shafts with keyed propeller, examination is to be carried out by an efficient crack detection method for the after end of the cylindrical part of the shaft (or from the after end of the liner, if any), and for about one-third of the length of the taper from the big end.

2.4.2. For shafts with keyless propeller, examination is to be carried out by an efficient crack detection method for the forward part of the aft shaft taper. And when the propeller is force-fitted, the pull-up length is to be in accordance with the Guidance relating to the Rules.

2.4.3. For shafts having coupling flanges at the after end, the flange fillet and coupling bolts are to be examined by an efficient crack detection method.

2.4.4. Propeller and propeller boss bore in way of the propeller shaft taper is to be examined. Pitch control gear and working parts for a controllable pitch propeller are to be examined and propeller blade fixing bolts are to be examined by an efficient crack detection method.

2.4.5. Where the water-lubricated stern tube bearings are adopted, the sea water piping for lubrication is to be examined.
2.4.6. Where the oil-lubricated stern tube bearings are adopted, low oil level alarms of lubricating oil tanks, oil temperature measuring devices and oil circulating pumps are to be confirmed in good operating condition, and lubricating oil records are to be examined.

**Section 3 Survey for ships with STCM (Stern Tube Condition Monitoring)**

3.1. Upon the request of the owner, an additional notation of STCM may be assigned provided that an approved oil-lubricated stern tube bearings comply with the following requirements. And if the Surveyor confirms at the periodical survey that parameters in the condition monitoring records are within permissible limits, the examination of this survey may be carried out without withdrawal of the shaft and omitted the requirements given in Section 2, 2.1 to 2.3 above. However, where the results of the surveys are not satisfactory, all the surveys required in Section, with the drawn shaft are to be carried out.

3.1.1. Regularly at intervals lubricating oil analysis specified separately is to be carried out.

3.1.2. Lubricating oil consumption is to be recorded.

3.1.3. At the aft stern tube bearing, two temperature sensors are to be provided, or if only one temperature sensor is provided, a spare temperature sensor which can be replaced easily is to be provided when the using sensor is out of order.

3.1.4. Aft stern tube bearing temperatures are to be recorded.

3.1.5. Measurement of bearing weardown is to be provided.

3.1.6. Oil seals devices are to be renewed without removal of propeller.

**Section 4 Flanged propeller shafts**

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

4.1. Water-lubricated bearings
The survey is to consist of withdrawing the shaft in its entirety.

4.2. 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 weardown, shaft seal effectiveness, and for controllable pitch propellers, a blade seal leak and function test.

4.3. 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.
Section 5 Tapered Shafts
The following survey details, apply to a shafting arrangement where the propeller is taper fitted to the shaft.

5.1. 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).

5.2. 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).

Section 6 Miscellaneous propellers
6.1. Controllable pitch propellers where fitted are to be opened up and the working parts examined, together with the control gear.

6.2. Directional propeller units are to be dismantled for examination of the propellers, shafts, gearing and control gear.

6.3. Water jet 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.

Section 7 Propeller shaft condition monitoring
7.1. Where oil lubricated shaft with approved oil glands are fitted, a machinery notation PSCM may be assigned, if it’s 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:

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

7.1.1.1. Chloride content;
7.1.1.2. Water content;
7.1.1.3. Bearing material and metal particles content; and
7.1.1.4. Oil ageing (resistance to oxidation). Oil samples are to be taken under service conditions and representative of the oil within the stern-tube.

7.1.2. Oil consumption is to be recorded.

7.1.3. Bearing temperatures are to be recorded, (two temperature sensors or other approved arrangements are to be provided).

7.1.4. Facilities are to be provided for measurement of bearing wear down.

7.1.5. Oil glands are to be capable of being replaced without withdrawal of the propeller shaft.

7.2. For maintenance of the PSCM notation, the records of analysis, consumption and temperatures, together with wear down readings, are to be retained on board and audited at annual survey.

7.3. Where the notation PSCM has been assigned, the propeller shaft need not be withdrawn at surveys, 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.

Section 8 Wear-down Limits

8.1. The maximum allowable wear-down limit of aft lignum-vitae bush is to be as follows:

8.1.1. For machinery placed amidships:

\[
C = \begin{cases} 
5 + D/100 & \text{when } D \leq 400 \text{ mm} \\
9.5 & \text{when } D > 400 \text{ mm}
\end{cases}
\]

Where:
D = Diameter of propeller shaft, in mm.
C = Max., allowable wear down limit, in mm.

8.1.2. For machinery placed aft, the clearance is to be 1.5 mm less than the above values.

8.2. Water lubricated rubber bearing are to be re-bushed when any water groove is half of the original depth, or whenever the clearance exceeds the limits as given above for water-lubricated bearings other than rubber, whichever occurs first.

8.3. Oil-lubricated bearings are to be re-bushed when the wear down exceeds manufacturer’s recommendations.

8.4. Standard of wear down 0.3mm
In case where the wear down exceeds 0.3mm, the following are to be verified and the condition of propeller shaft and its bearing should be estimated. It should then be decided whether the shaft will be drawn out for survey or not.
Section 9 Extension of Propeller Shaft Survey

9.1. Upon the request of the owner, where the propeller shaft is Kind 1 type fitted with oil-lubricated stern tube bearings and oil sealing gland and provided that new oil seals are able to be fitted without removal of the propeller (except in case of keyed propeller), instead of the survey specified in Section 2., after survey of the following items, the survey interval may be prolonged for not more than 5 years from the due date but not to be applied twice consecutively. However, where the results of the following surveys are not satisfactory, all the surveys required in Section 2, with the drawn shaft are to be carried out.

9.1.1. The shaft is to be drawn partially to expose the aft bearing contact area of the shaft for the examination. However, it may be exempted where stern tube bearing temperature and oil consumption are recorded and considered to be within permissible limits, and data of lubricating oil analysis in accordance with the Guidance relating to the Rules are satisfactory.

9.1.2. The forward bearing is to be examined as far as possible and all accessible parts of the shaft including the propeller connection to the shaft is to be examined.

9.1.3. Visual examination to confirm the good condition of oil sealing gland is to be carried out. And clearance or wear down of the aft bearing (or the after end of the strut bearing, if any) is to be measured.

9.1.4. For shafts with keyed propeller, examination is to be carried out by an efficient crack detection method for about one-third of the length of the taper from the big end after removal of the propeller.

9.2. Upon the request of the owner, where the propeller shaft is Kind 1 type fitted with oil-lubricated stern tube bearings and oil sealing gland and provided that new oil seals are able to be fitted without removal of the propeller (except in case of keyed propeller), the following survey without drawing the propeller shaft may be carried out and after finding the good results, the survey interval may be prolonged for not more than 30 months from the due date but to be applied only once.

9.2.1. Oil sealing devices of stern tube

9.2.2. Measurement of clearance or wear down of the aft bearing (or the after end of the strut bearing, if any)

9.2.3. For shafts with keyed propeller, examination is to be carried out by an efficient crack detection method for the forward part of the taper after removal of the propeller.
Section 1 General

1.1. The following boilers (including thermal oil heaters) are to be internally examined minimum twice during each 5 year Special Survey period. In all cases the interval between any two such examinations is not to exceed 36 months.

1.1.1. Water tube boilers used for propulsion, including reheat boilers

1.1.2. All other boilers of essential service

1.1.3. Boilers of non-essential service having working pressure exceeding 3.5 bar and a heating surface exceeding 4.5 m²

1.2. For main boilers with smoke tube type or single main boiler with water tube type which are over 7.5 years of age, the surveys are to be carried out within 3 months before or after every year.

1.3. All boilers economizers, steam receivers, steam heated steam generators, thermal oil and hot water units intended for essential services, together with boilers used exclusively for non-essential services having a working pressure exceeding 3.5 bar and a heating surface exceeding 4.5 m² are to be surveyed internally. There is to be a minimum of two internal examinations during each 5-year special survey period. In all cases the interval between any two such examinations is not to exceed 36 months.

1.4. An extension of the internal examination of the boiler up to 3 months beyond the due date can be granted in exceptional circumstances. The extension may be granted by the Society after the following is satisfactorily carried out:

1.4.1. External examination of the boiler

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

1.4.3. Boiler protective devices operationally tested

1.4.4. Review of the following records since the last Boiler Survey:

1.4.4.1. Operation

1.4.4.2. Maintenance

1.4.4.3. Repair history

1.4.4.4. Feed water chemistry
Section 2 Annual Surveys

2.1. The surveys of boilers are to be carried out as follows, and where deemed necessary by the Surveyor, the parts of lagging are to be removed and inspected. Where deemed necessary by the Surveyor, further surveys may be required.

2.1.1. At each survey, the boilers, super heaters and economizers are to be examined internally on water-steam side and fire side. Boiler mountings and safety valves are to be examined at each survey and opened out as considered necessary by the Surveyor.

2.1.2. The adjustment of the safety valves is to be verified during each boiler internal survey. Boiler safety valve and relieving gear are to be examined and tested to verify satisfactory operation. However, for exhaust gas heated economizers, if steam cannot be raised at port, the safety valves may be set by the Chief Engineer at sea, and the results recorded in the log book for review by the Surveyor.

2.1.3. Review of the following records since the last Boiler Survey is to be carried out as part of the survey:

2.1.3.1. Operation

2.1.3.2. Maintenance

2.1.3.3. Repair history

2.1.3.4. Feed water chemistry

2.2. In exhaust gas heated economizers of the shell type, all accessible welded joints are to be subjected to a visual examination for cracking. Non-destructive Testing may be required as deemed necessary by the Surveyor.

2.3. The surveys of thermal oil heaters are to be carried out as follows. Where deemed necessary by the Surveyor, further surveys may be required.

2.3.1. The tightness of the installation to flange connections and valves and packing is to be examined.

2.3.2. The coils in the oil fired furnace are to be externally examined.

2.3.3. Plant instrumentation including regulation and safety systems is to be examined and tested.

2.3.4. Liquid relief valves are to be examined, and the pressure is to adjusted.

2.3.5. For thermal oil heater tubes heated by exhaust gas, hydraulic testing to the design pressure is to be carried out.

2.3.6. Fuel oil equipments are to be examined.
Section 3 Intermediate Survey

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

3.2. 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.

3.3. 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.

3.4. 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.

3.5. Automatic combustion control devices, if provided, are to be tested under working condition.

3.6. 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:

<table>
<thead>
<tr>
<th>Boiler's age</th>
<th>Test pressure</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 12 years</td>
<td>P = 1.25 P_o</td>
<td>P_o ≤ 4 MPa</td>
</tr>
<tr>
<td>Age ≥ 12 years</td>
<td>P = 1.2 P_o + 0.2</td>
<td>P_o ≥ 4 MPa</td>
</tr>
</tbody>
</table>

P_o is the working pressure.

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

3.8. Thermal oil heater surveys

3.8.1. Thermal oil plants are to be subjected to functional tests, while in operation.

3.8.2. The following items are to be examined:

3.8.2.1. The entire thermal oil plant for leakage.

3.8.2.2. The condition of the insulation.

3.8.2.3. The functioning of the indication, control and safety equipment.

3.8.2.4. Remote controls for the shut-off and discharge valves.
3.8.2.5. Leakage monitors for heaters (for exhausting gas heating).

3.8.2.6. The testing of safety devices.

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

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

Section 4 Special Survey

4.1. Special survey includes survey of main and auxiliary steam and water heating (including waste-heat) boilers, as well as incinerators and thermal oil boilers.

4.2. At special survey internal survey of steam boilers, their hydraulic testing, if necessary, and external examination at the steam working pressure shall be carried out if it is the surveyor who makes a decision on the necessity of hydraulic testing based upon results of internal examination and type and scope of repair of the boiler, if any.

It is mandatory to carry out the hydraulic testing of steam boilers after significant repair or replacement of piping.

Steam boilers that are not accessible for internal survey are subjected to hydraulic testing at each special survey of the ship. A boiler, to any component of which (other than tubes of less than 200 mm in diameter under internal pressure) no access for visual examination from two sides is available, shall be considered inaccessible for thorough internal survey.

If any defects decreasing the strength of some components (thinning of walls, wear of stiffeners, etc) are identified during survey of steam boilers, their further operation at the ship owner's request may be permitted at reduced parameters (pressure, temperature) till the first scheduled repair or for a limited period.

The possibility of operation at reduced parameters shall be confirmed by a strength analysis of components subjected to internal pressure.

Besides, calculations shall be submitted confirming that:
temperature of tube stack walls at the gas outlet is at least, 140 °C; velocity of steam-water mixture in the heating surfaces does not exceed 14 m/s; satisfactory operation of steam pipelines is provided; operation of equipment at reduced steam parameters will not decrease the ship safety.

4.3. Before commencement of survey, preparation works shall be carried out with opening-up, providing access, dismantling, measurements being submitted, as well as information regarding repairs and replacements performed.
4.4. Internal survey of steam boilers shall be carried out after significant repair and replacements, as well as between the second and third annual surveys for ships between 0 and 5 years of age, at intermediate surveys of ships between 5 and 10 years of age, at each special survey, but after the second special survey at each annual survey.

At internal survey of boilers contemporized with special survey, boiler arrangement shall be subjected to a thorough examination and testing for defects.

4.5. Before internal survey is commenced, the surveyor shall be provided with measurement results of tube thickness to determine tube general deformation, sketch of internal layout of headers and tube plates (end plates) with notes of tube and tube plate condition (places and dates of tube plugs installation, their replacement or repairs), measurement of water or fire tubes slacks and bends. Both water steam side and gas (fire) side of boilers shall be cleaned for the internal survey.

At each internal survey steam boilers, steam super heaters and economizers shall be checked from the steam water and gas sides. Boiler fittings and safety valves shall be checked during each survey and dismantled, if necessary, at the request of the surveyor.

The following records shall be checked as an integral part of internal survey beginning from the last survey of boiler: operations; technical maintenance; performed repairs; chemical preparation of feed water.

In addition to other requirements of the present paragraph, during internal survey of exhaust gas boiler all weld joints accessible for examination shall be visually checked for cracking. At that, non-destructive testing may be required.

4.6. Extension of the terms of internal survey up to 3 months after the specified date may be granted on extraordinary occasions, such as absence of repair facilities, repair materials, equipment and spare parts or due to actions taken to avoid harsh weather conditions. Submission of boiler for internal survey may be postponed by the Register upon performance of the following conditions to the surveyor satisfaction: external examination of boiler; visual examination and operational testing of safety valves; testing of boiler protective arrangements and check of the following records since the date of the last survey of boiler: operations; technical maintenance; performed repairs; chemical preparation of feed water.

4.7. Before hydraulic test is commenced, it shall be verified that all the defects detected at internal survey are eliminated and manhole and scuttle seats are fitted. Watertightness of safety valves shall be ensured by disabling regular springs.

4.8. At hydraulic test of boilers, super heaters, economizers, pressure shall be taken equal to $1.25P_{\text{working}}$ but shall not be less than $P_{\text{working}} + 100 \text{ kPa}$. For boilers after significant repairs (for instance, after flame tubes replacement or straightening, replacement of more than 25 per cent of short stays of the same wall...
or more than 15 per cent of the total number of short stays, overwelding of patches etc.), test pressure shall be taken equal to \(1.5P_{\text{working}}\) but shall not be less than \(P_{\text{working}} + 100\, \text{kPa}\).

4.9. Hydraulic test of boilers shall be carried out when the following is ensured: boiler is filled with water and there is no air inside; two tested pressure gauges are available; water and ambient air temperature is not less than + 5 °C. Temperature difference of water and ambient air shall exclude sweating; pressure shall be increased by a pump operating gradually.

During hydraulic tests the following is not allowed: use of rubber hoses; works being performed on board, which cause noise or taps; delivery during exposure at working pressure.

4.10. The boiler is acknowledged to have passed the test, if examination reveals no leakage, local bulges, notice able changes of shape, seam fractures or signs of integrity breakage of any part or joint. During exposure to test pressure no falls of pressure shall be noted.

Sweating or signs of water in expansion joints in the form of single non-leaking drops ("tears") shall not be considered a leakage. These signs are not allowed in weld seams; such seams shall be cut off and welded again following the technique approved by the Head Office. Correction of weld seam defects by caulking, punching or other mechanical procedure is not allowed. Elimination of detected defects in the boiler under pressure, as well as welding of a boiler filled with water is not allowed.

4.11. External examination of the boiler under working pressure shall be carried out: at each periodical survey of the ship; after each internal survey of the boiler; after each hydraulic testing; after significant repairs or replacements.

4.12. External examination of boilers together with fittings, equipment, serving machinery and heat exchangers, systems and pipelines shall be carried out at steam working pressure and if possible combined with operational testing of the ship's machinery.

All water level indicators face and bottom blow-off instruments, valve actuators shall be submitted to the surveyor in operation.

4.13. Safety valves shall be adjusted at external survey of a steam boiler. Safety valves of the steam boiler and their remote drives shall be checked and tested to confirm their satisfactory operation. Valves shall be adjusted for the following opening pressures:

\[
P_{\text{opening}} \leq 1.05 \, P_{\text{working}} \quad \text{for} \quad P_{\text{working}} < 1\, \text{MPA};
\]

\[
P_{\text{opening}} \leq 1.03 \, P_{\text{working}} \quad \text{for} \quad P_{\text{working}} \geq 1\, \text{MPA}.
\]

Maximum allowable pressure for safety valve in operation \(P_{\text{max}} \leq 1.1\, P_{\text{working}}\).

When lifted, the safety valves of main and auxiliary boilers for essential services shall fully interrupt the outgoing steam flow in case of the pressure drop in the boiler not below 0.85 of the working pressure. Safety valves of steam super heaters shall be adjusted to switch on in advance of the boiler valves.
If external examination and operational testing results are satisfactory, one of the boiler safety valves shall be sealed in the presence of the surveyor.

If external examination of waste-heat boilers with steam and check of their safety valves in port is not possible, safety valves may be adjusted by the chief engineer at sea. The record thereof shall be made in the ship's (engine) log to be checked by the surveyor to the Register.

4.14. Where defects have been detected during external examination, and their causes cannot be determined through the examination, the surveyor shall require the cause of the defect to be investigated and, if necessary, internal survey and/or hydraulic test to be carried out.

4.15. Automatic control, protection and alarm system, as well as manual operation of the boiler shall be shown in operation.

4.16. The boiler plant is recognized fit for service with regard to the technical condition, provided no defects were found or found defects do not exceed the standards established by the manufacturer. In the absence of such standards one shall be guided by the standards given in the present Chapter.

4.17. Corrosion wear of the responsible boiler components is established by comparison of the measured residual thicknesses in relation to as-built (initial) thicknesses. In necessary cases excessive thicknesses in relation to those required by the Rules may be taken into consideration.

4.18. The boiler plant is recognized fit for service till the next survey, provided the following non progressing defects are found: bulges on flat walls of fire sides with a bending curve not more than plate thickness in absence of damaged stays and signs of steaming; deformation of fire tubes not exceeding 3 per cent; contraction of fire tubes without deformation of circumference up to 5 per cent of as-built values, as well as local bulges with curve of bending not more than two thicknesses of fire tube wall; local tubercular corrosion of boiler plates outside weld area, tube holes and flanging of ends with a depth of pock marks not more than 20 per cent of plate thickness and total square not more than 100 cm²; thinning of ends of fire tubes not more than by 30 per cent of the initial thickness in the place of rolling in absence of burning and leaks; thinning of ends of water-heating pipes in the place of rolling and their plungers by not more than 30 per cent of the initial thickness in absence of leaks; reduction of the transverse section squares of short and long members by not more than 10 per cent of as-built thickness, if a number of thinned members do not exceed 10 per cent of members strengthening this boiler wall; plugged fire or water boiler tubes in amount not more than 10 per cent of the total number of tubes, provided the boiler tubes do not serve as a screen preventing overheating of other parts. It is allowed than not more than 5 per cent of tubes constituting a screen are plugged, provided they are not located close to each other; sagging of straight boiler tubes with a sagging curve of up to 1 per cent of the tube length in absence of steaming signs in the rolling connections.
4.19. Upon the surveyor's conclusion the main and auxiliary steam boilers may be allowed for service at reduced working pressure. The value of the reset (reduced) pressure shall be confirmed by verification calculation of strength scantlings taking into account the results of residual thickness measurements.

In order to avoid sulphur corrosion it is not allowed to reduce the working pressure up to the value when the pressure of switching on the automatic burner in the position regulation regime is 0.3MPa and less. Exhaust gas boilers are not allowed to operate at reduced steam pressure.

4.20. Steam boilers shall not recognized fit for service, if their technical condition does not provide the safe operation due to insufficient strength, provided the following defects have been found: dangerous defects of metal found during research and testing of the boiler material in the defective area; wears and damages exceeding permissible standards; cracks in responsible parts of the boiler, member tears, weld leakages; leaks of tubes in tube plates, if it is impossible to eliminate them by rolling; destruction of setting of protected parts of steam-water and water header and chambers or at least one of the boiler walls.

Boiler plant operation shall be prohibited, if at least one pressure gauge, safety valve, water-level indicator, feed valve, stopping, fuel quick-closing valve, remote drive, protection and signaling system of automated boiler plant is out of service, as well as if there are any failures of blow-down systems, feeding systems, fuel and air supply enabling safe operation of the boiler plant.

4.21. Monitoring of condition and quality of the steam boiler metal in service in necessary cases (suspicion for overheat of metal of fire parts, systematic cracking and lamination, etc.) shall be carried out by non-destructive testing, as well as by mechanical tests, chemical and metallographic analysis.

In relation to the nature of revealed defects the method of their elimination is determined upon agreement with the surveyor.

4.22. Internal surveys and hydraulic tests of boilers with organic coolant shall be carried out at special and intermediate surveys. It is allowed to conducts tests using coolants from boilers. Results of the coolant analysis shall be submitted with a conclusion of the laboratory of its fitness for further use. The drawing of heating elements (coils) with marks indicating condition of coils, sagging measurements and bending of some coils shall be submitted for boilers with organic coolants.

Boiler plant with organic coolant may be recognized fit for service until the next survey, provided the following non-progressing defects are found: sagging of coil branches with a sagging curve up to 1 per cent of the branch length in absence of cracking in welds; local pitting of coils at a depth of not more than 20 per cent of wall thickness and total square not more than 30 cm$^2$. 
Table 5.1 Requirements of Boiler Survey

<table>
<thead>
<tr>
<th>Items</th>
<th>Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pressure parts of boilers</td>
<td>To be internally examined with the manholes, cleaning holes and inspection holes dismantled. Were considered to be necessary for external examination by the Surveyor, the parts are to be examined to the Surveyor’s satisfaction with the insulation around the parts removed.</td>
</tr>
<tr>
<td>2. Super heaters, economizers and exhaust gas economizers</td>
<td>To be examined internally and externally. For example gas economizers of the shell type, all accessible welded joints are to be subject to a visual examination for cracking and non-destructive testing may be requested where deemed necessary by the Surveyor.</td>
</tr>
<tr>
<td>3. Combustion parts of boilers and thermal oil heaters (1)</td>
<td>The furnaces, combustion chambers combustion gas chambers, etc. are internally examined with their doors opened.</td>
</tr>
<tr>
<td>4. Valves and cocks</td>
<td>The principal mountings and their fastening bolts or studs are to be opened up and examined.</td>
</tr>
<tr>
<td>5. Thickness of plates and tubes and size of stays</td>
<td>To be measured where deemed necessary by the Surveyor.</td>
</tr>
<tr>
<td>6. Safety valves and relevant parts of boilers, super heaters and</td>
<td>The safety valves are to be adjusted under steam not more than 103% the approved working pressure after the open – up examination. The pressure gauge used for this adjustment is to be calibrated properly. The relieving gears of the valves are to be examined and tested to verify satisfactory operation. However, for exhaust gas economizers, if steam cannot be raised at port, the relief valves may be set by the chief engineer at sea, and the results recorded in the logbook for review by the Surveyor. The general conditions of relief pipes for thermal oil heaters are to be examined. The popping pressure of safety valves fitted on thermal oil heaters is to be ascertained.</td>
</tr>
<tr>
<td>thermal oil heaters (1)</td>
<td></td>
</tr>
<tr>
<td>7. Safety devices, alarm devices and automatic combustion control</td>
<td>These devices are to be tested in order to ascertain that they are in good working conditions after the above examinations.</td>
</tr>
<tr>
<td>devices</td>
<td></td>
</tr>
<tr>
<td>8. Review of the records of the logbook</td>
<td>Review of the following records since last boiler survey is to be carried out. 1. Operation 2. Maintenance 3. Repair history 4. Quality control of the feed water or thermal oil</td>
</tr>
</tbody>
</table>
Chapter 6 REFRIGERATED CARGO INSTALLATIONS

Section 1 General

1.1. At a special Owner’s request, Class PMDS may assign a class to:

1.1.1. Refrigerating plants intended for generating and maintaining the required temperatures in refrigerated cargo chambers of cargo ships;

1.1.2. Refrigerating plants intended for generating and maintaining the required temperatures in cargo chambers designed for cold treatment (cooling, freezing) of sea products and supplying the cold necessary for all production processes in fishing factory ships.

1.2. The requirements in this chapter apply to the refrigerating machinery of refrigerating chamber using the primary refrigerants listed below and forming the refrigerating cycle used for refrigeration, etc. However, the refrigerating machinery with compressors of 7.5 kw or less and the refrigerating machinery using primary refrigerants other than those listed below are to be as deemed appropriate by Class PMDS.

\[
\begin{align*}
R22 & : \text{CHClF2} \\
R134a & : \text{CH2FCF3} \\
R404A & : R 125/R 143a/R 134a (44/52/4 wt\%) \\
CH2FCF3 & / CH3CF3 / CH2FCF3 \\
R 407C & : R 32/R 125/R 134a(23/25/52 wt\%) \\
CH2F2/CHF2CF3/CH2FCF3 & \\
R 410A & : R 32/R 125 (50/50 wt\%) CH2F2/CHF2CF3 \\
R507A & : R 125/R 143a 50/50 wt\%) \\
CHF2CF3/CH3CF3 &
\end{align*}
\]

1.3. Survey of refrigerating plant shall be carried out in compliance with this Rule (Chapter 6).

1.4. The following types of surveys apply to the technical supervision of refrigerating plants: annual survey; special survey; continuous surveys when requested by the ship owner and agreed upon with the Register; occasional survey.

1.4.1. Periodical surveys (special and annual) of a refrigerating plant shall be held concurrently with appropriate periodical surveys of the ship, provided the technical condition of the refrigerating plant does not require reduction of intervals between its surveys.

Class PMDS does not provide the extension of terms of annual surveys of a refrigerating plant.

1.5. Occasional surveys are carried out when a refrigerating plant is submitted for survey in all cases other than initial and periodical surveys, including extension of terms of special survey of a refrigerating plant. The scope of survey and its procedure shall be specified by the Register depending on the purpose of the survey, age and technical condition of the refrigerating plant.

1.5.1. Occasional survey is held when requested by the shipowner or the underwriter to an extent necessary to fulfill the request.
1.5.2. Occasional survey of a refrigerating plant before loading or unloading of cargo shall be carried out upon special request of the ship owner.

1.5.3. A survey after the accident shall be carried out in case damage has been sustained by the entire refrigerating plant or by its separate items of machinery, arrangements or parts subject to the Class PMDS technical supervision. The survey shall be held in the port the ship is at the moment or in the first port that the ship calls at after an accident with the refrigerating plant. The survey is held in order to reveal failures, to agree upon the scope of work required to eliminate the consequences of the accident and to determine the possibility and conditions to maintain the class of the refrigerating plant or to permit further operation of an unclassed refrigerating plant.

Section 2 Annual Surveys
2.1. 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.

2.2. 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.

2.3. 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.

2.4. 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.

2.5. 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.

2.6. 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.

2.7. Brine coils and grids and brine return tanks, together with valves and fittings are to be examined under working condition.

2.8. Primary refrigerant cooler coils and cooling grids together with valves and fittings are to be examined under working condition.
2.9. 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.

2.10. Thermometers concerned are to be examined. The Surveyor may request one or more thermometers to be calibrated by a competent person.

2.11. 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 results of insulation resistance measuring carried out by a competent person may be acceptable at the discretion of the Surveyor.

2.12. 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.

Where, as a result of the performed surveys or checking the records in the *Log Book of the Refrigerating Cargo Installation*, the plant output or the condition of thermal insulation of refrigerated cargo chamber is found unsatisfactory, Class PMDS has the right to carry out the test of the plant output, thermal insulation test or both tests.

**Section 3 Special Survey**

3.1. Class Renewal Survey covers all survey activities, specified in Section 2, and additionally:

3.2. External examination of all reciprocating compressors, refrigerant pumps, cooling agent pumps, cooling water pumps, defrosting system of freezer hydraulic system. Examination of screw compressors shall be performed according to the manufacturer's recommendations.

3.3. External examination of sources of electric power, distributing devices, cables, electric motors, control and monitoring consoles.

3.4. External examination of all side covers, tube plates, tubes of condensers and "shell and tube" evaporators.

3.5. Checking the condition of shell, connections and fittings of heat exchangers, liquid separators, driers, filters and pressure vessels, especially underneath the insulation.

3.6. Checking the condition of fans, ducts of emergency ventilation of refrigerating machinery space;

3.7. Checking the condition of all protective devices: valves, discs; dismantling and the workshop operation test. Required by Class PMDS.
3.8. Checking the condition of lining, insulation of the floor, decks, bulkheads, sides, cantilevers, coamings, ducts in refrigerated cargo chambers, with a partial dismantling if required by Class PMD.;

3.9. Checking the condition of control instruments and gauges of the refrigerant, cooling agent, cooling water systems, as well as freezer hydraulic system on the basis of their examination; correctness of the instruments and gauges indications shall be checked by comparing indications of two parallel instruments or by means of a portable control instrument;

3.10. Strength and tightness pressure tests, of the following:
3.10.1. Heat exchangers, pressure vessels, pipelines and fittings of refrigerant system – 10 years from their installation, thereafter at interval of 5 years;

3.10.2. Heat exchangers, pipelines and fittings of coolant (brine) system – 10 years from the date of installation, thereafter at interval of 5 years;

3.10.3. Heat exchangers, pipelines and fittings of cooling water system – 10 years from the date of installation, thereafter at interval of 5 years.

In well-justified cases, Class PMDS may depart from strength tests or limit them if examinations and operation tests prove that the given arrangement is in a good and efficient condition.

**Section 4 Continuous Survey**
4.1. At the request of the Owner, the Committee will give consideration to the Special Survey requirements, as detailed in Section 3 being carried out on a Continuous Survey basis. This will normally require that one fifth of the refrigerating machinery and arrangements, insulated holds and chambers is surveyed annually. When it has been agreed that the complete survey of the refrigerating installation may be carried out employing the Continuous Survey procedure, the various items of machinery should be opened out for survey in rotation, so far as practicable, to ensure that the interval between consecutive examinations of each item will not normally exceed five years.

**Section 5 Occasional Surveys**
5.1 Occasional Surveys are performed when a refrigerating plant is submitted for survey in all cases other than Initial Surveys for Class Assignment and Periodical Surveys or surveys resulting from Continuous Survey. The scope of the surveys and their procedure are specified by Class PMDS Head Office, depending on the purpose of the survey, the age and technical condition of the refrigerating plant.
5.2. Occasional Surveys may be performed at the request of the Owner or Underwriter or may be consequent, PSC or Flag State verification of performed classification activities.
5.3. One of Occasional Surveys is Survey after Damage; notification to Class PMDS of damage is the Owner’s responsibility.
5.3.1. Survey After Damage shall be held in the case when damage to a refrigerating plant or its various mechanisms, installations or elements, covered by the requirements of the Rules and subject to Class PMDS survey, has been reported.

5.3.2. The survey shall be performed at a port where the damage occurred or at the first port the ship calls at after damage of the refrigerating plant.

5.3.3. The aim of the survey is to assess the extent of damage, to agree the scope of work required to eliminate the consequences of damage and to determine the possibility and conditions for maintaining the class of the refrigerating plant or ship if the plant is surveyed for the safety only.

Section 6 Loading Port Surveys

6.1. When a loading port certificate is required by the owner or his representative, a survey as detailed in 6.4 hereunder is to be carried out at the loading port.

6.2. 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.

6.3. 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.

6.4. Requirements of loading port survey are to be as follows:

6.4.1. 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.

6.4.2. Brine or other refrigerant pipe grids, cooler coils and connections are to be examined to ascertain that they are free from leakage.

6.4.3. Wood sheathings and cargo battens are to be examined to ascertain that they are well fitted in position.

6.4.4. Insulation and linings are to be examined to ascertain that no damage has been sustained prior to the loading of the refrigerated cargo.

6.4.5. 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.
6.4.6. The refrigerating machinery is to be examined under working condition, and temperatures in the refrigerated chambers are to be noted.

6.5. Where any repair is deemed necessary by Class PMDS 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.

Table 6.1: Test Pressure for Components under Refrigerant Pressure Test

<table>
<thead>
<tr>
<th>Test</th>
<th>Item to be Tested</th>
<th>Test Pressure, Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hydraulic</td>
</tr>
<tr>
<td></td>
<td>Compressor (high-pressure side)</td>
<td>1.5 x HP</td>
</tr>
<tr>
<td></td>
<td>Compressor (low-pressure side)</td>
<td>1.5 x LP</td>
</tr>
<tr>
<td></td>
<td>Compressors with integrally cast cylinders and crankcase</td>
<td>1.5 x HP</td>
</tr>
<tr>
<td>Prior to Installation</td>
<td>Motor compressors, assembled</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Refrigerant circulating pumps</td>
<td>1.5 x HP</td>
</tr>
<tr>
<td></td>
<td>High-pressure vessels and apparatuses</td>
<td>1.5 x HP</td>
</tr>
<tr>
<td></td>
<td>Low-pressure vessels and apparatuses</td>
<td>1.5 x LP</td>
</tr>
<tr>
<td>Prior to start-up</td>
<td>Refrigerant valves on fittings (except automatic control valves)</td>
<td>Complete installations: High-pressure side</td>
</tr>
<tr>
<td></td>
<td>Low-pressure side</td>
<td>-</td>
</tr>
</tbody>
</table>

Note:
1. $P_{e,per}$ = maximum allowable working pressure, bar.

Table 6.2: Test Pressure for Components under Cooling Water or Brine Pressure

<table>
<thead>
<tr>
<th>Test</th>
<th>Item to be Tested</th>
<th>Hydraulic test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to Installation</td>
<td>Cooling water spaces of machines and equipment, cooling water pumps</td>
<td>1.5 $P_{e,per}$, minimum 4 bar</td>
</tr>
<tr>
<td></td>
<td>Vessels and equipment on the pressure side of brine pumps, brine pumps</td>
<td>1.5 $P_{e,per}$, minimum 4 bar</td>
</tr>
<tr>
<td></td>
<td>Vessels and equipment on the suction side on brine pumps</td>
<td>1.5 $P_{e,per}$, minimum $P_{e,per} + 02$ bar</td>
</tr>
<tr>
<td></td>
<td>Cooling water lines, valves and fittings</td>
<td>1.5 $P_{e,per}$, minimum 4 bar</td>
</tr>
<tr>
<td></td>
<td>Brine pipeline, valves and fittings (prior to insulation)</td>
<td>1.5 $P_{e,per}$, minimum 4 bar</td>
</tr>
</tbody>
</table>

Note:
1. $P_{e,per}$ = maximum allowable working pressure, bar.
Section 1 Annual Survey

1.1. Verification, so far as is practicable, that no significant changes have been made to the arrangement of structural fire protection.

1.2. Verification of the operation of manual and/or automatic doors where fitted.

1.2.1. Fire bulkheads and decks shall be examined, as well as closing appliances of openings therein, fire doors, closing appliances of external openings (ventilation ducts, annular spaces of stacks, skylights). The remote control systems of fire doors shall be operationally tested.

1.3. Verification that fire control plans are properly posted.

1.4. Examination, so far as is possible, and testing as feasible, of the fire and/or smoke detection system(s).

1.5. Examination of fire main system, and confirmation that each fire pump, including the emergency fire pump can be operated separately so that the two required powerful jets of water can be produced simultaneously from different hydrants.

1.6. Verification that fire hoses, nozzles, applicators and spanners are in good working condition and situated at their respective locations.

1.7. Examination of fixed fire-fighting systems controls, piping, instructions and marking, checking for evidence of proper maintenance and servicing, including date of last systems tests.

1.8. Verification that all portable and semi-portable fire extinguishers are in their stowed positions, checking for evidence of proper maintenance and servicing, conducting random checks for evidence of discharged containers.

1.8.1. Fire extinguishing systems are examined and operationally tested complete with cylinders, tanks, and arrangements.

1.8.1.1. The piping of carbon dioxide smothering systems, fire extinguishing using freons, foam fire extinguishing systems shall be air-tested for free passage of the medium transferred.

1.8.1.2. The aerosol fire extinguishing systems shall be checked by means of visual examination of the working order through indication on the remote control device and the efficiency of fastening of the system equipment and cables.

1.8.1.3. The operational testing of fire extinguishing systems shall be carried out concurrently with that of the pumps, compressors, ventilators, boilers, apparatuses and pressure vessels, by which they are served, along with testing of their systems, connecting devices, remote control drives, automation systems and devices, monitoring devices.
1.8.1.4. The visual and audible alarms warning about the fire extinguishing system starting shall be operationally tested.

1.8.1.5. All cylinders for the storage of fire extinguishing medium shall be surveyed, and a check for completeness and external examination shall be carried out in respect of fire-fighting outfit, including emergency escape breathing devices (their expiry date shall be checked), spares and tools.

1.8.1.6. At survey of cabinets for fire hoses it is necessary to check the structure integrity, drainage and absence of corrosion.

1.9. For the purpose of survey of fire smothering systems, it shall be checked whether the volume of fire extinguishing medium is sufficient, whether the cylinders bear the stamps of competent authorities, as well as whether certificates from a recognized laboratory or competent body are available to testify that the fire extinguishing medium may be used.

1.10. Verification, so far as is practicable, that the remote control for stopping fans and machinery and shutting off fuel supplies in machinery spaces are in good working order.

1.11. Examination of the closing arrangements of ventilators, funnel annular spaces, skylights, doorways and tunnels where applicable.

1.12. Verification that the firemen’s' outfits are complete and in good condition and properly stored.

Section 2 Intermediate Survey
In application to Section 1, Chapter 7 of the Rules in this case, for foam fire-extinguishing systems, the foam is to be tested by the manufacturer or recognized test organization and the test records are to be submitted for approval.

Section 3 Special Survey
The renewal survey of fire protection shall cover the Annual Survey scope and additionally:

3.1. Water fire-extinguishing systems: water fire main system, sprinkler system, water-spraying fire extinguishing system and water screen system:
   3.1.1. Internal examination of the control valves;
   3.1.2. Hydraulic test of all fire hoses;
   3.1.3. Hydraulic test of pipelines (to be performed every 10 years for ships under 20 years old and every 5 years – for ships older than 20 years).
3.2. CO₂, halon and other gas fire-extinguishing systems:
The use of halon systems on new ships is not permitted. This applies also to tests of the existing systems during which halon is released into atmosphere.

3.2.1. Hydraulic test of high pressure CO$_2$ cylinders.

3.2.1.1. To be performed every 10 years for cylinders up to 20 years of age (commencing from the date of manufacture), every 5 years for cylinders over 20 years of age and after each repair of cylinder (irrespective of its age). The hydraulic test shall be performed on not less than 10% of the total number of cylinders, the cylinders chosen for the test being in the worst technical condition. Prior to the hydraulic test, internal examination of the cylinders shall be performed. Satisfactory result of the test will constitute the basis for certification of the remaining cylinders.

3.2.2. Low pressure carbon dioxide system storage tanks

3.2.2.1. Internal examination to be performed at least every 10 years and at each emptying in the case of storage tanks over 5 years old. Depending on the result of internal examination, hydraulic test of the storage tank may be required; for CO$_2$ systems.

3.2.2.2. Hydraulic test of manifolds and pipelines from cylinders/storage tanks up to distribution valves and hydraulic test of distribution pipelines passing through accommodation and service spaces, to be performed every 10 years for ships under 20 years old, every 5 years for ships older than 20 years and after each repair of the manifolds and pipelines.

3.2.3. Halon system storage tanks/cylinders are subject to hydraulic test after each discharging and if more than 10 years passed from the previous hydraulic test. For the existing halon systems, the hydraulic test of cylinders may be replaced by the cylinder wall thickness measurement.

3.2.4. Internal examination of control valves.

3.3. Foam fire-extinguishing system:

3.3.1. Hydraulic test of pipelines, to be performed every 10 years for ships under 20 years old and every 5 years for ships older than 20 years.

3.4. Powder fire-extinguishing system:

3.4.1. Hydraulic test of powder containers and gas (powder carrier) pressure vessels, to be performed every 10 years for containers/pressure vessels under 20 years of age (counting from the date of manufacture) and every 5 years.

3.4.1.1. For containers/pressure vessels over 20 years of age. If an internal examination of powder container reveals no signs of surface defects or corrosion, hydraulic test of the container is not required.

3.4.2. Internal examination of powder containers.

3.4.2.1. After each exchange of powder, but at least every 10 years.

3.5. Inert gas system (on oil tankers):
3.5.1. Internal examination (inert gas generator, scrubber, water seal, gas control valve, the main stop valve and shut-off valve) to be performed every 5 years.

3.5.2. Hydraulic test of pipelines, to be performed every 10 years for ships under 20 years old and every 5 years for ships older than 20 years.
Section 1 General

1.1. There shall be a minimum of two surveys of the outside of the ship’s bottom and related items during each five-year special survey period. One such examination shall be carried out in conjunction with the special survey, which may begin not earlier than 15 months prior to the due date of the special survey. In all cases the interval between these two surveys shall not exceed 36 months.

1.2. Intermediate Surveys are to be held on all ships instead of the second or third Annual Survey after completion, commissioning or Special Survey.

1.3. Ships are to be examined in dry dock or on a slipway two times in any five-year special survey period, with an interval not exceeding 36 months. One of the two Docking Surveys required in each five year period should coincide with the Special Survey. A Docking Survey is considered to coincide with the Special Survey when held within the 15 months prior to the due date of the Special Survey. Class PMDS may accept an In-water Survey in lieu of the intermediate docking between Special Surveys. The interval between examinations of the outside of ship’s bottom and related items for ships operating in fresh water and for certain harbor or non-self-propelled craft may be greater than that given above. An extension of examination of the ship’s bottom of 3 months beyond the due date can be granted in exceptional circumstances such as:

1.3.1. Unavailability of dry-docking facilities;

1.3.2. Unavailability of repair facilities;

1.3.3. Unavailability of essential materials, equipment or spare parts; or

1.3.4. Delays incurred by action taken to avoid severe weather conditions

1.4. All ships are to be subjected to Special Surveys, at five year intervals. The first Special Survey becomes due five years from the date of build or date of Special Survey for Classification. At the discretion of Class PMDS consideration can be given to any exceptional circumstances justifying an extension of the hull Classification to a maximum of three months beyond the fifth year. If an extension is agreed the next period of hull Classification will start from the due date of the Special Survey before the extension was granted.

1.5. Special Surveys may be commenced on the fourth anniversary after completion, commissioning or a previous Special Survey and progressed during the succeeding year with a view to completion by the fifth anniversary. As part of the preparation for the Special Survey, the thickness determination should be dealt with so far as is practicable, in connection with the fourth Annual Survey. When the Special Surveys is commenced prior to the fourth Annual Survey, the entire survey is to be completed within fifteen months if such work is to be credited to the Special Survey. Where the Special Survey is completed more
than three months before the due date, the new record of Special Survey will be the final date of survey. In all cases the date recorded will be the fifth anniversary.

1.6. Survey of the outside of the ship's bottom is carried out in order to periodically check the technical condition of the underwater hull bottom, openings, bottom and side valves, external underwater parts of rudder and steering gear, propulsion plant and navigational equipment.

Section 2 Bottom Surveys in dry dock
At each bottom survey in dry dock the following requirements are to be complied with:

2.1. 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 the bottom and side plating, stern frame and rudder, as well as steering fins, shaft brackets 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.

2.2. 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 bilge keels.

2.3. 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.

2.4. Rudder, rudder pintles, rudder shafts and couplings and stern frame 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 bearings is to be ascertained and recorded. If it exceeds the values given below, the bush is to be adjusted. Where applicable, pressure test of the rudder may be required as deemed necessary by the Surveyor.

<table>
<thead>
<tr>
<th>Pintle (Diameter of Pintle: ( d_p ))</th>
<th>Allowable clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>( d_p \leq 50 \text{ mm} )</td>
<td>3.0 mm</td>
</tr>
<tr>
<td>50 \text{ mm} &lt; ( d_p \leq 100\text{mm} )</td>
<td>5.0 mm</td>
</tr>
<tr>
<td>100 \text{ mm} &lt; ( d_p )</td>
<td>( 0.01d_p + 4.0 \text{ mm} )</td>
</tr>
<tr>
<td>Neck bearing (Diameter of rudder stock: ( d_e ))</td>
<td>( 0.01d_e + 2.0 \text{ mm} )</td>
</tr>
</tbody>
</table>

2.5. The propeller is to be examined. The efficiency of the oil gland, if fitted, is to be ascertained and clearance or wear down in the stern bush are to be measured. For controllable pitch propellers and special type propellers, the sealing and tightness conditions are to be ascertained and recorded. In the
case where the pitch control device is fitted, it is to be ascertained that the device is in good working order. However, if considered necessary by the Surveyor, the device is to be opened up for further examination.

2.5.1. The clearance between the propeller shaft and the after bearing of stern tube or the shaft bracket bearing is to be measured for water-lubricated stern tube bearings, and if it exceeds the values given below, the lignum vitæ bush is to be adjusted. Stern tube shafts are also to be complying with these requirements.

<table>
<thead>
<tr>
<th>Diameter of propeller shaft ( D_p )</th>
<th>Allowable clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>( D_p \leq 230 \text{ mm} )</td>
<td>6.0 mm</td>
</tr>
<tr>
<td>230 mm &lt; ( D_p \leq 305 \text{ mm} )</td>
<td>8.0 mm</td>
</tr>
<tr>
<td>305 mm &lt; ( D_p )</td>
<td>9.5 mm</td>
</tr>
</tbody>
</table>

2.6. Visible parts of side thrusters and anti-rolling devices are to be examined.

2.7. 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.

2.8. The surveys for water jet propulsion systems and azimuth or rotatable thruster are to be carried out in accordance with instructions of Class PMDS (Head office).

2.9. A mooring trial is to be carried out to attending Surveyor's satisfaction to confirm satisfactory operation of main and auxiliary machinery. If significant repairs are carried out to main or auxiliary machinery or steering gear, consideration is to be given to a sea trial to attending Surveyor's satisfaction.

Section 3 In-water surveys

3.1. The in-water survey shall provide the information on the outside of the ship's bottom normally obtained from the dry dock 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 shall be included in the proposals for in-water survey, which shall be submitted in advance of the survey so that the satisfactory arrangements can be agreed with Class PMDS.

3.2. In-water survey shall be carried out in sheltered water and preferably with weak tidal streams and currents. In-water visibility and cleanliness of the ship's hull below waterline shall be sufficient to perform meaningful examination allowing the surveyor and diver to determine condition of the shell plating, appendages, welds. The diver localization methods during survey where has been necessary, shall be permanent markings on the shell plating at selected points shall be agreed with Class PMDS.
3.3. The equipment, procedure for observing and reporting the survey shall be discussed with the parties involved prior to the in-water survey, and suitable time shall be allowed to permit the diving company to test all equipment beforehand.

3.4. The in-water survey shall be carried out by the surveyor from Class PMDS with participation of the qualified divers using technical facilities thereof. The diver shall be employed by a firm recognized as a service supplier approved by Class PMDS.

3.5. The surveyor shall be satisfied with the method of pictorial representation, and a good two-way communication between the surveyor and the diver shall be provided.

3.6. 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 detailed survey can be undertaken and the necessary repairs carried out.

Section 4 Rudder
The requirements in this Section apply to double plate rudders of stream line section and ordinary shape, being divided into the following types.

1. Type A: Rudders with upper and bottom pintles (See Fig. A)
2. Type B: Rudders with neck bearing and bottom pintle (See Fig. B)
3. Type C: Rudders having no bearing below the neck bearing (See Fig. C)
4. Type D: Mariner type rudders with neck bearing and pintle, of which lower end is fixed (See Fig. D)
5. Type E: Mariner type rudders with two pintles, of which lower ends are fixed (See Fig. E)

Fig. A  Fig. B
Allowable Clearance of rudder bearing:

- Neck Bearing: 4mm
- Pintle: 6mm (Type D and E)
- 7.5mm (Type A, B, C)

Section 5 Chain Cables
The chain cables are to be ranged and examined on all ships over five years old.

5.1. Survey Preparation
- The chain locker is to be cleaned internally.
- The chain cables are to be ranged for inspection.
- The anchors are to be cleaned and placed in an accessible position for inspection

5.2. The anchors are to be examined. If the chain cables are ranged they are to be examined. If any length of chain cable is found to be reduced in mean diameter at its most worn part by 13.5 per cent
or more from its nominal diameter, it is to be renewed. The windlass is to be examined. For equipment forming part of a positional mooring system, see 5.3.

5.3. On ships fitted with positional mooring equipment, the anchors are to be cleaned and examined. Wire rope anchor cables are to be examined.

If cables are found to contain broken, badly corroded or bird caging wires they are to be renewed. Chain cables are to be ranged and examined. If any length of chain cable is found to be reduced in mean diameter at its most worn part by 12 per cent or more from its nominal diameter it is to be renewed. The windlasses or winches are to be examined.

5.4. Annual Survey
The efficient operating condition of mechanically operated hatch covers including stowage and securing in open condition; proper fit and efficiency of sealing in closed condition; operational testing of hydraulic and power components, wires, chains and link drives.

**Table 5.2.1 Anchor Chains**

<table>
<thead>
<tr>
<th>D</th>
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<th>D</th>
<th>D*</th>
<th>D</th>
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Note: Anchors (axles, shackles) = 25% of section, whence renewal at 13.5% of original diameter

Steering Chains (Chain, rods, sheave axles) = 25% of section, whence renewal at 13.5% of original diameter
Section 1 General

1.1. Application
This chapter, hereinafter called the Regulations, takes into account the basic safety principals that can be applied to non-convention sized ships of the following International Conventions:

1.1.1. The International Convention for the safety of Life at Sea (SOLAS), 1974, as amended;

1.1.2. The International Convention on Load Lines (LL), 1966, as amended;

1.1.3. The International Convention for Prevention of pollution from Ships (MARPOL), 1973/78, as amended; and

1.1.4. The International Convention on Standard of Training, Certification and Watch keeping of Seafarer (STCW), 1978/95;

1.1.5. The International Regulations for Preventing Collisions at Sea (COLREG), 1972, as amended.

1.2. The Regulations should apply to ships and barges as follows:

1.2.1. New cargo ships of less than 500 GT but above 15 m in length, propelled by mechanical means,

1.2.2. New manned barges above 15 m in length,

1.2.3. New manned barges, less than 24 m but above 15 m in Length,

1.2.4. New unmanned barges above 15 m in length,

1.2.5. New unmanned barges, less than 24 m but above 15 m in Length,

1.2.6. Existing ships and barges.

1.3. Standards

1.3.1. The construction, installation, structural strength, fittings, material, appliances and apparatus unless expressly provided by Class PMDS, should be of recognized standards.

1.3.2. In addition to the requirements and standards referred in this chapter, other requirements and standards recommended by Class PMDS may be applied whenever such requirements and standards are considered appropriate.

1.4. Repairs, alterations and modifications of major character

1.4.1. Repairs, alterations and modifications of a major character and outfitting related thereto on existing ships should meet the requirements prescribed for a new ship to such extent as Class PMDS deems
reasonable and practicable. The owner should inform to Class PMDS of the proposed alterations and modifications before such alterations and modifications are carried out.

1.4.2. For the purpose of this Chapter, the following repairs, alterations and modifications should be recognized as being of "major character:"

1.4.2.1. Any changes that substantially alters the dimensions of the ship

1.4.2.2. Any changes that substantially increase a ship's service life; or

1.4.2.3. Any conversions that alters the functional aspects of the vessel.

1.5. Ship’s plans, signs, instruction manuals, name plates and language used

1.5.1. Ship’s name plates, signs, instructions, notices, plans and documents on board ships relating to safety and operation of the ship and its machinery should be drawn up in the official language (English) or working language.

1.5.2. Ships propelled by mechanical means should carry adequate information including drawings, plans and instruction manuals necessary for their safe operation and safety of life at sea.

Section 2 Surveys and Certificates

2.1. Surveys

2.1.1. All ships to which the Regulations apply should be subject to surveys. The general nature and the periodicity of such surveys should be as specified below:

2.1.1.1. An initial survey, including an inspection of the outside of the ship's bottom, before the ship is put in service;

2.1.1.2. A renewal survey at intervals specified by Class PMDS but not exceeding 5 years.

2.1.1.3. A periodical/intermediate survey within three months before or after the second anniversary date or within three months before or after the third anniversary date of the Certificate which should take the place of one of the annual surveys.

2.1.1.4. An annual survey within three months before or after each anniversary date of the Certificate;

2.1.1.5. An additional survey as the occasion arises;

2.1.1.6. Two inspections of the ship’s hull, including an inspection of the outside of the ship’s bottom, within a five year period.

2.1.2. The surveys referred to in paragraph 2.1 should be carried out as follows:

2.1.2.1. The initial survey before the ship is put into service should be such as to ensure that arrangements, equipments and systems specified below comply fully with the requirements of Class
PMDS and the workmanship of all such parts and equipment is in all respects satisfactory: the arrangement, materials and scantlings of the structure; boilers and other pressure vessels; main and auxiliary machinery including steering gear and associated control systems; fire safety systems and appliances, life saving appliances and arrangements, navigational equipment, nautical publications, means of embarkations for pilots; radio installation including those used in life saving appliances; arrangements for the control of discharge of oil and for the retention of oil on board; provision of the lights, shapes, means of making sound signals and distress signals as required by the provision of COLREG; the arrangements, materials and scantling fully comply with the requirements of Section chapter 12 and 13 relating to the condition for assignment of load lines and freeboard.

2.1.2.2. The renewal survey should include an inspection of the equipment referred to in paragraph 2.2.1 to ensure that it complies with the relevant requirements of Class PMDS and COLREG.

2.1.2.3. The periodical survey should include an inspection with tests where necessary of the equipment to ensure that the requirements relating to the life-salving appliances, fire appliances and the light and sound signals are complied with and that they are in satisfactory condition and are fit for the service for which the ship is intended. All certificates, record books, operating manuals and other instructions and documents specified should be checked for their adequacy.

2.1.2.4. The intermediate survey should include an inspection of items relating to Sections 3 to 6, 8 and 14 of this Chapter to ensure that they are in a satisfactory condition and fit for the service for which the ship is intended. When inspecting items of hull and machinery for detailed examination, due account should be taken of any continuous survey schemes adopted

2.1.2.5. The annual survey should include an inspection to ensure that:
2.1.2.5.1. The equipment referred to in paragraph 2.2.1 remains satisfactory for the service for which the ship is intended.

2.1.2.5.2. Alterations have not been made to the hull or superstructures which would affect the calculations determining the position of the load lines.

2.1.2.5.3. The fittings and appliances for the protection of openings, guard rails, freeing ports and means of access to crew's quarters are maintained in an effective condition.

2.1.2.6. An additional survey either general or partial, according to the circumstances, should be made after a repair resulting from investigations whenever an accident occurs to a ship or a defect is discovered, either of which affects the safety of the ship or whenever any important repair or renewals are made. The survey should be such as to ensure that the repairs and renewals are effectively made.

2.1.2.7. A minimum of two inspections of the outside of the ship's bottom during any five year period except where so authorized by the Administration. As far as practicable the interval between any two such inspections should not exceed 36 months. The inspection of the outside of the ship's bottom and the survey of related items inspected at the same time should be such as to ensure that they remain
satisfactory for the service for which the ship is intended. Preferably the inspection should coincide with the renewal survey.

2.1.3. The periodical/intermediate and the annual surveys referred to Class PMDS should be endorsed on the Certificate.

2.1.4. Where a ship complies with the Regulations partially and complies with the relevant provisions of the international Conventions specified in Section 1 (1.1), Class PMDS should ensure that prior to issue of any certificate under the Regulations compliance with such provisions of the other Conventions is assured.

2.2. Maintenance of condition after survey

2.2.1. The condition of the ship and its equipment should be maintained by the master and company to conform with the provisions of the Regulations to ensure that the ship in all respects will remain fit to proceed to sea without danger to the ship, persons on board or the marine environment.

2.2.2. After any survey of the ship under this chapter is completed, no change should be made in the structural arrangements, machinery, equipment and other items covered by the survey, without the sanction of Class PMDS.

2.2.3. Whenever an accident occurs to the ship or a defect is discovered, either of which affects the safety of the ship or the efficiency or completeness of its life-saving appliances or other equipment, a request shall be made immediately to Class PMDS responsible for issuing the relevant certificate for a survey as may be required by Section 2 of this chapter, to be carried out as soon as practicable.

2.3. Issue or endorsements of certificates

2.3.1. Subject to the provisions of 2.1.2.4 of this chapter, hereinafter called the Certificate, should be issued after an initial or renewal survey, and specified in regulation 2.1.2.2 of this chapter, to a ship which complies with the relevant requirements of the Regulations. In any case the Administration should ensure the completeness of the inspections prior to the issue of any certificates.

2.3.2. The Certificate issued under the provisions of paragraph I should be supplemented by a Record of Equipment.

2.3.3. When an exemption is granted Class PMDS to a ship under and in accordance with the provisions of Class PMDS should be issued in addition to the Certificate prescribed in this Chapter. The Exemption should be attached in the ship status report.

2.4. Duration and validity of certificates

2.4.1. The period should not exceed five years. An exemption certificate should not be valid for a longer period than the period of the certificate to which it relates.
2.4.2. Notwithstanding the requirements of paragraph 2.4.1, when the renewal survey is completed within three months before the expiry date of the existing certificate, the new certificate should be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of expiry of the existing certificate.

2.4.3. When the renewal survey is completed after the expiry date of the existing certificate, the new certificate should be valid from the date of completion of the renewal survey to a date not exceeding five years from the date of expiry of the existing certificate.

2.4.4. When the renewal survey is completed more than three months before the expiry date of the existing certificate, the new certificate should be valid from the date of completion of the renewal survey to a date not exceeding five years from the date of completion of the renewal survey.

2.4.5. If the certificate is issued for a period of less than 5 years, Class PMDS may extend the validity of the certificate beyond the expiry date to the maximum period specified in paragraph 2.4.1, provided that the applicable surveys referred to in 2.4.2 for the issue of the certificate for 5 years are carried out.

2.4.6. If a renewal survey has been completed and the new certificate cannot be issued or placed on board the ship before the expiry date of the existing certificate, the person or the organization authorized by Class PMDS may endorse the existing certificate and such certificate should be accepted as valid for a further period which should not exceed one month from the expiry date.

2.4.7. If a ship at the time when the certificate expires is not in a port in which it is to be surveyed, Class PMDS may extend the period of validity of the certificate but this extension should be granted only for the purpose of allowing the ship to complete its voyage to the port in which it is to be surveyed, and only in cases where it appears proper and reasonable to do so. No certificate should be extended for a period longer than one month, and a ship to which such an extension is granted should not, on its arrival in the port in which it is to be surveyed, be entitled by virtue of such extension to leave that port without a new certificate. Where the renewal survey is completed the new certificate should be valid to a date not exceeding five years from the date of expiry of the existing certificate before the extension was granted.

2.4.8. In special circumstances, as determined by Class PMDS, a new certificate need not be dated from the date of expiry of the existing certificate as required by paragraphs 2.4.2, 2.4.5 and 2.4.7. In these special circumstances the new certificate should be valid to a date not exceeding five years from the date of the completion of the renewal survey.

2.4.9. If an manual or periodical/intermediate survey is completed before the period specified in the relevant regulation then:

2.4.9.1. The anniversary date shown on the relevant certificate should be amended by endorsement to a date which should not be more than three months later than the date on which the survey was completed;
2.4.9.2. The subsequent annual or periodical survey required by the relevant regulations should be completed at the intervals prescribed by the Regulations using the new anniversary date;

2.4.9.3. The expiry date may remain unchanged provided one or more annual or periodical surveys, as appropriate, are carried out so that the maximum intervals between the surveys prescribed by the relevant regulations are not exceeded.

2.4.10. A certificate issued under this chapter should cease to be valid in any of the following cases:

2.4.10.1. If the relevant surveys and inspections are not completed within the periods specified in this chapter;

2.4.10.2. If the certificate is not endorsed in accordance with this chapter;

2.4.10.3. Upon transfer of the ship to the flag of another State.

2.4.11. Upon transfer of the ship to another flag a new certificate should only be issued when Class PMDS issuing the new certificate is fully satisfied that the ship is in compliance with the requirements of this Chapter.

2.5. Availability of certificates

The certificates issued under this chapter should be readily available on board for examination at all times.

Section 3 Construction and Equipment

3.1. General provisions

3.1.1. All existing helps should, as a rule, comply with the requirements existing prior to collage into force of the Regulations. Where no such requirements are applicable, ships should comply with the Regulations to the extent of Class PMDS considers to be reasonable or practicable. Existing ships which undergo replacement of equipment or outfitting related thereto should comply with the requirements specified in this section as far as it is considered reasonable and practicable by Class PMDS.

3.1.2. All machinery and electrical installations, mechanical and electrical equipment and appliances, boilers and other pressure vessels, associated piping systems, fittings and electrical cables and wiring should be of a design and construction adequate for the service for which they are intended and should be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design should have regard to materials used in construction, and to purposes for which the equipment is intended, the working I conditions and the environmental conditions to which it will be subjected.

3.2. Construction
3.2.1. The strength and construction of hull, superstructures, deckhouses, machinery casings, and companionways and any other structure and equipment should be sufficient to withstand all foreseeable conditions of the intended service. A ship built and maintained in conformity with the applicable rules of Class PMDS may be considered as adequate in this respect.

3.2.2. Ships propelled by mechanical means should be fitted with a collision bulkhead in accordance with Section 3 and with watertight bulkheads founding the machinery spaces. Such bulkheads should be extended up to the freeboard deck. In ships constructed of wood such bulkheads should be watertight as far as practicable.

3.2.3. Propeller shafts and shaft logs or stern tubes should not be situated in any space other than machinery spaces containing main propulsion machinery unless they are enclosed in watertight spaces or enclosures inside such spaces acceptable by Class PMDS. Class PMDS may exempt, from the requirements of this paragraph, ships having constraint of space or engaged on sheltered voyages, provided it is demonstrated that any progressive flooding of such space can be easily controlled and that the safety of the ship is not thus impaired.

3.2.4. Stern glands should be located in spaces which are easily accessible at all times for inspection and maintenance to the satisfaction of Class PMDS (Head Office).

3.3. Collision bulkhead

3.3.1. For the purpose of this regulation freeboard deck, length of ship and perpendiculars (forward and aft) have the meanings as defined in Section 2 of this chapter.

3.3.2. A collision bulkhead should be fitted which should be watertight up to the freeboard deck. This bulkhead should, as far as practicable, be located at a distance from the forward perpendicular of not less than 5 per cent and not more than 8 per cent of the length of the ship. Where it can be shown to the satisfaction of Class PMDS that it is impractical for the collision bulkhead to be located at distance from the forward perpendicular of not more than 8 per cent of the length of the ship, Class PMDS may allow relaxation there from, subject to the condition that should the space forward of the bulkhead be flooded, the ship at full load condition will not be submerged to a line drawn at least 76 mm below the upper surface of the bulkhead deck at side.

3.3.3. The collision bulkhead may have steps or recesses in it provided that they are within the limits prescribed in paragraph 3.3.2. Pipes piercing the collision bulkhead should be kept to the minimum. Such pipes should be fitted with suitable valves operable from above the freeboard deck and the valves chest should be secured at the collision bulkhead inside the forepeak. Class PMDS may permit the location of such valves on the after side of the collision bulkhead provided that they are readily accessible under all services conditions and the space in which they are located is not a cargo space. All such valves should be of material acceptable by Class PMDS.
3.3.4. Where a long forward superstructure is fitted, the collision bulkhead should be extended weather tight to the deck immediately above the freeboard deck. The extension should, subject to the requirements of paragraph 3.3.3, be located within the limits prescribed in paragraph 3.3.2. The part of the deck, if any, between the collision bulkhead and its extension should be weather tight.

3.3.5. Where a bow door and a sloping loading ramp that forms part of the extension of the collision bulkhead above the freeboard deck is fitted, the part of the extension, which is more than 2.3 m, or as specified by Class PMDS, above the freeboard deck may extend no more than 1 m forward of the forward limits specified in paragraph 3.3.2. The ramp should be weather tight over its complete length.

3.3.6. The number of openings in the extension of the collision bulkhead above the freeboard deck should be reduced to the minimum compatible with the design and normal operation of the ship. All such openings should be capable of being closed weather tight.

3.3.7. No doors, manholes, ventilation ducts or access openings are permitted in the collision if bulkhead below the freeboard deck.

3.3.8. Where a chain locker is located abaft the collision bulkhead or extends into the forepeak tank it should be watertight and provided with efficient means of drainage.

3.3.9. A chain locker should not be used for any purpose other than stowage of anchor chain cables.

3.4. Watertight bulkheads, decks, doors, trunks etc.
3.4.1. The Regulations should apply to new ships propelled by mechanical means. The Regulations should not apply to ships the hull of which is constructed of wood.

3.4.2. Each watertight subdivision bulkhead, whether transverse or longitudinal, should be constructed in such a manner that it should be capable of supporting, with a proper margin of resistance, the pressure due to the maximum head of water which it might have to sustain in the event of damage to the ship but at least the pressure due to a head of water up to the margin line. The construction of these bulkheads should be to the satisfaction of Class PMDS.

3.4.3. Steps and recesses in bulkheads should be watertight and of the same strength as the bulkhead at the place where each occurs.

3.4.4. Where frames or beams pass through a watertight deck or bulkhead, such deck or bulkhead should be made structurally watertight to the satisfaction of Class PMDS.

3.4.5. The number of openings in watertight bulkheads should be reduced to the minimum compatible with the general arrangements and operational needs of the ship. Openings should be fitted with watertight closing appliances to the satisfaction of Class PMDS. Watertight doors should be of equivalent strength to the adjacent unpaired structure.
3.4.6. Watertight decks, trunks, tunnels, duct keels and ventilators should be of the same strength as watertight bulkheads at corresponding levels. The means used for making them watertight, and the arrangements adopted for closing openings in them, should be to the satisfaction of Class PMDS. Watertight ventilators and trunks should be carried at least up to the freeboard deck.

3.4.7. Testing main compartments by filling them with water is not compulsory. When testing by filling with water is not carried out, a hose test should be carried out in the most advanced stage of the fitting out of the ship. In any case, a thorough inspection of watertight bulkheads should be carried out.

3.4.8. The forepeak, double bottom tanks (including duct keels) and inner skins should be tested with water to a head corresponding to the requirements of 3.4.2.

3.4.9. Tanks which are designed to hold liquids, and which form part of the subdivision bathe ship, should be tested for tightness with water to a head corresponding to two-third of the depth from the top of keel to the margin line in way of the tanks; provided that in no case should the test head be less than 0.9 m above the top of the tank.

3.4.10. The tests referred to in 3.48 and 3.4.9 are for the purpose of ensuring that the subdivision structural arrangements are watertight and are not to be regarded as a test of the fitness of any compartment for the storage of oil fuel or for other special purposes for which a test of a superior character may be required depending on the height to which the liquid has access in the tank or its connections.

3.5. Means for sounding
3.5.1. Means for sounding, to the satisfaction of Class PMDS should be provided for:
3.5.1.1. The bilges of those compartments which are not readily accessible at all times during the voyage; and
3.5.1.2. All tanks and cofferdams.

3.5.2. Where sounding pipes are fitted, their upper ends should be extended to a readily accessible position and, where practicable, above the freeboard deck. Their openings should be provided with permanently attached means of closing. Sounding pipes which are not extended above the freeboard deck should be fitted with automatic self-closing devices.

3.6. Anchoring and mooring equipment
3.6.1. At least two anchors of sufficient weight should be provided. One of these should be provided with a chain cable or wire rope of adequate strength and size and windlass, capstan or winch of suitable size for the cable and other anchor handling equipment and arrangements should be to the satisfaction of Class PMDS. Class PMDS may permit carriage of only one anchor with adequate chain or wire and other arrangements taking into account the size of the ship and its area of operation.
3.6.2. Windlass, capstan, winches, fairleads, bollards, mooring bits and other anchoring, mooring towing and hauling equipment should be:

3.6.2.1. Properly designed to meet all foreseeable operational loads and conditions

3.6.2.2. Correctly seated; and

3.6.2.3. Effectively secured to a part of the ship's structure which is strengthened suitably.

3.7. Requirements of towing and pushing arrangements provided on tugs

3.7.1. The design of the towing gear should be such as to minimize the overturning moment due to the lead of the towline. It should have a positive means of quick release which can be relied upon to function correctly under all operating conditions and released from the position from which towing operations are controlled.

3.7.2. Where a towing hook is provided with a quick release mechanism such mechanism should be controlled, as far as practicable, from the navigating bridge, the after control position, if fitted, and at the hook itself.

3.7.3. When a pushing tug and a barge pushed ahead are rigidly connected in a composite unit, the tug barge coupling system should be capable of being controlled and powered from the tug. Disassembly should be capable of being made without causing damage.

3.7.4. Every tug should be provided with at least one axe of sufficient size on each side of the ship so as to readily available for cutting the towline free in an event of an emergency.

3.7.5. Sufficient spare equipment to completely remake the towing and mooring arrangements for the tow should be available on the tug.

3.7.6. Secondary or emergency towing arrangements should be fitted on board the barge so as to be easily recoverable by the towing tug in the event of failure of the main towing wire or failure of ancillary equipment.

3.8. Mooring and towing arrangements for barges

3.8.1. The towing and mooring arrangements should be such as to reduce to a minimum any danger to personnel during towing or mooring operation. Such arrangements should be suitable for the particular type of barge and of adequate strength.

3.8.2. The design and arrangements of fittings or equipment for towing and mooring of barges should be to the satisfaction of Class PMDS and should take into account both normal and emergency conditions.

3.8.3. In addition to the provisions of the Regulations tugs and barges should comply with the applicable requirements for the safety of towed ships and other floating objects recommended.
3.9. General protection measures against accidents

3.9.1. Hinged covers of hatchways, manholes and other similar opening should be protected against accidental closing. In particular, heavy covers on escape hatches should be equipped with counter weights. Escape doors and covers of escape and access hatches should be so constructed as to be capable of being opened from either side of the door or cover.

3.9.2. The dimensions of access hatches should be such that it will allow a person to have a quick and easy escape to a safe place in the event of an emergency. Where practicable, the dimensions of access hatches of cargo and machinery spaces should be such that they will facilitate expeditious rescue operation.

3.9.3. Handrails, grab rails and handholds of sufficient size and strength should be provided to the satisfaction of Class PMDS as support for persons when the ship is severely rolling or pitching.

3.9.4. Skylights of machinery spaces or other similar openings which are normally kept open at sea should be provided with adequately spaced protective bars or other arrangements to the satisfaction of Class PMDS to prevent a person from falling into the space accidentally. Where the size of such an opening is small, Class PMDS may waive this requirement if satisfied that due to the small size of the opening no protective arrangement is necessary.

Section 4 Stability Requirement

4.1. Intact stability, subdivision and damage stability requirements for cargo ships other than offshore supply vessels

Point 4.1.2 to 4.1.4 of this Chapter should apply to ships propelled by mechanical means point 4.1.5 should apply to barges only. Point 4.1.6 should apply to all ships.

4.1.2. Subject to the provisions of point 4.1.3 ships of 24 m and above in length should comply with the applicable intact stability requirements for cargo ships specified in the Code on Intact Stability for All Types of Ships Covered by IMO Instruments, adopted by the Organization and hereinafter called the Stability Codes or comply with the equivalent stability standards adopted by Class PMDS.

4.1.3. Ships of 24 m and above in length whose characteristics, in the opinion of Class PMDS, render compliance with 4.1.2 impracticable should comply with the stability criteria recommended by Class PMDS.

4.1.4. In addition to complying with the applicable requirements of this regulation, Class PMDS may require, having regard to the nature of intended services, application of weather criteria specified in paragraph 3.2 of the Stability Code.

4.1.5. Intact stability of barges (including pontoons) carrying only deck cargoes, having no hatchways in the deck except small manholes closed with gasket covers, no machinery installations and no accommodation and service spaces should be in accordance with the stability requirements specified in
paragraph 4.7 of the Stability Code. The intact stability or subdivision and damage stability requirements, as appropriate, for barges carrying under deck cargoes or having machinery installations or service spaces should be determined by Class PMDS, having regard to the design and arrangements of cargo spaces, machinery, equipment, deck houses or superstructures.

4.1.6. For ships between 15 m and 24 m Class PMDS may apply the provisions of the Stability Code, if reasonable. The intact stability of ships which are not covered by the provisions of the Stability Code should be to a standard satisfactory to Class PMDS.

4.2. Intact stability, subdivision and damage stability requirements for offshore supply vessels
The intact stability and subdivision of offshore supply vessels should comply with the applicable requirements of 4.5 of the Stability Code or comply with the recognized standards. In addition by Class PMDS may require such ships to comply with the recommendations of the application of the weather criterion referred to in paragraph 3.2 of the Stability Code.

4.3. Inclining tests and stability information
4.3.1. Every ship should undergo an inclining test upon its completion and the actual displacement and position of the centre of gravity should be determined for the light ship condition.

4.3.2. Where alterations are made to a ship affecting its light condition and the position of the centre of gravity, the ship should, if Class considers this necessary, be re-inclined and the stability information amended.

4.3.3. Class PMDS may allow the inclining test of an individual ship to be dispensed with provided that reliable stability information for the exempted ship can be obtained from basic data available from the inclining test of a sister ship and that during the construction the same weights of components and weight distribution is observed.

4.3.4. Class PMDS may dispense the inclining test of a cargo ship or a class of ships especially designed for the carriage of liquids or ore in bulk, when reference to existing data for similar ships clearly indicates that due to ship proportions and arrangements more than sufficient transverse met centric height will be available in all probable loading conditions.

4.3.5. Stability information approved by Class PMDS should be supplied to ships propelled by mechanical means to enable the master to assess with ease and certainty the stability of the ship under various operating conditions chapter 2 of the Stability Code. Such information should include specific instructions to the master warning him of those operating conditions which could adversely affect either stability or the trim of the ship.

4.3.6. In particular, the information recommended in the Stability Code should be included as appropriate. A copy of the stability information should be submitted to Class PMDS.
4.3.7. The approved stability information should be kept on board, readily accessible at all times and inspected at the periodical surveys of the ship to ensure that it has been approved and the condition of the ship since its approval has not changed.

4.3.8. Where alterations are made to a ship affecting its stability, revised stability calculations should be prepared and submitted to Class PMDS for approval. Such revised information should be supplied to the master and the superseded information removed from the ship.

4.4. Bilge pumping arrangements

4.4.1. An efficient bilge pumping arrangement should be provided which under all practical conditions should be capable of pumping from and draining any watertight compartment other than a space permanently appropriated for the carriage of fresh water, water ballast, oil fuel or liquid cargoes for which other efficient means for pumping are provided. Where Class PMDS is satisfied that the safety of the ship is not impaired the bilge pumping arrangements may be dispensed with in any particular compartment and unmanned barges without machinery spaces.

4.4.2. The arrangement of the bilge and ballast pumping system should be such as to prevent the possibility of water passing from the sea and from water ballast spaces into the cargo and machinery spaces, or from one compartment to another.

4.4.3. All distribution boxes and manually operated valves in connection with the bilge pumping arrangements should be in positions which are accessible under ordinary circumstances.

4.4.4. At least two bilge pumps connected to the main bilge system should be provided, one of which may be driven by the propulsion machinery. The total capacity of the required bilge pumps should not be less than 125% of the total capacity.

4.4.5. Sanitary, ballast and general service pumps provided with suitable connections for bilge suction may be accepted as independent power bilge pumps.

4.4.6. A bilge ejector in combination with an independently driven high pressure sea-water pump may be installed, provided this arrangement is to the satisfaction of Class PMDS.

4.4.7. Bilge pipes should not be led through fuel oil, ballast or double bottom tanks, unless pipes are of heavy gauge steel construction.

Section 5 Machinery Installation

5.1. General requirements

5.1.1. All boilers and other pressure vessels, all parts of machinery, all steam, hydraulic, pneumatic and other systems and their associated fittings which are under internal pressure should be subjected to appropriate tests including a pressure test before being put into service.
5.1.2. Means should be provided to ensure that the machinery can be brought into operation from the dead ship condition without external aid.

5.1.3. Adequate provisions should be made to facilitate cleaning, inspection and maintenance of machinery installations including boilers and other pressure vessels.

5.1.4. Where risk from over speeding of machinery exists, means should be provided to ensure that the safe speed is not exceeded.

5.1.5. Where main or auxiliary machinery including pressure vessels or any parts of such machinery are subject to internal pressure and may be subject to dangerous overpressure, means should be provided where practicable to protect against such excessive pressure.

5.1.6. All gearing and every shaft and coupling used for transmission of power to machinery essential for the propulsion and safety of the ship or for the safety of persons on board should be so designed and constructed that they will withstand the maximum working stresses which may be subjected in all service conditions, and due consideration should be given to the type of engines by which they are driven or of which they form part.

5.1.7. Main turbine propulsion machinery and, where applicable, main internal combustion propulsion machinery and auxiliary machinery should be provided with automatic shutoff arrangements in the case of failures such as lubricating oil supply failure which could lead rapidly to complete breakdown, serious damage or explosion, Class PMDS may permit provisions for overriding automatic shutoff devices.

5.1.8. Internal combustion engine sofa cylinder diameter of 200 mm or a crankcase volume of 0.6 m³ and above should be provided with crankcase explosion relief valves of a suitable type with sufficient relief area. The relief valves should be arranged or provided with means to ensure that discharge from them is so directed as to minimize the possibility of injury to personnel.

5.2. Machinery controls

5.2.1. Main and auxiliary machinery essential for the propulsion and safety of the ship should be provided with effective means for its operation and control.

5.2.2. Means should be provided whereby normal operations of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative. Special consideration should be given to the malfunctioning of:

5.2.2.1. An electrical power generator which serves as a main source of electrical power;

5.2.2.2. The sources of lubricating oil pressure;

5.2.2.3. The fuel oil supply systems for engines;
5.2.2.4. The sources of water pressure;

5.2.2.5. An air compressor and receiver for starting or for control purposes;

5.2.2.6. The hydraulic, pneumatic or electrical means for control in main propulsion machinery including controllable pitch propellers; and

5.2.2.7. Steam boilers and boiler feed systems, if provided.

However, Class PMDS, having regard to overall safety considerations, may accept a partial reduction in propulsion capability from normal operation.

5.2.3. Special consideration should be given to the design, construction and installation of propulsion machinery systems so that any mode of their vibrations should not cause undue stresses in machinery in its normal operating ranges.

5.3. Remote control of propulsion machinery

5.3.1. Where remote control of propulsion machinery from the navigating bridge is provided and the machinery spaces are intended to be manned, the following should apply;

5.3.1.1. The speed, direction of thrust and, of applicable, the pitch of the propeller should be fully controllable from the navigating bridge under all sailing conditions, including, maneuvering;

5.3.1.2. The remote control should be performed, for each independent propeller, by a control device so designed and constructed that its operation does not require particular attention to the operational details of the machinery. Where multiple propellers are, designed to operate simultaneously, they may be controlled by one control device;

5.3.1.3. The main propulsion machinery should be provided with an emergency stopping device on the navigating bridge which should be independent of the navigating bridge control system;

5.3.1.4. Propulsion machinery orders from the navigating bridge should be indicated in the main machinery control room or at the maneuvering platform as appropriate;

5.3.1.5. Remote control of the propulsion machinery should be possible only from one location at a time; at such locations interconnected control positions are permitted. At each location there should be an indicator showing which location is in control of the propulsion machinery. The transfer of control between the navigating bridge and machinery spaces should be possible only in the main machinery space or the main machinery control room. This system should include means to prevent the propelling thrust from altering significantly when transferring control from one location to another;

5.3.1.6. It should be possible to control the propulsion machinery locally, even in the case of failure in any part of the remote control system;
5.3.1.7. The design of the remote control system should be such that in case of its failure an alarm will be given. Unless Class PMDS considers it impracticable the preset speed and direction of thrust of the propellers should be maintained until local control is in operation.

5.3.1.8. Indicators should be fitted on the navigating bridge for:
5.3.1.8.1. Propeller speed and direction of rotation in the case of fixed pitch propellers
5.3.1.8.2. Propeller speed and pitch position in the case of controllable pitch propellers;

5.3.1.9. An alarm should be provided on the navigating bridge and in the machinery space to indicate low starting air pressure or low electrical power which should be set at a level to permit further an engine starting operation. If the remote control systems of the Propulsion machinery is designed for automatic starting, the number of automatic consecutive attempts which fail to produce a start should be limited in order to safeguard sufficient starting air pressure or adequate electrical power for starting locally.

5.3.2. In all ships where the main propulsion and associated machinery, including main electrical supply, are provided with various degrees of automatic or remote control and are under continuous manual supervision from a control room, the arrangements and controls should be so designed, equipped and installed that the machinery operation will be as safe and effective as if it were under direct supervision. Particular consideration should be given to protect such spaces against fire and flooding.

5.4. Periodically unattended machinery spaces (if installed)
5.4.1. Ships having periodically unattended machinery spaces should, as far as practicable and reasonable in the opinion of Class PMDS, comply with the applicable requirements of SOLAS 74 for such machinery spaces.
5.4.2. Where alternative arrangements are provided to Class PMDS should ensure that:
5.4.2.1. The safety of the ship in all sailing conditions, including maneuvering, is equivalent to that of a ship having manned machinery spaces;
5.4.2.2. Documentary evidence indicating that such arrangements are satisfactory is provide

5.5. Steam boilers and boiler feed systems (if installed)
5.5.1. Every steam boiler and every unfired steam generator should be provided with not less than two safety valves of adequate capacity. However, having regard to the output or any other features of any boiler or unfired steam generator, Class PMDS may permit only one safety valve to be fitted if it is satisfied that adequate protection against overpressure is thereby provided.

5.5.2. Each oil-fired boiler which is intended to operate without manual supervision should have safety arrangements which shut off the fuel supply and give an alarm in the case of low water level, air supply failure or flame failure.
5.5.3. Every steam generating system which provides services essential for the safety of the ship, or which could be rendered dangerous by the failure of its feed water supply, should be provided with not less than two separate feed water systems from and including the feed pumps, noting that a single penetration of the steam drum is acceptable. Unless overpressure is prevented by the pump characteristics means should be provided which will prevent over pressure in any part of the systems.

5.5.4. Boilers should be provided with means to supervise and control the quality of the feed water. Suitable arrangements should be provided to preclude, as far as practicable, the entry of oil or other contaminants which may adversely affect the boiler.

5.5.5. Every boiler essential for the safety of the ship and designed to contain water at a specified level should be provided with at least two means for indicating its water level, at least one of which should be a direct reading gauge glass.

5.5.6. Water tube boilers serving turbine machinery should be fitted with a high water level alarm.

5.6. Steam pipe systems (if installed)
5.6.1. Every steam pipe and every fitting connected thereto through which steam may pass should be so designed, constructed and installed as to withstand the maximum working stresses to which it may be subjected.

5.6.2. Means should be provided for draining every steam pipe in which dangerous water hammer action might otherwise occur.

5.6.3. If a steam pipe or fitting may receive steam from any source at a higher pressure than that for which it is designed a suitable pressure reducing valve, relief valve or pressure gauge should be fitted.

5.7. Air pressure systems (if installed)
5.7.1. In every ship means should be provided to prevent overpressure in any part of compressed air systems and wherever water jackets or casings of air compressors and coolers might be subjected to dangerous overpressure due to leakage into them from air pressure parts. Suitable pressure refries-arrangements should be provided for all systems.

5.7.2. The main starting air arrangements for main propulsion internal combustion engines should be adequately protected against the effects of backfiring and internal explosion in the starting air pipes.

5.7.3. All discharge pipes from starting air compressors should lead directly to the starting air receivers, and all starting pipes from the air receivers to main or auxiliary engines should be entirely separate from the compressor discharge pipe system.

5.7.4. Provision should be made to reduce to a minimum the entry of oil into the air pressure systems and to drain these systems.
5.8. Ventilation systems in machinery spaces

5.8.1. Machinery spaces of category A should be adequately ventilated so as to ensure that when machinery or boilers therein are operating at full power in all weather conditions including heavy weather, an adequate supply of air is maintained to the spaces for the safety and comfort of personnel and the operation of the machinery. Any other machinery space should be adequately ventilated appropriate for the purpose of that machinery space.

5.8.2. In addition to complying with the requirements of 5.8.1, the ventilation of machinery spaces should also be sufficient under all normal conditions to prevent accumulation of oil vapor.

5.9. Protection against noise (Refer to the code on Noise Levels on Board Ships, adopted by the Organization by Res. A. 468(XII).) Measures should be taken to reduce machinery noise in machinery spaces to acceptable levels as determined by Class PMDS. If this noise cannot be sufficiently reduced, the source of excessive noise should be suitably insulated or isolated or a refuge from noise should be provided if the space is required to be manned. Ear protectors should be provided for personnel required to enter such spaces, if necessary.

5.10. Means of going astern

5.10.1. Sufficient power for going astern should be provided to secure proper control of the ship in all normal circumstances.

5.10.2. The ability of the machinery to reverse the direction of thrust of the propeller in sufficient time and so to bring the ship to rest within a reasonable distance from maximum ahead service speed, should be demonstrated and recorded.

5.10.3. The stopping times, ship headings and distances recorded on trials, together with the results of trials to determine the ability of ships having multiple propellers to navigate and maneuver with one or more propellers inoperative, should be available on board for the use of the master or designated personnel.

5.10.4. Where the ship is provided with supplementary means for maneuvering or stopping, the effectiveness of such means should be demonstrated and recorded as referred to in 5.10.2 and 5.10.3.

5.11. Steering gear

5.11.1. Unless expressly provided otherwise, every ship should be provided with a main steering gear and subject to the provisions of 5.11.4, with an auxiliary means of steering the ship in the event of failure of the main steering gear.

5.11.2. The main steering gear should be of adequate strength and capable of steering the ship at maximum ahead service speed. The main steering gear and rudder stock should be so designed that they will not be damaged at maximum astern speed.
5.11.3. The auxiliary means of steering should be of adequate strength and capable of steering the ship at navigable speed and of being brought speedily into action in an emergency.

5.11.4. Where power operated main and auxiliary steering gear units are provided:
5.11.4.1. The main steering gear should be capable of putting the rudder over from 35° on one side to 35° on. The other side with the ship at its deepest seagoing draught and running a head at maximum ahead service speed and, under the same conditions, from 35° on either side to 30 on the other side in not more than 28 seconds;

5.11.4.2. The auxiliary steering gear should be capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 seconds with the ship at its deepest seagoing draught and running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater;

5.11.4.3. Where power operated main steering gear units and the connections are fitted in duplicate and each unit complies with the provisions of 5.11.3 no auxiliary steering unit need be required.

5.11.5. The main steering power unit should be arranged to restart either by manual or automatic means when power is restored after a power failure.

5.11.6. In the event of a power failure to anyone of the steering gear power units, an audible and a visual alarm should be given on the navigating bridge.

5.11.7. The angular position of the rudder, if the main steering gear is power operated, should be indicated on the navigating bridge. The rudder angle indication should be independent of the steering gear control system.

5.11.8. Where a non conventional rudder is installed, Class PMDS should give special consideration to the steering system, so as to ensure that an acceptable degree of reliability and effectiveness which is based on the provisions of the Regulations is provided.

5.11.9. A means of communication should be provided, where necessary, between the navigating bridge and the steering gear compartment.

5.12. Communication between navigating bridge and machinery space
5.12.1. Ships should be provided with at least two independent means for communicating orders between navigating bridge and the machinery space or control room from which the main propulsion engines are normally controlled. One of the means should be an engine room telegraph. The arrangement of these means should be to the satisfaction of Class PMDS.

5.12.2. The engine room telegraph referred to 5.12.1 may be dispensed with if the main propulsion engine is directly controlled from the navigating bridge under normal operating conditions.
5.12.3. In lieu of meeting the requirements of 5.12.1, ships of less than 24 m in length may be provided with only one means for communication referred to in 5.12.1 if Class PMDS is satisfied that, due to close proximity of the navigating bridge and the position of local control of the main propulsion machinery, two means of communication are not necessary.

5.12.4. Appropriate means of communication should be provided to any position (other than navigating bridge) from which the engines may be controlled.

5.13. Engineer's alarm
An engineer's alarm should be provided to be operated from the engine control room or at the maneuvering platform as appropriate and should be clearly audible in the engineers' accommodation. Class PMDS may dispense with this requirement if satisfied that, due to particular manning patterns adopted in the engine room or close proximity of the engine control room or the maneuvering platform and the engineer's accommodation, no engineer's alarm is necessary.

Section 6 Electrical Installations
6.1. General electrical requirements
6.1.1. Electrical installations on ships and manned barges should comply with the requirements of this section, except as provided otherwise in 6.5.

6.1.2. Electrical installations should be such that:
6.1.2.1. All electrical auxiliary services necessary for maintaining the ship in normal operational and habitable conditions will be ensured without recourse to the emergency source of electrical power;

6.1.2.2. Electrical services essential for safety will be ensured under various emergency conditions; and
6.1.2.3. The safety of passengers, crew and ship from electrical hazards will be ensured.

6.2. Safety precautions
6.2.1. Exposed metal parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live should be earthed unless the machines or equipment are:
6.2.1.1. Supplied at a voltage not exceeding 55 Volts direct current or 55 Volts, root mean square 745 between conductors. Auto-transformers should not be used for the purpose of achieving this voltage; or

6.2.1.2. Supplied at a voltage not exceeding 250 V by safety isolating transformers supplying only one consuming device; or

6.2.1.3. Constructed in accordance with the principle of double insulation.

6.2.2. Class PMDS may require additional precautions for portable electrical equipment for use in confined or exceptionally damp spaces where particular risks due to conductivity may exist.
6.2.3. All electrical apparatus should be so constructed and so installed as not to cause injury when handled or touched in the normal manner.

6.2.4. Main and emergency switchboards shall be so arranged as to give easy access as may be needed to apparatus and equipment, without danger to personnel. The sides and the rear and, where necessary, the front of switchboards should be suitably guarded. Exposed live parts having voltages to earth exceeding a voltage to be specified by Class PMDS should not be installed on the front of such switchboards. Where necessary, no conducting mats or gratings should be provided at the front and rear of the switchboard.

6.2.5. The hull return system of distribution should not be used for any purpose in a tanker or a barge carrying liquid cargoes of flammable nature in bulk.

6.2.6. The requirement of 6.2.5 does not preclude under conditions approved by Class PMDS the use of:
   6.2.6.1. Impressed current cathodic protective systems;
   6.2.6.2. Limited and locally earthed systems (e.g. engine starting system);
   6.2.6.3. limited and locally earthed welding systems; where Class PMDS is satisfied at the equipotential of the structure is assured in a satisfactory manner, welding systems with hull return may be installed without restriction imposed by 6.2.5; or
   6.2.6.4. Insulation level monitoring devices provided the circulation current does not exceed 30 mA under the most unfavorable conditions.

6.2.7. Where the hull return system is used, all final sub-circuits, i.e. all circuits fitted after the last protective device, should be two-wire and special precautions should be taken to the satisfaction of Class PMDS.

6.2.8. Earthed distribution system should not be used in a tanker or barge carrying liquid cargoes of flammable nature in bulk. Class PMDS may permit the use of the following earthed system:
   6.2.8.1. Power supplied, control circuits and instrumentation circuits where technical or safety reasons preclude the use of a system with no connection to earth, provided the current in the hull is limited to not more than 5 A in both the normal and fault conditions;
   6.2.8.2. Limited and locally earthed systems, provided that any possible resulting current does not flow directly through any of the dangerous spaces; or
   6.2.8.3. Alternating current power network of 1000 V root mean square (tine to line) and over, provided that any possible resulting current does not flow directly through any of the dangerous spaces.
6.2.9. When a distribution system, whether primary or secondary, for power, heating or lighting, with no connection to earth is used, a device capable of continuously monitoring the situation level to earth and of giving an audible or visual indication of abnormally low insulation values should be provided.

6.2.10. Except as permitted by Class PMDS in exceptional circumstances, all metal sheaths and armor of cables should be electrically continuous and should be earthed.

6.2.11. All electric cables and wiring external to equipment should be at least of a flame retardant type and should be so installed as not to impair their original flame-retarding properties. Where has been necessary for particular applications Class PMDS may permit the use of special types of cables such as radio frequency cables, which do not comply with the foregoing.

6.2.12. Cables and wiring serving essential or emergency power, lighting, internal communications or signals should so far as practicable be routed clear of galleys, laundries, machinery spaces of category A and their casings and other high fire risk areas. Cables connecting fire pumps to the emergency switchboard should be of a fire-resistant type where they pass through high fire risk areas. Where practicable all such cables should be run in such a manner as to preclude their being rendered unserviceable by heating of the bulkheads that may be caused by a fire in an adjacent space.

6.2.13. Where cables which are installed in hazardous areas introduce the risk of fire or explosion in the event of an electrical fault in such areas, special precautions against such risks should be taken to the satisfaction of Class PMDS.

6.2.14. Cables and wiring should be installed and supported in such a manner as to avoid chafing or other damage.

6.2.15. Terminations and joints in all conductors should be so made as to retain the original electrical, mechanical, flame retarding and, where necessary, fire resisting properties of the cables.

6.2.16. Each separate circuit should be protected against short circuit and against overload, except the circuit for the steering gear and where Class PMDS may exceptionally otherwise permit. The rating or appropriate setting of the overload protective device for each circuit should be permanently indicated at the location of the protective device.

6.2.17. Lighting fittings should be so arranged as to prevent temperature rises which could damage the cables and wiring, and to prevent surrounding material from becoming excessively hot.

6.2.18. All lighting and power circuits terminating in a bunker or cargo space should be provided with a multiple pole switch outside the space for disconnecting such circuits.

6.2.19. Accumulator batteries should be suitably housed, and compartments used primarily for their accommodation should be properly constructed and efficiently ventilated.
6.2.20. Electrical or other equipment which may constitute a source of ignition of flammable vapors should not be permitted in those compartments except as permitted in paragraph 6.2.22.

6.2.21. Accumulator batteries except for batteries used in self-contained battery operated lights should not be located in sleeping quarters except where hermetically sealed to the satisfaction of Class PMDS.

6.2.22. No electrical equipment should be installed in any space where flammable mixtures are liable to collect including those on board tankers or barges carrying liquid cargoes Flammable nature in bulk or in compartments assigned principally to accumulator batteries, in paint lockers, acetylene stores or similar spaces, unless Class PMDS is satisfied that such equipment is:

6.2.22.1. Essential for operational purposes;

6.2.22.2. Of a type which will not ignite the mixture concerned;

6.2.22.3. Appropriate to the space concerned; and

6.2.22.4. Appropriately certified for safe usage in the dusts, vapors or gases likely to be encountered.

6.2.23. Lightning conductors should be fitted to all masts or topmasts constructed of non-conducting materials. In ships constructed of non-conductive materials the lightning conductors should be connected by suitable conductors to copper plate fixed to the vessel's hull well below the waterline.

6.3. Main source of electrical power

6.3.1. A main source of electrical power of sufficient capacity to supply those services mentioned in 6.1.2.1 should be provided. This main source of electrical power should consist of at least two generating sets (one could be accepted if driven by the main propulsion engine) and should comply with the following:

6.3.1.1. The capacity of these generating sets should be such that in the event of anyone generating set being stopped it will still be possible to supply those services necessary to provide normal operational conditions of propulsion and safety;

6.3.1.2. The arrangements of the ship's main source of electrical power should be such that the services referred to in 6.1.2.1 can be maintained regardless of the speed and direction of rotation of the propulsion machinery or shafting

6.3.1.3. In addition, the generating sets should be such as to ensure that with anyone generator or its primary source of power out of operation, the remaining generating sets should be capable of providing the electrical services necessary to start the main propulsion plant from a dead ship condition. The emergency source of electrical power may be used for such electrical service if its capability is sufficient to provide at the same time those services required to be supplied by regulation 6.4.5.
6.3.2. A main electrical lighting system which should provide illumination throughout those parts of the ship normally accessible to and used by passengers or crew should be supplied from the main source of electrical power.

6.3.3. The arrangement of the main electric lighting system should be such that a fire or other casualty in spaces containing the main source of electrical power, associated transforming equipment, if any, and the main switchboard will not render the emergency electric lighting system required by 6.4 inoperative.

6.3.4. The arrangement of the emergency electric lighting system should be such that a fire or other casualty in spaces containing the emergency source of electrical power, associated transforming equipment, if any, and the emergency switchboard will not render the main electric lighting system required by this regulation inoperative.

6.4. Emergency source of electrical power

6.4.1. A self contained emergency source of electrical power should be provided.

6.4.2. The emergency source of electrical power, associated transforming equipment, if any, and the emergency switchboard should be located above the uppermost continuous deck and should be readily accessible from the open deck. They should not be located forward of the collision bulkhead, except where permitted by Class PMDS in exceptional circumstances.

6.4.3. The location of the emergency source of electrical power, associated transforming equipment, if any, the emergency switchboard in relation to the main source of electrical power, associated transforming equipment, if any, and the main switchboard should be such as to ensure, to the satisfaction of Class PMDS, that a fire or other casualty in the space containing the main source of electrical power, associated transforming equipment, if any, and the main switchboard, or in any machinery space of category A will not interfere with the supply, control and distribution of emergency electrical power.

6.4.4. Provided at suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency generator may be used, exceptionally, and for short periods, to supply non emergency circuits.

6.4.5. The electrical power available should be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously. The emergency source of electrical power should be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source their operation:

6.4.5.1. For a period of 3 hours, emergency lighting at every muster and embarkation station and over the sides in the way of such stations;

6.4.5.2. For a period of 12 hours, emergency lighting;

6.4.5.2.1. In all service and accommodation alleys, stairways and exits;
6.4.5.2. In spaces containing propulsion machinery used for navigation, if any, and main source of electrical power and their control positions;

6.4.5.2.3. In all control stations, machinery control rooms, and at each main and emergency switchboard;

6.4.5.2.4. At all stowage positions for firemen's outfits;

6.4.5.2.5. At the steering gear, if any; and

6.4.5.2.6. At the emergency fire pump and its control position;

6.4.5.3. For a period of 12 hours, the navigation lights and other lights required by COLREG;

6.4.5.4. For a period of 12 hours:
6.4.5.4.1. All communication equipment required for transmission of distress and safety messages, including ship's whistle and all internal communication equipment as required in an emergency

6.4.5.4.2. The fire detection and fire alarm systems; and

6.4.5.4.3. Operation of emergency fire pumps, if electrically operated.
6.4.5.5. In a ship regularly engaged in voyages of short duration, Class PMDS, if satisfied that an adequate standard of safety would be attained, may accept a lesser period than the 12 hour period specified in 6.4.5.2 to 6.4.5.4 of this regulation but not less than 3 hours.

6.4.5.6. The emergency source of electrical power may be either:
6.4.5.6.1. An accumulator battery capable of carrying the emergency electrical load without recharging or excessive voltage drop; or

6.4.5.6.2. A generator driven by a suitable prime mover with an independent fuel supply and starting to the satisfaction of Class PMDS.

6.4.5.7. Where the emergency source of electrical power is an accumulator battery, it should be capable of automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power. Where an automatically connection to the emergency switchboard is not practical, manual connection may be acceptable to the satisfaction of Class PMDS.

6.4.5.8. Where the emergency source of power is a generator, it should be automatically started and connected to the emergency switchboard within 45 seconds of the loss of the main source of electrical power. It should be driven by a prime mover with an independent fuel supply having a flash point of not less than 43°C. Automatic starting of the emergency generator will not be required where a transitional source of power to the satisfaction of the Administration is provided.
6.5. Special considerations
Class PMDS may waive any of the requirements specified in this chapter taking into account the requirements of electrical power for operating the propulsion machinery and the size of the ship.

Section 7 Fire Safety Measures

7.1. General application
7.1.1. This Section applies to ships propelled by mechanical means and to manned barges which are provided with machinery spaces of category A to maintain its normal habitable and operational condition.

7.1.2. Ships and manned barges which are provided with machinery spaces other than machinery spaces of category A should comply with the provisions of this chapter to the satisfaction of Class PMDS.

7.2. Structural fire protection
7.2.1. The hull, superstructures, structural bulkheads, decks and deckhouses of ships propelled by mechanical means should be constructed of steel or other equivalent material.

7.2.2. The bulkheads and decks separating the machinery spaces of category A from control stations, corridors, accommodations spaces, stairways, service spaces and cargo spaces should be so constructed as to be capable of preventing the spread of fire to the unexposed side.

7.2.3. Interior stairways below the weather deck should be of steel or other material having acceptable fire resisting properties.

7.2.4. Insulation materials in accommodation spaces, service spaces, control stations and machinery spaces except domestic refrigeration compartments, should be non combustible. Vapor barriers and adhesive used in conjunction with insulation, as well as insulation of pipe fittings, for cold service systems, need not be non combustible materials, but they should be kept to the minimum quantity practicable and their exposed surfaces should have qualities of resistance to the propagation of flame to the satisfaction of Class PMDS.

7.2.5. All exposed surfaces in corridors and stairway enclosures and surfaces including grounds in concealed or inaccessible spaces in accommodation spaces, service spaces and control stations should have low flame spread characteristics. Exposed surfaces of ceilings in accommodation spaces, service spaces and control stations should have low flame spread characteristic.

7.2.6. Paints, varnishes and other finishes used on exposed interior surfaces should not offer an undue fire hazard in the opinion of Class PMDS and should not be capable of producing excessive quantities of smoke.
7.2.7. Primary deck coverings, if applied within accommodation spaces, service spaces and control stations, should be of approved materials which will not readily ignite or give rise to toxic or explosive hazards at elevated temperatures. In existing ships, Class PMDS may, in lieu of applying the requirements fully, apply such requirements only to deck coverings within accommodation spaces on decks forming the crown of machinery spaces and cargo spaces.

7.3. Means of escape and control of ventilation
7.3.1. Means of escape should be provided as follows:
7.3.1.1. Stairways and ladders should be so arranged as to provide means of escape from all accommodation spaces and from spaces in which the crew is normally employed, other than machinery spaces, ready means of escape to the open deck and thence to the survival craft;

7.3.1.2. Two means of escape should be provided from machinery spaces of category A which should be as widely separated as possible. Vertical escapes should be by means of steel ladders or other means acceptable to Class PMDS as suitable alternatives. Where the size of such machinery space makes it impracticable, one of these means of escape may be dispensed with provided that the exit is to the satisfaction of Class PMDS;

7.3.1.3. From machinery spaces other than those of category A, escape routes should be provided to the satisfaction of Class PMDS having regard to the nature and location of the spaces and whether persons are normally employed in such spaces;

7.3.1.4. No dead end corridors having a length of more than 7 m should be accepted. A dead end corridor is a corridor or part of a corridor from which there is only one escape route;

7.3.1.5. The width and continuity of the means of escape should be to the satisfaction of Class PMDS.

7.3.2. The following provisions should apply to machinery spaces of category A and, where Class PMDS considers it desirable, to the other machinery spaces:
7.3.2.1. Means of control should be provided for opening and closure of skylights, opening and closure of windows in machinery space boundaries, closure of openings in funnels which normally allow exhaust ventilation, and closure of ventilator dampers;

7.3.2.2. Means of control should be provided for permitting the release of smoke;

7.3.2.3. Means of control should be provided for stopping forced and induced draught fans, fuel oil transfer pumps, fuel oil unit pumps and to similar fuel pumps;

7.3.2.4. Controls required in paragraph 2.10 and 2.11 of this regulation should be located outside the space concerned, where they may be cut off in the event of fire in the space they serve;
7.3.2.5. The number of skylights, doors, ventilators for natural ventilation, openings in funnel to permit exhaust ventilation and other openings to machinery spaces should be in accordance with requirements of 5.8;

7.3.2.6. Skylights should not contain glass panels. However, skylights containing wire reinforced glass or toughened safety glass panels may be permitted provided that they are fitted with external shutters of steel or other equivalent material permanently attached. Suitable arrangements should be made to permit the release of smoke in the event of fire from the spaces to be protected;

7.3.2.7. Windows should not be fitted in machinery space boundaries. This does not preclude the use of glass for windows in control rooms within the machinery space;

7.3.2.8. Doors fitted in machinery space boundaries should as far as practicable be equivalent in resisting fire to the divisions forming such boundaries. If such doors are not weather tight or watertight they should be self closing;

7.3.2.9. Ventilation systems of each of the following groups of spaces should be entirely separated from each other. The arrangements of each ventilation system should be Such that fire in one space should not readily spread to:
  7.3.2.9.1. Machinery spaces;
  7.3.2.9.2. Galleys;
  7.3.2.9.3. Cargo spaces;
  7.3.2.9.4. Accommodation spaces and control stations;

7.3.2.10. Power ventilation of accommodation spaces, services spaces, cargo spaces, control stations and machinery spaces should be capable of being stopped from an easily accessible position located outside the space being served. This position should not be readily cut off in the event of a fire in the space served. The means provided for stopping the power ventilation of machinery spaces should be entirely separated from the means provided for stopping ventilation of other spaces;

7.3.2.11. The main inlets and outlets of all ventilation systems should be capable of being closed from outside the spaces being ventilated.

7.4. Ventilation of tanks and cofferdams
7.4.1. Subject to the provisions of regulations 7.11 and 7.12 of this Section, all tanks, cofferdams and other enclosed spaces, where dangerous vapors are liable to be trapped, should be provided with effective means for ventilation and access to the satisfaction of Class PMDS having regard to the intended services.
7.4.2. In tankers and barges carrying flammable liquid cargo in bulk (other than crude oil or petroleum products of low flashpoint) there should be provided for ventilation of cargo tanks a venting system consisting of one or more pressure/vacuum valves at the outlets to the atmosphere or air pipes the open ends of which are fitted with removable wire gauze diaphragms of non corrosive material. Such venting systems should be to the satisfaction of Class PMDS.

7.5. Miscellaneous items
7.5.1. Where bulkheads, decks, ceilings or linings are penetrated for the passage of electric cables, pipes, trunks, etc. or for the fitting of ventilation terminals, lighting fixtures and similar devices, or for girders, beams or other structural members, arrangements should be made to ensure that the fire integrity is not impaired.

7.5.2. Class PMDS may permit the conveying of oil and combustible liquid through accommodation and service spaces provided that the pipes conveying oil or combustible liquids are of a material approved by Class PMDS having regard to the fire risk.

7.5.3. Material readily rendered ineffective by heat should not be used for overboard scuppers including sanitary discharges and other outlets which are close to the water line and where the failure of the material in the event of fire would give rise to danger of flooding.

7.5.4. Electric radiators, if used, should be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiators should "be fitted with an element so exposed that clothing, curtains, or other similar materials can be scorched or set on fire by heat from the element or equivalent material.

7.5.5. Cellulose-nitrate based films should not be used for cinematography installations.

7.5.6. Paint lockers of more than 10 m² area should be provided with adequate measures to control fire in such spaces to recognized standards.

7.5.7. In spaces where penetration of oil products is possible, the surface of insulation should be impervious to oil or oil vapor.

7.6. Arrangements for oil fuel and other oil tanks
7.6.1. The following limitations should apply to the use of oil as fuel:
7.6.1.1. Except as otherwise permitted by this paragraph, no oil fuel with a flash point of less than 60°C should be used;

7.6.1.2. In emergency generators oil fuel with a flashpoint of not less than 43°C may be used;

7.6.1.3. Subject to such additional precautions as it may consider necessary and on condition that the ambient temperature of the space in which such oil fuel is stored or used should not be allowed to rise to within 10°C below the flashpoint of the oil fuel, Class PMDS may permit the general use of oil fuel having a flashpoint of less than 60°C but not less than 43°C;
7.6.1.4. Cargo ships the use of fuel having a lower flashpoint than otherwise specified in this paragraph, for example crude oil, may be permitted provided that such fuel is not stored in any machinery space and subject to the approval by Class PMDS of the complete installation;

7.6.1.5. The flashpoint of oils should be determined by an approved closed cup method.

7.6.2. In a ship in which oil fuel is used, the arrangements for the storage, distribution and utilization of the oil fuel should be such as to ensure the safety of the ship and persons on board and should at least comply with the following provisions:

7.6.2.1. Far as practicable, parts of the oil fuel systems containing heated oil under pressure exceeding 0.18 N/mm² should not be placed in a concealed position such that defects and leakage cannot readily be observed. The machinery spaces in way of such parts of the oil fuel system should be adequately illuminated;

7.6.2.2. As far as practicable, oil fuel tanks should be part of the ship's structure aid should be located outside machinery spaces of category A. Where 011 fuel tanks, other than 8 double bottom tanks, are necessarily located adjacent to or within machinery spaces of category A, at least one of their vertical sides should be contiguous to their machinery space boundaries, and should preferably have a common boundary with the double bottom tanks where fitted, and the area of the tank boundary common with the machinery spaces should be kept to a minimum. Where such tanks are situated, within the boundaries of machinery spaces of category A they should not contain oil fuel having a flashpoint of less than 60°C. In general, the use of free standing oil fuel tanks should be avoided. Where permitted, they should be placed in an oil tight spill tray of ample size having a suitable drain pipe leading to a safe place to the satisfaction of Class PMDS;

7.6.2.3. Every oil fuel pipe, which, if damaged, would allow oil to escape from a storage, settling or daily service tank situated above the double bottom should be fitted with a cock or valve directly on the tank capable of being closed from a safe position outside the space concerned in the event of a fire occurring in the space in which such tanks are situated. Tanks of not more than 250 l capacity need not comply with this subparagraph;

7.6.2.4. Safe and efficient means of ascertaining the amount of oil fuel contained in any oil fuel tank should be provided. Sounding pipes should not terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they should not terminate in accommodation spaces. Other means of ascertaining the amount of oil fuel contained in any fuel tank may be permitted, provided that the failure of such means or overfilling of the tanks will not permit release of fuel. Class PMDS may permit the use of oil level gauges with flat glasses and self closing valves between the gauges and fuel tanks. Cylindrical gauge glasses may also be permitted in free standing oil fuel tanks provided that they are suitably protected and fitted with self closing valves to the satisfaction of Class PMDS;
7.6.2.5. Provision should be made to prevent over pressure in any oil tank or in any part of the oil fuel system, including the filling pipes. Relief valves and air or over-flow pipes should discharge to a position which in the opinion of Class PMDS is safe. The open ends of air pipes should be fitted with wire gauze.

7.6.3. Lubricating oil arrangements: the arrangements for storage, distribution and utilization of oil used in pressure lubrication systems should be such as to ensure the safety of the ship and persons on board. The arrangements made in machinery spaces of category A and whenever practicable in other machinery spaces should at least comply with the provisions of 7.2.1, 7.2.3 to 7.2.5, as they apply to oil fuel arrangements, except that this does not preclude the use of sight-flow glasses in lubricating systems provided that they are shown by test to have a suitable degree of fire resistance.

7.6.4. The arrangements for storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heating systems should be such as to ensure the safety of ships and persons on board. In locations where means of ignition are present, such arrangements should at least comply with the provisions of paragraphs 7.2.4 and 7.2.5 in respect of strength and construction.

7.7. Spillage or leakage of oil
No oil fuel tank or lubricating oil tank or any other flammable oil tank should be situated where spillage or leakage there from can constitute a hazard by falling on heated surfaces. Precautions should be taken to prevent any oil that may escape under pressure or oil leakage from any pump, filter, piping system or heat exchanger from coming into contact with heated surfaces or enter into machinery air intakes. Where necessary, a suitable spill tray or gutter screen or other suitable arrangement should be provided to allow oil to drain to a safe place in the event of spillage or leakage of oil from such a tank, machinery, equipment or system. The number of joints in piping systems should be kept to a minimum practicable.

7.8. Pipes and fitting
Pipes, fittings and valves handling fuel oil, lubrication oil and other flammable oils should be of steel or other approved material, except that restricted use of flexible pipes should be permissible in positions where Class PMDS is satisfied that they are necessary. Such flexible pipes and end attachments should be of approved fire resisting materials of adequate strength and should be constructed to the satisfaction of Class PMDS.

7.9. Use of forepeak tanks for carrying oil
Oil fuel, lubrication oil and other liquid substances flammable or harmful to the marine environment should not be carried in forepeak tanks;

7.10. Carriage of oxygen and acetylene cylinders
7.10.1. Where more than one cylinder of oxygen and more than one cylinder of acetylene are carried simultaneously, such cylinders should be arranged in accordance with the following:
7.10.1.1. Permanent piping systems for oxyacetylene-acetylene may be accepted provided that they are designed having due regard to standards and codes of practice to the Satisfaction of Class PMDS;
7.10.1.2. Where two or more cylinders of each gas are intended to be carried in enclosed spaces, separate dedicated storage rooms should be provided for each gas;

7.10.1.3. Storage rooms should be constructed of steel, and be well ventilated and accessible from the open deck;

7.10.1.4. Provision should be made for the expeditious removal of cylinders from the storage Rooms in the event of fire;

7.10.1.5. NO SMOKING* signs should be displayed at the gas cylinder storage rooms;

7.10.1.6. Where cylinders are stowed in open locations means should be provided to:

7.10.1.6.1. Protect cylinders and associated piping from physical damage;

7.10.1.6.2. Minimize exposure to hydrocarbons; and

7.10.1.6.3. Ensure suitable drainage;

7.10.1.7. In all cases, cylinders and associated piping should be located at a safe distance away from the ship's sides to avoid leakage of gases due to damage to the cylinders in the case of an accident to the ship's side.

7.10.2. Fire-extinguishing arrangements for the protection of areas or spaces where such cylinders are stored should be to the satisfaction of Class PMDS.

7.11. Carriage of dangerous goods for ship's use

7.11.1. Stowage of explosives associated with ship's use should be in accordance with the requirements for explosives storage specified in chapter 7 of the Code of Safety For Special Purpose Ships (SPS Code) adopted by the Organization by Resolution A.534(XIII) as amended from time to time.

7.11.2. Subject to the provisions of Regulation 11, paragraph 2, of the SPS Code liquids which give off dangerous vapors and flammable gases and cylinders containing flammable or other dangerous gases should be stored in a well ventilated space or on deck and protected against sources of dangerous heat. All pipes and fittings associated with the gas cylinder should be adequately protected against damage. Where storage rooms are necessary, separate storage rooms meeting the requirements of the IMDG Code should be provided.

7.11.3. Substances which are liable to spontaneous heating or combustion should not be carried unless adequate precaution has been taken to prevent the outbreak of fire.
7.11.4. Radioactive substances should not be carried unless adequate precaution has been taken to the satisfaction of Class PMDS.

7.12. Fire protection arrangements in cargo spaces
7.12.1. Where ships are engaged in the carriage of dangerous goods, a fixed gas fire-extinguishing system complying with the relevant regulations of SOLAS 74 or a fire extinguishing system which in the opinion of Class PMDS gives equivalent protection for the cargoes carried should be provided in the cargo spaces.

7.12.2. In addition to complying with the applicable requirements of paragraph, ships intended for the carriage of dangerous goods should comply with the special requirements specified in regulation 54 of Chapter 11-2 of SOLAS 74, except when carrying dangerous goods in limited quantities 13.

7.12.3. Class PMDS should provide the ship with an appropriate document as evidence of compliance relating to construction and equipment with the requirements of this regulation.

7.13. Fire safety measures for tankers
7.13.1. The requirements of Regulations 55 to 63 of Chapter 11-2 of SOLAS 74 should apply to all tankers and barges carrying crude oil and petroleum products having a flashpoint not exceeding 60°C (closed cup test), as determined by an approved flash point apparatus and Reid vapor pressure which is below atmospheric pressure and other liquid products having a similar fire hazard.

7.13.2. In lieu of complying with the requirements of 7.13.1, existing tankers should comply with the requirements of the national regulation previously made applicable taking into account the safety of persons on board, property at sea and the marine environment.

7.14. Carriage of dangerous goods in ships and barges
The requirements of Chapter VII of SOLAS 74 should apply to the carriage of dangerous goods classified in regulation 2 of that chapter, which are carried in ships and barges in packaged form or in solid form in bulk as appropriate.

Section 8 Fire Protection and extinction
8.1. Application
8.1.1. Unless expressly provided otherwise this section should apply to all ships propelled by mechanical means and manned barges manned barges of less than 24 m in length.

8.2. Fire pumps
8.2.1. Every ship should be provided with at least one independent power operated fire pump, capable of delivering a jet of water as required by regulation 8.3.4. In ships of 150 gross tons and above propelled by mechanical means such pump shall be operated by means other than the propulsion machinery of the ship.
8.2.2. Where two main fire pumps are provided, the capacity of one of the two should not be less than 40% of their total capacity.

8.2.3. Sanitary, bilge, ballast or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil and that if they are subject to occasional duty for the transfer or pumping of oil fuel, suitable change over arrangements are fitted.

8.2.4. Every fire pump should be arranged to draw water directly from the sea and discharge into a fixed fire main, if any. However, in ships with high suction lifts, booster pumps and storage tanks may be installed, provided such arrangement satisfies all the requirements of this regulation.

8.2.5. Centrifugal pumps or other pumps connected to the fire main through which back flow could occur should be fitted with non return valves.

8.2.6. Where the fire pumps are capable of developing a pressure exceeding the design pressure of the fire mains, water service pipes, hydrants and hoses, relief valves should be fitted. These valves should be so placed and adjusted as to prevent excessive pressure in any part of the fire main system.

8.2.7. Location and arrangement of pumps required for the provision of water for other fire extinguishing systems required by this section, their sources of power and their controls should be installed outside the space or spaces protected by such systems and should be so arranged that a fire in the space or spaces protected will not put any such system out of action.

8.2.8. Location and arrangements of pumps should take into account:

8.2.8.1. If a fire in anyone compartment can put all the fire pumps out of action, there should be an alternate means to extinguish the fire;

8.2.8.2. An emergency fire pump should be an independently driven self contained pump either with its own prime mover and fuel supply fitted in an accessible position outside the compartment which may be an emergency generator of sufficient capacity and positioned in a safe place outside the engine room and above the freeboard deck;

8.2.8.3. The emergency fire pump, sea suction and other valves should be operable from outside the compartment containing the main fire pump and in a position not likely to be cut off by fire in that compartment;

8.2.8.4. The capacity of the emergency pump should not be less than 40% of the total capacity of the fire pumps required by this regulation.

8.3. Fire mains, water service pipes and fire hydrants

8.3.1. A fire main should be provided where more than one hydrant is required to provide a jet of water under the provisions of 8.3.3 of this section.
8.3.2. The diameter of the fire main and water service pipes should be sufficient for the effective
distribution of the maximum required discharge from the fire pump or where more than one pump is
provided the discharge from at least two pumps operated simultaneously. Such diameter need only be
sufficient for a discharge of 100 m³/h with a minimum pressure as indicated in 8.3.4.

8.3.3. In a ship where one or more main fire pumps are provided, the diameter of the fire main and of the
water service pipes connecting the hydrants thereto should be sufficient for the effective distribution of the
maximum required discharge specified in 8.3.2.

8.3.4. Where only one hydrant is required, the minimum pressure at the hydrant should be, N/mm² (2.1
kg/cm²). Where more than one hydrant is required, the main fire pump should be capable when
discharging the maximum out through adjacent fire hydrants with nozzles of the sizes specified in 8.4, of
maintaining at all hydrants a minimum pressure of 0.21 N/mm² (kg/cm²). In any case, the maximum
pressure at any hydrant should not exceed that at which the effective control of a fire hose can be
demonstrated. For manned barges of 1000 gross tons and above the minimum pressure at the hydrant
should be 0.25 N/mm².

8.3.5. In every ship, the number and position of hydrants should be such that at least one jet of water
from a single length of hose can reach any part of the ship normally accessible to the crew while the ship
is being navigated and any part of any cargo space when empty. In the case of ships propelled by
mechanical means in any ro-ro cargo or in any special category spaces at least two jets of water not
emanating from the same hydrant should reach any part of such space, each from a single length of
hose. Furthermore, such hydrants should be positioned near the accesses to the protected spaces.

8.3.6. Pipes and hydrants should be arranged as follows:
8.3.6.1. Material readily rendered ineffective by heat should not be used for fire mains and hydrants
unless adequately protected. The pipes and hydrants should be so placed that the fire hoses may be
easily coupled to them;

8.3.6.2. In ships where deck cargo may be carried, the position of the hydrants should be such that they
are always readily accessible and the pipes should be arranged as far as practicable to avoid risk of
damage by such cargo;

8.3.6.3. A valve should be fitted to serve each fire hose so that any fire hose may be removed while the
fire pumps are at work;

8.3.6.4. Fire mains should have no connections other than those required for fire fighting, except for the
purposes of washing the deck and anchor chains or operating the chain locker bilge ejector.

8.4. Fire hoses and nozzles
8.4.1. Every ship should be provided with a minimum of two fire hoses.
8.4.2. Where hydrants are required in any machinery spaces, each hydrant should be provided with a fire hose. Where practicable fire hoses should be connected to the hydrants in such machinery spaces.

8.4.3. Notwithstanding the requirement of 8.1 and 8.2, Class PMDS may increase the required number of fire hoses so as to ensure that hoses in sufficient number are available and accessible at all times, having regard to the type of ship and the nature of trade in which the ship is engaged.

8.4.4. A single length of fire hose should not exceed 20 m.

8.4.5. Fire hoses should be oil-resistant and of approved material.

8.4.6. Hoses of unlined canvas should have a diameter of not less than 64 mm. Lined hoses of at least 45 mm internal diameter having a throughput comparable to that of 64 mm internal diameter unlined canvas at corresponding pressure may be used. Fire hoses of an internal diameter not less than 50 mm may be accepted in accommodation spaces of all ships.

8.4.7. Unless one fire hose and nozzle is provided for each hydrant, there should be complete interchangeability of fire hose coupling or nozzles.

8.4.8. Fire hoses provided in compliance with this regulation should not be used for any purpose other than fire fighting or testing of the fire appliances.

8.4.9. Every fire hose should be provided with approved nozzles and the necessary couplings.

8.4.10. Nozzles should comply with the following requirements:
8.4.10.1. Nozzle sizes should be 12 mm, 16 mm, 19 mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Administration;

8.4.10.2. For accommodation and services spaces, a nozzle size greater than 12 mm need not be used;

8.4.10.3. For machinery spaces and exterior locations, the nozzle size should be such as to obtain the maximum discharge possible from the required jets at the pressure specified in 8.3.4 from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.

8.4.11. In tankers and in machinery spaces of category A the nozzles provided for fire hoses should be of an approved dual purpose type (spray/jet type) incorporating a shutoff.

8.5. Portable fire extinguishers / General requirements
8.5.1. All fire extinguishers should be of approved types and designs.

8.5.2. The capacity of required portable fluid extinguishers should be not more than 13.5 l and not less than 9 l.
8.5.3. The capacity of the required portable carbon dioxide extinguishers, the portable mechanical foam extinguishers and the portable dry powder fire extinguishers should be at least equivalent to that of a 9 l fluid extinguisher.

8.5.4. All required portable fire extinguishers should not exceed 23 kg in weight in a fully charged condition and should be at least as portable as 13.5 l fluid fire extinguisher.

8.5.5. With the Regulations, except that for each such fire extinguisher which is of a type that cannot readily be recharged while the ship is at sea an additional fire extinguisher of the same type, or its equivalent, should be provided in lieu of a spare charge.

8.5.6. Fire extinguishers containing an extinguishing medium which, in the opinion of Class PMDS, either by itself or under expected conditions of use gives off toxic gases in such quantities as to endanger persons should not be permitted.

8.5.7. Fire extinguishers should be periodically examined and subjected to such tests as follows:
8.5.7.1. The condition of the charges of extinguishers other than carbon dioxide extinguishers, should be checked annually. If on checking there is any indication of deterioration the charges should be renewed and, in any case, at least every four years. A record of the annual check is to be fixed to each fire extinguisher;

8.5.7.2. Carbon dioxide extinguisher and gas propellant cartridges of other (extinguishers should be examined externally for corrosion and for loss of content annually. They should be recharged or renewed if the loss of gas by weight exceeds 10% of the original charge as stamped on the bottles or cartridge, or have corroded excessively externally;

8.5.7.3. All portable fire extinguishers, other than carbon dioxide extinguishers, should be tested by hydraulic pressure once every four years and the date of such test legibly marked on the extinguisher;

8.5.7.4. New carbon dioxide extinguishers which do not require to be recharged, should be tested by hydraulic pressure twenty years after manufacture and thereafter every five years;

8.5.7.5. Carbon dioxide extinguishers which require recharging should be pressure tested before being recharged if four years have elapsed since the last hydraulic test was carried out.

8.5.8. One of the portable fire extinguishers intended for use in any space should be stowed near the entrance to that space.

8.5.9. Halon fire extinguishers should not be used.
8.5.10. Each fire extinguisher should as far as it is practicable be clearly marked on the front with a label of durable material containing the following minimum information in English:

8.5.10.1. Name of manufacturer, year of manufacture and serial number;

8.5.10.2. Type of fire for which the extinguisher is suitable;

8.5.10.3. Type and quantity of extinguishing medium;

8.5.10.4. Approval details;

8.5.10.5. Pictorial and legible operating instructions;

8.5.10.6. Intervals for recharging;

8.5.10.7. Temperature range over which the extinguisher will operate satisfactorily;

8.5.10.8. Test pressure; and

8.5.10.9. Date last tested.

8.6. Portable fire extinguishers to be carried in accommodation spaces, service spaces and control stations

8.6.1. In every ship there should be provided a sufficient number of approved portable fire extinguishers to ensure that at least one extinguisher will be readily available for use in any part of accommodation spaces, service space, and control stations. At least 3 fire extinguishers should be provided in such ships. The arrangement of such fire extinguishers should be to the satisfaction of Class PMDS.

8.6.2. In every ship, where, in the opinion of Class PMDS, electrical installations fitted in accommodation, service and control stations constitute hazard of fire or explosion, additional fire extinguishers suitable for extinguishing electrical fires should be provided.

8.7. Fixed fire extinguishing systems

8.7.1. Subject to the provisions of 8.2, fixed fire-extinguishing systems required by this section should comply with the relevant requirements for these systems specified in the regulations of chapter 11-2 of SOLAS 74.

8.7.2. Fixed halogenated hydrocarbon fire-extinguishing systems should not be used in new ships or new installations and should be phased out by the year 2002.

8.8. Fire extinguishing systems in machinery spaces

8.8.1. Machinery spaces containing main or auxiliary oil fired boilers or fuel oil units, should be provided with one of the fixed fire extinguishing systems required by chapter 11-2 of SOLAS 74. In any case, if the engine and boiler rooms are not entirely separate, or if fuel oil can drain from the boiler room into the
engine room, the combined boiler and engine rooms should be considered as one compartment and should be provided with:

8.8.1.1. At least one portable extinguisher suitable for extinguishing oil fires for each burner. However, the total capacity of such extinguishers should not be less than 18 l or equivalent and need not exceed 45 l or equivalent in each boiler room;

8.8.1.2. At least two portable extinguishers suitable for extinguishing oil fires in each space in which part of oil fuel units is situated;

8.8.1.3. A receptacle containing not less than 0.15 m$^3$ of sand, sawdust impregnated with soda or other approved dry material to the satisfaction of Class PMDS in each firing space. Alternatively, an approved portable extinguisher may be substituted.

8.8.2. Machinery spaces containing internal combustion machinery having a total power output of $V_o \cdot kW$ and above should be provided with:

8.8.2.1. one of the fixed fire-extinguishing systems referred to in 8.7; and

8.8.2.2. At least one portable extinguisher suitable for extinguishing oil fires for each 750 kW of engine power output or part thereof, but the total number of such fire extinguishers so supplied should not be less than two and need not exceed six.

8.8.3. Machinery spaces containing internal combustion type machinery having a total power output of less than 750 kW which do not comply with the requirements of paragraph 8.8.2 should at least be provided with:

8.8.3.1. At least one portable fire extinguisher suitable for extinguishing oil fires for each $V_o \cdot kW$ or part thereof of such machinery, but the total number of such extinguishers so supplied should not be less than two and need not exceed six; or

8.8.3.2. Such other arrangements Class PMDS considers adequate.

8.8.4. Machinery spaces containing electrical installations should be provided with one or more fire extinguishers suitable for extinguishing electrical fire as deemed necessary by Class PMDS having regard to the fire hazards of electrical origin. One or more of the fire extinguishers required by this regulation may be included in the fire extinguishers required by this pont.

8.8.5. Where, in the opinion of Class PMDS a fire hazard exists in any machinery space for which no specific provision for fire extinguishing appliances are prescribed in paragraph 8.8.1 to 8.8.4, there should be provided in, or adjacent to, that space a number of approved portable fire extinguishers or other means of fire extinction to the satisfaction of Class PMDS.

8.8.6. Where ships are fitted with auxiliary oil fired boilers a receptacle should be provided in each firing space of every such ship which should contain at least 0.28 m$^3$ of sand or other dry material suitable for quenching oil fires. Scoops should be provided for distributing the contents of the receptacle.
8.9. Fireman's outfit

8.9.1. Every ship having machinery spaces of category A should be provided with a fireman's outfit.

8.9.2. A fireman's outfit should consists of personal equipment comprising:

8.9.2.1. Protective clothing of material to protect the skin from the heat radiating from the fire and from burns and scalding by steam. The outer surface should be water resistant;

8.9.2.2. Boots and gloves of rubber or other electrically non conducting material;

8.9.2.3. A rigid helmet providing effective protection against impact;

8.9.2.4. An electric safety lamp (hand lantern) of an approved type with a minimum burning period of three hour

8.9.2.5. An axe to the satisfaction of Class PMDS; and

8.9.2.6. A breathing apparatus of an approved type.

8.9.3. The breathing apparatus may be either:

8.9.3.1. A smoke helmet or smoke mask which should be provided with a suitable air pump and a length of air hose sufficient to reach from the open deck, well clear of hatch or doorway, to any part of the holds or machinery spaces. If in order to comply with this point, an air hose exceeding 36 m in length would be necessary, a self contained breathing apparatus should be substituted or provided in addition as determined by Class PMDS; or

8.9.3.2. A self contained compressed air operated breathing apparatus, the volume of air contained in the cylinders of which should be at least 1200 l, or other self contained breathing apparatus which should be capable of functioning for at least 30 minutes. A number of spare charges, suitable for use with the apparatus provided, should be available on board to the satisfaction of Class PMDS.

8.9.4. For each breathing apparatus a fireproof lifeline of sufficient length and strength should be provided capable of being attached by means of a snap hook to the harness of the apparatus or to a separate belt in order to prevent the breathing apparatus becoming detached when the lifeline is operated.

8.9.5. Class PMDS may require additional sets of personal equipment and breathing apparatus, having due regard to the size and type of the ship.

8.9.6. The fireman's outfits or sets of personal equipment should be so stored as to be easily accessible and ready for use and, where more than one fireman's outfits or more than one set of personnel equipment is carried, they should be stored in widely separated positions.
8.10 Fireman's axe
Every ship should be provided with at least one fireman's axe in an easily accessible location outside the machinery, accommodation and service spaces.

8.11. Fire control plan
8.11.1. In ships having machinery spaces of category A there should be provided a permanently exhibited fire control plan or equivalent to the satisfaction of Class PMDS.

8.11.2. In all such ships, fire control plans should be kept up to date. Description in such plans should be in the official language, if required, in the English language.

8.11.3. In addition, instructions concerning the maintenance and operation of all the equipment and installations on board for the fighting and containment of fire should be kept under one cover, readily available in an accessible position.

8.12. Fire protection requirements for ships of less than 24 meters
8.12.1. In ships of less than 24 m in length the provisions specified in this chapter may be relaxed to the extent as follows except that no relaxation should be granted to ships carrying hazardous cargoes.
8.12.1.1. In lieu of the provisions specified in 8.2.1, in ships propelled by mechanical means, fire pumps may be driven by the main propulsion machinery provided that the propeller can be readily disconnected or that a controllable pitch propeller is fitted;

8.12.1.2. In lieu of the provisions specified in 8.4.6, fire hoses of an internal diameter of not less than 32 mm may be accepted;

8.12.1.3. Such ships should be provided with fire buckets as follows:
8.12.1.3.1. At least three fire buckets should be provided which should be of a material which is not readily flammable. They should be painted red, clearly marked with the word "FIRE" and provided with lanyards of sufficient length, having regard to the size of the ship;

8.12.1.3.2. The capacity of each of the fire buckets referred to in this part should be at least 9l;

8.12.1.3.3. Fire buckets provided in compliance with this section should not be used for any other purpose than extinguishing fire;

8.12.1.4. Where the provision of fixed fire extinguishing systems is considered to be impracticable Class PMDS may accept alternate arrangements.

8.13. Acceptance of substitutes
Where in this section a type of appliance, apparatus, extinguishing medium or arrangement is specified, any other type of appliance may be allowed provided Class PMDS is satisfied that it is not less efficient.
Section 9 Life Saving Appliances

9.1. Application

9.1.1. Unless expressly provided otherwise this chapter applies to new cargo ships and new manned barges.

9.1.2. Life saving appliances on existing ships should be in compliance with recognized standards. Existing survival crafts and their launching appliances should as far as practicable provide capacity for the ship's complement on each side with adequate launching appliances, where necessary.

9.1.3. Such ships should comply with the requirements of regulations relating to the following to the extent prescribed therein within two years of the coming into force of the Regulations:

9.1.3.1. Life jackets;

9.1.3.2. Lifebuoys;

9.1.3.3. Thermal protective aids, if applicable;

9.1.3.4. Radar transponders;

9.1.3.5. Life rafts and hydrostatic release units;

9.1.3.6. Muster and abandon ship drill training; J

9.1.3.7. Locating equipment specified under the Global Maritime Distress and Safety System (GMDSS).

9.2. General requirements

9.2.1. Life saving requirements required by this chapter should comply with the technical specifications of Part C, Chapter III of SOLAS 74. Where detailed specifications are not included the life saving appliances should be to the satisfaction of Class PMDS.

9.2.2. Class PMDS may, if it considers that the sheltered nature and conditions of the voyage are such as to render the application of any specific requirements of this section unreasonable or unnecessary, approve alternative specifications that are considered equally effective under the circumstances.

9.3. Approval of life-saving appliances and arrangements

9.3.1. Life-saving appliances and arrangements required by this chapter should be approved by Class PMDS. Before giving approval to life-saving appliances and arrangements Class PMDS should ensure that such life-saving appliances and arrangements comply with the recommendations of the Organization (Refer to the Recommendation on Testing of Life – Saving Appliances, adopted by the Organization by Resolution A.689(1)).

9.3.2. Where novel life saving appliances or arrangements are to be approved Class PMDS should ensure that they provide the same safety standards as specified herein and that such appliances and
arrangements are evaluated and tested in accordance with the recommendations of the Organization (Refer to the Code of Practice for the Evaluation, Testing and Acceptance of Prototype Novel Lifesaving Appliances and Arrangements, adopted by the Organization by Resolution A.520 (13)).

9.4. Communications
9.4.1. Every ship and manned barge should carry:

9.4.1.2. At least one radar transponder for search and rescue operations. Such radar transponder should be so stowed that it can be rapidly placed in any survival craft; Refer to the Performance Standards for Survival Craft Radar Transponders for Use in Search and Rescue Operations, adopted by the Organization by Resolution A.802(19).

9.4.1.3. One satellite emergency position-indicating radio beacon (satellite EPIRB)18;

9.4.1.4. At least 6 rocket parachute flares on the bridge of the ship. Taking into consideration the nature and conditions of the voyage Class PMDS may accept hand flares in lieu of rocket parachute flares;

9.4.1.5. An emergency means comprising either fixed or portable equipment or both for two way communications between emergency control stations, muster and embarkation stations and strategic positions on board;

9.4.1.6. A general emergency alarm system for summoning the crew to muster stations capable of sounding a signal consisting of seven or more short blasts followed by a long blast on the ship's whistle or siren which should be powered from the ship's main or the emergency power. The system should be operated from the ship's bridge and be audible throughout all the accommodation and normal crew spaces.

9.4.2. The satellite EPIRB referred to in 9.4.1 should be:
9.4.2.1. Capable of transmitting a distress alert through the polar orbiting satellite service operating on 406 MHz or through the in mar sat E geostationary satellite service operating on 1.6 GHz frequencies;

9.4.2.2. Installed in an easily accessible position;

9.4.2.3. Ready to be manually released and capable of being carried by one person into a survival craft;

9.4.2.4. Capable of floating free if the ship sinks and of being automatically activated when afloat; and

9.4.2.5. Capable of being activated manually.

9.5. Personal life-saving appliances
9.5.1. Lifebuoys
Every ship and manned barge should carry at least four lifebuoys of which at least:
9.5.1.1. One such buoy should be provided with a self-igniting light;
9.5.1.2. One such buoy should be fitted with a buoyant lifeline;
9.5.1.3. Two such buoys should be fitted with self-activating smoke signals and be capable of quick release from the navigating bridge;
9.5.1.4. Lifebuoys with light and those with light and smoke signals should be equally distributed on both sides of the ship.

9.5.2. Life jackets
Every ship and manned barge should carry life jackets for every person on board. In addition they should carry a sufficient number of life jackets for persons on watch. Every such lifejacket should be provided with a light complying with the requirements of Regulation 111/28.2 of SOLAS

9.5.3. Thermal protective aids
Every ship and manned barge provided with survival crafts without enclosures should carry at least two thermal protective aids in every such craft.

9.6. Manning and survival procedures
9.6.1. All persons manning such ships and barges should be trained in launching and operating the survival crafts. Refer to Instructions for action in survival craft, adopted by the Organization, A.657(16).

9.6.2. Illustrations and instructions relating to the use of life saving appliances in appropriate languages should be posted at muster stations and other crew spaces.

9.6.3. Posters or signs should be provided on or in the vicinity of survival craft and their launching controls. Refer to Symbols related to life-saving appliances and arrangements, adopted by the Organization by Resolution A.760(18).

9.6.4. Muster stations should be provided close to the embarkation stations. Both should be adequately illuminated by lighting supplied from the emergency source of electric power.

9.6.5. Each member of the crew should participate in at least one abandon ship drill and one fire drill every month. On board training in the use of life saving appliances, including survival craft equipment, should be provided at such drills.

9.6.6. Records should be maintained relating to abandon ship drills, fire drills and on board training, in such log books as may be prescribed by Class PMDS.

9.7. Survival craft
9.7.1. Cargo ships other than oil tankers, chemical tankers and gas carriers, and manned barges should comply with the following:

9.7.1.1. They should carry on each side of the ship one or more survival craft, complying with the requirements of the Life Saving Appliances (LSA) Code21 and of such aggregate capacity as will accommodate the total number of persons on board.

9.7.1.2. Unless the survival crafts required by paragraph 9.7.1.1 are stowed in a position providing for easy side-to-side transfer at a single open deck level, additional survival crafts should be provided so that the total capacity available on each side will accommodate 150% of the total number of persons on board.

9.7.2. Every oil tanker carrying crude oil or petroleum products of low flashpoint, chemical tankers and gas carriers should in addition to complying with the requirements of 9.7.1 as appropriate, carry at least one rigid rescue boat unless:

9.7.2.1. All the required survival crafts are lifeboats; or
9.7.2.2. At least one of the required survival craft is a lifeboat complying with the requirements for a rescue boat.

9.7.3. The equipment to be provided in the survival crafts should be to the satisfaction of Class PMDS and should take into account:

9.7.3.1. The area of operations;
9.7.3.2. Distance from the nearest port of refuge; and
9.7.3.3. Search and rescue services available in the area.

9.8. Stowage, launching and recovery of survival crafts

9.8.1. Survival craft should be stowed:

9.8.1.1. So that neither the survival craft nor its stowage arrangements will interfere with the operation of any other survival craft or rescue boat at any other launching station;

9.8.1.2. As near the water surface as is safe and practicable but not less than 2 m above the waterline with the ship in the fully loaded condition under unfavorable condition of trim and listed up to 20° either way;

9.8.1.3. So that the life boats and the rescue boats can easily be launched from the ship. Recovery arrangements for rescue boats should be to the satisfaction of Class PMDS;

9.8.1.4. In a state of continuous readiness so that two crew members can carry out preparations for embarkation and launching in less than 5 minutes;
9.8.1.5. Life rafts intended for throw overboard launching should be so stowed as to be readily transferable for launching on either side of the ship unless life rafts are provided in accordance with 9.7.1.2.

9.8.2. Where the life rafts are not provided with launching appliances they should be stowed with its painter permanently attached to the ship with a float free arrangement complying with the recognized standards.

9.9. Marking of survival craft
All survival craft should be marked in block capitals of the Roman alphabet with the:
9.9.1. Name and port of registry of the ship;
9.9.2. Name of approving authority; and
9.9.3. Number of persons it is permitted to accommodate.

9.10. Operational readiness, maintenance and inspections
9.10.1. Operational readiness
Before the ship leaves port and at all times during the voyage and in the case of barges at all times when the barge is operational and manned, all life saving appliances should be in working order and ready for immediate use.

9.10.2. Maintenance
Instructions for on board maintenance of life saving appliances should be easily understood and illustrated where possible.

9.10.3. Weekly inspection
The following tests and inspections should be carried out weekly:
9.10.3.1. All survival craft, rescue boats and launching appliances should be visually inspected to ensure that they are ready for use;
9.10.3.2. The general emergency alarm system should be tested.

9.10.4. Monthly inspection
Inspection of the life saving appliances, including lifeboat equipment, should be carried out monthly using a check list to ensure that such equipment is complete and in good order. A report of the inspection should be entered in the log book.

9.10.5. Servicing of inflatable life rafts and inflated rescue boats
Every inflatable life raft and inflated rescue boats should be serviced at intervals of not more than 12 months and at an approved servicing station to the satisfaction of Class PMDS. However, in cases where it appears proper and reasonable, Class PMDS may extend this period to 17 months.
9.10.6. Servicing of hydrostatic release units
Hydrostatic release units should be serviced at intervals not exceeding 18 months at an approved servicing station.

Section 10 Radio communications

10.1. General
10.1.1. Unless expressly provided otherwise the radio communication equipment specified under the requirements of Chapter IV of SOLAS 74 (GMDSS) should be carried by ships of less than 300 gross tonnage and by manned barges, in the same manner as that prescribed for ships of above 300 gross tonnage.

10.1.2. No provision in this chapter should prevent the use by any ship, survival craft or person in distress, of any means at their disposal to attract attention, make known their position and obtain help.

10.1.3. All ships and manned barges should comply with all applicable requirements.
10.1.4. Manned barges when in attendance by a tug or an offshore supply vessel may comply with only the requirements approved by Class PMDS taking into account the communications available between the two ships. In any case, the requirements relating to EPIRBs, radar transponders and VHF radio communication apparatus system as specified herein should be complied with.

10.2. Functional requirements
10.2.1. Every ship and manned barge while at sea should be provided with radio installations capable of complying with the functional requirements identified in this regulation throughout its intended voyage for the sea area or areas through which it will pass during the intended voyage.

10.2.2. Every ship, while at sea, should be capable of:
10.2.2.1. Transmitting ship to shore distress alerts by at least two separate and independent means, each using a different radio communication service;

10.2.2.2. Receiving shore-to-ship distress alerts;

10.2.2.3. Transmitting and receiving ship-to-ship distress alerts;

10.2.2.4. Transmitting and receiving search and rescue coordinating communications;

10.2.2.5. Transmitting and receiving on-scene communications;

10.2.2.6. Transmitting and, where applicable, receiving signals for locating (Refer to Performance standards for radar equipment, adopted by the Organization by Res. MSC.64(67))

10.2.2.7. Transmitting and receiving maritime safety information;
10.2.2.8. Transmitting and receiving general radio communications to and from shore based radio systems or networks;

10.2.2.9. Transmitting and receiving bridge to bridge communications.

10.3. Ship requirements
10.3.1. Every radio installation should be:
10.3.1.1. So located that no harmful interference of mechanical, electrical or other origin affects its proper use;
10.3.1.2. So located as to ensure the greatest possible degree of safety and operational availability;
10.3.1.3. Be protected against harmful effects of adverse environmental conditions;
10.3.1.4. Provided with reliable permanently arranged electrical lighting for adequate illumination; and
10.3.1.5. Clearly marked with the call sign, the ship station identity and other qualified codes.

10.3.2. Control of the VHF radiotelephone channels required for navigational safety should be available on the navigation bridge.

10.4. Watches
10.4.1. Every ship, while at sea, should maintain continuous watch keeping on the appropriate distress frequencies identified for the relevant sea area.
10.4.2. Every ship, while at sea, should maintain a radio watch for broadcasts of maritime safety information on the appropriate frequency or frequencies on which such information is broadcast for the area in which the ship is navigating.
10.4.3. Every ship, while at sea, should maintain a continuous listening watch on:
10.4.3.1. VHF channel 16; and
10.4.3.2. Radiotelephone distress frequency 2,182 kHz.

10.5. Maintenance requirements
10.5.1. Class PMDS should ensure that the radio equipment required by this chapter is maintained to provide the availability of the functional requirements and to meet the recommended performance standards for such equipment.
10.5.2. Adequate information should be provided to enable the equipment to be properly operated and maintained, taking into account the recommendations of the Organization (Refer to Radio maintenance guidelines for the GMDSS related to sea areas A3 and A4 Res. A. 702(17)).
10.6. Radio equipment - General
10.6.1. Every ship should be provided with:
10.6.1.1. A VHF installation capable of transmitting and receiving:
10.6.1.1.1. DSC on the frequency 156.525 MHz (channel 70) and maintaining a continuous DSC watch on VHF channel 70. It should be possible to initiate the transmission of distress alerts on channel 70 from the position from which the ship is normally navigated. Ships plying exclusively in sea area A2 need not comply with this requirement if they maintain a continuous listening watch on VHF channel 16 from the navigation bridge;

10.6.1.2. Radiotelephony on frequencies 156.300 MHz (channel 6), 156.650 MHz (channel 13) and 156.800 MHz (channel 16);

10.6.1.3. A receiver capable of receiving international NAVTEX service broadcasts if the ship is engaged on voyages in any area in which an international NAVTEX service is Provided; and
10.6.1.3.1. Maritime safety information service by the In mar sat enhanced group call receiver; or

10.6.1.3.2. The HF direct printing telegraphy maritime safety information service.

10.6.2. Where ships regularly ply on voyages of less than 24 hours Class PMDS may exempt such ships from the requirements above provided arrangements to receive NAVTEX messages and weather broadcasts are made prior to sailing.

10.7. Radio equipment
10.7.1. Every ship shock be provided with a radio installation of initiating the transmission of Ship to shore distress alerts meeting the requirements of the sea area in which the ship is navigating.

10.7.2. Where the ship is usually plying in sea areas A2 or A3, the equipment on board, instead of meeting the requirements of Regulation IV/10 of SOLAS 74, should comprise of an In mar sat ship earth station capable of:
10.7.2.1. Transmitting and receiving distress and safety communications using direct printing telegraphy;

10.7.2.2. Initiating and receiving distress priority calls; and

10.7.2.3. Transmitting and receiving general radio communications using direct printing telegraphy in addition to the requirements of 10.6 of this section.

10.8. Sources of energy
There should be available at all times, while the ship is at sea, a supply of electrical energy sufficient to operate the radio installations and to charge any batteries used as part of a reserve source or sources of energy for the radio installations for a period of 18 hours as specified in 6.4.4 of section 6.
10.9. Radio log

10.9.1. A radio log should be maintained in accordance with the Radio Regulations in a ship which is fitted with a GMDSS radio communication station. Every qualified operator, master, officer or crew member maintaining a watch in accordance with 10.4.3 should enter in the log his name, the details of all incidents connected with the radio service which occur during his watch which may appear to be of importance to safety of life at sea. In addition, there should be entered in the log:

10.9.1.1. The details required by the Radio Regulations;

10.9.1.2. The time listening watch begins when the ship leaves port, and the time at which it ends when the ship reaches port;

10.9.1.3. The time at which listening watch was discontinued for any reason together with the reason thereof, and the time at which listening watch was resumed thereafter; and

10.9.1.4. Details of the maintenance of the batteries (if provided), including a record of the charging required.

10.9.2. The radio log should be available for inspection by the officers authorized by Class PMDS to make such inspection.

Section 11 Safety of Navigation

11.1. General

Unless expressly provided otherwise, this chapter applies to ships propelled by mechanical means including those towed or pushed by a tug or other such ship. Wooden ships of primitive built when propelled by mechanical means should as far as practicable comply with the regulations relating to the prevention of collisions (COLREG) and the routing measures adopted by the Organization.

11.2. Danger messages

11.2.1. The master of every ship which meets with dangerous derelict, or any other direct danger to navigation, or a tropical storm or winds of force 10 or above on the Beaufort scale should communicate such information by all the means at his disposal to ships in the vicinity and to the competent authorities at the first point on the coast with which he can communicate.

11.2.2. All radio messages issued under this regulation should be preceded by the safety signal, using the procedure as prescribed by the Radio Regulations.

11.2.3. The information to be transmitted should be as complete as practicable and may be sent in plain language (preferably in English).

11.3. Routing

Ships should comply with the traffic separation schemes or routing requirements applicable to the area including avoidance of passage through areas designated as areas to be avoided by ships or certain classes of ships.
11.4. Misuse of distress signals
The use of an international distress signal, except for the purpose of indicating that a ship, aircraft or person is in distress, and the use of any signal which may be confused with any international distress signal are prohibited.

11.5. Distress messages: obligations and procedures
11.5.1. The master of a ship at sea, on receiving a signal from any source that a ship or aircraft or survival craft thereof is in distress, is bound to proceed with all speed to the assistance of the persons in distress informing them if possible that he is doing so. If he is unable or, in the special circumstances of the case, considers it unreasonable or unnecessary to proceed to their assistance, he must enter in the log book the reason for failing to proceed to the assistance of the persons in distress.

11.5.2. The master of such ship should be released from the obligation imposed by 11.5.1 if he is informed by the persons in distress or by the master of another ship which has reached such persons that assistance is no longer necessary.

11.6. Signaling lamps
Requirements of regulation V 11, 1 of SOLAS 74 relating to the provision of an efficient Day light signaling lamp not solely dependent upon the ship's main source of electrical power are applicable to ships of over 150 gross tonnages. Class PMDS may extend this requirement to all ships to which the Regulations apply.

11.7. Ship borne navigational equipment
11.7.1. Ships should be fitted with:
11.7.1.1. Standard magnetic compass, except as provided in 11.7.4;

11.7.1.2. Steering magnetic compass, unless heading information provided by the standard compass required under sub paragraph 11.7.1.1 is made available and is clearly readable by the helmsman at the main steering position;

11.7.1.3. Adequate means of communication between the standard compass position and the normal navigation control position to the satisfaction of Class PMDS;

11.7.1.4. Means for taking bearings as nearly as practicable over an arc of the horizon of 3600.

11.7.2. Each magnetic compass referred to in sub paragraph 11.7.1.1 should be properly adjusted and its table or curve of residual deviations should be available at all times.

11.7.3. A spare magnetic compass, interchangeable with the standard compass, should be carried, unless the steering compass mentioned in sub paragraph 11.7.1.2 or a gyro compass is fitted.
11.7.4. Class PMDS, if it considers it unreasonable or unnecessary to require a standard magnetic compass, may exempt individual ships or classes of ships from these requirements if the nature of the voyage, the ship's proximity to land or the type of ship does not warrant a standard compass. A suitable steering compass should in all cases be carried with means for taking bearings according to the recognized standards.

11.7.5. Ships of 300 gross tonnage and above should be fitted with a radar installation capable of operating in the 9 GHz frequency band. A ship may be exempted from compliance with the requirements of 11.7.6 at the discretion of Class PMDS, provided that the equipment is fully compatible with the radar transponder for search and rescue.

11.7.6. All equipment fitted in compliance with this regulation should be of a type approved by Class PMDS. Equipment installed on board ships on or after 1 February 1999 should conform to appropriate performance standards not inferior to those adopted by the Organization. Equipment fitted prior to the adoption of related performance standards may be exempted from full compliance with those standards at discretion of Class PMDS having due regard to the recommended criteria which the Organization might adopt in connection with the standards concerned.

Refer to the following resolutions:
1. A.694(17) concerning general requirements for ship borne radio equipment forming part of the GMDSS and for electronic navigational aids;
2. A.382(X) concerning performance standards for magnetic compasses;
3. MSC.64(67) concerning performance standards for radar equipment.

11.8. Nautical Publications
All ships shall carry adequate and up to date charts, sailing directions, lists of lights, notices to mariners, tide tables and all other nautical publications necessary for the intended voyage.

11.9. International Code of Signals
All ships which in accordance with the present Convention are required to carry a radiotelegraph or a radiotelephone installation shall carry the International Code of Signals.
This publication shall also be carried by any other ship which in the opinion of Class PMDS has a need to use it (Refer to International Code of Signals (Res. A.113 (V)), as amended by MSC 63.)

11.10. Life-Saving Signals
Life-saving signals shall be used by ships when communicating with ships or persons in distress or to direct ships, and by ships or persons in distress when communicating with life-saving stations, maritime rescue units and aircraft engaged in search and rescue operations. An illustrated table describing the life-saving signals shall be readily available to the officer of the watch of every ship (AS illustrated in the International Code of Signals.)

11.11. Manning
11.11.1. Class PMDS should adopt measures, each for its national ships, for the purpose of ensuring that, from the point of view of safety of life at sea, all ships should be sufficiently and efficiently manned (Refer to the Principles of Safe Manning, adopted by the Organization by Res. A.481 (XII).)

11.11.2. Every ship to which the Regulations apply should be provided with an appropriate safe manning document or equivalent issued by the Administration as evidence of the minimum safe manning considered necessary to comply with 11.11.1 of this regulation.

Section 12 Assignment of Load Lines


12.1.1. Ships and barges of less than 24 m in length, to which the Regulations apply should not proceed to sea unless surveyed, marked and certified in accordance with the provisions of the Regulations.

12.1.2. Nothing in the Regulations should prevent Class PMDS from assigning a greater freeboard than the minimum freeboard determined in accordance with Section 13.

12.2. Submersion

12.2.1. Except as provided in 12.2.2 and 12.2.3 of this regulation, the appropriate load lines on the sides of the ship corresponding to the season of the year and the zone or area in which the ship may be should not be submerged at any time when the ship puts to sea, during the voyage or on arrival.

12.2.2. When a ship is in fresh water of unit density the appropriate load line may be submerged by the amount of the fresh water allowance shown on the appropriate certificate issued under the provision of the Regulations. Where the density is other than unity, an allowance should be made proportional to the difference between 1.025 and the actual density.

12.2.3. When a ship departs from a port situated on a river or inland waters, deeper loading should be remitted corresponding to the weight of fuel and all other materials required for consumption between the point of departure and the sea.

12.3. Survey and certification

Survey and certification, as regards the enforcement of the provisions of the Regulations specified in section 13 and 14 relating to assignment of load lines and the granting of exemptions there from, should be in accordance to the provisions of section 1 of the chapter.

12.4. Strength of the ship

Class PMDS should satisfy itself that the general structural strength of the ship is sufficient for the draught corresponding to the freeboard assigned. Ships built and maintained in conformity with the requirements of a classification society recognized by Class PMDS, may be considered to possess adequate strength.
12.5. General assumptions
The Regulations assume that the nature and stowage of the cargo, ballast, etc. are such as to secure sufficient stability of the ship and the avoidance of excessive structural stress. The Regulations also assume that applicable international requirements relating to stability or subdivision are complied with.

12.6. Deck line
The deck line is a horizontal line 300 mm in length and 25 mm in breadth. It should be marked amidships on each side of the ship, and its upper edge should normally pass through the point where the continuation outwards of the upper surface of the freeboard deck intersects the outer surface of the shell (as illustrated in Figure 1), provided that the deck line may be placed with reference to another fixed "point on the ship on condition that the freeboard is correspondingly corrected. The location of the reference point and the identification of the freeboard deck should in all cases be indicated on the Certificate issued in compliance with the Regulations.

12.7. Load line marks
12.7.1. The Load Line Mark should consist of a ring 300 mm in outside diameter and 25 mm wide which is intersected by a horizontal line 450 mm in length and 25 mm in breadth, the upper edge of which passes through the centre of the ring. The centre of the ring should be placed amidships and at a distance equal to the assigned summer freeboard measured vertically below the upper edge of the deck line (as illustrated in Figure 2). If there is not sufficient space for placing a full load line mark, the mark may be cut off after marking the upper half circle as far as possible.

12.7.2. The lines which indicate the load line assigned in accordance with the Regulations should be horizontal lines 230 mm in length and 25 mm in breadth which extend forward of, unless expressly provided otherwise, and at right angles to, a vertical line 25 mm in breadth marked at a distance 540 mm forward of the centre of the ring (as illustrated in Figure 2).

12.8. Marks of assigning authority
The mark of the Authority by whom the load lines are assigned may be indicated alongside the load line ring above the horizontal line which passes through the centre of the ring, or above and below it. This mark should consist of not more than four initials to identify the Authority's name, each measuring approximately 115 mm in height and 75 mm in width.
12.9. Details of marking

The ring, lines and letters should be painted in white or yellow on a dark ground or in black on a light ground. They should also be permanently marked on the sides of the ships to the satisfaction of Class PMDS. The marks should be plainly visible and, if necessary, special arrangements should be made for this purpose.

12.10. Verification of marks

The Regional Cargo Ship's Safety Certificate should not be delivered to the ship until the officer or surveyor acting under the provisions of 2.1 of this chapter has certified that the marks are correctly and permanently indicated on the ship's sides.

12.11. Information to be supplied to the master

12.11.1. The master of every new ship which is not already provided with stability information, should be supplied with sufficient information, in an approved form, to enable him to arrange for the loading and ballasting of his ship in such a way as to avoid the creation of an unacceptable stresses in the ship's structure, provided that this requirement need not apply to any particular length, design or class of ship where Class PMDS considers it to be unnecessary.

12.11.2. Stability information approved by Class PMDS should be supplied to ships propelled by, mechanical means to enable the master to assess with ease and certainty the stability of the ship under various operating conditions (Refer to the Code on Intact Stability for All Types of ships covered by IMO Instruments, adopted by the Organization by Res. A.749(18)). Such information should include specific instructions to the master warning him of those operating conditions which could adversely affect either stability or the trim of the ship. In particular, the information recommended in the Code should be included as appropriate. A copy of the stability information should be submitted to Class PMDS.
12.11.3. The approved stability information should be kept on board, readily accessible at all times and inspected at the periodical surveys of the ship to ensure that it is has been approved.

12.12. Superstructure end bulkheads
Bulkheads at exposed ends of enclosed superstructures should be of efficient construction and should be to the satisfaction of Class PMDS.

12.13. Doors
12.13.1. All access openings in bulkheads at ends of enclosed superstructures should be fitted with doors of steel or other equivalent material, permanently and strongly attached to bulkhead, and framed, stiffened and fitted so that the whole structure is of equivalent strength to the unpaired bulkhead and weather tight when closed. The means for securing these doors weather tight should consist of gaskets and clamping devices or equivalent means and should be permanently attached to the bulkheads or to the doors themselves. The doors should be so arranged that they can be operated from both sides of the bulkhead.
12.13.2. Except as otherwise provided in this chapter, the height of the sill of access openings in bulkheads at ends of enclosed superstructures should be at least 300 mm above the deck.

12.14. Position of hatchways, doorways and ventilators
12.14.1. For the purpose of this chapter, two positions of hatchways, doorways and ventilators are defined as follows:
Position 1 - Upon exposed freeboard and raised quarter decks, and upon exposed Superstructure decks situated forward of a point located a quarter of the ship's length from the forward perpendicular.
Position 2 - Upon exposed superstructure decks situated abaft a quarter of the ship's length from the forward perpendicular.

12.15. Cargo and other hatchways
12.15.1. The construction and the means for securing the weather tightness of cargo and other hatchways in positions 1 and 2 should be at least equivalent to the requirements of Class PMDS.
12.15.2. Coamings and hatchway covers to exposed hatchways on decks above the superstructure deck should comply with the requirements of Class PMDS.

12.16. Hatchways closed by portable covers and secured weather tight by tarpaulins and battening devices
12.16.1. The coamings of hatchways closed by portable covers secured weather tight by tarpaulins and battening devices should be of substantial construction, and their height above the deck should be at least as follows:
   450 mm, if in position 1.
   300 mm, if in position 2.
12.16.2. The width of each bearing surface for hatchway covers should be at least 65 mm.

12.16.3. Where covers are made of wood, the finished thickness should be at least 60 mm in association with a span of not more than 1.5 m.

12.16.4. Where covers are made of mild steel the strength should be calculated with assumed loads of not less than 1 metric tons per square meter on hatchways in position 1, and not less than 0.75 metric tons per square meter on hatchways in position 2, and the product of the maximum stress thus calculated and the factor 4.25 should not exceed the minimum ultimate strength of the material. They should be so designed as to limit the deflection to not more than 0.0028 times the span under these loads.

12.16.5. Cleats should be set to fit the taper of the wedges. They should be at least 65 mm wide and spaced not more than 600 mm centre to centre; the cleats along each side or end should be not more than 150 mm from the hatch corners.

12.16.6. Battens and wedges should be efficient and in good condition. Wedges should be of tough wood or other equivalent material. They should have a taper of not more than 1 in 6 and should be not less than 13 mm thick at the toes.

12.16.7. At least two layers of tarpaulin in good condition should be provided for each hatchway in position 1 or 2. The tarpaulins should be waterproof and of ample strength. They should be of a material of at least an approved standard weight and quality.

12.16.8. For all hatchways in position 1 or 2 steel bars or other equivalent means should be provided in order to secure efficiently and independently each section of hatchway covers after the tarpaulins are battened down. Hatchway covers of more than 1.5 m in length should be secured by at least two such securing appliances.

12.17. Hatches closed by weather tight covers of steel or other equivalent material fitted with gaskets and clamping devices

12.17.1. At positions 1 and 2 the height above the deck of hatchway coamings fitted with weather tight hatch covers of steel or other equivalent material fitted with gaskets and clamping devices should be as specified by Class PMDS. The height of these coamings may be reduced, or the coamings omitted entirely, on condition that Class PMDS is satisfied that the safety of the ship is not thereby impaired in any sea conditions. Where coamings are provided they should be of substantial construction.

12.17.2. Where weather tight covers are of mild steel, the strength should be calculated.

12.17.3. The strength and stiffness of covers made of materials other than mild steel should be equivalent to those of mild steel to the satisfaction of Class PMDS.
12.17.4. The means for securing and maintaining weather tightness should be to the satisfaction of Class PMDS. The arrangements should ensure that the tightness can be maintained in any sea conditions, and for this purpose tests for tightness should be required at the initial survey, and may be required at periodical surveys and at annual inspections or at more frequent intervals.

12.18. Machinery space openings
12.18.1. Machinery space openings in position 1 and 2 should be properly framed and efficiently enclosed by steel casings of ample strength. Access openings in such casings should be fitted with doors complying with the requirements of regulation 12.1 of this chapter, the sills of which should be at least 450 mm above the deck if in position 1, and at least 300 mm above the deck if in position 2. Other openings in such casings should be fitted with equivalent covers, permanently attached in their proper positions.

12.18.2. Coamings of any fiddly, funnel or machinery space ventilator in an exposed position on the freeboard or superstructure deck should be as high above the deck as is reasonable and practicable. Fiddly openings should be fitted with strong covers of steel or other equivalent material permanently.

12.19. Openings in freeboard and superstructure decks
12.19.1. Manholes and flush scuttles in position 1 or 2 or within superstructures other than enclosed superstructures should be closed by substantial covers capable of being made watertight. Unless secured by closely spaced bolts, the covers should be permanently attached.

12.19.2. Openings in freeboard decks other than hatchways, machinery space openings, manholes and flush scuttles should be protected by an enclosed superstructure, or by a deckhouse or companionway of equivalent strength and weather tightness. Any such opening in an exposed superstructure deck or in the top of a deckhouse on the freeboard deck which gives access to a space below the freeboard deck or a space within an enclosed superstructure should be protected by an efficient deckhouse or companionway. Doorways in such deckhouses or companionways should be fitted with doors complying with the requirements of Section 12.

12.19.3. In position 1 the height above the deck of sills to the doorways in companionways should be at least 450 mm. In position 2 it should be at least 300 mm.

12.20. Ventilators
12.20.1 Ventilators in position 1 or 2 to spaces below freeboard decks or decks of enclosed superstructures should have coamings of steel or other equivalent material, substantially constructed and efficiently connected to the deck. Where the coaming of any ventilator exceeds 760 mm in height it should be specially supported.

12.20.2. Ventilators passing through superstructures other than enclosed superstructures should have substantially constructed coamings of steel or other equivalent material at the freeboard deck.
12.20.3. Ventilators in position 1 the coamings of which extend to more than 2.5 above the deck, and in position 2 the coamings of which extend to more than 1.0 m above the deck, need not be fitted with closing arrangements unless specifically required by Class PMDS.

12.20.4. Ventilators in position 1 should have coamings of a height of at least 600 mm above the deck; in position 2 the coaming should be of a height at least 300 mm above the deck. They should be provided with efficient weather tight closing appliances which should be conveniently stowed near the ventilators to which they are to be fitted.

12.20.5. In exposed position, the height of coamings may be required to be increased to the satisfaction of Class PMDS.

12.21. Air pipes
Where air pipes to ballast and other tanks extend above the freeboard or superstructure decks, the exposed parts of the pipes should be of substantial construction; the height from the deck to the point where water may have access below should be at least 600 mm on the freeboard deck and 300 mm on the superstructure deck. Where these heights may interfere with the working of the ship, a lower height may be approved, provided Class PMDS is satisfied that the closing arrangements and other circumstances justify a lower height. Satisfactory means permanently attached, should be provided for closing the openings of the air pipes.

12.22. Cargo ports and other similar openings
12.22.1. Cargo ports and other similar openings in the sides of ships below the freeboard deck should be fitted with doors so designed as to ensure water tightness and structural integrity commensurate with the surrounding shell plating. The number of such openings should be the minimum compatible with the design and proper working of the ship.

12.22.2. Unless permitted by Class PMDS, the lower edge of such openings should not be below a line drawn parallel to the freeboard deck at side, which has at its lowest point the upper edge of the uppermost load line.

12.23. Scuppers, inlets and discharges
12.23.1. Discharges led through the shell either from spaces below the freeboard deck or from within superstructures and deckhouses on the freeboard deck fitted with doors complying with the requirements of Section 12 should be fitted with efficient and accessible means for preventing water from passing inboard. Normally each separate discharge should have one automatic non return valve with a positive means of closing it from a position above the freeboard deck. The means for operating the positive action valve should be readily accessible and be provided with an indicator showing whether the valve is open or closed. The open inboard end of any discharge system should be above the deepest operating waterline at an angle of heel satisfactory to Class PMDS.
12.23.2. In manned machinery spaces main and auxiliary sea inlets and discharges in connection with the operation of machinery may be controlled locally. The controls should be readily accessible and should be provided with indicators showing whether the valves are open or closed.

12.23.3. Scuppers and discharge pipes originating at any level and penetrating the shell either more than 450 mm below the freeboard deck or less than 600 mm above the summer load waterline should be provided with a non rectum valve at the shell. This valve, unless required by 12.23.1, may be omitted if the piping is of substantial thickness.

12.23.4. Scuppers leading from superstructures or deckhouses not fitted with doors complying with the requirements of section 12 should be led overboard.

12.23.5. All valves and shell fittings required by this regulation should be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable. All pipes to which this regulation refers should be of steel or other equivalent material to the satisfaction of Class PMDS.

12.24. Side scuttles, windows and other openings

12.24.1. Side scuttles to spaces below the freeboard deck or to spaces within enclosed superstructures should be fitted with efficient hinged inboard deadlights arranged so that they can be effectively close and secured watertight.

12.24.2. No side scuttle should be fitted in a position so that its sill is below a line drawn parallel to the freeboard deck at side and having its lowest point 500 mm above the load waterline.

12.24.3. The side scuttles, together with their glasses, if fitted, and deadlights should be of substantial and approved construction.

12.24.4. Class PMDS may accept side scuttles and windows without deadlights in side or aft bulkheads of superstructures located on or above the freeboard deck if satisfied that the safety of the ship will not be impaired.

12.24.5. The number of openings in the side of the ship below the freeboard deck should be the minimum compatible with the design and proper working of the ship and such openings should be provided with closing arrangement of adequate strength to ensure water tightness and the structural integrity of the surrounding structure.

12.25. Freeing ports

12.25.1. Where bulwarks on the weather portions of freeboard or superstructure decks form wells, ample Provision should be made for rapidly freeing the decks of water and for draining them. Except as; provided in paragraphs 12.25.2 and 12.25.3 of this Section, the minimum freeing port area (A) on each side of the ship for each well on the freeboard deck should be that given by the following formulae in
cases where the sheer in way of the well is standard or greater than standard. The minimum area of each well on superstructure decks should be one-half of the area given by the formula.

Where the length of bulwark \( l \) in the well is 20 m or less: \( A = 0.7 + 0.035 l^2 \) square meters.

Where \( l \) exceeds 20 m: \( A = 0.071 l^2 \) square meters.

1 need in no case be taken as greater than 0.7 L.

If the bulwark is more than 1.2 m in average height the required area should be increased by 0.004 square meters per meter of length of well for each 0.1 m difference in height. If the bulwark is less than 0.9 m in average height, the required area may be decreased by 0.004 square meters per meter of length of well for each 0.1 m difference in height.

12.25.2. In ships with no sheer the area calculated according to paragraph I should be increased by 50%. Where the sheer is less than the standard the percentage should be obtained by interpolation.

12.25.3. Where a ship is fitted with a trunk and open rails are not fitted on the weather part of the freeboard deck in way of the trunk for at least half their length or where continuous or substantially continuous hatchway side coamings are fitted between detached superstructures the minimum area of the freeing port openings should be calculated from the following table:

<table>
<thead>
<tr>
<th>Breadth of Hatchway or Trunk in Relation to the Breadth of Ship</th>
<th>Area of Freeing Ports in Relation to the Total Area of the Bulwarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>40% or less</td>
<td>20%</td>
</tr>
<tr>
<td>75% or more</td>
<td>10%</td>
</tr>
</tbody>
</table>

The area of freeing ports at intermediate breadths should be obtained by linear interpolation.

12.25.4. In ships having superstructures which are open at either or both ends, adequate provision for freeing the space within such superstructures should be provided to the satisfaction of Class PMDS.

12.25.5. The lower edges of the freeing ports should be as near the deck as practicable. Two thirds of the freeing port area required should be provided in the half of the well nearest the lowest point of the sheer curve.

12.25.6. All such openings in bulwarks should be protected by rails or bars spaced approximately 230 mm apart. If shutters are fitted to freeing ports, ample clearance should be provided to prevent jamming. Hinges should have pins or bearings of non corrodible material. If shutters are fitted with securing appliances, these appliances should be of approved construction.

12.26. Protection of the crew
12.26.1. The strength of the deckhouses used for the accommodation of the crew should be to the satisfaction of Class PMDS.
12.26.2. Efficient guard rails or bulwarks should be fitted on all exposed parts of the freeboard and superstructure decks. The height of the bulwarks or guard rails should be at least 1 m from the deck, provided that where this height would interfere with the normal operation of the ship, a lesser height may be approved if Class PMDS is satisfied that adequate protection is provided but in no case a height of less than 600 mm should be permitted.

12.26.3. The opening below the lowest course of the guard rails should not exceed 230mm. The other courses should be not more than 380 mm apart. In the case of ships with rounded gunwales the guard rail supports should be placed on the flat of the deck.

12.26.4. Satisfactory means (in the form of guard rails, life lines, gangways or under deck passages etc), should be provided for the protection of the crew in getting to and from their quarters, the machinery space and all other parts used in the necessary work of the ship.

12.26.5. Deck cargo carried on any ship should be so stowed that any opening which is in way of the cargo and which gives access to and from the crew's quarters, the machinery space and all other parts used in the necessary work of the ship, can be properly closed and secured against the admission of water. Effective protection for the crew in the form of guard rails or life lines should be provided above the deck cargo if there is no convenient passage on or below the deck of the ship.

12.27. Special condition of assignment for tankers

12.27.1. Tankers of less than 24 m in length should comply with the provisions of this Section.

12.27.2. Machinery casings should be protected by an enclosed poop or bridge of at least standard height or by a deckhouse of equal height and equivalent strength, provided that machinery casings may be exposed if there are no openings giving direct access from the freeboard deck to the machinery space. A door complying with the requirements of section 12 may, however, be permitted in the machinery casing, provided that it leads to a space separated from the stairway to the engine room by a second weather tight door of steel or other equivalent material.

12.27.3. An efficiently constructed fore and aft permanent gangway of sufficient strength should be fitted on tankers at the level of the superstructure deck between the poop and the amidships bridge or deckhouse where fitted, or equivalent means of access should be provided to carry out the purpose of the gangway, such as passages below deck. Elsewhere, and on tankers without an amidships bridge, arrangements to the satisfaction of Class PMDS should be provided to safeguard the crew in reaching all parts used in the necessary work of the ship.

12.27.4. Safe and satisfactory access from the gangway level should be available between separate crew accommodations and also between crew accommodations and the machinery space.
12.27.5. Exposed hatchways on the freeboard and forecastle decks or on the tops of expansion trunks on tankers should be provided with efficient watertight covers of steel or other equivalent material.

12.27.6. Tankers with bulwarks should have open rails fitted for at least half the length of the exposed parts of the weather deck or other effective freeing arrangements. The upper edge of the sheer strake should be kept as low as practicable.

12.27.7. Where superstructures are connected by trunks, open rails should be fitted for the whole length of the exposed parts of the freeboard deck.

**Section 13 Calculation of Freeboard**

13.1. Calculation of basic freeboard

13.1.1. The basic freeboard $F$ for all ships of less than 24 m in length is obtained from the formula:

$$F = 50 + \left(\frac{150L}{24}\right)$$

Where

- $L =$ Length of ship in m
- $F =$ Freeboard in mm.

13.1.2. Where the actual depth to the upper edge of the deck line is greater or less than $D$, the difference between the depths should be added to or deducted from the freeboard.

13.2. Correction to the freeboard

13.2.1. Class PMDS should apply the appropriate provisions of the Load Line Convention to apply corrections to the basic freeboard.

13.2.2. In calculating the correction to the basic freeboard Class PMDS should take into account the general provisions and conditions of assignment specified in Section chapter 12 of this Chapter to ensure the safety of life at sea and in particular:

13.2.2.1. The position of openings;

13.2.2.2. The height of sills to the doorways;

13.2.2.3. The height of hatchways;

13.2.2.4. The height of ventilators and air pipes; and

13.2.2.5. The weather tightness of the closing appliances including doorways, hatchways, ventilators, machinery space openings and air pipes.

13.2.3. The freeboard in salt water in the summer zone, as corrected in accordance with 13.2.1 and 13.2.2 of this regulation, but without the correction for deck line, as provided in regulation 1, should not be
less than 50 mm. For ships having hatchways with covers in position 1 which do not comply with the requirements of 12.17 of this chapter the freeboard should be not less than 150 mm.

13.2.4. The minimum freeboard in the tropical zone should be the freeboard obtained by a deduction from the summer freeboard of one forty eighth of the summer draught measured from the top of the keel to the centre of the ring of the load line mark and should not be less than 50 mm. For ships having hatchways with covers in position 1 which do not comply with the requirements of 12.17 of this chapter the freeboard should be not less than 150 mm.

13.2.5. The minimum freeboard in fresh water of unit density should be obtained by deducting from the minimum freeboard in salt water the displacement of the vessel in salt water in tones at the summer load waterline divided by forty times the tons per centimeter immersion in salt water at summer load waterline.

13.2.6. Where the displacement at the summer load waterline cannot be certified, the deduction shall be one forty eighth of summer draught, measured from the top of the keel to the centre of the ring of the load line mark.

Section 14 Prevention of Marine Pollution
14.1. Application of MARPOL 73/78
The provisions of the International Convention for the Prevention of Pollution from Ships 1973 and its 1978 Protocol should also apply to non convention sized ships. Where Class PMDS considers the provisions relating to construction and equipment unreasonable or impracticable, it may exempt such ships from such provisions, provided that the construction and equipment of that ship provides equivalent protection against pollution of the marine environment, having regard to the service for which the ship is intended.
Section 1 Introduction
The principles for determining the allowable thickness diminution of the different elements in the hull structure are developed under consideration of the following aspects:
- The principles are applicable to units in worldwide service as well as in benign waters.
- The minimum thickness list shall, be as far as possible, be based on the same principles for structural.
- Harmonized with the ship rules as far as possible.

At Periodical Survey it is a requirement to carry out overall examination and Thickness Measurement of hull structures. Additionally for oil tankers (including ore/oil ships and ore/bulk/oil ships), chemical tankers, dry bulk cargo ships, ships for liquefied gases and general dry cargo ships it is a requirement to carry out Close-up Surveys.

Class PMDS Rules for Maintenance and Survey for Existing Ships details, amongst other things, the periodical Survey requirements for existing ships. Planning and preparation for Survey, Thickness Measurement and Close-up Survey are important aspects of the survey process, detailed within this Chapter.

The requirements for Thickness Measurement and Close-up Survey of ships at Special Survey are indicated in the Regulations, Part 2; the extent of these Surveys being dependent on ship type and ship age. The requirements for Thickness Measurement of Inland Waterways Ships, Special Service Craft and Naval Ships can be found in separate Rules and Regulations.

Section 2 Categories of Corrosion
Corrosion may be divided into the categories General, Pitting, Grooving and Edges.

General:
Where, uniform reductions of material are found. Criteria for minimum thickness of hull structural elements may be applied in order to determine average diminution values. Typically, repairs will include steel replacement to original scantlings and/or reinforcement upon special consideration.

Pitting:
Random scattered corrosion spots/areas with local material reductions. The intensity of the pitting must first be estimated before applying criteria. Typically, repairs will include renewal of plates, building up pits by welding.

Grooving:
Local line material wears normally adjacent to welding joints along abutting stiffeners and at stiffener or plate butts or seams. Due to the complexity and effects of groove corrosion, diminution criteria are limited and special repair considerations are required.
Edges:
Local material wears at the free edges of plates and stiffeners. Typically, if not renewed, repairs may be carried out by means of edge stiffeners/doublers.

![Figure 10.1 Pitting Intensity Diagrams](image)

Section 3 Procedure for class surveys and thickness measurements on board ships

3.1 PMDS surveyor to be onboard
A PMDS surveyor shall be onboard, to the extent he or she finds necessary to control the process, when thickness measurements are done for class. Measurements which have not been carried out in cooperation with PMDS cannot be accepted. The UTM company shall inform the owner accordingly. This applies to all steel ships where the measurements will make the basis for the surveyor's decisions during
class surveys. Thickness measurements which are per our rules are required in connection with close-up examination (such as web frames and transverse bulkheads), shall always be taken with the surveyor in attendance.

When onboard the operator/supervisor shall have his certificate and identification papers readily available for verification.

The operator shall notify the PMDS surveyor of any structural deficiencies, such as cracks, indents, buckling or abnormal measurements detected.

3.2 Kick-off meeting
The Rule for Maintenance and Survey for Existing Ships require a meeting for planning of the thickness measurements, including Owners representative, UTM company and PMDS. The meeting shall clarify initial scope of close-up examination and thickness measurements.

At the meeting, unless requested earlier, the surveyor will hand over the minimum thickness list. For ESP ships it may be found in the Survey Programme. The minimum thickness list is individual for each and every ship, and shall always be made by PMDS. Upon receiving the minimum thickness list, the UTM operators shall enter the minimum thickness values into the UTM report template, prior to commencing thickness measurements, in order to facilitate the evaluation of the results on a day by day basis onboard.

3.3 Requirements to cleaning
Cleaning is the owner's responsibility. The Owners should ensure that efficient means for de-scaling is available at the survey, hydro or sandblasting equipment. When satisfactory descaling may not be arranged, the surveyor will only be able to provide a preliminary specification of necessary upgrading, without crediting the tank. A new survey will be carried out after descaling, additional thickness measurements may be required and the scope of repairs extended.

3.4 Means of Access
Access is the owner's responsibility. All spaces shall be made safe for access gas freed, ventilated and illuminated, and prepared for the surveyor to examine the structure in a safe and practical way. One or more of the following means for access, acceptable to the surveyor shall be provided:
- Permanent staging and passages through structures
- Temporary staging and passages through structures
- Lifts and moveable platforms
- Boats or rafts
- Portable ladders
- Other equivalent means.

3.4.1 If the depth of the webs is more than 1.5 m, rafts or boats alone may be allowed only:
3.4.1.1 When the coating of the under deck structure is in GOOD condition and there is no evidence of wastage; or
3.4.1.2 If a permanent means of access is provided in each bay to allow safe entry and exit. This means:

- Access directly from deck via a vertical ladder and a small platform fitted approximately 2 m below the deck in each bay, or

- Access to deck from a longitudinal permanent platform having ladders to deck in each end of the tank.

The platform shall, for full length of the tank, be arranged in level with, or above, the maximum water level needed for rafting of under deck structure. For this purpose, the ullage corresponding to the maximum water level is to be assumed not more than 3 m from deck plate measured at the midspan of deck transverse and in the middle length of the tank.

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

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

Alternatives with climbers doing thickness measurements while carrying a camera, in order to let the surveyor do the close-up survey by watching a TV screen onboard, will only be accepted on a case by case basis, and must be clarified with PMDS well in advance of the survey. PMDS do have climbers performing "climbing survey".

3.5 Execution of the Thickness Measurements on board

Prior to commencing the thickness measurements, the surveyor will:

3.5.1 Check type of equipment and verify that the equipment is calibrated according to recognized national / international standards and properly labelled.

3.5.2 Witness calibration appropriate for size and type of material.

3.5.3 Be satisfied with operator’s competence and documentation.

The operators shall keep the equipment and required certificates ready for inspection at commencement of measurements, requirements to equipment and operators.

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

Thickness measurements are mainly to evaluate the extent of corrosion which may affect the hull girder strength (transverse sections), should be carried out in a systematic manner of all longitudinal, structural members.

The surveyor should be in attendance during this process. The location of the sections longitudinally shall be decided by the surveyor, and will normally be decided after deck and bottom plating has been
measured, where required, in order to determine which areas have corroded the most. The sections should be placed where the upper and lower plating has corroded the most. One transverse section will normally be placed amidship.

Thickness measurements of structures in areas where close-up surveys are required should be carried out simultaneously with the close-up surveys in order to facilitate a meaningful survey.

The surveyor may specially consider the extent of thickness measurements of certain structures, within spaces where the protective coating is found to be in GOOD condition, but there are restrictions to how much of the measurements may be reduced. In any case, clarify with the surveyor in each case.

The thickness measurement operators shall keep the surveyor continuously informed (at the end of each day of measurements) about measurement results and structural deficiencies found, such as excessive or substantial corrosion, cracks, indents or buckling. If doublers plates used as repairs are discovered inside oil tanks or on oil/water boundary plating or stiffeners, this shall also be informed to the surveyor.

Where thickness measurements indicate substantial corrosion or excessive diminution, the UTM Company shall contact the PMDS surveyor onboard in order to get directions for additional thickness measurements, in order to map the areas of substantial corrosion, and to identify structural members for repairs / renewals. The Rules for Maintenance and Survey for Existing Ships, Chapter 2 (Tables of Close-Up Examinations and Thickness Measurements).

Upon completion of the thickness measurements, the surveyor must have confirmed that no further gauging is needed, before the job of taking measurements can be regarded as completed.

Upon completion of the thickness measurements onboard, the surveyor shall verify the preliminary thickness measurement report. The preliminary report should be kept until the final report has been verified and signed.

3.6. Extent of thickness measurements
The requirements vary with ship type, age and survey type, and may generally be divided in three groups:
3.6.1 Thickness measurements including requirements of shell plating and transverse sections, to help evaluate the overall strength of the ship. The requirements cannot be waived due to GOOD coating, but the extent of measurement points may be reduced to some extent. What may be reduced shall always be decided by the surveyor, who may also decide to increase the scope based on findings onboard.

3.6.2 Measurements for assessment of corrosion level in way off close-up inspections. The requirements may be reduced in case original coating is in GOOD condition, to be decided by the surveyor. The surveyor may also decide to increase the scope based on findings onboard.
3.6.3 Mapping of areas found with Substantial Corrosion Areas found with Substantial Corrosion, at previous surveys or through the measurements described in 1 and 2, should be subject to intensive measurements.
3.7 Reporting
The report shall also inform which parts of the structure has been replaced, and it should include a clear
indication of which transverse sections have been measured, when applicable. The report shall be
prepared onboard, with measurements being filled in on a daily basis, and made available for the
surveyor upon request.

Upon completion of the measurements onboard, a digital copy of the preliminary report, with all
measurements entered, shall be given to the attending surveyor before the UTM company leave the ship.
Sketches showing the location of measurement points shall also be given to the surveyor, but need not
be digital.

Final report shall be sent to PMDS Head Office no later than 2 weeks after the measurements are
finished. The final report shall consist of one digital copy and one paper copy or digital copy in non-
editable form (pdf file). Content of the paper copy or the non editable digital copy should be as for the
preliminary report, with integrated sketches showing measurement points, but in addition it shall contain a
front page with a stamp and signature from the operator and the attending surveyor. The front page shall
inform about date and place of measurements, number of pages in the report and which company did the
measurements.

3.8 Requirements to the UTM Company
UTM shall be carried out by an approved UTM company and with a PMDS Surveyor present. The
company shall have a valid certificate issued by Class PMDS or an IACS approved, with any of two
options, PMDS surveyor authorizing the company to do measurements onboard.

Section 4 Permissible Diminution
Tables 10.1 to 10.4 detail permissible levels of diminution on different ship types. These Tables should be
read in conjunction with Tables 10.5 and 10.6 which detail permissible diminution for generic structural
members.

Ship categories are defined as follows:
**Category A:** Oil tankers, chemical tankers, dry bulk cargo ships, combination carriers and liquefied gas
ships having a length \( L \) equal to or greater than 90 metres.

**Category B:** All remaining ship types not included in Category A and having a length \( L \) equal to or greater
than 90 metres.

**Category C:** All ship types having a length \( L \) less than 90 metres.
### Table 10.1 Permissible Diminution Levels for Category A Oil Tankers, Chemical Tankers and Liquefied Gas Carriers

#### Hull Envelope

<table>
<thead>
<tr>
<th>Component</th>
<th>Permissible Diminution Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength deck plating</td>
<td>20%</td>
</tr>
<tr>
<td>Side shell plating</td>
<td>20%</td>
</tr>
<tr>
<td>Bottom shell plating</td>
<td>20%</td>
</tr>
<tr>
<td>Forecastle deck plating</td>
<td>25%</td>
</tr>
<tr>
<td>Poop deck plating</td>
<td>25%</td>
</tr>
<tr>
<td>Superstructure deck plating</td>
<td>25%</td>
</tr>
</tbody>
</table>

#### General – Internal Structure

<table>
<thead>
<tr>
<th>Component</th>
<th>Permissible Diminution Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse bulkhead plating</td>
<td>25%</td>
</tr>
<tr>
<td>Transverse bulkhead stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Transverse bulkhead horizontal stringer plating and face plates</td>
<td>25%</td>
</tr>
<tr>
<td>Longitudinal bulkhead plating</td>
<td>20%</td>
</tr>
<tr>
<td>Longitudinal bulkhead longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Strength deck longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Side shell longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Bottom shell longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Inner bottom plating</td>
<td>20%</td>
</tr>
<tr>
<td>Inner bottom longitudinals</td>
<td>25%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Permissible Diminution Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal girder (fabricated)</td>
<td>20%</td>
</tr>
<tr>
<td>Horizontal girder face plate</td>
<td>25%</td>
</tr>
<tr>
<td>Horizontal girder rolled section</td>
<td>25%</td>
</tr>
<tr>
<td>Deck girder plating (fabricated)</td>
<td>20%</td>
</tr>
<tr>
<td>Deck girder face plates</td>
<td>25%</td>
</tr>
<tr>
<td>Deck girder (rolled section)</td>
<td>25%</td>
</tr>
<tr>
<td>Bottom girder plating (fabricated)</td>
<td>20%</td>
</tr>
<tr>
<td>Bottom girder face plates</td>
<td>25%</td>
</tr>
<tr>
<td>Bottom girder (rolled section)</td>
<td>25%</td>
</tr>
<tr>
<td>SWBT* &amp; COT web frame plating</td>
<td>20%</td>
</tr>
<tr>
<td>SWBT* &amp; COT web frame face plates</td>
<td>20%</td>
</tr>
<tr>
<td>SWBT* &amp; COT web frame stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>SWBT* &amp; COT web frame secondary structure</td>
<td>25%</td>
</tr>
</tbody>
</table>

*SWBT includes any tanks (including peak tanks, wing tanks, centre tanks, double bottom tanks, side tanks and deep tanks) designated for the use of salt water ballast*
**COT: Cargo Oil Tank**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre tank deck transverse plating</td>
<td>20%</td>
</tr>
<tr>
<td>Centre tank deck transverse face plate</td>
<td>20%</td>
</tr>
<tr>
<td>Centre tank deck transverse stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank deck transverse secondary structure</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank bottom transverse plating</td>
<td>20%</td>
</tr>
<tr>
<td>Centre tank bottom transverse face plates</td>
<td>20%</td>
</tr>
<tr>
<td>Centre tank bottom transverse stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank bottom transverse secondary structure</td>
<td>25%</td>
</tr>
<tr>
<td>Peak tank longitudinal bulkhead plating and stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Peak tank stringer plating</td>
<td>25%</td>
</tr>
</tbody>
</table>
### Table 10.2 Permissible Diminution Levels for Category C Oil Tankers, Chemical Tankers and Liquefied Gas Ships

**Hull Envelope**
- Strength deck plating: 30%
- Side shell plating: 30%
- Bottom shell plating: 30%
- Forecastle deck plating: 30%
- Poop deck plating: 30%
- Superstructure deck plating: 30%

**General – Internal Structure**
- Transverse bulkhead plain plating: 30%
- Transverse bulkhead corrugated plating: 25%
- Transverse bulkhead stiffeners: 25%
- Transverse bulkhead horizontal stringer plating: 30%
- Transverse bulkhead horizontal stringer face plates: 25%
- Longitudinal bulkhead plating: 30%
- Longitudinal bulkhead longitudinals: 25%
- Strength deck longitudinals: 25%
- Side shell longitudinals: 25%
- Bottom shell longitudinals: 25%
- Inner bottom plating: 30%
- Inner bottom longitudinals: 25%
- Horizontal girder (fabricated): 30%
- Horizontal girder face plates: 25%
- Horizontal girder (rolled sections): 25%
- Deck girder plating (fabricated): 30%
- Deck girder face plates: 25%
- Deck girder (rolled section): 25%
- Bottom girder plating (fabricated): 30%
- Bottom girder plating (rolled section): 25%
- Bottom girder face plates: 25%
- SWBT* & COT web frame plating: 25%
- SWBT* & COT web frame face plates: 25%
- SWBT* & COT web frame stiffeners: 25%
- SWBT* & COT web frame secondary structure: 30%

*SWBT includes any tanks (including peak tanks, wing tanks, centre tanks, double bottom tanks, side tanks and deep tanks) designated for the use of salt water ballast*
**COT: Cargo Oil Tank**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centre tank deck transverse plating</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank deck transverse face plate</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank deck transverse stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank deck transverse secondary structure</td>
<td>30%</td>
</tr>
<tr>
<td>Centre tank bottom transverse plating</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank bottom transverse face plates</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank bottom transverse stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Centre tank bottom transverse secondary structure</td>
<td>30%</td>
</tr>
<tr>
<td>Peak tank longitudinal bulkhead plating</td>
<td>30%</td>
</tr>
<tr>
<td>Peak tank longitudinal bulkhead stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Peak tank stringer plating</td>
<td>30%</td>
</tr>
<tr>
<td>Plating of sea chests</td>
<td>30%</td>
</tr>
<tr>
<td>Shell plaiting in way of overboard discharges</td>
<td>30%</td>
</tr>
</tbody>
</table>
10.3 Permissible Diminution Levels for Category A Bulk Carriers, Ore/Oil Ships and Ore/Bulk/Oil Ships

**Hull Envelope**

<table>
<thead>
<tr>
<th>Part</th>
<th>Permissible Diminution Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength deck plating</td>
<td>20%</td>
</tr>
<tr>
<td>Deck plating inside line of hatch openings</td>
<td>25%</td>
</tr>
<tr>
<td>Side shell plating</td>
<td>20%</td>
</tr>
<tr>
<td>Bottom shell plating</td>
<td>20%</td>
</tr>
<tr>
<td>Forecastle deck plating</td>
<td>25%</td>
</tr>
<tr>
<td>Poop deck plating</td>
<td>25%</td>
</tr>
<tr>
<td>Superstructure deck plating</td>
<td>25%</td>
</tr>
</tbody>
</table>

**General – Internal Structure**

<table>
<thead>
<tr>
<th>Part</th>
<th>Permissible Diminution Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo hold / Tank transverse bulkhead plain plating</td>
<td>25%</td>
</tr>
<tr>
<td>Cargo hold / Tank transverse bulkhead stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Longitudinal bulkhead plating</td>
<td>20%</td>
</tr>
<tr>
<td>Longitudinal bulkhead longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Strength deck longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Side shell longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Bottom shell longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Inner bottom plating</td>
<td>20%</td>
</tr>
<tr>
<td>Inner bottom longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Hopper sloping plating</td>
<td>20%</td>
</tr>
<tr>
<td>Hopper sloping longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Topside sloping plating</td>
<td>20%</td>
</tr>
<tr>
<td>Topside sloping longitudinals</td>
<td>25%</td>
</tr>
<tr>
<td>Cargo hold shell frames and end brackets</td>
<td>20%</td>
</tr>
<tr>
<td>SWBT &amp; COT web frame plating</td>
<td>20%</td>
</tr>
<tr>
<td>SWBT &amp; COT web frame face plates</td>
<td>20%</td>
</tr>
<tr>
<td>SWBT &amp; COT transverse bulkhead plating</td>
<td>25%</td>
</tr>
<tr>
<td>SWBT &amp; COT transverse bulkhead stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>SWBT or COT web frame secondary structure</td>
<td>25%</td>
</tr>
</tbody>
</table>

*SWBT includes any tanks (including peak tanks, wing tanks, centre tanks, double bottom tanks, side tanks and deep tanks) designated for the use of salt water ballast*

*COT: Cargo Oil Tank*  
Cargo hold hatch cover plating | 25%  
Cargo hold hatch cover stiffeners | 25%
Cargo hold hatch coaming plating 25%
Cargo hold hatch coaming stiffeners 25%

Deck girder plating (fabricated) 20%
Deck girder face plates 25%
Deck girder (rolled section) 25%
Bottom girder plating (fabricated) 20%
Bottom girder face plates 25%
Bottom girder (rolled section) 25%

Peak tank longitudinal bulkhead plating and stiffeners 25%
Peak tank stringer plating 25%

Plating of sea chests 25%
Shell plating in way of overboard discharges 20%

**Additional criteria applicable only to Bulk Carrier Cargo Holds**
Corrugated plating of transverse bulkheads within holds designed to be fully filled with SWB (deep tank) 25%
Corrugated plating of transverse bulkheads within holds designed to be partially filled with SWB 15%
Corrugated plating of aft transverse bulkhead of the forward hold** 15%
Corrugated plating of remaining transverse bulkhead 20%
Inner bottom plating** 25%
Hopper sloping plating** 25%

**Applicable where ship length (L) is greater than 150 meters and the notation Strengthened for Heavy Cargoes is assigned.
### 10.4 Permissible Diminution Levels for General Dry Cargo Ships and All Other Category B & C Type Ships

#### Hull Envelope
- Strength deck plating: 30%
- Side shell plating: 30%
- Bottom shell plating: 30%
- Deck plating inside line of openings, where fitted: 30%
- Forecastle deck plating: 30%
- Poop deck plating: 30%
- Superstructure deck plating: 30%

#### Miscellaneous – Internal Structure
- Strength deck longitudinals: 25%
- Side shell longitudinals: 25%
- Bottom shell longitudinals: 25%
- Transverse bulkhead plain plating: 30%
- Transverse bulkhead corrugated plating: 25%
- Transverse bulkhead stiffeners: 25%
- Longitudinal bulkhead plating: 30%
- Longitudinal bulkhead stiffeners: 25%
- Inner bottom plating: 30%
- Inner bottom longitudinals: 25%
- Hopper sloping plating: 30%
- Hopper sloping longitudinals: 25%
- Topside sloping plating: 30%
- Topside sloping longitudinals: 25%
- SWBT frames or diaphragms: 25%
- Cargo hold shell frames and end brackets: 25%
- Cargo hold hatch cover plating: 30%
- Cargo hold hatch cover stiffeners: 25%
- Cargo hold hatch coaming plating: 30%
- Cargo hold hatch coaming stiffeners: 25%

#### SWDBT Floors
- *SWDBT: Salt-water double Bottom Tanks* 25%

*ClassPMDS* 224
<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web frame plating</td>
<td>25%</td>
</tr>
<tr>
<td>Web frame face plates</td>
<td>25%</td>
</tr>
<tr>
<td>Web frame secondary structure</td>
<td>30%</td>
</tr>
<tr>
<td>Other miscellaneous plating</td>
<td>30%</td>
</tr>
<tr>
<td>Other miscellaneous longitudinals or stiffeners</td>
<td>25%</td>
</tr>
<tr>
<td>Plating of sea chests</td>
<td>30%</td>
</tr>
<tr>
<td>Shell plating in way of overboard discharges</td>
<td>30%</td>
</tr>
</tbody>
</table>
10.5 Maximum Permissible Diminution of Individual Plates and Stiffeners

<table>
<thead>
<tr>
<th>Structural Item</th>
<th>Category A Ships</th>
<th>Category B &amp; C Ships</th>
<th>TM Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hull envelope: individual plates, shell and deck plating recorded along the strake (deck, bottom, side, wind and water)</td>
<td>20% see Note 2</td>
<td>30%</td>
<td>Depending of type and survey See Note 3</td>
</tr>
<tr>
<td>Hull envelope: transverse section, plates recorded by frame number and strake position (deck and sheer/bottom and side)</td>
<td>20%</td>
<td>30%</td>
<td>Depending of type and survey See Note 4.1 (a / b)</td>
</tr>
<tr>
<td>Longitudinal structural members (including deck and shell longitudinal stiffeners, longitudinal bulkhead plating and stiffeners, inner bottom plating and stiffeners, hopper sloping plating and stiffeners. See Note 4 for additional bulk carrier diminution criteria)</td>
<td>Plating 20% Stiffeners 20%</td>
<td>Plating 30% Stiffeners 25%</td>
<td>Depending of type and survey See Note 3</td>
</tr>
<tr>
<td>Transverse structural members in C.O. and W.B. tanks (including web frame plating and face plates)</td>
<td>20%</td>
<td>25%</td>
<td>Depending of type and survey</td>
</tr>
<tr>
<td>W.T. and O.T. transverse bulkheads including deep tank bulkheads (See Note 4 for additional bulk carrier diminution criteria)</td>
<td>Plating 25% Stiffeners and Corrugated bulkhead plating 25%</td>
<td>Plating 30% Stiffeners and Corrugated bulkhead plating 25%</td>
<td>Depending of type and survey See Note 4.1 (a)</td>
</tr>
<tr>
<td>Miscellaneous structural members (including deck plating inside the line of cargo hatch openings)</td>
<td>Plating 25% Stiffeners 25%</td>
<td>Plating 30% Stiffeners 25%</td>
<td>Depending of type and survey See Note 3 / 7</td>
</tr>
<tr>
<td>Cargo hold transverse frames and end brackets (See Note 4 for additional bulk carrier diminution criteria)</td>
<td>20%</td>
<td>25%</td>
<td>Depending of type and survey See Note 4.1 (a)</td>
</tr>
</tbody>
</table>

Notes:
1. For ships with a corrosion control, Surveyors are to compare the measurements with the original Rule thickness and not the reduced, as built, scantlings which were approved in association with a corrosion control.

2. For oil tankers of Category A the strength deck residual buckling thickness requirement is to be complied with in accordance with Class PMDS requirements as advised by the attending Surveyor.

3. Where extensive additional measurements are taken for continuous longitudinal plating these may be reported on the Forms H-TM.

4. Additional Bulk Carrier diminution criteria:

   4.1 Cargo holds transverse bulkheads
   (a) Corrugated parts within cargo holds designed to be fully filled with salt-water ballast (deep tank) - 25%.
   (b) Corrugated parts within cargo holds designed to be partially filled with salt-water ballast - 15%.
   (c) Corrugated parts of the aft transverse bulkhead of the forward cargo hold - 15%, see (f) below.
   (d) Corrugated parts of the remaining transverse bulkheads in cargo hold - 20%.
   (e) All plain transverse bulkhead plating (including stool plating) - 25%.
(f) For the aft transverse bulkhead of the forward cargo hold on bulk carriers which have been assessed and/or upgraded in order to comply with requirements of Enhanced Survivability - HOLD 1 & Enhanced Survivability - ALL HOLDS (UR S19), refer to the Approved Bulkhead Upgrade Plan for diminution criteria. These measurements are to be recorded on Forms H -TM.

(g) For the bulkheads of cargo holds on bulk carriers which are contracted for construction on or after 1 July 1998, of 150m in length and above and of single skin (have been assessed in order to comply with requirements of Enhanced Survivability and double skin construction, intended to carry solid bulk cargoes having density of 1.0t/m$^3$, or above, with vertically corrugated transverse bulkheads (UR S18), measurements are to be recorded on Forms H -TM.

4.2 Cargo holds inner bottom and hopper sloping plating

(a) Where the Strengthened for Heavy Cargoes is assigned and length $L$ is greater than 150 metres then the maximum diminution applicable is 25%. For all other bulk carriers refer to longitudinal structural members above.

4.3 Cargo hold transverse frames (shell frames)

For single skin bulk carriers contracted for construction prior to 1 July 1998 undergoing a re-assessment of their cargo hold shell frames in accordance with the Rule (UR S31), measurements are to be compared against the minimum thickness values shown in the evaluation records. These measurements are to be recorded on Forms H -TM. For all other bulk carriers refer to 'Cargo hold transverse frames and end brackets' above.

5. For definition of ship category, see table 10.6 – Note 6

6. The maximum diminutions are for the average thickness measured over the plate area or over the length between supports.

7. Bulk Carriers which are contracted for construction on or after 1 July 1998 (not including to bulk carriers and double hull oil tankers compliant with IACS common Structural Rules), are required to comply with the evaluation of scantlings of hatch covers of cargo holds (UR S21). In addition to the above, Bulk Carriers, Ore Carriers and Combination Carriers contracted for construction on or after 1 January 2004 are required to comply with the evaluation of scantlings of hatch coamings of cargo holds in accordance to UR S21.6.2. Measurements are to be recorded on the Forms H -TM.
10.6 Maximum Permissible Diminution of Topside and Bottom Areas

<table>
<thead>
<tr>
<th>Structural Item</th>
<th>Category A Ships</th>
<th>Category B Ships</th>
<th>Category C Ships</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 0.5L amidships</td>
<td>At 0.075L From ends</td>
<td>Over 0.5L amidships</td>
</tr>
<tr>
<td>Topside Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment as reported on TM (a) and TM</td>
<td>Plating</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Longitudinals</td>
<td>15%</td>
<td>25%</td>
</tr>
<tr>
<td>Bottom Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment as reported on TM(b) and TM</td>
<td>Plating - Single bottom construction</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plating – double bottom construction</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Longitudinals</td>
<td>15%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Notes

1. Intermediate values are to be obtained by linear interpolation.

2. Topside area comprises deck (outside line of openings for dry cargo ships), stringer and sheer strake (including rounded gunwales) together with associated longitudinals.

3. Bottom area comprises keel, bottom and bilge plating together with associated longitudinals.

4. For ships of Category A and B a greater diminution may be permitted over 0.5L amidships provided the hull girder section modulus, using the actual gauged thicknesses, is not less than 90% of the Rule section modulus as a new ship. A reassessment of scantlings would be required where consideration of this is required.

5. For ships with a corrosion control, see Table 10.5 - Note 1.

6. Ship categories are defined as follows:
**Category A:** Oil tankers, chemical tankers, dry bulk cargo ships, combination carriers and liquefied gas ships having a length $L$ equal to or greater than 90 metres.

**Category B:** All remaining ship types not included in Category A and having a length $L$ equal to or greater than 90 metres.

**Category C:** All ship types having a length $L$ less than 90 metres.

$L$ is defined in Part 1 / Section 6 (6.6)

7. Where the diminution of the topside or bottom area (plating and longitudinals) is in excess of 0.75 of the values given above, additional transverse sections are to be measured as recommended by the Surveyor.

8. For oil tankers of 130 metres in length and upwards (as defined by the International Convention on Load Lines in force), in addition to topside and bottom area assessment, the ship’s longitudinal strength is to be evaluated by using the thickness of longitudinal structural members (deck plating, deck longitudinals, bottom shell plating and bottom longitudinals) measured, renewed or reinforced as appropriate, during the Special Surveys carried out after the ship reaches 10 years of age.
### 10.7 Upper Deck Plating $t_\alpha$ and $J_\alpha$ Values for Residual Buckling Thickness Calculations

<table>
<thead>
<tr>
<th>Longitudinals Stiffeners spacing s (mm)</th>
<th>LOCATION</th>
<th>STEEL GRADE</th>
<th>MILD steel</th>
<th>HT32</th>
<th>HT36</th>
<th>MILD steel</th>
<th>HT32</th>
<th>HT36</th>
<th>MILD steel</th>
<th>HT32</th>
<th>HT36</th>
<th>ALL grades</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OVER 0.4L amidships</td>
<td>AT 0.25L from amidships</td>
<td>AT 0.35L from amidships</td>
<td>At 0.075L from ends</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>s</td>
<td>t</td>
<td>s</td>
<td>t</td>
<td>s</td>
<td>t</td>
<td>s</td>
<td>t</td>
<td>s</td>
<td>t</td>
<td>s</td>
<td>t</td>
</tr>
<tr>
<td>550</td>
<td>56.7</td>
<td>52.1</td>
<td>51.3</td>
<td>65.2</td>
<td>61.6</td>
<td>61.0</td>
<td>82.2</td>
<td>80.7</td>
<td>80.4</td>
<td>95.0</td>
<td></td>
<td></td>
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<tr>
<td>575</td>
<td>10.1</td>
<td>11.0</td>
<td>11.2</td>
<td>8.8</td>
<td>9.3</td>
<td>9.4</td>
<td>7.0</td>
<td>7.1</td>
<td>7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>10.6</td>
<td>11.5</td>
<td>11.7</td>
<td>9.2</td>
<td>9.7</td>
<td>9.8</td>
<td>7.3</td>
<td>7.4</td>
<td>7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>625</td>
<td>11.0</td>
<td>12.0</td>
<td>12.2</td>
<td>9.6</td>
<td>10.1</td>
<td>10.2</td>
<td>7.6</td>
<td>7.7</td>
<td>7.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>650</td>
<td>11.5</td>
<td>12.5</td>
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**Note**

The Table gives values of $J_\alpha$ and residual thickness, $t_\alpha$, for the equation below at specific locations and longitudinal stiffener spacing. When necessary intermediate values may be obtained by linear interpolation.

The residual buckling thickness, $t_\alpha$, is to be not less than the smaller of the following two equations, where $t_\alpha$ is the original thickness, $s$ the spacing of deck longitudinals, in mm and $J_\alpha$ a factor dependent on location and steel type.

1) \[ t_\alpha = (t_\alpha - 1.5) \text{ mm} \]

2) \[ t_\alpha = S / J_\alpha \text{ mm} \]
where

\[ J_r = 56.7 \text{ over } 0.4L \text{ amidships (mild steel)} \]
\[ = 52.1 \text{ over } 0.4L \text{ amidships (Higher tensile steel Grade 32)} \]
\[ = 51.3 \text{ over } 0.4L \text{ amidships (Higher tensile steel Grade 36)} \]
\[ = 95.0 \text{ at } 0.075L \text{ from ends} \]

Intermediate values are to be obtained by linear interpolation.

For ships built with excess hull girder section modulus the diminution will be specially considered.
Section 1 General

1.1. Application

1.1.1. The requirements in this Chapter apply to the materials intended to be used for the components specified in each Part of hull construction (below 500 Gt) or repair (all ships), equipment and machinery.

1.1.2. The materials other than those prescribed in this Chapter may be used where specially approved in connection with the design. In such cases, the detailed data relating to the chemical compositions and mechanical properties, etc. of the materials are to be submitted for approval.

1.1.3. Reinforced plastic materials used for construction or repair of plastic pipes, FRP ships or composite vessels should be in accordance with the Rules specified by Class PMDS.

1.1.4. Class PMDS is entitled to use for Classification purposes any requirements other than those dictated by this chapter, provided the former lead to equivalent standards of strength. To this purpose, IACS requirements are considered as equivalent.

1.2. Approval of manufacturing process and manufacturing control

1.2.1. Approval of manufacturing process

1.2.1.1. The materials prescribed in this Chapter, unless otherwise specially provided, are to be manufactured by open-hearth, electric furnace, basic oxygen processes, or other processes at works approved by Class PMDS. In this case, the manufacturer is to obtain the approval in accordance with the Guidance specially specified by the Society in advance concerning the process of manufacture (melting process, ingot casting, rolling, casting, forging and heat treating).

1.2.1.2. The manufacturing process of semi-finished products such as ingots, slabs, blooms and billets for the normal and higher strength hull structural steels or forgings are to be approved in accordance with the Guidance specially specified by Class PMDS in advance.

1.2.1.3. The rolled steel manufacturer supplied semi-finished products from other steel works or hot coil processor is required to obtain the approval of the manufacturing process according to the requirement of proceeding 1.2.1.1 as appropriate.

2. Manufacturing control

2.1. It is the manufacturer's responsibility to assure that effective process and production controls in operation are adhered to within the manufacturing specifications.

2.2. Where control imperfection inducing possible inferior quality of product occurs, the manufacturer is to identify the cause and establish a countermeasure to prevent its recurrence. Also, the complete investigation report is to be submitted to the Surveyor.
2.3. For further use, each product affected by previous (2.2) is to be tested to the Surveyor's satisfaction. The frequency of testing for subsequent products offered may be increased to gain confidence in the quality at the discretion of Class PMDS.

2.4. When steel is not produced at the works at which it is rolled, a certificate is to be supplied to the Surveyor at the rolling mill stating the process by which it was manufactured, the name of the manufacturer who supplied it, the number of the cast from which it was made and the ladle analysis. The Surveyor is to have access to the works at which the steel was produced.

3. Chemical composition
3.1. The chemical composition of samples taken from each ladle of each cast is to be determined by the manufacturer in an adequately equipped and competently staffed laboratory and is to comply with the appropriate requirements for chemical composition provided in this Chapter.

3.2. The Manufacturer's declared analysis will be accepted subject to occasional checks if required by the Surveyor.

3.3. Product analysis may be required where the final product chemistry is not well represented by the analysis from the cast.

4. Testing and inspection
4.1. The materials are to be tested and inspected in the presence of the Class PMDS Surveyor except otherwise specially provided, and are to comply with the requirements in this Chapter.

4.2. The materials other than those prescribed in this Chapter are to be tested and inspected according to the specification for the testing approved in accordance with the requirements in 1.1.2.

4.3. Class PMDS may accept to omit the tests for materials having the appropriate certificates.

4.4. Where the materials are manufactured by the approval of quality assurance scheme specially specified by Class PMDS, a part or all of test and inspection in the presence of the Class PMDS Surveyor may be omitted.

5. Execution of testing and inspection
5.1. The manufacturers shall afford the Surveyor all necessary facilities and access to all relevant parts of the works to enable him to verify that the approved process is adhered to, for the selection of test materials, and the witnessing of tests, as required by the Rules, and for verifying the accuracy of the testing equipment.

5.2. All tests and inspections are to be carried out at the place of manufacture before dispatch. The test specimens and procedures are to be in accordance with the rule. All the test specimens are to be selected and stamped by the Surveyor and tested in his presence, unless otherwise agreed.
5.3. In the case of special order, the manufacturer is to show the order specifications, special requirements, etc. of the materials to the Surveyor prior to the material test.

5.4. Surface inspection and verification of dimensions are the responsibility of the steel maker. The acceptance by the Surveyor shall not absolve the steel maker from this responsibility.

6. Identification of materials
6.1. The manufacturer is to take a suitable measure for the identification of ingots, slabs, castings, forgings, and finished pieces, etc. which will enable the material to be traced to its original heat, roll, etc.

6.2. The steelmaker is to adopt a system for the identification of ingots, slabs and finished pieces which will enable the material to be traced to its original cast. The Surveyor is to be given full facilities for so tracing the material when required.

6.3. Where small products such as castings are manufactured in large numbers, modified arrangements for identification may be specially agreed with Class PMDS.

7. Test certificates
7.1. The Certificate for Materials Inspection is to be issued to the materials that have been satisfactorily tested and inspected in accordance with the requirements in this Chapter.

7.2. The Certificate for Materials Inspection is to contain in addition to the dimensions and weight of steels at least the following particulars;
7.2.1. Purchaser's name or purchaser's order number and if known the hull number for which the material is intended.
7.2.2. Identification of the cast and rolled piece.
7.2.3. Identification of the steelworks.
7.2.4. Material grade mark
7.2.5. Chemical composition (ladle analysis values of elements controlled by the requirements) and carbon equivalent calculated by following a formula. (if required)

\[
C_{eq} = C + \left( \frac{Mn}{6} \right) + \left( \frac{Cr + Mo + V}{5} \right) + \left( \frac{Ni + Cu}{15} \right) \%
\]

7.2.6. Mechanical properties.
7.2.7. Condition of heat treatment (e.g. normalized or controlled roll except for as rolled)
7.2.8. Deoxidization procedure is to be stated. (rimmed steel only)

7.3. Notwithstanding the previous provisions, the accepted material may be omitted the issue of the Certificate for Materials Inspection where the manufacturer supplies the Mill Sheets stated the requirement for this rule and each accepted steel grade to the Surveyor for his signature. In this case, the manufacturer is to enter the following statement on the certificate to show that the steel material has been made by an approval process and that it has withstand satisfactory the required tests. The following form of declaration will be accepted if stamped or printed on each test certificate with the name of the steel works in English or Spanish, and is to be signed by the personnel of the manufacturing shop in charge of product quality assurance or inspector.

8. Quality and repair of defects
8.1. All materials are to be free from surface or internal defects which would be prejudicial to their proper application in service. The surface finish is to be in accordance with good practice and any specific requirements of the approved plan.

8.2. In the event of any material proving unsatisfactory during subsequent working or fabrication, such material may be rejected, notwithstanding any previous satisfactory testing and/or certification where the Surveyor considers necessary.

8.3. Welding or other means for the purpose of repairing defects is not permitted, unless the extent and method of repair (including welding procedure and heat treatment) are approved by the Surveyor. The repair of defects is to be carried out in the presence of the Surveyor, unless otherwise agreed.

8.4. Where repair by grinding is carried out then the remaining plate thickness below the ground area must be within the allowable under thickness tolerance.

9. Retest procedures
9.1. Where a part of the results of any test except impact test does not comply with the requirements, but the remainders are satisfactory, additional test specimens twice in number may be taken from the same material and retests for the failed test may be carried out. In such a case, all of the test specimens are to comply with the requirements.

9.2. Impact test
9.2.1. Where the result of the impact test is unsatisfactory, additional tests may be carried out, with the exception of the cases specified in (9.2.1.1) and (9.2.1.2) below, by taking a set of test specimens out of the same piece from which the above-mentioned test specimens have been taken.
9.2.1.1. The absorbed energy of all test specimens is under the required average absorbed energy.
9.2.1.2. The absorbed energy of two of the test specimens is under 70% the required average absorbed energy.
9.2.2 In case of the previous (9.2.1), all pieces of the same lot from which the test specimens have been taken, may be accepted, provided that the average absorbed energy of the six test specimens, including those which have been rejected as unsatisfactory, is not less than the required average absorbed energy, and that not more than two individual results are lower than the required average absorbed energy and of these, not more than one result is below 70 % of the required average absorbed energy.

9.3. If a heat treated material fails to meet the requirements in any test, retest and heat treatment may be allowed two times (three times including the first test). In this case, however, the material is not to be considered as having complied with the requirements, unless all tests fully comply with the test requirements.

9.4. If the percentage of elongation of any tension test specimen is less than that specified and any part of fracture is outside the one-fourth of the gauge length from the centre of gauge length, the test is to be considered as invalid, and a retest for the material from which the first test specimen has been taken may be allowed.

10. Marking
10.1. Every material complying with the requirements is to be clearly stamped with Class PMDS brand and material grade mark, and marked with the following particulars at least in one position by the maker:
10.1.1. Name or mark to identify the steel works.
10.1.2. Number or mark to identify the material.
10.1.3. Name or mark to identify the purchaser. (if required by the purchaser)

10.2. Materials which have been specially approved by Class PMDS in accordance with the requirements in 1.1.2 are to have the letter "PS" after the material grade mark.

10.3. Materials which are unsuitable for stamping may be marked with brands, seals or by other suitable means.

10.4. The marking particulars, but excluding the manufacturer's name or trade mark where this is embossed on finished products are to be encircled with paint or otherwise marked so as to be easily recognizable.

10.5. Materials which cannot be stamped and marked in accordance with the requirements in this chapter due to small size may be properly marked in the lump.

10.6. Where a number of light materials are securely fastened together in bundles the manufacturer may, subject to the agreement of Class PMDS, brand only the top piece of each bundle, or alternatively, a firmly fastened durable label containing the brand may be attached to each bundle.
10.7. In the event of any material bearing Class PMDS brand failing to comply with the test requirements, the brand is to be unmistakably defaced by the manufacturer.

**Section 2 Rolled steels for Hull Construction**

**2.1. General**

2.1.1 This chapter gives the requirements for weldable normal, higher and extra high strength hot rolled steels, such as plates, wide flats, sections and bars, intended for use in hull construction.

2.1.2 The requirements are primarily intended to apply to steel products with a thickness as follows:

2.1.2.1. For plates and wide flats

Up to 100 mm: Grades A, B, D, E

AH32, DH32, EH32,

AH36, DH36, EH36,

AH40, DH40, EH40,

FH32, FH36, FH40.

Up to 70 mm: Grades A420 ~ 690,

D420 ~ 690,

E420 ~ 690,

F420 ~ 690.

2.1.2.2. For sections of all grades up to 50 mm.

2.1.2.3. For products of greater thickness, certain variations in the requirements may be allowed or required in particular cases after consideration of the technical circumstances involved.

2.1.3 Rolled steels having characteristics differing from the requirements in this chapter may be accepted subject to compliance with the requirements given in 2.1.2 and 2.1.3 of this Chapter. Such rolled steels are to be given a special designation.

2.1.4 The requirements given in this chapter may also be applicable to the rolled steels intended for use in the construction of machinery. Where rolled slabs, billets and bars used as a substitute for steel forgings, the requirements of this Part are to be complied with.

**2.2. Manufactures**

2.2.1 Rolled steels are to be manufactured at works which have been approved by Class PMDS for the type and grade of steel which is being supplied in compliance with the requirements given in 2.1.2 of this Chapter.
2.2.2 When rolled plates or wide flats, intended for welded construction, are subject to significant strains in a direction perpendicular to the rolled surfaces, it is recommended that consideration be given to the use of special plate material with improved through thickness properties relating to the structural design.

2.2.3 In the context of the Rules, strip refers to material which is hot coiled after rolling and subsequently uncoiled, cold flattened and cut to the required dimensions.

2.2.4 The deoxidation practice used for each grade of rolled steels is to comply with the requirements given in Table 2.1.

Table 2.1 Deoxidation Practice for Rolled Steels

<table>
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<th>Material Grade (t = thickness)</th>
<th>Deoxidation Practice</th>
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<td><strong>Normal Strength Steels</strong></td>
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<tr>
<td>A</td>
<td>t ≤ 12.5 mm: Any method (For section only)</td>
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<td>t ≤ 50 mm: Any method except rimmed</td>
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<td>t &gt; 50 mm: Killed</td>
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<tr>
<td>B</td>
<td>t ≤ 50 mm: Any method except rimmed</td>
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<td></td>
<td>t &gt; 50 mm: Killed</td>
</tr>
<tr>
<td>D</td>
<td>t ≤ 25 mm: Killed</td>
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<td>t &gt; 25 mm: Killed</td>
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<td><strong>Extra High Strength Steels</strong></td>
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<td>A690, D690, E690, F690</td>
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Killed and fine grain treated
### Table 2.2 Chemical Composition for Normal Strength Steels

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<th>Material Grade</th>
<th>C (max.)</th>
<th>Si (max.)</th>
<th>Mn (max.)</th>
<th>P (max.)</th>
<th>S (max.)</th>
<th>Al (ac.sol) (min.)</th>
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<tbody>
<tr>
<td>A</td>
<td>0.21 (Note 5)</td>
<td>0.50</td>
<td>2.5 x C</td>
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<td>Not required</td>
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<td>B</td>
<td>0.21</td>
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<td>0.80</td>
<td>0.035</td>
<td>0.035</td>
<td>0.015 (Notes 7 and 8)</td>
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<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.015 (Note 8)</td>
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<td>E</td>
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<td>0.70</td>
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</table>

Notes:

1. For all grades of steel, Carbon plus 1/6 of the Manganese content is not to exceed 0.40%.
2. When any grade of steel is supplied in thermo-mechanically controlled processed condition, variations in the specified chemical composition may be allowed or required by the Society.
3. The amount of residual elements which may have an adverse effect on the working and use of the steel, e.g. Copper and Tin, may be limited by the Society if deemed necessary.
4. Where additions of any other element have been made as part of the steelmaking practice, the content is to be indicated.
5. Max. 0.23% for Grade A sections.
6. When Grade B steel is impact tested, the minimum Manganese content may be reduced to 0.60%.
7. Aluminium is not required for Grade D steel up to 25 mm in thickness.
8. For Grade D over 25 mm and Grade E steels, the total Aluminium content may be determined instead of acid soluble content. In such cases the total Aluminium content is to be not less than 0.020%. A maximum Aluminium content may also be specified by the Society if deemed necessary. Other suitable grain refining elements may be used subject to the special approval of the Society.

### 2.3. Chemical Composition

2.3.1. The chemical composition of rolled steels are to be in compliance with the requirements given in Table 2.2 and Table 2.3.

2.3.2. When rolled steels are supplied in the thermo-mechanically controlled processed condition as defined in 2.4.2 of this Chapter, variations in the specified chemical composition may be allowed subject to the approval of the Society.

2.3.3. For steel plates and wide flats over 50 mm in thickness, slight deviations in the chemical composition may be allowed subject to the approval of the Society.

### 2.4. Heat Treatment and Condition of Supply

2.4.1. The rolled steels are to be supplied in a condition complying with the requirements given in Table 2.5. When controlled rolling (PM) or thermo-mechanical controlled processing (TMCP) is permitted as an alternative to normalizing, these procedures may be used subject to the special approval by Class PMDS.
2.4.2 The applicable rolling procedures are defined as follows:

2.4.2.1. Controlled rolling is a procedure in which the final deformation is carried out in the normalizing temperature range, resulting in a material condition generally equivalent to that obtained by normalizing.

2.4.2.2. TMCP is a procedure which involves the strict control of both the steel temperature and the rolling reduction. Generally a high proportion of the rolling reduction is carried out close to the Ar3 temperature and may involve the rolling in the dual phase temperature region. Unlike controlled rolled, the properties conferred by TMCP cannot be reproduced by subsequent normalizing or other heat treatment. The use of accelerated cooling (AcC) on completion of TMCP-rolling may also be accepted subjected to the special approval of the Society. The same applied for the use of tempering after completion of the TMCP-rolling.

2.4.2.3. Accelerated cooling (AcC) is a process which aims to improve technical properties by controlled cooling with rates higher than air cooling immediately after the final TMCP-rolling operation. Direct quenching is excluded from accelerated cooling. The material properties conferred by TMCP and AcC cannot be reproduced by subsequent normalizing or other heat treatment.

### Table 2.3 Chemical Composition for Higher and Extra High Strength Steels

<table>
<thead>
<tr>
<th>Material Grade</th>
<th>Chemical Composition (%) (Note 1, 2, 3 and 4)</th>
<th>Grain Refining Elements</th>
<th>Residual Elements (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH32, DH32, EH32</td>
<td>C (max.) 0.18, Si (max.) 0.50, Mn 0.90 ~ 1.60, P 0.035, S 0.035</td>
<td>Al (acid soluble Min 0.015 (Note 6))</td>
<td>Ni 0.40, Cu 0.35, Cr 0.20, Mo 0.08</td>
</tr>
<tr>
<td>AH36, DH36, EH36</td>
<td>C 0.18, Si 0.50, Mn 0.90 ~ 1.60, P 0.025, S 0.025</td>
<td>Nb 0.02 ~ 0.05, V 0.05 ~ 0.10</td>
<td>Ni 0.80, Cu 0.35, Cr 0.20, Mo 0.08, N 0.009 (0.012*) (*If Al is present)</td>
</tr>
<tr>
<td>AH40, DH40, EH40</td>
<td>C 0.16, Si 0.50, Mn 0.90 ~ 1.60, P 0.025, S 0.025</td>
<td>Al (acid soluble Min 0.015 (Note 6))</td>
<td>Ni 0.40, Cu 0.35, Cr 0.20, Mo 0.08</td>
</tr>
<tr>
<td>FH32, FH36, FH40</td>
<td>C 0.16, Si 0.50, Mn 0.90 ~ 1.60, P 0.025, S 0.025</td>
<td>Cr 0.02 ~ 0.05, V 0.05 ~ 0.10</td>
<td>Ni 0.80, Cu 0.35, Cr 0.20, Mo 0.08, N 0.009 (0.012*) (*If Al is present)</td>
</tr>
<tr>
<td>A420, A460, A500</td>
<td>C 0.21, Si 0.55, Mn 1.70, P 0.035, S 0.035</td>
<td>Ti Max. 0.02, Total (Nb+V+Ti) Max. 0.12 (Note 7)</td>
<td>Ni 0.020 and other elements are to comply with the approved specification</td>
</tr>
<tr>
<td>A550, A620, A690</td>
<td>C 0.20, Si 0.55, Mn 1.70, P 0.030, S 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D420, E420</td>
<td>C 0.20, Si 0.55, Mn 1.70, P 0.030, S 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D460, E460</td>
<td>C 0.20, Si 0.55, Mn 1.70, P 0.030, S 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D500, E500</td>
<td>C 0.20, Si 0.55, Mn 1.70, P 0.030, S 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D550, E550</td>
<td>C 0.20, Si 0.55, Mn 1.70, P 0.030, S 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D620, E620</td>
<td>C 0.20, Si 0.55, Mn 1.70, P 0.030, S 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D690, E690</td>
<td>C 0.20, Si 0.55, Mn 1.70, P 0.030, S 0.030</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F420, F460, F500</td>
<td>C 0.18, Si 0.55, Mn 1.60, P 0.025, S 0.025</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F550, F620, F690</td>
<td>C 0.18, Si 0.55, Mn 1.60, P 0.025, S 0.025</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Notes:
1. When any steel is supplied in thermo-mechanically controlled processed condition, variations in the specified chemical composition may be allowed or required by the Society.
2. When required, the carbon equivalent value (Ceq) is to be calculated from the ladle analysis using the following formula:

\[
\text{Ceq} = C + \frac{\text{Mn}}{6} + \frac{\text{Cr} + \text{Mo} + V}{5} + \frac{\text{Ni} + \text{Cu}}{15} \quad (\%)
\]

For thermo-mechanically controlled rolled steel, the carbon equivalent value (Ceq) is to comply with the requirements of following Note 8 and the weldability evaluation may use the following cold cracking susceptibility value (Pcm) formula instead of the carbon equivalent, in such cases, the Pcm value is subject to the special approval of the Society.

\[
\text{Pcm} = C + \frac{\text{Si}}{30} + \frac{\text{Mn} + \text{Cu} + \text{Cr}}{20} + \frac{\text{Ni}}{60} + \frac{\text{Mo}}{15} + \frac{\text{V}}{10} + 5B \quad (\%)
\]

4. Where additions of any other element have been made as part of the steelmaking practice, the content is to be indicated.
5. Up to a thickness of 12.5 mm, the minimum Manganese content may be reduced to 0.70%.
6. The total Aluminium content may be determined instead of the acid soluble content. In such cases, the total Aluminium content is to be not less than 0.020%.
7. The steel is to contain Aluminium, Niobium, Vanadium or other suitable grain refining elements, either singly or in any combination. When used singly the steel is to contain the specified minimum content of the grain refining element. When used in combination, the specified minimum content of each grain refining element is not applicable.
8. The maximum carbon equivalent (%) for higher strength steels up to 100 mm in thickness rolled by TMCP are to be follows:

<table>
<thead>
<tr>
<th>Thickness t (mm)</th>
<th>AH32</th>
<th>AH36</th>
<th>AH40</th>
</tr>
</thead>
<tbody>
<tr>
<td>t \leq 50</td>
<td>0.36</td>
<td>0.38</td>
<td>0.40</td>
</tr>
<tr>
<td>50 &lt; t \leq 100</td>
<td>0.38</td>
<td>0.40</td>
<td>0.42</td>
</tr>
</tbody>
</table>

2.5. Mechanical Properties
2.5.1. The mechanical properties of the rolled steels for the construction of hull are to comply with the requirements given in Table 2.4.

2.5.2. Test samples
Unless otherwise agreed, the test samples are to be taken from the following positions:
2.5.2.1. For plates and wide flats with a width of 600 mm and over, the test samples are to be taken from one end at a position approximately midway between the axis in the direction of rolling and the edge of the rolled product as shown in Fig. 11.1(a).
### Table 2.4 Mechanical Properties Requirements of Rolled Steels

<table>
<thead>
<tr>
<th>Material Grade</th>
<th>Tensile Test</th>
<th>Impact Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min. Yield stress (N/mm²)</td>
<td>Tensile Strength (N/mm²)</td>
</tr>
<tr>
<td></td>
<td>(Note 1)</td>
<td>(Notes 7 and 8)</td>
</tr>
<tr>
<td>A</td>
<td>235</td>
<td>400 ~ 520</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AH32</td>
<td>315</td>
<td>440 ~ 570</td>
</tr>
<tr>
<td></td>
<td>(Note 6)</td>
<td></td>
</tr>
<tr>
<td>DH32</td>
<td>355</td>
<td>490 ~ 630</td>
</tr>
<tr>
<td>EH32</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>FH32</td>
<td></td>
<td>-60</td>
</tr>
<tr>
<td>AH36</td>
<td>390</td>
<td>510 ~ 660</td>
</tr>
<tr>
<td>DH36</td>
<td></td>
<td>39 (26)</td>
</tr>
<tr>
<td>EH36</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>FH36</td>
<td></td>
<td>-60</td>
</tr>
<tr>
<td>AH40</td>
<td>420</td>
<td>530 ~ 680</td>
</tr>
<tr>
<td>DH40</td>
<td></td>
<td>42 (28)</td>
</tr>
<tr>
<td>EH40</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>FH40</td>
<td></td>
<td>-60</td>
</tr>
<tr>
<td>A420</td>
<td>460</td>
<td>570 ~ 720</td>
</tr>
<tr>
<td>D420</td>
<td></td>
<td>46 (31)</td>
</tr>
<tr>
<td>E420</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>F420</td>
<td></td>
<td>-60</td>
</tr>
<tr>
<td>A500</td>
<td>500</td>
<td>610 ~ 770</td>
</tr>
<tr>
<td>D500</td>
<td></td>
<td>50 (33)</td>
</tr>
<tr>
<td>E500</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>F500</td>
<td></td>
<td>-60</td>
</tr>
<tr>
<td>A550</td>
<td>550</td>
<td>670 ~ 830</td>
</tr>
<tr>
<td>D550</td>
<td></td>
<td>55 (37)</td>
</tr>
<tr>
<td>E550</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>F550</td>
<td></td>
<td>-60</td>
</tr>
<tr>
<td>A620</td>
<td>620</td>
<td>720 ~ 890</td>
</tr>
<tr>
<td>D620</td>
<td></td>
<td>62 (41)</td>
</tr>
<tr>
<td>E620</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>F620</td>
<td></td>
<td>-60</td>
</tr>
</tbody>
</table>
Notes:
1. For all grades of Extra high strength steels, a yield strength to ultimate tensile strength ratio may be required by the Society. Where the yield stress does not mark in the tensile test, the 0.2% proof stress is applicable.
2. For all thicknesses of Grade A steel sections, the upper limit for the specified tensile strength range may be exceeded to 550 N/mm².
3. The specified values of minimum average impact energy are required to the average values of 3 test specimens of Type N1 as given in Table XI 2-3 taken with their axes parallel to the main direction of rolling. The values shown in parentheses are applicable to the test specimens taken with their axes transverse to the main direction of rolling.
4. Impact tests are generally not required for Grade B steel with thickness of 25 mm or less.
5. Impact tests for Grade A steel over 50 mm in thickness are not required when the material is produced using fine grain practice and furnished normalized or is produced by TMCP rolling.
6. For Grades AH32 and AH36 steels, a relaxation in the number of impact tests for acceptance purposes may be permitted by special agreement with the Society provided that satisfactory results obtained from occasional check tests.
7. For full thickness flat tensile test specimens with a width of 25 mm and a gauge length of 200 mm, the elongation is to comply with the following minimum values (%):

<table>
<thead>
<tr>
<th>Thickness (mm)</th>
<th>≤ 5</th>
<th>&gt; 5</th>
<th>&gt; 10</th>
<th>&gt; 15</th>
<th>&gt; 20</th>
<th>&gt; 25</th>
<th>&gt; 30</th>
<th>&gt; 40</th>
<th>&gt; 50</th>
<th>≤ 70</th>
<th>Subject to The special consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A, B, D, E</td>
<td>14</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AH / DH / EH / FH 32</td>
<td>13</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AH / DH / EH / FH 36</td>
<td>12</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AH / DH / EH / FH 40</td>
<td>11</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A / D / E / F 420</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A / D / E / F 460</td>
<td>9</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A / D / E / F 500</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A / D / E / F 550</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A / D / E / F 620</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A / D / E / F 690</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. For extra high strength steels, in case of the tensile test specimen is taken longitudinally to the direction of rolling, the minimum elongation values are to be 2% above those listed in this Table.
### Table 2.5 Conditions of Supply and Impact Test Requirements of Rolled Steels (to be continued)

<table>
<thead>
<tr>
<th>Material Grade</th>
<th>Products (Note 1)</th>
<th>Thickness (t mm)</th>
<th>Condition of Supply (Note 2)</th>
<th>Batch for Impact Test (ton) (Note 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Sections</td>
<td>t ≤ 50</td>
<td>Any</td>
<td>Not Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>t ≤ 50</td>
<td>Any</td>
<td>Not Required</td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>50 &lt; t ≤ 100</td>
<td>N TMCP</td>
<td>50 (Note 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CR ARG</td>
<td>50</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Sections</td>
<td>t ≤ 25</td>
<td>Any</td>
<td>Not Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 &lt; t ≤ 50</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>t ≤ 25</td>
<td>Any</td>
<td>Not Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 &lt; t ≤ 50</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 &lt; t ≤ 100</td>
<td>N TMCP</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CR ARG</td>
<td></td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>Sections</td>
<td>t ≤ 35</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35 &lt; t ≤ 50</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>t ≤ 35</td>
<td>Any</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35 &lt; t ≤ 50</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 &lt; t ≤ 100</td>
<td>N TMCP</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CR</td>
<td></td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>Section</td>
<td>t ≤ 50</td>
<td>N TMCP</td>
<td>25</td>
</tr>
<tr>
<td>EH32,</td>
<td></td>
<td></td>
<td>ARG CRG</td>
<td>15</td>
</tr>
<tr>
<td>EH36</td>
<td>Plates</td>
<td>t ≤ 100</td>
<td>N TMCP</td>
<td>Each Piece</td>
</tr>
</tbody>
</table>
### Table 2.5 Conditions of Supply and Impact Test Requirements of Rolled Steels (continued)

<table>
<thead>
<tr>
<th>Material Grade</th>
<th>Products (Note 1)</th>
<th>Thickness $(t = \text{mm})$</th>
<th>Condition of Supply (Note 2)</th>
<th>Batch for Impact Test (ton) (Note 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH32, AH36 (Nb and/or V refining)</td>
<td>Sections</td>
<td>$t \leq 12.5$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12.5 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>$t \leq 12.5$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12.5 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$50 &lt; t \leq 100$</td>
<td>N TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CR</td>
<td>25</td>
</tr>
<tr>
<td>AH32, AH36 (Al alone or Al + Ti refining)</td>
<td>Sections</td>
<td>$t \leq 12.5$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12.5 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>$t \leq 20$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 &lt; t \leq 35$</td>
<td>ARG</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$50 &lt; t \leq 100$</td>
<td>N TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CR</td>
<td>25</td>
</tr>
<tr>
<td>DH32, DH36 (Nb and/or V refining)</td>
<td>Sections</td>
<td>$t \leq 12.5$</td>
<td>ANY</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12.5 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>$t \leq 12.5$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12.5 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$50 &lt; t \leq 100$</td>
<td>N TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CR</td>
<td>25</td>
</tr>
<tr>
<td>DH32, DH36 (Al alone or Al + Ti refining)</td>
<td>Sections</td>
<td>$t \leq 20$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>$t \leq 20$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 &lt; t \leq 25$</td>
<td>ARG</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$50 &lt; t \leq 100$</td>
<td>N TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CR</td>
<td>25</td>
</tr>
<tr>
<td>AH 40</td>
<td>Sections</td>
<td>$t \leq 12.5$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12.5 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>$t \leq 12.5$</td>
<td>Any</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$12.5 &lt; t \leq 50$</td>
<td>N CR TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$50 &lt; t \leq 100$</td>
<td>N TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>QT</td>
<td>Each length as heat-treated</td>
</tr>
<tr>
<td>Material Grade</td>
<td>Products (Note 1)</td>
<td>Thickness (t = mm)</td>
<td>Condition of Supply (Note 2)</td>
<td>Batch for Impact Test (ton) (Note 3)</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------</td>
<td>--------------------</td>
<td>------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>DH40</td>
<td>Sections</td>
<td>t ≤ 50</td>
<td>N CR TMCP</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>t ≤ 50</td>
<td>N CR TMCP</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 &lt; t ≤ 100</td>
<td>N TMCP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>QT</td>
<td>Each length as heat-treated</td>
</tr>
<tr>
<td>EH40 / FH40</td>
<td>Sections</td>
<td>t ≤ 50</td>
<td>N TMCP QT</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>t ≤ 100</td>
<td>N TMCP</td>
<td>Each Piece</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>QT</td>
<td>Each length as heat-treated</td>
</tr>
<tr>
<td>FH32 / FH36</td>
<td>Sections</td>
<td>t ≤ 50</td>
<td>N QT TMCP</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Plates</td>
<td>t ≤ 100</td>
<td>N TMCP</td>
<td>Each Piece</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>QT</td>
<td>Each length as heat-treated</td>
</tr>
<tr>
<td>A420 ~ 690</td>
<td>Sections</td>
<td>t ≤ 50</td>
<td>TMCP</td>
<td>Each Piece</td>
</tr>
<tr>
<td>D420 ~ 690</td>
<td></td>
<td></td>
<td>QT</td>
<td>Each length as heat-treated</td>
</tr>
<tr>
<td>E420 ~ 690</td>
<td>Plates</td>
<td>t ≤ 70</td>
<td>TMCP (Note 5)</td>
<td>Each Piece</td>
</tr>
<tr>
<td>F420 ~ 690</td>
<td></td>
<td></td>
<td>QT</td>
<td>Each length as heat-treated</td>
</tr>
</tbody>
</table>

Notes:
1. Plates include flats with a width ≥ 600 mm.
2. Symbols used in “Condition of supply” are as follows:
   - Any: Any conditions, including as rolled, controlled rolled, TMCP rolled and any other heat treatments.
   - N: Normalized condition.
   - TMCP: Thermo-mechanically controlled processed rolling as approved by the Society.
   - CR: Controlled rolled condition as an alternative to normalizing.
   - ARG: As rolled condition subject to the special approval of the Society.
   - CRG: Controlled rolled condition subject to the special approval of the Society.
   - QT: Quenched and tempered condition.
3. One set of 3 impact specimens is to be taken from each batch of the specified mass in tons or fraction thereof.
4. Impact tests for Grade A steel over 50 mm in thickness are not required when the material is produced using fine grain practice and furnished normalizing or is produced by TMCP rolling.
5. Extra high strength steels supplied in TMCP condition is applicable for the thickness ≤ 50 mm.
2.5.2.2. For flats with a width less than 600 mm and other sections, the test samples are to be taken from one end at a position approximately $\frac{1}{3}$ from the outer edge or in the case of small sections, as near as possible to this position. In the case of channels, bulb plates and H-beams, the test samples may alternatively be taken from a position approximately $\frac{1}{4}$ of the depth from the web center line or axis. See Figs. 11.1(b), (c), (d) and (e).

2.5.2.3. For bars and other similar products, the test samples are to be taken so that the longitudinal axes of the test specimens are parallel to the direction of rolling and are as near as possible to the following:

2.5.2.3.1. For cylindrical sections, at $\frac{1}{3}$ of the radius from the outside surface as shown in Fig. 11.1(f).

2.5.2.3.2. For non-cylindrical sections, at $\frac{1}{3}$ of the half diagonal from the outside surface.

2.5.3. Tensile test specimens

2.5.3.1. For normal and higher strength steels, 1 tensile test is to be made for each batch of 50 tons or fraction thereof. Additional tests are to be made for every variation of 10 mm in thickness or diameter of products from the same cast. For extra high strength steels, 1 tensile test is to be made for each length as heat-treated of the quenched and tempered products or for each piece of TMCP products.

2.5.3.2. Generally for plates, wide flats and sections, the tensile test specimens of full product thickness are to be used. Round test specimens may be used for bars and other similar products. Alternatively for small size of bars, etc., test specimens may consist of a suitable length of the full cross-section of the product.
2.5.3.3. Where plates and wide flats with a finished width of 600 mm and over, the tensile test specimens are to be cut with their principal axes perpendicular to the final direction of rolling. For all other rolled products, the principal axes may be either parallel or perpendicular to the final direction of rolling.

2.5.3.4. When round tensile test specimens are taken from any rolled steel other than bars, the test specimens are to be taken at a portion approximately 1/4 of the thickness from the surface.

2.5.4. Impact test specimens

2.5.4.1. One impact test is to be made for each batch in the frequency as given in Table 2.5. One set of three test specimens is to be taken from the thickest product in each batch.

2.5.4.2. The impact test specimens are to be taken from the position in the vicinity of the test samples as specified in 2.5.2 above with their principal axes parallel to the final direction of rolling, unless otherwise specified or specially required by the Society.

2.5.4.4. The impact test specimens are also to be taken from a position close to one of the rolled surfaces, except that for plates or sections over 40 mm in thickness, the axes of the test specimens are to be at 1/4 of the thickness from one of the rolled surfaces. For bars and other similar products, the axes of the test specimens are to be as specified in 2.5.2.3 above.

2.6 Quality Inspections

2.6.1 All products are to have a workman-like finish and to be free from defects and imperfections which may impair their proper workability and use. This may, however, include some discontinuities of a harmless nature, minor imperfections, e.g. pitting, rolled-in scale, indentations, roll marks, scratches, and grooves which cannot be avoided completely despite proper manufacturing and which will not be objected to provided they do not exceed the acceptable limits contained herein.

2.6.2 Notwithstanding this, the products may have imperfections exceeding the discontinuities inherent to the manufacturing process as defined in 2.6.1 above. In such cases, limits for their acceptability are to be agreed with the Society, taking the end use of the product into consideration.

2.6.3 Cracks, shells, sand patches and sharp edged seams are always considered defects which would impair the end use of the product and which require rejection or repair irrespective of their size and number. The same applies to other imperfections exceeding the acceptable limits.

2.6.4 The responsibility for the required surface finish rests with the manufacturer of the material, who is to take necessary precautions and to inspect the products prior to delivery. At that stage, however, rolling or heat treatment scale may conceal surface discontinuities. If, during the subsequent descaling or working operations, the material is found to be defective, the Surveyor may require materials to be repaired or rejected.
2.6.5 If the product is ordered with non-destructive examinations, these are to be made in accordance with an acceptable standard at the discretion of the Society.

2.6.6 Surface inspection and verification of dimensions are the responsibility of the steel manufacturer. The acceptance by the Surveyor of Class PMDS is not to absolve the steel manufacturer from this responsibility.

2.6.7 Dimensional tolerances

2.6.7.1. The maximum permissible under thickness tolerance for hull construction rolled steel plates and wide flats is −0.3 mm.

2.6.7.2. For rolled steel plates and wide flats intended for machinery structures, the under thickness tolerance may relax to as follows:

<table>
<thead>
<tr>
<th>Nominal thickness t (mm)</th>
<th>Minus tolerance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 ≤ t &lt; 8</td>
<td>0.4</td>
</tr>
<tr>
<td>8 ≤ t &lt; 15</td>
<td>0.5</td>
</tr>
<tr>
<td>15 ≤ t &lt; 25</td>
<td>0.6</td>
</tr>
<tr>
<td>25 ≤ t &lt; 40</td>
<td>0.8</td>
</tr>
<tr>
<td>40 ≤ t</td>
<td>1.0</td>
</tr>
</tbody>
</table>

2.6.7.3. Tolerances for length, width, flatness and over thickness of plates and wide flats and those for other products are to comply with the requirements of the recognized national or international standards.

2.6.7.4. The attention of Shipbuilders and Ship owners is to be drawn to the fact that when thickness gauging is carried out during the ship's life, estimation of the diminution of hull plating and structure is to be based on the nominal thickness, this being the original approved thickness for the item of structure under consideration.

2.6.7.5. The under thickness tolerance acceptable for classification is to be considered as the lower limit of a plus-minus range of thickness tolerance which could be found in the normal production of a conventional rolling mill manufacturing material, on average, to the nominal thickness.

2.6.7.6. The thickness is to be measured at random locations whose distance from a longitudinal edge is to be at least 10 mm. Local surface depression resulting from imperfections and ground areas resulting from the elimination of defects may be disregarded provided the imperfections or grinding are in accordance with the requirements of the recognized national or international standards.

2.7. Repair of Defects

2.7.1. The unacceptable imperfections or defects are to be completely removed by grinding.
2.7.1.1. The ground depth is not to be more than 7% of the nominal thickness or 3 mm, whichever is the less.

2.7.1.2. Each single ground area is not to exceed \(0.25 \, m^2\) and all ground areas are not to exceed 2% of the total surface in question. Ground areas lying in a distance less than their average breadth to each other are to be regarded as one single area.

2.7.1.3. The ground areas must have smooth transitions to the sounding surface of the products. Ground areas lying opposite each other on both surfaces must not decrease the product thickness by value exceeding the limits as stated in 2.7.1.1 above.

2.7.2. Local defects which cannot be repaired grinding, may be repaired with the Surveyor's consent by chipping and/or grinding followed by welding subject to the following conditions:

2.7.2.1. The depth of removed area is not to be more than 20% of the nominal thickness.

2.7.2.2. Any single welded area is not to exceed \(0.125 \, m^2\) and the sum of all areas is not to exceed 2% of the total surface side in question.

2.7.2.3. The distance between two welded areas is not to be less than their average breadth.

2.7.2.4. Welding is to be carried out by an approved procedure and by qualified welder using approved welding materials and the welded areas are to be ground smoothly to the correct nominal thickness.

2.7.2.5. Generally a suitable post-weld heat treatment is required, unless otherwise specially approved by the Society or in case of the welding repair has been performed prior to heat treatment for the steels to be supplied in heat treated condition.

2.7.3. Complete repair of the defects may be verified by suitable non-destructive examinations at the Surveyor's discretion.

2.7.4. The steel manufacturer is to submit a written repair report concerning the details of defects, repair procedures and results for Surveyor's approval.

2.8 Additional Requirements for Through Thickness Properties

2.8.1. General

2.8.1.1. Provision is made in 2.8 of this Chapter for special quality plate material with improved ductility in the through thickness or Z-direction relating to the structural design.

2.8.1.2. This special quality material is to comply with the requirements of rolled steel plates and wide flats with thickness of 15 mm and over for the construction of hull in this chapter, as appropriate, and the additional requirements in 2.8 of this Section.
2.8.1.3. The requirements are applicable to the other steels than the material specified in 2.8.1.2 above, where deemed appropriate by Class PMDS.

2.8.2 Manufacture

2.8.2.1. All plates and wide flats are to be manufactured at works which have been approved by Class PMDS for this quality of material.

2.8.2.2. It is recommended that the steel is to be efficiently vacuum de-gassed, and that the sulphur content is not to exceed 0.010%.

2.8.3. Through thickness tensile test

2.8.3.1. For plates, a test sample in a size sufficient for six test specimens is to be taken from the center of one end of each piece. Where appropriate, the end selected is to be representative of the top end of an ingot or the start of a concast strand. Three tensile test specimens are to be prepared from each of these test samples in a line transverse to the final direction of rolling as shown in Fig. 11.2. Generally, the other three test specimens are prepared while the rest of the sample remains for possible retests.

![Fig. 11.2 Test Sample for Through Thick-ness Tensile Test](image)

2.8.3.2. For wide flats, a similar test sample is to be taken from each batch of products derived from a single cast and in the same heat treatment condition. A batch is not to exceed 10 tons for thickness up to 25 mm and not to exceed 20 tons for thickness exceeds 25 mm.

2.8.3.3. In lieu of the above 2.8.3.1 and 2.8.3.2, the test sampling may be performed in accordance with an acceptable national or international standard.

2.8.3.4. The test specimens are to be machined in accordance with a recognized standard to the dimensions as shown in Table 2.6. Where the product thickness is not allow to prepare specimens of sufficient length suitable for the gripping jaws of the testing machine, the ends of the test specimens may be built up by suitable welding methods. The welding is not to impair the portion of the specimen within the parallel length.
2.8.3.5. The three through thickness tensile test specimens are to be tested at ambient temperature and for acceptance are to give an average reduction of area value of not less than 25%. Only one individual value may be less than 25% but not less than 20%.

2.8.3.6. If the test results fail to fulfill the requirements given in above 2.8.3.5, three additional specimens taken from same test sample for retest may be permitted. The results of these tests are to be added to those previously obtained to form a new average, which for acceptance is to be not less than 25% and individual result from the second series is to be not less than 25%.

2.9. Identification and Marking
2.9.1. Every finished piece of the rolled steels is to be clearly marked by the steel manufacturer at least in one place with the markings in compliance with the requirements of this Rule.

2.9.2. Steels which have been specially approved by Class PMDS and which differ from the requirements of this chapter are to be affixed with a letter 'P' to the material grade designation, e.g. EH36P.

2.9.3. When required by Class PMDS, material supplied in the TMCP condition is to be affixed with the marks 'PTM' to the material grade designation, e.g. EH36-PTM.

2.9.4. The rolled steels complying with the requirements of through thickness properties given in 2.8 of this Section are to be affixed with a letter 'M' to the material grade designation, e.g. EH36M.

<table>
<thead>
<tr>
<th>Product Thickness t (mm)</th>
<th>Test Specimen Diameter d (mm)</th>
<th>Test Specimen Parallel Length L (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 ≤ t ≤ 25</td>
<td>6</td>
<td>L ≥ 1.5d</td>
</tr>
<tr>
<td>25 &lt;</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.6 Through Thickness Tensile Test Specimens

Section 3 Rolled Steel for Boilers, Pressure Vessels and Low temperature Service
3.1 General
3.1.1 This section specifies the requirements for rolled steel intended for use in the construction of boilers and pressure vessels and of tanks and process equipment for low temperature service. Mechanical properties at high temperatures for design purposes are stated. The rules also apply to rolled austenitic and ferritic austenitic (duplex) stainless steel.
3.1.2. Method of manufacture

3.1.2.1 The steel shall be manufactured by an electric or one of the basic oxygen processes. The use of other processes may be especially approved by Class PMDS.

3.1.2.2 The reduction ratio of thickness from continuously cast slab to plate shall be minimum 5 to 1 unless otherwise approved by Class PMDS.

3.2 Steel for Boilers and Pressure Vessels

3.2.1 Steel grades

3.2.1.1 Requirements regarding carbon and carbon-manganese steels are specified for the as rolled condition in thicknesses up to 25 mm and for the normalised condition in thicknesses up to 100 mm. Requirements are also given for alloy steels in thicknesses up to 100 mm. As alternatives to the steel grades specified below, materials complying with relevant standards may be accepted, subject to approval in each case.

3.2.1.2 The designations for carbon and carbon-manganese steel grades are built up as follows:

The letters PM are followed by three figures which stand for the specified minimum tensile strength in N/mm². Further, there is a single figure referring to the impact test temperature:

The figures 0.1 and 2 mean impact testing at +20°, 0° and −20°C respectively. The suffix letters are symbolizing the heat treatment and deoxidation practice. The suffix P means as rolled, M means normalised, RT means quenched and tempered and K means fine grain treated steels. Where controlled rolling is used as a substitute for normalising, the suffix KS shall be used instead of M.

Example:

PM 360–1KM means a steel grade with specified minimum tensile strength 360 N/mm² impact tested at 0°C, fine grain treated and normalised.

3.2.2 Chemical composition

3.2.2.1 The chemical composition shall satisfy the requirements specified in Table 3.1 for carbon and carbon-manganese steels and in Table 3.2 for alloy steels.

3.2.2.2 The content of all elements given in the specification including grain refining elements shall be determined and entered on the certificate. The content of residual elements shall be checked by random tests as agreed upon with the surveyor.

3.2.2.3 Where Al is replaced by other grain refining elements, the minimum contents of such elements shall be:

- Nb, minimum 0.02%
- V, minimum 0.05%.
3.2.2.4 For carbon and carbon-manganese steels, the carbon equivalent shall be calculated from the ladle analysis using the following formula when applicable:

\[ C_{eq} = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15} \]  

(%) 

3.2.3 Mechanical properties

3.2.3.1 The mechanical properties of the material shall comply with the requirements specified in the following tables:
Table 3.3: Carbon and carbon-manganese steels, as rolled
Table 3.4: Carbon and carbon-manganese steels, normalised or controlled rolled
Table 3.5: Alloy steels

The values for tensile strength, yield stress and elongation specified in the tables refer to testing at room temperature.

3.2.3.2 Values for lower yield stress or 0.2% proof stress at high temperatures are given in Table 3.6. The values are intended for design purposes and verification is not required.

If the material is produced in compliance with a recognized standard where the lower yield stress or 0.2% proof stress at high temperatures is higher than stated in Table 3.6, these higher values will be accepted, provided that tensile tests at high temperatures, in compliance with E300, are carried out with satisfactory results.

The tensile test at high temperatures may be dispensed with if the steelmaker can demonstrate to the satisfaction of Class PMDS that the specified minimum mechanical properties at high temperatures can be consistently obtained in the running production.

3.2.3.3 Estimated average values for stress to rupture in 100,000 and 200,000 hours are given in Table 3.7 for design purposes.

3.2.4 Heat treatment

3.2.4.1 The materials shall be supplied in the heat treatment conditions stated in Table 3.8; except that materials which shall be heat treated after hot or cold forming may be supplied in the as rolled condition, subject to the customer’s consent. In such cases heat treatment and subsequent mechanical testing shall be carried out after forming.

3.2.4.2 The designation of controlled rolled- and thermo-mechanically treated steel grades shall be given the suffix KS and TM respectively instead of M.
# Table 3.1 Carbon and carbon-manganese steels for boilers and pressure vessels. Chemical Composition

<table>
<thead>
<tr>
<th>Grade</th>
<th>C max/min</th>
<th>Si</th>
<th>Mn</th>
<th>P max/min</th>
<th>S max/min</th>
<th>Al_{max}</th>
<th>N max/min</th>
<th>Residual elements, maximum</th>
<th>Decarburization</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 150 – 0A</td>
<td>0.15–0.20</td>
<td>0.05</td>
<td>0.50–0.80</td>
<td>0.035</td>
<td>0.030</td>
<td>0.012</td>
<td>≤ 0.25</td>
<td>0.04–0.10</td>
<td>0.015</td>
</tr>
<tr>
<td>PM 160 – 0K</td>
<td>0.20–0.25</td>
<td>0.05</td>
<td>0.50–0.10</td>
<td>0.035</td>
<td>0.030</td>
<td>0.015</td>
<td>0.015</td>
<td>0.015–0.040</td>
<td>0.015</td>
</tr>
<tr>
<td>PM 170 – 0K</td>
<td>0.20–0.30</td>
<td>0.05</td>
<td>0.50–0.10</td>
<td>0.035</td>
<td>0.030</td>
<td>0.015</td>
<td>0.015</td>
<td>0.015–0.040</td>
<td>0.015</td>
</tr>
<tr>
<td>PM 180 – 0K</td>
<td>0.20–0.40</td>
<td>0.05</td>
<td>0.50–0.10</td>
<td>0.035</td>
<td>0.030</td>
<td>0.015</td>
<td>0.015</td>
<td>0.015–0.040</td>
<td>0.015</td>
</tr>
<tr>
<td>PM 190 – 0K</td>
<td>0.20–0.50</td>
<td>0.05</td>
<td>0.50–0.10</td>
<td>0.035</td>
<td>0.030</td>
<td>0.015</td>
<td>0.015</td>
<td>0.015–0.040</td>
<td>0.015</td>
</tr>
<tr>
<td>PM 200 – 0K</td>
<td>0.20–0.60</td>
<td>0.05</td>
<td>0.50–0.10</td>
<td>0.035</td>
<td>0.030</td>
<td>0.015</td>
<td>0.015</td>
<td>0.015–0.040</td>
<td>0.015</td>
</tr>
</tbody>
</table>

1) For electric furnace steel, maximum 0.012
2) For thicknesses exceeding 40 mm, Mn = 0.40 – 1.20%
3) If high temperature properties of Table 87 are specified, Mn content shall be 0.40 – 1.40%
4) For thickness t > 30 mm and t ≤ 100 mm, Cu = 0.22%
5) Aluminium may be replaced by other grain refining elements.

# Table 3.2 Alloy steels for boilers and pressure vessels. Chemical composition

<table>
<thead>
<tr>
<th>Grade</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P max/min</th>
<th>S max/min</th>
<th>Al_{max}</th>
<th>Cr</th>
<th>Mo</th>
<th>Residual elements, maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 0.3 Mo</td>
<td>0.12–0.20</td>
<td>0.15–0.35</td>
<td>0.50–0.80</td>
<td>0.035</td>
<td>0.030</td>
<td>0.012</td>
<td>r ≤ 0.30</td>
<td>0.25–0.35</td>
<td>Cu 0.25 Ni 0.30</td>
</tr>
<tr>
<td>PM 1 Cr 0.5 Mo</td>
<td>0.10–0.18</td>
<td>0.15–0.35</td>
<td>0.40–0.80</td>
<td>0.035</td>
<td>0.030</td>
<td>0.020</td>
<td>0.70–1.30</td>
<td>0.40–0.60</td>
<td></td>
</tr>
<tr>
<td>PM 2 Cr 1 Mo</td>
<td>0.08–0.18</td>
<td>0.15–0.35</td>
<td>0.40–0.80</td>
<td>0.035</td>
<td>0.030</td>
<td>0.020</td>
<td>2.00–2.50</td>
<td>0.90–1.10</td>
<td></td>
</tr>
</tbody>
</table>

# Table 3.3 Carbon and carbon-manganese steels for boilers and pressure vessels, as rolled condition. Mechanical properties

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile strength $R_m$ (N/mm²)</th>
<th>Yield stress, $R_m$ or $R_{p0.2}$ (N/mm²) minimum for thickness, (mm)</th>
<th>Elongation $A_t$ (%) minimum</th>
<th>KV, average</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 360 – 0A</td>
<td>360 – 480</td>
<td>205</td>
<td>26</td>
<td>20 20 27</td>
</tr>
<tr>
<td>PM 410 – 0A</td>
<td>410 – 530</td>
<td>235</td>
<td>24</td>
<td>20 20 27</td>
</tr>
<tr>
<td>PM 460 – 0A</td>
<td>460 – 580</td>
<td>285</td>
<td>22</td>
<td>20 20 27</td>
</tr>
</tbody>
</table>
Table 3.4 Carbon and carbon-manganese steels for boilers and pressure vessels, normalised or controlled rolled condition.

**Mechanical properties**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile strength $R_m$ (N/mm²)</th>
<th>Yield stress, $R_{y1}$ or $R_{y2}$ (N/mm²) minimum for thickness, (mm)</th>
<th>Elongation $A_S$ (%) minimum</th>
<th>KV, average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\leq 16$</td>
<td>$&gt; 16 \leq 40$</td>
<td>$&gt; 40 \leq 63$</td>
</tr>
<tr>
<td>PM 360 – 0M</td>
<td>360 - 480</td>
<td>205</td>
<td>195</td>
<td>185</td>
</tr>
<tr>
<td>PM 360 – 1 KM</td>
<td>360 - 480</td>
<td>235</td>
<td>215</td>
<td>195</td>
</tr>
<tr>
<td>PM 410 – 0M</td>
<td>410 - 530</td>
<td>235</td>
<td>225</td>
<td>215</td>
</tr>
<tr>
<td>PM 410 – 1 KM</td>
<td>410 - 530</td>
<td>265</td>
<td>245</td>
<td>235</td>
</tr>
<tr>
<td>PM 460 – 0M</td>
<td>460 - 580</td>
<td>285</td>
<td>255</td>
<td>245</td>
</tr>
<tr>
<td>PM 460 – 1 KM</td>
<td>460 - 580</td>
<td>295</td>
<td>285</td>
<td>275</td>
</tr>
<tr>
<td>PM 490 – 0M</td>
<td>490 - 610</td>
<td>305</td>
<td>275</td>
<td>265</td>
</tr>
<tr>
<td>PM 490 – 1 KM</td>
<td>490 - 610</td>
<td>315</td>
<td>315</td>
<td>305</td>
</tr>
<tr>
<td>PM 510 – 1 KM</td>
<td>510 - 650$^b$</td>
<td>355</td>
<td>345</td>
<td>335</td>
</tr>
</tbody>
</table>

1) For thicknesses 40 – 63 mm, the minimum value is 1 unit lower and for thicknesses 63 – 100 mm 2 units lower.
2) For thickness t≥63mm but t≤100mm, the values specified for the thickness range t>40 mm but t ≤ 63mm are lowered by 1% for each 5 mm of thickness over 63mm.
3) For thicknesses 63 – 100mm: $R_m$ 490 – 630.

Table 3.5 Alloy steels for boilers and pressure vessels.

**Mechanical properties**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile strength $R_m$ (N/mm²)</th>
<th>Yield stress, $R_{y1}$ or $R_{y2}$ (N/mm²) minimum for thickness, (mm)</th>
<th>Elongation $A_S$ (%) minimum</th>
<th>KV, average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\leq 16$</td>
<td>$&gt; 16 \leq 40$</td>
<td>$&gt; 40 \leq 63$</td>
</tr>
<tr>
<td>PM 0.3 Mo</td>
<td>440 - 590</td>
<td>260</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>PM 1 Cr 0.5 Mo</td>
<td>470 - 620</td>
<td>305</td>
<td>305</td>
<td>305</td>
</tr>
<tr>
<td>PM 2.25 Cr 1 Mo</td>
<td>480 - 630</td>
<td>275</td>
<td>265</td>
<td>265</td>
</tr>
</tbody>
</table>

1) For thicknesses 40 – 63 mm, the minimum value is 1 unit lower and for thicknesses 63 – 100mm, 2 units lower.
2) For thicknesses $t > 63$ mm but $t \leq 100$ mm, the values specified for the thickness range $t > 40$ mm but $t \leq 63$mm are lowered by 1% for each 5 mm of thickness over 63mm.
Table 3.6 Steels for boilers and pressure vessels. Minimum lower yield stress \( (R_{el}) \) or 0.2% proof stress \( (R_{p0.2}) \) values at high temperatures for design purposes

<table>
<thead>
<tr>
<th>Grade</th>
<th>Thickness (mm)</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 360 – 0M</td>
<td>&lt; 16</td>
<td>175</td>
<td>172</td>
<td>168</td>
<td>170</td>
<td>174</td>
<td>179</td>
<td>181</td>
<td>183</td>
<td>185</td>
</tr>
<tr>
<td></td>
<td>16 ≤ 40</td>
<td>171</td>
<td>169</td>
<td>165</td>
<td>166</td>
<td>170</td>
<td>172</td>
<td>173</td>
<td>173</td>
<td>174</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ≤ 63</td>
<td>162</td>
<td>158</td>
<td>152</td>
<td>154</td>
<td>158</td>
<td>160</td>
<td>161</td>
<td>162</td>
<td>163</td>
</tr>
<tr>
<td>PM 360 – 1KM</td>
<td>&lt; 16</td>
<td>204</td>
<td>185</td>
<td>165</td>
<td>145</td>
<td>127</td>
<td>116</td>
<td>110</td>
<td>105</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>16 ≤ 40</td>
<td>195</td>
<td>183</td>
<td>164</td>
<td>145</td>
<td>127</td>
<td>116</td>
<td>110</td>
<td>105</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ≤ 63</td>
<td>179</td>
<td>172</td>
<td>159</td>
<td>145</td>
<td>127</td>
<td>116</td>
<td>110</td>
<td>105</td>
<td>111</td>
</tr>
<tr>
<td>PM 410 – 0M</td>
<td>&lt; 16</td>
<td>211</td>
<td>208</td>
<td>201</td>
<td>180</td>
<td>150</td>
<td>142</td>
<td>138</td>
<td>136</td>
<td>134</td>
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<tr>
<td></td>
<td>16 ≤ 40</td>
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<td>191</td>
<td>171</td>
<td>150</td>
<td>142</td>
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<td>134</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ≤ 63</td>
<td>192</td>
<td>188</td>
<td>181</td>
<td>168</td>
<td>150</td>
<td>142</td>
<td>138</td>
<td>136</td>
<td>134</td>
</tr>
<tr>
<td>PM 410 – 1KM</td>
<td>&lt; 16</td>
<td>235</td>
<td>216</td>
<td>194</td>
<td>171</td>
<td>152</td>
<td>141</td>
<td>134</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>16 ≤ 40</td>
<td>228</td>
<td>213</td>
<td>192</td>
<td>171</td>
<td>152</td>
<td>141</td>
<td>134</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ≤ 63</td>
<td>215</td>
<td>204</td>
<td>188</td>
<td>171</td>
<td>152</td>
<td>141</td>
<td>134</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td>PM 460 – 0M</td>
<td>&lt; 16</td>
<td>248</td>
<td>243</td>
<td>235</td>
<td>210</td>
<td>176</td>
<td>168</td>
<td>162</td>
<td>158</td>
<td>158</td>
</tr>
<tr>
<td></td>
<td>16 ≤ 40</td>
<td>230</td>
<td>227</td>
<td>220</td>
<td>198</td>
<td>176</td>
<td>168</td>
<td>162</td>
<td>158</td>
<td>158</td>
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<tr>
<td></td>
<td>&gt;40 ≤ 63</td>
<td>222</td>
<td>218</td>
<td>210</td>
<td>194</td>
<td>176</td>
<td>168</td>
<td>162</td>
<td>158</td>
<td>158</td>
</tr>
<tr>
<td>PM 460 – 1KM</td>
<td>&lt; 16</td>
<td>266</td>
<td>247</td>
<td>223</td>
<td>198</td>
<td>177</td>
<td>167</td>
<td>158</td>
<td>153</td>
<td>153</td>
</tr>
<tr>
<td></td>
<td>16 ≤ 40</td>
<td>260</td>
<td>242</td>
<td>220</td>
<td>198</td>
<td>177</td>
<td>167</td>
<td>158</td>
<td>153</td>
<td>153</td>
</tr>
<tr>
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<td>&gt;40 ≤ 63</td>
<td>251</td>
<td>236</td>
<td>217</td>
<td>198</td>
<td>177</td>
<td>167</td>
<td>158</td>
<td>153</td>
<td>153</td>
</tr>
<tr>
<td>PM 490 – 0M</td>
<td>&lt; 16</td>
<td>270</td>
<td>264</td>
<td>255</td>
<td>228</td>
<td>192</td>
<td>183</td>
<td>177</td>
<td>172</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>16 ≤ 40</td>
<td>248</td>
<td>245</td>
<td>237</td>
<td>214</td>
<td>192</td>
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<td>172</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ≤ 63</td>
<td>240</td>
<td>236</td>
<td>227</td>
<td>210</td>
<td>192</td>
<td>183</td>
<td>177</td>
<td>172</td>
<td>172</td>
</tr>
<tr>
<td>PM 490 – 1KM</td>
<td>&lt; 16</td>
<td>284</td>
<td>265</td>
<td>240</td>
<td>213</td>
<td>192</td>
<td>182</td>
<td>173</td>
<td>168</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>16 ≤ 40</td>
<td>279</td>
<td>260</td>
<td>237</td>
<td>213</td>
<td>192</td>
<td>182</td>
<td>173</td>
<td>168</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ≤ 63</td>
<td>272</td>
<td>256</td>
<td>234</td>
<td>213</td>
<td>192</td>
<td>182</td>
<td>173</td>
<td>168</td>
<td>168</td>
</tr>
<tr>
<td>PM 510 – 1FN</td>
<td>&lt; 63</td>
<td>--</td>
<td>--</td>
<td>265</td>
<td>245</td>
<td>225</td>
<td>205</td>
<td>175</td>
<td>155</td>
<td>155</td>
</tr>
</tbody>
</table>

| PM 360 – 0A | ≤ 25          | 150  | 150  | 145  | 125  | 110  | 105  | 105  | 105  | 105  |
| PM 410 – 0A | ≤ 25          | 180  | 180  | 170  | 150  | 130  | 125  | 125  | 125  | 125  |
| PM 460 – 0A | ≤ 25          | 210  | 210  | 200  | 180  | 160  | 150  | 150  | 150  | 150  |
| PM 0.3 Mo  | < 63          | 237  | 232  | 218  | 200  | 167  | 153  | 143  | 139  | 139  |
| PM 1 Cr 0.5 Mo | < 63      | 270  | 259  | 248  | 237  | 216  | 203  | 199  | 194  | 188  |
| PM 2.25 Cr 1 Mo | < 63       | 249  | 241  | 233  | 224  | 212  | 207  | 194  | 184  | 184  |

1) For thickness t > 63 but t ≤ 100 mm the values specified for thickness range t = 40 but t ≤ 63 mm are lowered by 1% for each 5mm of thickness over 63 mm.
Table 3.7 Estimated average stress to rupture values in 100 000 and 200 000 hours for design purposes

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Stress to rupture, (N/mm²) for steel grades</th>
<th>PM 0.3 Mo</th>
<th>PM 1 Cr 0.5 Mo</th>
<th>PM 2.25 Cr 1 Mo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 000 h</td>
<td>200 000 h</td>
<td>100 000 h</td>
<td>200 000 h</td>
</tr>
<tr>
<td>380</td>
<td>165</td>
<td>145</td>
<td>227</td>
<td>206</td>
</tr>
<tr>
<td>390</td>
<td>148</td>
<td>129</td>
<td>203</td>
<td>181</td>
</tr>
<tr>
<td>400</td>
<td>132</td>
<td>115</td>
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<td>157</td>
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<tr>
<td>410</td>
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<td>430</td>
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<td>78</td>
<td>117</td>
<td>97</td>
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<tr>
<td>440</td>
<td>79</td>
<td>67</td>
<td>100</td>
<td>82</td>
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<td>450</td>
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<td>460</td>
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<td>470</td>
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<td>480</td>
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<tr>
<td>510</td>
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<td>34</td>
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<tr>
<td>580</td>
<td></td>
<td></td>
<td>35</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 3.8 Heat treatment of steel for boilers and pressure vessels

<table>
<thead>
<tr>
<th>Grade</th>
<th>Heat treatment or condition of supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 360-0A</td>
<td>As rolled</td>
</tr>
<tr>
<td>PM 410-0A</td>
<td></td>
</tr>
<tr>
<td>PM 460-0A</td>
<td></td>
</tr>
<tr>
<td>PM 360-0M, 1 KM</td>
<td>Normalized/control rolled&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>PM 410-0M, 1 KM</td>
<td>Thermo - mechanically treated</td>
</tr>
<tr>
<td>PM 490-0M, 1 KM</td>
<td></td>
</tr>
<tr>
<td>PM 510-1 KM</td>
<td></td>
</tr>
<tr>
<td>PM 0.3 Mo</td>
<td>Normalized</td>
</tr>
<tr>
<td>PM 1 Cr 0.5 Mo</td>
<td>Normalized and tempered</td>
</tr>
<tr>
<td>PM 2.25 Cr 1 Mo</td>
<td></td>
</tr>
</tbody>
</table>

3.3 Steel for Low Temperature Service

3.3.1 Steel grades

3.3.1.1 Requirements are specified for fine grained carbon-manganese steels and nickel alloy steels with toughness properties at low temperatures.

3.3.2 Chemical composition

3.3.2.1 The chemical composition shall satisfy the requirements specified in Table 3.1C for carbon manganese steels and in Table 3.2C for nickel alloy steels.
3.3.2.2 The content of all elements given in the specifications including grain refining elements shall be determined and entered on the certificate. The content of residual elements shall be checked by random tests as agreed upon with the surveyor.

3.3.2.3 Where Al is replaced by other grain refining elements, the minimum contents of such elements shall be:
- Nb, minimum 0.02%
- V, minimum 0.05%.

3.3.2.4 For carbon and carbon-manganese steels, the carbon equivalent shall be calculated from the ladle analysis using the following formula when applicable:

\[
C_{eq} = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15} \quad (\%)
\]

3.3.3 Mechanical properties
3.3.3.1 The mechanical properties of the material shall comply with the requirements specified in the following tables:
- Table 3.3C: Carbon-manganese steels
- Table 3.4C: Nickel alloy steels

The values for tensile strength, yield stress and elongation specified in the tables refer to testing at room temperature.

3.3.3.2 Pellini’s drop weight test shall be carried out for plates and sections of nickel alloy steels with thickness 13 mm and more in the following cases:
- PM 1.5 Ni when intended for design temperature below – 60°C
- PM 3.5 Ni when intended for design temperature below – 80°C
- PM 5 Ni when intended for design temperature below – 90°C

The test specimens shall display a “no break performance” when tested 5°C below the design temperature.

3.3.4 Heat treatment
3.3.4.1 The materials shall be supplied in the heat treatment conditions stated in Table 3.5C.

3.3.4.2 The designation of quenched and tempered controlled rolled and thermo-mechanically treated steel grades shall be given the suffix RT, KS, and TMTS respectively instead of M.

Note:
Hot forming or normalising of thermo-mechanically treated steels may result in considerable reduction of tensile strength and yield stress. Thermo-mechanically treated steels shall not be used where hot forming or normalising will be carried out.
### Table 3.1C Carbon-manganese steels for low temperature service.

**Chemical composition**

<table>
<thead>
<tr>
<th>Grade</th>
<th>C maximum</th>
<th>Si</th>
<th>Mn maximum</th>
<th>S maximum</th>
<th>P maximum</th>
<th>Al total</th>
<th>N maximum</th>
<th>Residual elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 360 – 2KM</td>
<td>0.17</td>
<td>0.10</td>
<td>0.40</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td>Cr 0.20 maximum</td>
</tr>
<tr>
<td>PM 2 - 2</td>
<td>0.16</td>
<td>0.10</td>
<td>0.40</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td>Cu 0.35 maximum</td>
</tr>
<tr>
<td>PM 2 - 3</td>
<td>0.14</td>
<td>0.10</td>
<td>0.70</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td>Ni 0.40 maximum</td>
</tr>
<tr>
<td>PM 2 - 4</td>
<td>0.14</td>
<td>0.10</td>
<td>0.70</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td>Mo 0.08 maximum</td>
</tr>
<tr>
<td>PM 2 – 4L</td>
<td>0.14</td>
<td>0.10</td>
<td>0.70</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td>Cr + Mo + Cu 0.45 maximum</td>
</tr>
<tr>
<td>PM 4 - 2</td>
<td>0.16</td>
<td>0.10</td>
<td>1.60</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>PM 4 - 3</td>
<td>0.16</td>
<td>0.10</td>
<td>0.70</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>PM 4 - 4</td>
<td>0.16</td>
<td>0.10</td>
<td>0.70</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>PM 4 – 4L</td>
<td>0.16</td>
<td>0.10</td>
<td>0.70</td>
<td>0.025</td>
<td>0.030</td>
<td>≥ 0.018</td>
<td>0.015</td>
<td></td>
</tr>
</tbody>
</table>

1) For the steel grades PM 2 – 3, PM 2 – 4, PM 2 – 4L, PM 4 – 3, PM 4 – 4 and PM 4 – 4L a Ni content up to 1.25% may be approved.
2) For thicknesses exceeding 40 mm, Mn=0.40 – 1.20%
3) A maximum Mn content of 1.65% is accepted provided the carbon – content does not exceed 0.13% for PM 2 – 4 or PM 2 – 4L and 0.14% for PM 4 – 4L.
4) Aluminum may be either partly or totally replaced by other grain refining elements.

### Table 3.2C Nickel alloy steels for low temperature service.

**Chemical composition**

<table>
<thead>
<tr>
<th>Grade</th>
<th>C maximum</th>
<th>Si</th>
<th>Mn maximum</th>
<th>S maximum</th>
<th>P maximum</th>
<th>Ni maximum</th>
<th>Al total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 1.5 Ni</td>
<td>0.14</td>
<td>0.10 – 0.35</td>
<td>0.30 – 1.50</td>
<td>0.025</td>
<td>0.025</td>
<td>1.30 – 1.70</td>
<td>≥ 0.018</td>
<td></td>
</tr>
<tr>
<td>PM 3.5 Ni</td>
<td>0.12</td>
<td>0.10 – 0.35</td>
<td>0.30 – 0.70</td>
<td>0.025</td>
<td>0.025</td>
<td>3.25 – 3.75</td>
<td>≥ 0.018</td>
<td></td>
</tr>
<tr>
<td>PM 5 Ni</td>
<td>0.12</td>
<td>0.10 – 0.35</td>
<td>0.30 – 0.80</td>
<td>0.025</td>
<td>0.025</td>
<td>4.70 – 5.30</td>
<td>≥ 0.018</td>
<td></td>
</tr>
<tr>
<td>PM 9 Ni</td>
<td>0.10</td>
<td>0.10 – 0.35</td>
<td>0.30 – 0.90</td>
<td>0.025</td>
<td>0.025</td>
<td>8.50 – 10.0</td>
<td>≥ 0.018</td>
<td></td>
</tr>
</tbody>
</table>
Table 3.3C Carbon-manganese steels for low temperature service.

Mechanical properties 1)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile strength (N/mm²)</th>
<th>Yield stress (%/mm²) minimum for thickness, (mm)</th>
<th>Elongation A₅ (%) minimum</th>
<th>Impact energy KJ, average ²)</th>
<th>Min design Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>360 - 480</td>
<td>≤ 15</td>
<td>235</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 16</td>
<td>215</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 40</td>
<td>26</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 360 - 2XM</td>
<td>400 - 490</td>
<td>265</td>
<td>24</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 2 - 2</td>
<td>400 - 490</td>
<td>255</td>
<td>24</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 2 - 3</td>
<td>400 - 490</td>
<td>255</td>
<td>24</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 2 - 4</td>
<td>400 - 490</td>
<td>255</td>
<td>24</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 2 - 4L</td>
<td>400 - 490</td>
<td>265</td>
<td>24</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 4 - 2</td>
<td>490 - 610</td>
<td>335</td>
<td>21</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 4 - 3</td>
<td>490 - 610</td>
<td>335</td>
<td>21</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 4 - 4</td>
<td>490 - 610</td>
<td>335</td>
<td>21</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
<tr>
<td>PM 4 - 4L</td>
<td>490 - 610</td>
<td>335</td>
<td>21</td>
<td>≤ 25</td>
<td>-25 - 35</td>
</tr>
</tbody>
</table>

1) These requirements are applicable to products up to maximum 40 mm thickness. For thickness exceeding 40 mm the requirements shall be agreed.
2) The specified impact toughness requirements also apply in the heat affected zone of welded connections and it is recommended that the steel is ordered with sufficient margin.
3) Materials for tanks or parts of tanks completely thermally stress relieved after welding may for all thicknesses up to 40 mm be tested at a temperature 5°C below the minimum design temperature.
4) Materials for liquefied gas carriers.
5) For thickness 25≤ts≤40 mm the impact test temperature shall be stamped on the products and stated in the certificate.
Table 3.4C Nickel alloy steels for low temperature service.

Mechanical properties

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile strength (N/mm²)</th>
<th>Yield stress minimum for thickness, (mm)</th>
<th>Elongation AV (%) minimum</th>
<th>Impact energy KV, average</th>
<th>Min design Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 1.5 Ni</td>
<td>470 - 640</td>
<td>275</td>
<td>265</td>
<td>22</td>
<td>≤ 25</td>
</tr>
<tr>
<td>PM 3.5 Ni</td>
<td>540 - 690</td>
<td>345</td>
<td>335</td>
<td>22</td>
<td>≤ 25</td>
</tr>
<tr>
<td>PM 5 Ni</td>
<td>570 - 710</td>
<td>390</td>
<td>380</td>
<td>21</td>
<td>≤ 25</td>
</tr>
<tr>
<td>PM 9 Ni</td>
<td>640 - 840</td>
<td>490</td>
<td>480</td>
<td>19</td>
<td>≤ 140</td>
</tr>
</tbody>
</table>

1) These requirements are applicable to products up to maximum 40 mm thickness. For thickness exceeding 40 mm the requirements shall be agreed.
2) The specified impact toughness requirements also apply in the heat affected zone of welded connections and it is recommended that the steel is ordered with sufficient margin.
3) Materials for liquefied gas carriers.
4) For thickness 25x≤540 mm the impact test temperature shall be stamped on the products and stated in the certificate.
5) In certain cases the materials shall be subjected to Pellini's drop weight test.

Table 3.5C Heat treatment of steels for low temperature service

<table>
<thead>
<tr>
<th>Grade</th>
<th>Heat treatment or condition of supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM 360 - 2KM</td>
<td>Plates: normalized sections: normalized, thermo-mechanically treated or controlled rolled</td>
</tr>
<tr>
<td>PM 2 - 2</td>
<td>Normalised, normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 2 - 3</td>
<td>Normalised, normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 2 - 4</td>
<td>Normalised, normalised and tempered or quench and temper</td>
</tr>
<tr>
<td>PM 2 - 4L</td>
<td>Normalised, normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 4 - 2</td>
<td>Normalised, normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 4 - 3</td>
<td>Normalised, normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 4 - 4</td>
<td>Normalised, normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 4 - 5L</td>
<td>Normalised, normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 1.5 Ni</td>
<td>Double normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 3.5 Ni</td>
<td>Double normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 5 Ni</td>
<td>Double normalised and tempered or quenched and tempered</td>
</tr>
<tr>
<td>PM 9 Ni</td>
<td>Double normalised and tempered or quenched and tempered</td>
</tr>
</tbody>
</table>

1) Other heat treating processes, e.g. quenching and tempering or thermo-mechanical controlled processing may be approved.
3) Quenching and tempering will normally be required for thicknesses above 30 mm.

3.4 Stainless Steel

3.4.1 Steel grades

3.4.1.1 Requirements are specified for seven grades of austenitic and two grades of duplex (ferritic/austenitic) stainless steels.

Steel grades with chemical composition and mechanical properties deviating from these specifications may be accepted for the purpose in question after consideration in each separate case.
The austenitic steels may be used for applications where the design temperature is not lower than -165°C.

3.4.2 Chemical composition
3.4.2.1 The chemical composition shall comply with the requirements given in Table 3.6C, or the approved specification.

3.4.3 Mechanical properties
3.4.3.1 The mechanical properties of the material shall comply with the requirements specified in Table 3.7C. For austenitic steels both the 0.2 and 1.0% yield stress shall be reported.
The values for tensile strength, yield stress and elongation refer to testing at room temperature.
For austenitic steels impact tests are only required for design temperatures below -105°C.
For duplex steels impact tests at design temperature or -20°C, whichever is the lower, are required.

3.4.4 Heat treatment
3.4.4.1 All materials shall be supplied in the solution treated condition.

3.4.5 Intercrystalline corrosion tests
3.4.5.1 Unless otherwise agreed by the Society for the order in question, the materials shall be subjected to intercrystalline corrosion test, in order to demonstrate that the material is not susceptible to intergranular corrosion resulting from grain boundary precipitation of chromium-rich carbides. One test shall be carried out for each tensile test. The testing shall be carried out according to ASTM A262, Practice E, Copper – Copper Sulphate - Sulphuric Acid Test or another recognized standard.
The bent specimens shall be free from cracks indicating the presence of intergranular attack.

### Table 3.6C Austenitic and duplex stainless steels.

#### Chemical composition

<table>
<thead>
<tr>
<th>Grade</th>
<th>C maximum</th>
<th>Si maximum</th>
<th>Mn maximum</th>
<th>P maximum</th>
<th>S maximum</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Austenitic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM 304 L</td>
<td>0.03</td>
<td>1.0</td>
<td>2.0</td>
<td>0.045</td>
<td>0.030</td>
<td>18.0 – 20.0</td>
<td>8.0 – 12.0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>PM 316 L</td>
<td>0.03</td>
<td>1.0</td>
<td>2.0</td>
<td>0.045</td>
<td>0.030</td>
<td>16.5 – 18.5</td>
<td>11.0 – 15.0</td>
<td>2.5 – 3.0</td>
<td></td>
</tr>
<tr>
<td>PM 316 LN</td>
<td>0.03</td>
<td>1.0</td>
<td>2.0</td>
<td>0.045</td>
<td>0.030</td>
<td>16.5 – 18.5</td>
<td>11.0 – 14.5</td>
<td>2.5 – 3.0</td>
<td>0.14 – 0.22</td>
</tr>
<tr>
<td>PM 317 L</td>
<td>0.03</td>
<td>1.0</td>
<td>2.0</td>
<td>0.045</td>
<td>0.030</td>
<td>18.0 – 20.0</td>
<td>11.0 – 15.0</td>
<td>3.0 – 4.0</td>
<td></td>
</tr>
<tr>
<td>PM 317 LN</td>
<td>0.03</td>
<td>1.0</td>
<td>2.0</td>
<td>0.045</td>
<td>0.030</td>
<td>18.0 – 20.0</td>
<td>12.5 – 15.0</td>
<td>3.0 – 4.0</td>
<td>0.14 – 0.22</td>
</tr>
<tr>
<td>PM 321</td>
<td>0.06</td>
<td>1.0</td>
<td>2.0</td>
<td>0.045</td>
<td>0.030</td>
<td>17.0 – 19.0</td>
<td>9.0 – 12.0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>PM 347</td>
<td>0.08</td>
<td>1.0</td>
<td>2.0</td>
<td>0.045</td>
<td>0.030</td>
<td>17.0 – 19.0</td>
<td>9.0 – 13.0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Duplex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNS S31803</td>
<td>0.03</td>
<td>1.0</td>
<td>2.0</td>
<td>0.036</td>
<td>0.020</td>
<td>21.0 – 23.0</td>
<td>4.5 – 6.5</td>
<td>2.5 – 3.5</td>
<td>M</td>
</tr>
<tr>
<td>UNS S32750</td>
<td>0.03</td>
<td>0.8</td>
<td>1.2</td>
<td>0.035</td>
<td>0.020</td>
<td>24.0 – 26.0</td>
<td>6.0 – 8.0</td>
<td>3.0 – 5.0</td>
<td>0.14 – 0.20</td>
</tr>
</tbody>
</table>
Table 3.7C Austenitic and duplex stainless steel.  
Mechanical properties

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile strength (N/mm²) $R_m$</th>
<th>Yield stress¹ (N/mm²) minimum $R_p0.2$, $R_p0.0$</th>
<th>Elongation (%) $A_S$</th>
<th>Impact energy Charpy V – notch⁵</th>
<th>Test temperature (°C)</th>
<th>Minimum Average (J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austenitic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM 304 L</td>
<td>450 – 700</td>
<td>175</td>
<td>215</td>
<td>40</td>
<td>-196</td>
<td>transverse: 27</td>
</tr>
<tr>
<td>PM 316 L</td>
<td>450 – 700</td>
<td>175</td>
<td>215</td>
<td>40</td>
<td>-196</td>
<td>longitudinal: 41</td>
</tr>
<tr>
<td>PM 316 L M</td>
<td>600 – 800</td>
<td>300</td>
<td>340</td>
<td>40</td>
<td>-196</td>
<td>transverse: 27</td>
</tr>
<tr>
<td>PM 317 L</td>
<td>500 – 700</td>
<td>175</td>
<td>215</td>
<td>40</td>
<td>-196</td>
<td>longitudinal: 41</td>
</tr>
<tr>
<td>PM 317 L M</td>
<td>600 – 800</td>
<td>300</td>
<td>340</td>
<td>40</td>
<td>-196</td>
<td>transverse: 27</td>
</tr>
<tr>
<td>PM 321</td>
<td>500 – 750</td>
<td>205</td>
<td>245</td>
<td>40</td>
<td>-196</td>
<td>longitudinal: 41</td>
</tr>
<tr>
<td>PM 347</td>
<td>500 – 750</td>
<td>205</td>
<td>245</td>
<td>40</td>
<td>-196</td>
<td>transverse: 27</td>
</tr>
<tr>
<td>Duplex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNS S31803</td>
<td>minimum 620</td>
<td>450</td>
<td>25</td>
<td>-20</td>
<td>longitudinal: 41</td>
<td></td>
</tr>
<tr>
<td>UNS S32750</td>
<td>minimum 690</td>
<td>550</td>
<td>25</td>
<td>-20</td>
<td>longitudinal: 41</td>
<td></td>
</tr>
</tbody>
</table>

¹ The specified yield stress at both 0.2% and 0.0% $R_p0.2$ and $R_p0.0$ respectively, shall be documented for austenitic stainless steels.
² Verification of impact values for austenitic stainless steel is required only for materials intended for design temperatures below -105°C.

3.5 Testing
3.5.1 General
3.5.1.1 The procedures used for all tests shall be in accordance with the appropriate requirements of this rule.

3.5.1.2 Test samples shall be taken from positions as required according to this Section.

3.5.2 Tensile testing at ambient temperature
3.5.2.1 Test pieces for tensile testing of plates at ambient temperature shall be cut with their principal axes transverse to the final direction of rolling.

For testing of sections the test pieces shall be taken transverse or parallel to the final direction of rolling at the option of the steelmaker.

3.5.2.2 For plates, one tensile test piece shall be taken from each rolled plate provided the weight of the piece does not exceed 2 500 kg.

Where ingot casting is used, the test piece shall represent the top of the ingot.

When the weight exceeds 2 500 kg, tensile test pieces shall be taken from both ends of the rolled plate.

3.5.2.3 When test pieces are required from each end of a rolled plate, the difference between the values obtained for the tensile strength shall not exceed 60 N/mm².

3.5.2.4 For sections, one tensile test piece shall be taken from test units of not more than 10 tonnes. The material in each test unit shall be from the same heat and of the same shape with a thickness variation of not more than 5 mm.
3.5.2.5 For thermo-mechanically controlled processed steel, accelerated cooled, additional testing in the simulated stress relieved condition may be required.

3.5.3 Tensile testing at high temperatures

3.5.3.1 When determination of lower yield stress or proof stress at high temperatures is required according to 3.2.3.2, the testing shall be carried out in compliance with ISO 783.

The straining rate when approaching the stress values shall be controlled to within 0.1 to 0.3% strain per minute.

The intervals used for estimation of strain rate from measurements of strain shall not exceed 6 seconds.

3.5.3.2 The test pieces shall be cut with their principal axes transverse to the final direction of rolling.

At least one tensile test shall be made on material from each cast. The pieces shall be taken from the thickest plate of the cast.

3.5.3.3 When no special test temperature is specified in the order, the tests shall be carried out at 300°C.

3.5.4 Impact testing

3.5.4.1 For material thickness 6 mm and above, impact testing shall be carried out at the prescribed temperatures.

The average value from each set of three impact test pieces shall comply with the appropriate requirements in tables 2.3, 2.4, 2.5, 3.3, 3.4, and 4.2. Further, only one individual value within each set may be below the specified minimum average value, but not lower than 70% of this value.

3.5.4.2 The required minimum values specified in 3.2, 3.3 and 3.4 refer to standard test pieces 10 x 10 mm. Where it is impossible to use a standard test piece, the larger of the following pieces shall be used: 10 x 7.5 mm, 10 x 5 mm.

The impact values required are then reduced to respectively 5/6 and 2/3 of the required values for standard test pieces.

3.5.4.3 The impact test pieces shall be situated so that the distance between the centre line of the test piece and the plate surface is not less than 1/4 of the plate thickness, where practicable.

3.5.4.4 For plates and flats having a width of 600 mm or more the test pieces shall be cut with their longitudinal axes transverse to the final direction of rolling. For other products the test pieces may be taken transverse or parallel to the final direction of rolling.

Requirements for test pieces cut with their longitudinal axes transverse and parallel to the final direction of rolling are stated in the tables as “transverse” and “longitudinal” respectively.

3.5.4.5 The notch shall be cut in a face of the test pieces which was originally perpendicular to the rolled surface.
3.5.4.6 For plates at least one set (3 pieces) of tests shall be made for each tensile test. When the test temperature is \(-50^\circ C\) or lower, one set of tests shall be taken from each end of the rolled plate regardless of the plate weight. For sections at least one set of tests shall be made for each tensile test. When the test temperature is \(-50^\circ C\) or lower, one set of tests shall be made for every 2 tonnes or part thereof of each type from the same heat and with thickness variation less than 5 mm.

3.5.5 Drop weight testing
3.5.5.1 When drop weight test is required according to 3.3.3.2, one set of tests (2 test pieces) shall be taken from the thickest plate alternatively section of each cast. The extent of testing may be reduced subject to a thorough statistical documentation.

3.5.6 Testing of through thickness properties
3.5.6.1 When steel with improved through thickness properties (Z-steel) is required or specified in the order, the materials shall be manufactured and tested in accordance with this chapter.

3.5.7 Intercrystalline corrosion testing
3.5.7.1 When intercrystalline corrosion testing is required, the test shall be carried out according to ASTM, A62, Practice E, Copper–Copper Sulfate–Sulfuric Acid Test or another recognized standard.

3.6 Inspection, Dimensional Tolerances and Surface Condition
3.6.1 Inspection
3.6.1.1 Surface inspection and checking of dimensions are the responsibility of the steelmaker who has to verify that the requirements concerning quality and dimensional tolerances are fulfilled prior to dispatch. The steelmaker is also responsible for compliance with the general requirements concerning freedom from harmful internal defects. Acceptance by the surveyors of material which is later found to be defective does not absolve the steelmaker from this responsibility.

3.6.1.2 Plates and other products shall be subjected to a thorough, visual inspection on both sides by the manufacturer to ensure freedom from defects and harmful imperfections. Examination by means of suitable non-destructive methods such as magnetic particle, dye penetrant and/or ultrasonic inspection may be required. All plates shall be accessible to the surveyor for final inspection and checking.

3.6.2 Tolerances
3.6.2.1 No minus tolerance is permitted in the thickness of plates intended for boilers, pressure vessels and low temperature service. For stainless steels intended for chemical tankers without pressure rating no plate shall vary more than 0.30 mm or 6% under the thickness specified whichever is the lesser. For sections the minus tolerance shall be in accordance with a recognized national or international standard.
3.6.3 Surface condition and rectification of defects
3.6.3.1 All products shall display a workmanlike finish free from defects and imperfections which may impair their proper workability and use.

3.6.3.2 Surface defects may be removed by local grinding. Normally the thickness beneath the ground area shall not be less than the nominal thickness of the material. Repair of deeper defects by grinding or welding will be subject to special consideration in each separate case, and shall not be carried out unless a detailed repair procedure is submitted and approved.

3.6.3.3 When defects are removed by grinding, complete elimination of the defects shall be proven by suitable non-destructive examination of the affected area.

3.6.3.4 Depressions caused by grinding shall show a smooth transition to the surface.

Section 4 Steel Tubes and Pipes
4.1 General
4.1.1 This section gives the requirements for steel tubes intended for use in the construction of boilers and heat exchangers, and for steel pipes intended for use in the pressure piping systems and in cargo and process piping arrangements in ships for liquefied gases where the design temperature is less than 0°C.

4.1.2 Steel pipes and tubes specified in this section, unless, where the materials are intended to be used in pressure vessel, are to be manufactured at the works which have been approved by Class PMDS in compliance with the requirements given in this chapter.

4.1.3 Steel pipes and tubes specified in this section are to be manufactured by seamless process in hot finished or cold-drawn condition or, unless otherwise specified hereunder, by electric resistance, induction or arc welded process in as welded condition or with subsequent hot-finished or cold-drawn conditioning.

4.1.4 Steel pipes and tubes having characteristics differing from the requirements in this section may be accepted subject to compliance with the requirements given in Class PMDS Rule. Such pipes and tubes are to be given a special designation.

4.2 Steel Tubes for Boilers and Heat Exchangers
4.2.1 Manufacture
4.2.1.1 The steel tubes are to be manufactured in accordance with the processes given in 4.1.3 of this Section, unless, where the tubes of grades T21, T22, T23 and T24 in welded process are not acceptable.

4.2.1.2 The tubes are to be supplied in a heat-treated condition in compliance with the requirements of Table 4.1.
Table 4.1 Requirements of Heat-treatment for Steel Pipes and Tubes

<table>
<thead>
<tr>
<th>MATERIAL GRADE</th>
<th>SEAMLESS PROCESS</th>
<th>WELDED PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HOT-FINISHED</td>
<td>COLD-DRAWN</td>
</tr>
<tr>
<td>T11</td>
<td>ANY</td>
<td>A or N</td>
</tr>
<tr>
<td>T12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P31L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P32L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P33L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P34L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Symbols used in this Table are as follows;
Any: Heat-treatment is not required, however, they may be heat-treated as deemed necessary.
A: Annealed
N: Normalized
N+T: Normalized and tempered
N2+T: Double normalized and tempered
Q+T: Quenched and tempered
Not applicable: The materials manufactured by welded process are not acceptable.

Table 4.2 Chemical Composition and Deoxidation Method of Steel Tubes for Boiler and Heat Exchanger

<table>
<thead>
<tr>
<th>MATERIAL GRADE</th>
<th>METHOD OF DEOXYDATION</th>
<th>CARBON STEEL</th>
<th>CHEMICAL COMPOSITION (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
</tr>
<tr>
<td>T11</td>
<td>ANY METHOD</td>
<td>0.18 max.</td>
<td>0.35 max</td>
</tr>
<tr>
<td>T12</td>
<td></td>
<td>0.10 – 0.20</td>
<td>0.10 – 0.35</td>
</tr>
<tr>
<td>T13</td>
<td></td>
<td>0.32 max.</td>
<td>0.30 – 0.50</td>
</tr>
<tr>
<td>T21</td>
<td>KILLED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T23</td>
<td></td>
<td>0.15 max.</td>
<td>0.50 max</td>
</tr>
<tr>
<td>T24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.2 Chemical composition
The chemical composition and deoxidation method of the steel tubes are to comply with the requirements given in Table 4.2.

4.2.3 Mechanical properties
4.2.3.1 The mechanical properties of the steel tubes are to comply with the requirements given in Table 4.3.

4.2.3.2 The steel tubes are to be subjected to the following mechanical tests in compliance with the requirements as given in 4.2.3.1 above:
- Tensile test.
- Flattening test.
- Flaring test or Flanging test.
- Reverse flattening test for welded tubes.

4.2.3.3 The procedures of the mechanical tests are to comply with requirements given in Class PMDS Rule.

4.3 Steel Pipes for Pressure Piping

4.3.1 Manufacture

4.3.1.1 The steel pipes are to be manufactured in accordance with the processes given in 4.1.3 of this Section, unless, where the pipes of Grades P13, P21, P22, P23 and P24 in welded process are not acceptable.

4.3.1.2 The pipes are to be supplied in a heat-treated condition in compliance with the requirements of Table 4.1.

4.3.2 Chemical composition

The chemical composition and deoxidation method of the steel pipes are to comply with the requirements given in Table 4.4.

4.3.3 Mechanical properties

4.3.3.1 The mechanical properties of the steel pipes are to comply with the requirements given in Table 4.5.

4.3.3.2 The steel pipes are to be subjected to the following mechanical tests in compliance with the requirements as given in 4.3.3.1 above:
- Tensile test.
- Flattening test or bending test.

4.3.3.3 The procedures of the mechanical tests are to comply with the requirements given in Class PMDS Rule.

4.4 Steel Pipes for Low Temperature Service

4.4.1 Manufacture
4.4.1.1 The requirements in applying to the steel pipes for low temperature service are limited in thickness up to 25 mm. Any requirement regarding these pipes over 25 mm in thickness is left to the discretion of Class PMDS.

Table 4.3 Mechanical Properties and Test Requirements of Steel Tubes for Boiler and Heat Exchanger

<table>
<thead>
<tr>
<th>MATERIAL GRADE</th>
<th>TENSILE STRENGTH (N/mm²)</th>
<th>YIELD STRESS min. (N/mm²)</th>
<th>ELONGATION %</th>
<th>FLATTENING TEST</th>
<th>FLARING OR FLANGING TEST</th>
<th>NO. OF TEST SPECIMENS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBON STEEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T11</td>
<td>320</td>
<td>175</td>
<td>26 (22)</td>
<td>0.09</td>
<td>1.20 D</td>
<td>D ≤ 63</td>
</tr>
<tr>
<td>T12</td>
<td>340</td>
<td></td>
<td></td>
<td></td>
<td>1.30 D</td>
<td>D+20</td>
</tr>
<tr>
<td>T13</td>
<td>410</td>
<td>255</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOW ALLOY STEEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T21</td>
<td>380</td>
<td>205</td>
<td>21 (17)</td>
<td>0.08</td>
<td>1.14 D</td>
<td></td>
</tr>
<tr>
<td>T22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. In case a test specimen of Type T2 as given in PMDS Rule is taken from the welded tubes, the test specimen is to be taken from the part in which the welded line is not included.
2. The values of elongation in parentheses are applicable to the test specimens taken transversely. In this case, the sampling material is to be heated 600°C to 650°C after being flattened and annealed in order to make it free from strain.
3. See PMDS Rule
4. Flanging test is only required for Grade T11 tubes having a wall thickness neither more than 110 of the outside diameter nor more than 5 mm.
5. Where: D = Outside diameter of the tube, mm.
6. No. of test specimens for Grade T11 seamless tubes: One sampling tube is to be selected from each lot of 100 lengths or fraction thereof with same size and same heat. Each one of tensile, flattening and flaring or flanging test specimens is to be taken from each of the sampling tubes.
7. No. of test specimens for seamless tubes other than Grade T11: One sampling tube is to be selected from each lot of 50 lengths or fraction thereof with same size and same heat. Each one of tensile, flattening and flaring test specimens is to be taken from each of the sampling tubes.
8. For welded tubes, in addition to the above Note 6 or Note 7, one sampling tube is to be selected from each lot of 50 lengths or fraction thereof with same size and same heat. One reverse flattening test specimen is to be taken from each of the sampling tubes. In this case, the sampling tubes may be the same as that in above Note 6 or Note 7.

Table 4.4 Chemical Composition and Deoxidation Method of Steel Pipes for Pressure Piping

<table>
<thead>
<tr>
<th>MATERIAL GRADE</th>
<th>METHOD OF DEOXIDATION</th>
<th>CHEMICAL COMPOSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C</td>
</tr>
<tr>
<td>CARBON STEEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P11</td>
<td>(SEE NOTE)</td>
<td>0.25 max</td>
</tr>
<tr>
<td>P12</td>
<td>KILLED</td>
<td>0.30 max</td>
</tr>
<tr>
<td>P13</td>
<td></td>
<td>0.33 max</td>
</tr>
<tr>
<td>LOW ALLOY STEEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P21</td>
<td>KILLED</td>
<td>0.10 – 0.20</td>
</tr>
<tr>
<td>P22</td>
<td></td>
<td>0.15 max</td>
</tr>
<tr>
<td>P23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Grade P11 seamless pipes: Semi-killed or killed.
Grade P11 welded pipes: Any method.
Table 4.5 Mechanical Properties and Test Requirements of Steel Pipes for Pressure Piping

<table>
<thead>
<tr>
<th>MATERIAL GRADE</th>
<th>TENSILE TEST</th>
<th>FLATTENING TEST (SEE NOTE 3)</th>
<th>BENDING TEST (SEE NOTE 5)</th>
<th>No. OF TEST SPECIMENS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TENSION STRENGTH min. (N/mm²)</td>
<td>YIELD STRESS min. (N/mm²)</td>
<td>ELONGATION ON L = 5.65 x A min. (SEE NOTE 2)</td>
<td>CONSTANT “e” for Formula of H (See Note 4)</td>
</tr>
<tr>
<td>CARBON STEEL</td>
<td>P11</td>
<td>370</td>
<td>215</td>
<td>24 (20)</td>
</tr>
<tr>
<td></td>
<td>P12</td>
<td>410</td>
<td>245</td>
<td>21 (17)</td>
</tr>
<tr>
<td></td>
<td>P13</td>
<td>480</td>
<td>275</td>
<td>19 (15)</td>
</tr>
<tr>
<td></td>
<td>P21</td>
<td>380</td>
<td>205</td>
<td>21 (17)</td>
</tr>
<tr>
<td></td>
<td>P22</td>
<td>410</td>
<td>205</td>
<td>21 (17)</td>
</tr>
<tr>
<td></td>
<td>P23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Where a test specimen of Type T2 as given in PMDS Rule is taken from welded pipes, the test specimen is to be taken from the part in which the welded line is not included.
2. The values of elongation in parentheses are applicable to the test specimens taken transversely. In this case, the sampling material is to be heated 600°C to 650°C after being flattened and annealed in order to make it free from strain.
3. The flattening test is required of the pipes of which the bending test is not required. See Note 5.
4. PMDS Rule.
5. Bending test is only required of carbon steel pipes of all grades having outside diameter not exceeding 50 mm. In case of the welded pipes, the welded line is to be so placed as it is subjected to the greatest tension during the test.
6. No. of test specimens for Grade P11:
   (a) For pipes of 150 mm and under in outside diameter:
       One sampling pipe is to be selected from each lot of 200 lengths or fraction thereof with same size and same heat. Each one of tensile and flattening or bending test specimen is to be taken from each of the sampling pipe.
   (b) For pipes over 150 mm in outside diameter:
       One sampling pipe is to be selected from each lot of 100 lengths or fraction thereof with same size and same heat. Each one of tensile and flattening test specimen is to be taken from each of the sampling pipe.
7. No. of test specimens for steel pipes other than Grade P11:
   One sampling pipe is to be selected from each lot of 50 lengths or fraction thereof with same size and same heat. Each one of tensile and flattening test specimen is to be taken from each of the sampling pipe.

4.4.1.2 The steel pipes are to be manufactured in accordance with the processes given in 4.1.3 of this Section, unless, where the pipes of Grades P33L and P34L in welded process are not acceptable.

4.4.1.3 The pipes are to be supplied in a heat-treated condition in compliance with the requirements of Table 4.1.

4.4.2 Chemical composition
The steel pipes are to be of killed and fine grain treated. The chemical composition of the steel pipes is to be in compliance with requirements given in Table 4.6.

4.4.3 Mechanical properties
4.4.3.1 The mechanical properties of the steel pipes are to comply with the requirements given in Table 4.7.
4.4.3.2 The steel pipes are to be subjected to the following mechanical tests in compliance with the requirements as given in 4.4.3.1 above:
- Tensile test.
- Flattening test or Bending test.
- Impact test.

4.4.3.3 The procedures of the mechanical tests are to comply with the requirements given in Class PMDS Rule.

4.5 Hydraulic Tests
4.5.1 Each pipe and tube is to be subjected to a satisfactory hydraulic test at the manufacturer’s works by a pressure determined from the following formula and need not to exceed 20MPa.

\[ P = (1.2)(Y)(t) / D \]

Where:
- \( P \) = Hydraulic test pressure, in MPa.
- \( t \) = Wall thickness of pipe or tube, in mm.
- \( D \) = Outside diameter of pipe or tube, in mm
- \( Y \) = Specified minimum yield stress, in N/mm\(^2\)

### Table 4.6 Chemical Composition of Steel Pipes for Low Temperature Service

<table>
<thead>
<tr>
<th>MATERIAL GRADE</th>
<th>CHEMICAL COMPOSITION (%) (SEE NOTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C (max)</td>
</tr>
<tr>
<td>P31L</td>
<td>0.25</td>
</tr>
<tr>
<td>P32L</td>
<td>0.19</td>
</tr>
<tr>
<td>P33L</td>
<td>0.18</td>
</tr>
<tr>
<td>P34L</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Note: The grain refining elements and residual elements are to comply with the manufacturing specifications approved by the Society.

### Table 4.7 Mechanical Properties and Test Requirements of Steel Pipes for Low Temperature Service

<table>
<thead>
<tr>
<th>MATERIAL GRADE</th>
<th>APPLICABLE DESIGN TEMPERATURE (°C)</th>
<th>TENSILE TEST (SEE NOTES 1 AND 2)</th>
<th>FLATTENING TEST (SEE NOTE 4)</th>
<th>BENDING TEST (SEE NOTE 7)</th>
<th>IMPACT TEST</th>
<th>No. OF TEST SPECIMENS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TENSILE STRENGTH min. (N/mm²)</td>
<td>YIELD STRESS min. (N/mm²)</td>
<td>ELONGATION on L = 5.65 X A (SEE NOTE 3) (%)</td>
<td>CONSTANT “e” FOR FORMULA OF H (SEE NOTE 5)</td>
<td>MANDREL DI x ANGLE</td>
</tr>
<tr>
<td>P31L</td>
<td>-55</td>
<td>390</td>
<td>205</td>
<td>26 (19)</td>
<td>0.06</td>
<td>12 TIMES THE OUTSIDE DI OF PIPE</td>
</tr>
<tr>
<td>P33L</td>
<td>-65</td>
<td>450</td>
<td>245</td>
<td>20 (14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P34L</td>
<td>-80</td>
<td>650</td>
<td>320</td>
<td>15 (11)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Where a test specimen of Type T2 as given in PMDS Rule is taken from the electric resistance welded pipes, the test specimen is to be taken from the part in which the welded line is not included.
2. Where the nominal diameter of steel pipes is 200 mm and over, the tensile test specimen may be taken transversely.
3. The values of elongation in parentheses are applicable to the test specimens taken transversely. In this case, the sampling material is to be heated 600°C after being flattened and annealed in order to make it free from strain.
4. The flattening test is required of the pipes of which the bending test is not required. See Note 6.
5. See PMDS Rule.
6. Bending test is only required of steel pipes of all grades having outside diameter not exceeding 50 mm. In case of the welded pipes, the welded line is to be placed on the side subject to the greatest tension during the test.
7. For Grade P31L steel pipes intended to be applied in a higher design temperature, the impact test may be carried out at a temperature 5°C below design temperature or −20°C, whichever is the lower.
8. No. of test specimens:
   One sampling pipe is to be taken from each lot of 50 lengths or fraction thereof with same size and same heat.
   One tensile test specimen, one flattening or bending test specimen and one set of three impact test specimens of Type N1 are to be taken from each of the sampling pipes.
9. For welded pipes, in addition to the above Note 8, one set of three impact test specimens of Type N1 is to be taken from the middle of pipe wall thickness, and is notched perpendicular to surface of pipe at center of weld metal.

4.5.2 Notwithstanding the requirements of 4.5.1 above, the test pressure in compliance with a recognized national or international standard may be accepted subject to special approval of Class PMDS.
4.5.3 Either an ultrasonic or eddy current test can be accepted in lieu of the hydraulic test, subject to special approval.
4.5.4 In case the tubes or pipes intend only for stanchion, the hydraulic test may be omitted.
4.5.5 Unless otherwise agreed, the manufacturer’s certificate of satisfactory hydraulic test will be accepted.

4.6 Quality Inspections
4.6.1 Dimensional tolerances
4.6.1.1 The tolerances on the wall thickness and diameter of the pipes and tubes are to be in accordance with a recognized national or international standard.
4.6.1.2 Notwithstanding the requirements of 4.6.1.1 above, wall thickness of the steel tubes for boiler and heat exchanger in minus tolerance is not acceptable.
4.6.2 The finished tubes and pipes are to have workmanlike internal and outer surfaces and to be free from any defects prejudicial to their intended proper applications. The wall thickness is to be regular and within the specified tolerance throughout.
4.6.3 The tubes and pipes are to be presented for visual examination and verification of dimensions.

Section 5 Bars for Chain Cables
5.1 General
5.1.1 Scope
5.1.1.1 This section specifies the requirements for hot rolled steel bars of grades PM K1, PM K2 and PM K3 intended for chain cable links and accessories.
5.2 Manufacture
5.2.1 All bars shall be made at works approved by Class PMDS.
5.3 Chemical composition

5.3.1 The chemical composition of each heat shall be determined and comply with the overall limits given in Table 5.1 and, where applicable, the approved specification.

5.4 Mechanical properties

5.4.1 The mechanical properties shall comply with the requirements given in Table 5.1.

5.5 Heat treatment

5.5.1 Unless otherwise approved, the bars shall be delivered in the as rolled condition. For mechanical testing, bar material shall be tested in the condition of heat treatment used for the chain as advised by the chain manufacturer and indicated in Table 5.1.

**Table 5.1 Material requirements for bars for chain cables**

<table>
<thead>
<tr>
<th>GRADE</th>
<th>NV K1</th>
<th>NV K2</th>
<th>NV K3</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEOXIDATION AND FINE-GRAIN TREATMENT</td>
<td>KILLED</td>
<td>KILLED, FINE-GRAN TREATED WITH AI</td>
<td>KILLED, FINE-GRAN TREATED</td>
</tr>
<tr>
<td>HEAT TREATMENT FOR FINISHED CHAIN CABLES</td>
<td>AS WELDED OR NORMALISED</td>
<td>AS WELDED OR NORMALISED</td>
<td>QUENCHED AND TEMPERED, NORMALISED OR NORMALISED</td>
</tr>
<tr>
<td>CHEMICAL COMPOSITION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARBON</td>
<td>%</td>
<td>MAXIMUM 0.20</td>
<td>MAXIMUM 0.24</td>
</tr>
<tr>
<td>MANGANESE</td>
<td>%</td>
<td>0.40 – 1.60</td>
<td>0.50 – 1.60</td>
</tr>
<tr>
<td>SILICON</td>
<td>%</td>
<td>0.15 – 0.35</td>
<td>0.15 – 0.35</td>
</tr>
<tr>
<td>PHOSPHORUS</td>
<td>%</td>
<td>MAXIMUM 0.040</td>
<td>MAXIMUM 0.035</td>
</tr>
<tr>
<td>SULPHUR</td>
<td>%</td>
<td>MAXIMUM 0.040</td>
<td>MAXIMUM 0.035</td>
</tr>
<tr>
<td>ALUMINIUM</td>
<td>%</td>
<td>--</td>
<td>0.020 – 0.065</td>
</tr>
<tr>
<td>NITROGEN</td>
<td>%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>MECHANICAL PROPERTIES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YIELD STRESS $R_y$ (MPA)</td>
<td>--</td>
<td>MINIMUM 295</td>
<td>MINIMUM 410</td>
</tr>
<tr>
<td>TENSILE STRENGTH $R_m$ (MPA)</td>
<td>--</td>
<td>490 – 690</td>
<td>MINIMUM 690</td>
</tr>
<tr>
<td>ELONGATION $A_5$ (%)</td>
<td>--</td>
<td>MINIMUM 22</td>
<td>MINIMUM 17</td>
</tr>
<tr>
<td>REDUCTION OF AREA $Z$ (%)</td>
<td>--</td>
<td>--</td>
<td>MINIMUM 40</td>
</tr>
<tr>
<td>AVERAGE IMPACT ENERGY ($\Delta$) and test temperature</td>
<td>--</td>
<td>MINIMUM 27, 0°C</td>
<td>MINIMUM 60, 0°C</td>
</tr>
</tbody>
</table>

5.6. Testing

5.6.1 Test units, test material and number of tests

5.6.1.1 Bars of the same nominal diameter shall be presented in test units of 50 tonnes or fraction thereof from the same heat.

5.6.1.2 Test material shall consist of a suitable length from one bar in each test unit. Where chain cables are supplied heat treated, see 5.5.1, the test material shall be simulated heat treated in full cross-section. Test material shall be suitably marked for identification with the bars represented.

5.6.1.3 For each test unit, one tensile and, where required, three Charpy V-notch test pieces shall be taken in the longitudinal direction at a depth one third radius below the surface. For Charpy testing, the notch shall be cut in a face of the test piece which was originally approximately perpendicular to the rolled surface.
5.6.1.4 The preparation of test pieces and the procedures used for mechanical testing shall comply with the relevant requirements of Class PMDS Rule.

5.7 Mechanical properties
5.7.1 The mechanical properties shall comply with the values given in Table 5.1.

5.7.2 If the results do not meet the specified requirements the re-test procedures in Class PMDS Rule may be adopted. Where bars and the associated test material are submitted to re-heat treatment, all the tests previously performed shall be repeated and the results must meet the specified requirements.

5.8 Inspection, Tolerances and Repair
5.8.1 Inspection and tolerances
5.8.1.1 Surface inspection and verification of dimensions are the responsibility of the manufacturer.

5.8.1.2 The diameter and roundness shall be within the tolerances given in Table 5.2.

**Table 5.2 Dimensional tolerance of rolled bars**

<table>
<thead>
<tr>
<th>NOMINAL DIAMETER (mm)</th>
<th>TOLERANCE ON DIAMETER (mm)</th>
<th>TOLERANCE ON ROUNDNESS (d_max - d_min) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25</td>
<td>-0.1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>25 – 35</td>
<td>-0.1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>36 – 50</td>
<td>-0.1.6</td>
<td>1.1</td>
</tr>
<tr>
<td>51 – 80</td>
<td>-0.2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>81 – 100</td>
<td>-0.2.6</td>
<td>1.95</td>
</tr>
<tr>
<td>101 – 120</td>
<td>-0.3.0</td>
<td>2.25</td>
</tr>
<tr>
<td>121 – 160</td>
<td>-0.4.0</td>
<td>3.00</td>
</tr>
</tbody>
</table>

5.9 Repair
5.9.1 Surface defects may be repaired by grinding provided the admissible tolerance is not exceeded.

5.10 Identification and Certification
5.10.1 Marking
5.10.1.1 The minimum markings required for the bars are the manufacturer's brand mark, the steel grade and an abbreviated symbol of the heat.

Bars having diameter of up to and including 40 mm combined into bundles, may be marked on permanently affixed labels.

5.10.2 Certification
5.10.2.1 The manufacturer shall provide the type of inspection certificate required in the relevant design and construction rules giving the following particulars for each test unit which has been accepted:

- purchaser’s name, order number and vessel identification, where known
- manufacturer’s name
- number and dimensions of bars and steel grade
- identification marking of bars
- heat number and chemical composition
- results of mechanical tests
- details of heat treatment of test material, where applicable
- results of any supplementary and additional test requirements specified.
MAJOR CHANGES AND EFFECTIVE DATES

3. Amendments on November 15th 2013.
   3.1. Chapter 11 has been amended.

   Effective date and Application
   - The effective date of the amendments is 30 December 2013.

   2.1. Chapter 10 has been amended.
   2.2. Chapter 4 – Section 8
       2.2.1. Sub paragraph 8.4 has been amended.
   2.3. Chapter 8 – Section 4 has been amended.
   2.4. Chapter 8 – Section 5 has been amended.

   Effective date and Application
   - The effective date of the amendments is 7 July 2013.

1. Amendments on June 14th 2013.
   1.1. Chapter 1 – Section 4.
       1.1.1. Sub paragraph 4.1 has been amended.
       1.1.2. Sub paragraph 4.2 has been amended.
       1.1.3. Sub paragraph 4.2.1 has been amended.
       1.1.4. Sub paragraph 4.2.2 has been amended.
       1.1.5. Sub paragraph 4.2.3 has been amended.
       1.1.6. Sub paragraph 4.2.4 has been amended.
   1.2. Chapter 1 – Section 6.
       1.2.1. Sub paragraph 6.59 has been amended.
       1.2.2. Sub paragraph 6.60 has been amended.
       1.2.3. Sub paragraph 6.61 has been amended.
       1.2.4. Sub paragraph 6.62 has been amended.

   Effective date and Application
   - The effective date of the amendments is 30 June 2013.
## Record of Changes

<table>
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<tr>
<th>Old Version</th>
<th>New Revision</th>
<th>Date</th>
<th>By Approved</th>
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<tbody>
<tr>
<td><strong>3.1. PS</strong></td>
<td><strong>3.1. H</strong></td>
<td>June 23/15</td>
<td>José Stoute</td>
</tr>
<tr>
<td>This class is to be assigned to the ship’s hull which in all their parts complies with the Rules for the draught required.</td>
<td>This class notation is to be assigned to the ship’s hull which in all their parts complies with the Rules for the draught required.</td>
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<td></td>
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<tr>
<td><strong>3.2. MPS</strong></td>
<td><strong>3.2. M</strong></td>
<td>June 23/15</td>
<td>José Stoute</td>
</tr>
<tr>
<td>This class is to be assigned to the machinery including propelling and essential auxiliary machinery and all other equipment covered by the classification which complies with the Rules.</td>
<td>This class notation is to be assigned to the machinery including propelling and essential auxiliary machinery and all other equipment covered by the classification which complies with the Rules.</td>
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<tr>
<td><strong>3.3.1.1.</strong></td>
<td><strong>3.3.1.1.</strong></td>
<td>June 23/15</td>
<td>José Stoute</td>
</tr>
<tr>
<td>For ships engaged in service restricted to only coastal areas within generally 20 miles from the nearest land or areas deemed equivalent by the Society (hereinafter, referred to as smooth water service):</td>
<td>Area I means an area in open seas in which the ship in the course of navigation is not more than 200 miles from a place of refuge, the permissible distance between places of refuge not exceeding 400 miles. Area II means an area in open seas in which the ship in the course of navigation is not more than 50 miles from a place of refuge, the permissible distance between places of refuge not exceeding 100 miles. Area III Coastal navigation up to 25 miles from a shelter place and a distance between two shelter places up to 50 miles. For ships engaged in service restricted to only coastal areas within generally 20 miles from the nearest land or areas deemed equivalent by the Society (hereinafter, referred to as smooth water service):</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Coasting Service (Abbreviated to CS)</em></td>
<td><em>Coasting Service (Abbreviated to CS)</em></td>
<td></td>
<td></td>
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<tr>
<td><strong>3.3.2.3.</strong></td>
<td><strong>3.3.2.3.</strong></td>
<td>June 23/15</td>
<td>José Stoute</td>
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<tr>
<td>3.3.2.3. For ships made of Glass reinforced plastics:</td>
<td>Glass reinforced plastics (abbreviated to GRP)</td>
<td></td>
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</table>
## Record of Changes

<table>
<thead>
<tr>
<th>Old Version</th>
<th>New Revision</th>
<th>Date</th>
<th>By Approved</th>
</tr>
</thead>
</table>
| 2.3. Annual Survey  
2.3.1. Shall be carried out between special surveys (or between initial and special survey) within three months before or after each anniversary date of the Classification Certificate. | 2.3. Annual Survey  
2.3.1. Shall be carried out between special surveys (or between initial and special survey) within three months before or after each anniversary date of the Classification Certificate. In case whereas any annual survey is due and not completed in time, within any given window period, PMDS Technical Committee will decide upon validating an “Occasional survey equivalent to an Annual Survey”, on a case-by-case basis. | Nov/ 18 / 15 | José Stoute |