Tasneef®
Life Environmentally Optimized

RULES FOR THE CLASSIFICATION OF FAST PATROL VESSELS

Effective from 1 January 2016

Part C

Machinery, Systems and Fire Protection

Emirates Classification Society (Tasneef)
Aldar HQ 19th Floor,
Al Raha Beach, Abu Dhabi, UAE
Abu Dhabi, United Arab Emirates

Phone (+971) 2 692 2333
Fax (+971) 2 445 433
P.O. Box. 111155
info@tasneef.ae

GENERAL CONDITIONS

Definitions:

"*Administration*" means the Government of the State whose flag the Ship is entitled to fly or under whose authority the Ship is authorized to operate in the specific case.

"IACS" means the International Association of Classification Societies.

"*Interested Party*" means the party, other than the Society, having an interest in or responsibility for the Ship, product, plant or system subject to classification or certification (such as the owner of the Ship and his representatives, the ship builder, the engine builder or the supplier of parts to be tested) who requests the Services or on whose behalf the Services are requested.

"*Owner*" means the registered owner, the ship owner, the manager or any other party with the responsibility, legally or contractually, to keep the ship seaworthy or in service, having particular regard to the provisions relating to the maintenance of class laid down in Part A, Chapter 2 of the Rules for the Classification of Ships or in the corresponding rules indicated in the specific Rules.

"Rules" in these General Conditions means the documents below issued by the Society:

(i) Rules for the Classification of Ships or other special units;
(ii) Complementary Rules containing the requirements for product, plant, system and other certification or containing the requirements for the assignment of additional class notations;
(iii) Rules for the application of statutory rules, containing the rules to perform the duties delegated by Administrations;
(iv) Guides to carry out particular activities connected with Services;
(v) Any other technical document, as for example rule variations or interpretations.

"*Services*" means the activities described in Article 1 below, rendered by the Society upon request made by or on behalf of the Interested Party.

"Ship" means ships, boats, craft and other special units, as for example offshore structures, floating units and underwater craft.

"*Society*" or *"TASNEEF"* means Tasneef and/or all the companies in the Tasneef Group which provide the Services.

"*Surveyor*" means technical staff acting on behalf of the Society in performing the Services.

Article 1

1.1. The purpose of the Society is, among others, the classification and certification of ships and the certification of their parts and components. In particular, the Society:
(i) sets forth and develops Rules;
(ii) publishes the Register of Ships;
(iii) issues certificates, statements and reports based on its survey activities.

1.2. The Society also takes part in the implementation of national and international rules and standards as delegated by various Governments.

1.3. The Society carries out technical assistance activities on request and provides special services outside the scope of classification, which are regulated by these general conditions, unless expressly excluded in the particular contract.

Article 2

2.1. The Rules developed by the Society reflect the level of its technical knowledge at the time they are published. Therefore, the Society, although committed also through its research and development services to continuous updating of the Rules, does not guarantee the Rules meet state-of-the-art science and technology at the time of publication or that they meet the Society's or others' subsequent technical developments.

2.2. The Interested Party is required to know the Rules on the basis of which the Services are provided. With particular reference to Classification Services, special attention is to be given to the Rules concerning class suspension, withdrawal and reinstatement. In case of doubt or inaccuracy, the Interested Party is to promptly contact the Society for clarification.
The Rules for Classification of Ships are published on the Society's website: www.tasneef.ae.

2.3. The Society exercises due care and skill:
(i) in the selection of its Surveyors
(ii) in the performance of its Services, taking into account the level of its technical knowledge at the time the Services are performed.

2.4. Surveys conducted by the Society include, but are not limited to, visual inspection and non-destructive testing. Unless otherwise required, surveys are conducted through sampling techniques and do not consist of comprehensive verification or monitoring of the Ship or of the items subject to certification. The surveys and checks made by the Society on board ship do not necessarily require the constant and continuous presence of the Surveyor. The Society may also commission laboratory testing, underwater inspection and other checks carried out by and under the responsibility of qualified service suppliers. Survey practices and procedures are selected by the Society based on its experience and knowledge and according to generally accepted technical standards in the sector.

Article 3

3.1. The class assigned to a Ship, like the reports, statements, certificates or any other document or information issued by the Society, reflects the opinion of the Society concerning compliance, at the time the Service is provided, of the Ship or product subject to certification, with the applicable Rules (given the intended use and within the relevant time frame).
The Society is under no obligation to make statements or provide information about elements or facts which are not part of the specific scope of the Service requested by the Interested Party or on its behalf.

3.2. No report, statement, notation on a plan, review, Certificate of Classification, document or information issued or given as part of the Services provided by the Society shall have any legal effect or implication other than a representation that, on the basis of the checks made by the Society, the Ship, structure, materials, equipment, machinery or any other item covered by such document or information meet the Rules. Any such document is issued solely for the use of the Society, its committees and clients or other duly authorised bodies and for no other purpose. Therefore, the Society cannot be held liable for any act made or document issued by other parties on the basis of the statements or information given by the Society. The validity, application, meaning and interpretation of a Certificate of Classification, or any other document or information issued by the Society in connection with its Services, is governed by the Rules of the Society, which is the sole subject entitled to make such interpretation. Any disagreement on technical matters between the Interested Party and the Surveyor in the carrying out of his functions shall be raised in writing as soon as possible with the Society, which will settle any divergence of opinion or dispute.

3.3. The classification of a Ship, or the issuance of a certificate or other document connected with classification or certificate on and in general with the performance of Services by the Society shall have the validity conferred upon it by the Rules of the Society at the time of the assignment of class or issuance of the certificate; in no case shall it amount to a statement or warranty of seaworthiness,

structural integrity, quality or fitness for a particular purpose or service of any Ship, structure, material, equipment or machinery inspected or tested by the Society.

3.4. Any document issued by the Society in relation to its activities reflects the condition of the Ship or the subject of certification or other activity at the time of the check.

3.5. The Rules, surveys and activities performed by the Society, reports, certificates and other documents issued by the Society are in no way intended to replace the duties and responsibilities of other parties such as Governments, designers, ship builders, manufacturers, repairers, suppliers, contractors or sub-contractors, Owners, operators, charterers, underwriters, sellers or intended buyers of a Ship or other product or system surveyed.

These documents and activities do not relieve such parties from any fulfilment, warranty, responsibility, duty or obligation (also of a contractual nature) expressed or implied or in any case incumbent on them, nor do they confer on such parties any right, claim or cause of action against the Society. With particular regard to the duties of the ship Owner, the Services undertaken by the Society do not relieve the Owner of his duty to ensure proper maintenance of the Ship and ensure seaworthiness at all times. Likewise, the Rules, surveys performed, reports, certificates and other documents issued by the Society are intended neither to guarantee the buyers of the Ship, its components or any other surveyed or certified item, nor to relieve the seller of the duties arising out of the law or the contract, regarding the quality, commercial value or characteristics of the item which is the subject of transaction.

In no case, therefore, shall the Society assume the obligations incumbent upon the above-mentioned parties, even when it is consulted in connection with matters not covered by its Rules or other documents.

In consideration of the above, the Interested Party undertakes to relieve and hold harmless the Society from any third party claim, as well as from any liability in relation to the latter concerning the Services rendered.

Insofar as they are not expressly provided for in these General Conditions, the duties and responsibilities of the Owner and Interested Parties with respect to the services rendered by the Society are described in the Rules applicable to the specific Service rendered.

Article 4

4.1. Any request for the Society's Services shall be submitted in writing and signed by or on behalf of the Interested Party. Such a request will be considered irrevocable as soon as received by the Society and shall entail acceptance by the applicant of all relevant requirements of the Rules, including these General Conditions. Upon acceptance of the written request by the Society, a contract between the Society and the Interested Party is entered into, which is regulated by the present General Conditions.

4.2. In consideration of the Services rendered by the Society, the Interested Party and the person requesting the service shall be jointly liable for the payment of the relevant fees, even if the service is not concluded for any cause not pertaining to the Society. In the latter case, the Society shall not be held liable for non-fulfilment or partial fulfilment of the Services requested. In the event of late payment, interest at the legal current rate increased by 1.5% may be demanded.

4.3. The contract for the classification of a Ship or for other Services may be terminated and any certificates revoked at the request of one of the parties, subject to at least 30 days' notice to be given in writing. Failure to pay, even in part, the fees due for Services carried out by the Society will entitle the Society to immediately terminate the contract and suspend the Services.

For every termination of the contract, the fees for the activities performed until the time of the termination shall be owed to the Society as well as the expenses incurred in view of activities already programmed; this is without prejudice to the right to compensation due to the Society as a consequence of the termination.

With particular reference to Ship classification and certification, unless decided otherwise by the Society, termination of the contract implies that the assignment of class to a Ship is withheld or, if already assigned, that it is suspended or withdrawn; any statutory certificates issued by the Society will be withdrawn in those cases where provided for by agreements between the Society and the flag State.

Article 5

5.1. In providing the Services, as well as other correlated information or advice, the Society, its Surveyors, servants or agents operate with due diligence for the proper execution of the activity. However, considering the nature of the activities performed (see art. 2.4), it is not possible to guarantee absolute accuracy, correctness and completeness of any information or advice supplied. Express and implied warranties are specifically disclaimed.

Therefore, except as provided for in paragraph 5.2 below, and also in the case of activities carried out by delegation of Governments, neither the Society nor any of its Surveyors will be liable for any loss, damage or expense of whatever nature sustained by any person, in tort or in contract, derived from carrying out the Services.

5.2. Notwithstanding the provisions in paragraph 5.1 above, should any user of the Society's Services prove that he has suffered a loss or damage due to any negligent act or omission of the Society, its Surveyors, servants or agents, then the Society will pay compensation to such person for his proved loss, up to, but not exceeding, five times the amount of the fees charged for the specific services, information or opinions from which the loss or damage derives or, if no fee has been charged, a maximum of AED5,000 (Arab Emirates Dirhams Five Thousand only). Where the fees charged are related to a number of Services, the amount of the fees will be apportioned for the purpose of the calculation of the maximum compensation, by reference to the estimated time involved in the performance of the Service from which the damage or loss derives. Any liability for indirect or consequential loss, damage or expense is specifically excluded. In any case, irrespective of the amount of the fees charged, the maximum damages payable by the Society will not be more than AED5,000,000 (Arab Emirates Dirhams Five Millions only). Payment of compensation under this paragraph will not entail any admission of responsibility and/or liability by the Society and will be made without prejudice to the disclaimer clause contained in paragraph 5.1 above.

5.3. Any claim for loss or damage of whatever nature by virtue of the provisions set forth herein shall be made to the Society in writing, within the shorter of the following periods: (i) THREE (3) MONTHS from the date on which the Services were performed, or (ii) THREE (3) MONTHS from the date on which the damage was discovered. Failure to comply with the above deadline will constitute an absolute bar to the pursuit of such a claim against the Society.

Article 6

6.1. These General Conditions shall be governed by and construed in accordance with United Arab Emirates (UAE) law, and any dispute arising from or in connection with the Rules or with the Services of the Society, including any issues concerning responsibility, liability or limitations of liability of the Society, shall be determined in accordance with UAE law. The courts of the Dubai International Financial Centre (DIFC) shall have exclusive jurisdiction in relation to any claim or dispute which may arise out of or in connection with the Rules or with the Services of the Society.

6.2. However,

(i) In cases where neither the claim nor any counterclaim exceeds the sum of AED300,000 (Arab Emirates Dirhams Three Hundred Thousand) the dispute shall be referred to the jurisdiction of the DIFC Small Claims Tribunal; and

(ii) for disputes concerning non-payment of the fees and/or expenses due to the Society for services, the Society shall have the

right to submit any claim to the jurisdiction of the Courts of the place where the registered or operating office of the Interested Party or of the applicant who requested the Service is located.
In the case of actions taken against the Society by a third party before a public Court, the Society shall also have the right to summon the Interested Party or the subject who requested the Service before that Court, in order to be relieved and held harmless according to art. 3.5 above.

Article 7

7.1. All plans, specifications, documents and information provided by, issued by, or made known to the Society, in connection with the performance of its Services, will be treated as confidential and will not be made available to any other party other than the Owner without authorization of the Interested Party, except as provided for or required by any applicable international, European or domestic legislation, Charter or other IACS resolutions, or order from a competent authority. Information about the status and validity of class and statutory certificates, including transfers, changes, suspensions, withdrawals of class, recommendations/conditions of class, operating conditions or restrictions issued against classed ships and other related information, as may be required, may be published on the website or released by other means, without the prior consent of the Interested Party.
Information about the status and validity of other certificates and statements may also be published on the website or released by other means, without the prior consent of the Interested Party.

7.2. Notwithstanding the general duty of confidentiality owed by the Society to its clients in clause 7.1 above, the Society's clients hereby accept that the Society may participate in the IACS Early Warning System which requires each Classification Society to provide other involved Classification Societies with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and used to facilitate the proper working of the IACS Early Warning System. The Society will provide its clients with written details of such information sent to the involved Classification Societies.

7.3. In the event of transfer of class, addition of a second class or withdrawal from a double/dual class, the Interested Party undertakes to provide or to permit the Society to provide the other Classification Society with all building plans and drawings, certificates, documents and information relevant to the classed unit, including its history file, as the other Classification Society may require for the purpose of classification in compliance with the applicable legislation and relative IACS Procedure. It is the Owner's duty to ensure that, whenever required, the consent of the builder is obtained with regard to the provision of plans and drawings to the new Society, either by way of appropriate stipulation in the building contract or by other agreement.
In the event that the ownership of the ship, product or system subject to certification is transferred to a new subject, the latter shall have the right to access all pertinent drawings, specifications, documents or information issued by the Society or which has come to the knowledge of the Society while carrying out its Services, even if related to a period prior to transfer of ownership.

Article 8

8.1. Should any part of these General Conditions be declared invalid, this will not affect the validity of the remaining provisions.

EXPLANATORY NOTE TO PART C

1. Reference edition

The reference edition for Part C is this edition effective from 1 January 2016.

2. New editions after the reference edition

Except in particular cases, a new edition of the Rules is published annually.

3. Effective date of the requirements

3.1 All requirements in which new or amended provisions with respect to those contained in the reference edition have been introduced are followed by a date shown in brackets.

3.2 The date shown in brackets is the effective date of entry into force of the requirements as amended by the last updating. The effective date of all those requirements not followed by any date shown in brackets is that of the reference edition.

4. Rule Variations and Corrigenda

Until the next edition of the Rules is published, Rule Variations and/or corrigenda, as necessary, will be published on the TASNEEF web site (www.tasneef.ae). Except in particular cases, paper copies of Rule Variations or corrigenda are not issued.

5. Rule subdivision and cross-references

5.1 Rule subdivision

The Rules are subdivided into six parts, from A to F.

Part A: Classification and Surveys

Part B: Hull and Stability

Part C: Machinery, Systems and Fire Protection

Part D: Materials and Welding

Part E: Service Notations

Part F: Additional Class Notations

Each Part consists of:

- Chapters
- Sections and possible Appendices
- Articles
- Sub-articles
- Requirements

Figures (abbr. Fig) and Tables (abbr. Tab) are numbered in ascending order within each Section or Appendix.

5.2 Cross-references

Examples: Pt A, Ch 1, Sec 1, [3.2.1]or Pt A, Ch 1, App 1, [3.2.1]

- Pt A means Part A

The part is indicated when it is different from the part in which the cross-reference appears. Otherwise, it is not indicated.

- Ch 1 means Chapter 1

The Chapter is indicated when it is different from the chapter in which the cross-reference appears. Otherwise, it is not indicated.

- Sec 1 means Section 1 (or App 1 means Appendix 1)

The Section (or Appendix) is indicated when it is different from the Section (or Appendix) in which the cross-reference appears. Otherwise, it is not indicated.

- [3.2.1] refers to requirement 1, within sub-article 2 of article 3.

Cross-references to an entire Part or Chapter are not abbreviated as indicated in the following examples:

- Part A for a cross-reference to Part A
- Part A, Chapter 1 for a cross-reference to Chapter 1 of Part A.

6. Summary of amendments introduced in the edition effective from 1st January 2016.

This edition of the Rules for the classification of Fast Patrol Vessels is considered as a reference edition for future amendments.

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RULES FOR THE CLASSIFICATION OF FAST PATROL VESSELS

Part C
Machinery, Systems and Fire Protection

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Part C

Machinery, Systems and Fire Protection

Chapter 1
MACHINERY

SECTION 1 GENERAL REQUIREMENTS

1 General

1.1 Application

1.1.1 Chapter 1 applies to the design, construction, installation, tests and trials of main propulsion and essential auxiliary machinery systems and associated equipment, pressure vessels, piping systems, and steering and manoeuvring systems installed on board classed vessels, as indicated in each Section of this Chapter.

1.2 Additional requirements

1.2.1 Additional requirements for machinery are given in:

- Part E, for the assignment of the service notations;
- Part F, for the assignment of additional class notations.

1.3 Documentation to be submitted

1.3.1 Before the actual construction is commenced, the Manufacturer, Designer or Shipbuilder is to submit to Tasneef the documents (plans, diagrams, specifications and calculations) requested in the relevant Sections of this Chapter.

The list of documents requested in each Section is to be intended as guidance for the complete set of information to be submitted, rather than an actual list of titles.

Tasneef reserves the right to request the submission of additional documents to those detailed in the Sections, in the case of non-conventional design or if it is deemed necessary for the evaluation of the system, equipment or component.

Plans are to include all the data necessary for their interpretation, verification and approval.

Unless otherwise stated in the other Sections of this Chapter or agreed with Tasneef, documents for approval are to be sent in triplicate if submitted by the Shipyard and in four copies if submitted by the equipment supplier. Documents requested for information are to be sent in duplicate.

In any case, Tasneef reserves the rights to require additional copies when deemed necessary.

1.4 Definitions

1.4.1 Machinery spaces of Category A

Machinery spaces of Category A are those spaces and trunks to such spaces which contain:

- internal combustion machinery used for main propulsion, or
- internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW, or
- any oil fired boiler or fuel oil unit, or
- gas generators, incinerators, waste disposal units, etc., which use oil fired equipment.

1.4.2 Machinery spaces

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

1.4.3 Fuel oil unit

Fuel oil unit is the equipment used for the preparation of fuel oil for delivery to an oil fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0,18 N/mm^2.

1.4.4 Dead vessel condition

Dead vessel condition is the condition under which the whole propulsion system, including the main power supply, is not in operation and auxiliary means for bringing the main propulsion machinery into operation and for the restoration of the main power supply, such as compressed air and starting current from batteries, are not available, but assuming that means are available to start the emergency generator at all times.

1.4.5 Length L

Length **L** of the vessel is intended to be, unless otherwise indicated, the length of measurement in m, as defined in Pt B of this Rules.

2 Design and construction

2.1 General

2.1.1 The machinery, pressure vessels, associated piping systems and fittings are to be of a design and construction adequate for the service for which they are intended and shall 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 is to have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

2.2 Materials, welding and testing

2.2.1 General

Materials, welding and testing procedures are to be in accordance with the requirements of Part D of TASNEEFMIL and those given in the other Sections of this Chapter. In addition, for machinery components fabricated by welding the requirements given in [2.2.2] apply.

2.2.2 Welded machinery components

Welding processes and welders are to be approved by Tasneef in accordance with Part D, Chapter 5 of RINAMIL.

References to welding procedures adopted are to be clearly indicated on the plans submitted for approval.

Joints transmitting loads are to be either:

- full penetration butt-joints welded on both sides, except when an equivalent procedure is approved;
- full penetration T- or cruciform joints.

For joints between plates having a difference in thickness greater than 3 mm, a taper having a length of not less than 4 times the difference in thickness is required. Depending on the type of stress to which the joint is subjected, a taper equal to three times the difference in thickness may be accepted.

T-joints on scalloped edges are not permitted.

Lap-joints and T-joints subjected to tensile stresses are to have a throat size of fillet welds equal to 0,7 times the thickness of the thinner plate on both sides.

In the case of welded structures including cast pieces, the latter are to be cast with appropriate extensions to permit connection, through butt-welded joints, to the surrounding structures, and to allow any radiographic and ultrasonic examinations to be easily carried out.

Where required, preheating and stress relieving treatments are to be performed according to the welding procedure specification.

2.3 Vibrations

2.3.1 Special consideration is to be given to the design, construction and installation of propulsion machinery systems and auxiliary machinery so that any mode of their vibrations shall not cause undue stresses in this machinery in the normal operating ranges.

2.4 Operation in inclined position

2.4.1 Main propulsion machinery and all auxiliary machinery essential to the propulsion and the vessel's safety are, as fitted in the vessel, be designed to operate when the vessel is upright and when inclined at any angle of list either way and trim by bow or stern as stated in Tab 1.

Tasneef may permit deviations from angles given in Tab 1, taking into consideration type, size and service conditions of the vessel, unless otherwise indicated by the Administration.

Machinery with a horizontal rotation axis is generally to be fitted on board with such axis arranged along ships. If this is not possible, the Manufacturer is to be informed at the time the machinery is ordered.

2.5 Ambient conditions

2.5.1 Machinery and systems covered by the Rules are to be designed to operate properly under the ambient conditions specified in Tab 2, unless otherwise specified in each Section of this Chapter.

2.6 Power of machinery

2.6.1 Unless otherwise stated in each Section of this Chapter, where scantlings of components are based on power, the values to be used are determined as follows:

- for main propulsion machinery, the power/rotational speed for which classification is requested
- for auxiliary machinery, the power/rotational speed which is available in service.

2.7 Astern power

2.7.1 Sufficient power for going astern is to be provided to secure proper control of the vessel in all normal circumstances.

The main propulsion machinery is to be capable of maintaining in free route astern at least 70% of the maximum ahead revolutions for a period of at least 30 min.

For main propulsion systems with reversing gears, controllable pitch propellers or electrical propeller drive, running astern is not to lead to an overload of propulsion machinery.

During the sea trials, the ability of the main propulsion machinery to reverse the direction of thrust of the

propeller is to be demonstrated and recorded (see also Sec 13).

2.8 Safety devices

2.8.1 Where risk from overspeeding of machinery exists, means are to be provided to ensure that the safe speed is not exceeded.

2.8.2 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 shall be provided, where practicable, to protect against such excessive pressure.

2.8.3 Where applicable main internal combustion propulsion machinery and auxiliary machinery shall be provided with automatic shut-off arrangements in the case of failures, such as lubricating oil supply failure, which could lead rapidly to complete breakdown, serious damage or explosion.

Tasneef may permit provisions for overriding automatic shut-off devices.

See also the specific requirements given in the other Sections of this Chapter.

2.9 Fuels

2.9.1 Fuel oils employed for engines are, in general, to have a flash point (determined using the closed cup test) of not less than 60°C.

However, for engines driving emergency generators, fuel oils having a flash point of less than 60°C but not less than 43°C are acceptable.

The use of fuel oil having a flashpoint of less than 60º C but not less than 43º C may be permitted (e.g. for feeding the emergency fire pump's engines and auxiliary machines which are not located in category A machinery spaces) subject to the following:

- fuel oil tanks except those arranged in double bottom compartments are located outside of category A machinery spaces;
- provisions for the measurement of oil temperature are provided on the suction pipe of the fuel oil pump;
- stop valves and/or cocks are provided on the inlet side and outlet side of the fuel oil strainers; and pipe joints of welded construction or of circular cone type or spherical type union joint are applied as far as possible.

Fuel oil having flash points of less than 43°C may be employed on board provided that it is stored outside machinery spaces and the arrangements adopted are specially approved by Tasneef.

Table 1 : Inclination of vessel

Installations, components	Angle of inclination (degrees) **(1)**			
	Athwartship		Fore and aft	
	static	dynamic	static	dynamic
Main and auxiliary machinery	15	22,5	5	7,5
Safety equipment, e.g.: - emergency power installations, emergency fire pumps and their devices, - Switch gear, electrical and electronic appliances and remote control systems. **(2)**	22,5	22,5	10	10

(1) Athwartship and fore-and-aft inclinations may occur simultaneously.

(2) Up to an angle of inclination of 45° no undesired switching operations or operational changes may occur.

Table 2 : Ambient conditions

AIR TEMPERATURE	
Location, arrangement	Temperature range (°C)
In enclosed spaces	between 0 and +45 **(2)**
On machinery components, boilers In spaces subject to higher or lower temperatures	According to specific local conditions
On exposed decks	between -25 and +45 **(1)**
WATER TEMPERATURE	
Coolant	Temperature (°C)
Sea water or, if applicable, sea water at charge air coolant inlet	up to +32

(1) Electronic appliances are to be designed for an air temperature up to 55°C (for electronic appliances see also Chapter 2).

(2) Different temperatures may be accepted by Tasneef in the case of vessels intended for restricted service.

3 Arrangement and installation on board

3.1 General

3.1.1 Provision shall be made to facilitate cleaning, inspection and maintenance of main propulsion and auxiliary machinery, including boilers and pressure vessels.

Easy access to the various parts of the propulsion machinery is to be provided by means of metallic ladders and gratings fitted with strong and safe handrails.

Spaces containing main and auxiliary machinery are to be provided with adequate lighting and ventilation.

3.2 Floors

3.2.1 Floors in engine rooms are to be metallic, divided into easily removable panels.

3.3 Bolting down

3.3.1 Bedplates of machinery are to be securely fixed to the supporting structures by means of foundation bolts which are to be distributed as evenly as practicable and of a sufficient number and size so as to ensure a perfect fit.

Where the bedplates bear directly on the inner bottom plating, the bolts are to be fitted with suitable gaskets so as to ensure a tight fit and are to be arranged with their heads within the double bottom.

Continuous contact between bedplates and foundations along the bolting line is to be achieved by means of chocks of suitable thickness, carefully arranged to ensure a complete contact. The same requirements apply to thrust block and shaft line bearing foundations.

Particular care is to be taken to obtain a perfect levelling and general alignment between the propulsion engines and their shafting (see Sec 6).

3.3.2 Chocking resins are to be type approved.

3.4 Safety devices on moving parts

3.4.1 Suitable protective devices are to be provided in way of moving parts (flywheels, couplings, etc.) in order to avoid injuries to personnel.

3.5 Gauges

3.5.1 All gauges are to be grouped, as far as possible, near each manoeuvring position; in any event, they are to be clearly visible.

3.6 Ventilation in machinery spaces

3.6.1 Machinery spaces are to be sufficiently ventilated so as to ensure that when machinery or boilers therein are operating at full power in all weather conditions, including heavy weather, a sufficient supply of air is maintained to the spaces for the operation of the machinery.

This sufficient amount of air is to be supplied through suitably protected openings arranged in such a way that they can be used in all weather conditions.

Special attention is to be paid both to air delivery and extraction and to air distribution in the various spaces.

The quantity and distribution of air are to be such as to satisfy machinery requirements for developing maximum continuous power.

The ventilation is to be so arranged as to prevent any accumulation of flammable gases or vapours.

3.7 Hot surfaces and fire protection

3.7.1 Surfaces, having temperature exceeding 60°C, with which the crew are likely to come into contact during operation are to be suitably protected or insulated.

Surfaces of machinery with temperatures above 220°C, e.g. steam, thermal oil and exhaust gas lines, silencers, exhaust gas boilers and turbochargers, are to be effectively insulated with non-combustible material or equivalently protected to prevent the ignition of combustible materials coming into contact with them. Where the insulation used for this purpose is oil absorbent or may permit the penetration of oil, the insulation is to be encased in steel sheathing or equivalent material.

The insulation of hot surfaces is to be of a type and so supported that it does not crack or deteriorate when subject to vibration.

Fire protection, detection and extinction is to comply with the requirements of Chapter 4.

3.8 Communications

3.8.1 At least two independent means are to be provided for communicating orders from the navigating bridge to the position in the machinery space or in the control room from which the speed and the direction of the thrust of the propellers are normally controlled; one of these is to be an engine room telegraph, which provides visual indication of the orders and responses both in the machinery space and on the navigating bridge, with audible alarm mismatch between order and response.

Appropriate means of communication shall be provided from the navigating bridge and the engine room to any other position from which the speed and direction of thrust of the propellers may be controlled.

The second means for communicating orders is to be fed by an independent power supply and is to be independent of other means of communication.

Where the main propulsion system of the vessel is controlled from the navigating bridge by a remote control system, the second means of communication may be the same bridge control system.

The engine room telegraph is required for machinery spaces accessible by personnel during navigation, even if the remote control of the engine is foreseen, irrespective of whether the engine room is attended.

For vessels assigned with a restricted navigation notation and/or limited length, in general **L** ≤ 20 m, these requirements may be relaxed at Tasneef's discretion.

3.9 Machinery remote control, alarms and safety systems

3.9.1 For remote control systems of main propulsion machinery and essential auxiliary machinery and relevant alarms and safety systems, the requirements of Chapter 3 apply.

3.9.2 Where overnight stay of on board personnel during navigation is provided, an engineers' alarm shall be provided to be operated from the engine control room or at the manoeuvring platform as appropriate, and shall be clearly audible in the engineers' accommodation.

4 Tests and trials

4.1 Works tests

4.1.1 Equipment and its components are subjected to works tests which are detailed in the relevant Sections of this Chapter and are to be witnessed by the Surveyor.

Where such tests cannot be performed in the workshop, Tasneef may allow them to be carried out on board, provided this is not judged to be in contrast either with the general characteristics of the machinery being tested or with particular features of the shipboard installation. In such cases, the Surveyor entrusted with the acceptance of machinery on board and the purchaser are to be informed in advance and the tests are to be carried out in accordance with the provisions of Part D relative to incomplete tests.

All parts of machinery, all steam, hydraulic, pneumatic and other systems and their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time as detailed in the other Sections of this Chapter.

4.2 Trials on board

4.2.1 Trials on board of machinery are detailed in Sec 12.

SECTION 2 DIESEL ENGINES

1 General

1.1 Application

1.1.1 Diesel engines listed below are to be designed, constructed, installed, tested and certified in accordance with the requirements of Pt C, Ch 1, Sec 2 of TASNEEFMIL:

a) Main propulsion engines

b) Engines driving electrical generators, including the emergency ones

c) Engines driving other auxiliaries essential for safety and navigation, when they develop a power of 110 kW and over.

All other engines are to be designed and constructed according to sound marine practice, with the equipment required in [2.3.4] and delivered with the relevant works' certificate (see Pt D, Ch 1, Sec 1, [4.2.3] of TASNEEFMIL).

Where required by the Administration, engines intended for propulsion of lifeboats and compression ignition engines intended for propulsion of rescue boats, are to be certified in accordance with MED Directive.

1.2 Documentation to be submitted

1.2.1 The documents listed in Tab 1, Pt C, Ch 1, Sec 2 of TASNEEFMIL, are to be submitted by Manufacturer to Tasneef for the approval of the engine type.

Plans listed under items 2 and 3 in Tab 1 are also to contain details of the lubricating oil sump in order to demonstrate compliance with Sec 1, [2.4].

Where changes are made to an engine type for which the documents have already been examined or approved, the engine Manufacturer is to resubmit to Tasneef for consideration and approval only those documents concerning the engine parts which have undergone substantial changes.

If the engines are manufactured by a licensee, the licensee is to submit, for each engine type, a list of all the drawings specified in Tab 1, indicating for each drawing the relevant number and revision status from both licensor and licensee.

Where the licensee proposes design modifications to components, the associated documents are to be submitted by the licensee to Tasneef for approval or for information purposes. In the case of significant modifications, the licensee is to provide Tasneef with a statement confirming the licensor's acceptance of the changes. In all cases, the licensee is to provide the Surveyor entrusted to carry out the testing, with a complete set of the documents specified in Tab 1.

1.3 Definitions

1.3.1 Engine type

In general, the engine type is defined by the following characteristics:

- the cylinder diameter;
- the piston stroke;
- the method of injection (direct or indirect injection);
- the kind of fuel;
- the working cycle (4-stroke, 2-stroke);
- the gas exchange (naturally aspirated or supercharged),
- the maximum continuous power per cylinder at the corresponding speed and/or brake mean effective pressure corresponding to the above-mentioned maximum continuous power;
- the method of pressure charging (pulsating system or constant pressure system);
- the charging air cooling system (with or without intercooler, number of stages, etc.);
- cylinder arrangement (in-line or V-type).

1.3.2 Engine power

The maximum continuous power is the maximum power at ambient reference conditions [1.3.3] which the engine is capable of delivering continuously, at nominal maximum speed, in the period of time between two consecutive overhauls.

Power, speed and the period of time between two consecutive overhauls are to be stated by the Manufacturer and agreed by Tasneef.

The rated power is the maximum power at ambient reference conditions [1.5] which the engine is capable of delivering as set after works trials (fuel stop power) at the maximum speed permitted by the governor.

The rated power for engines driving electric generators is the nominal power, taken at the net of overload, at ambient reference conditions [1.5], which the engine is capable of delivering as set after the works trials [4.5].

1.4 Light duty e medium duty engines

1.4.1 In vessels with light duty or medium duty operating profile, as defined in Pt A, Ch 1, Sec 3, [6], engines set for intermittent duty which maximum power P_{MAX} will be defined by the Manufacturer according to Tab 1 may be installed. The maximum speed and the period between the two subsequent maintenances are to be established by the Manufacturer and accepted by Tasneef.

1.4.2 Engines set for intermittent duty will be identify by a duty operating profile, as defined in Tab 1. Such engines are to be approved according to [1.4.3] and individually tested.

Table 1 : Operating profile

Operating profile	$O_{A\ MAX}$	$O_{P\ MAX}$	I_C
LIGHT DUTY	≥ 1000	≥ 100	≥ 0,4
MEDIUM DUTY	≥ 3000	≥ 750	≥ 0,6
Note: Parameters are defined in [1.4.3]			

1.4.3 Procedure for the approval of light duty and medium duty engines

The Manufacturer demanding the approval of light duty or medium duty engines operating profile is obliged to declare contextually with the demand the following parameters:

P_{MAX} = Maximum pressure in kW

n_{MAX} = round per minute at power P_{MAX}

TBO = time between two main overhaul, in number of running hours

$O_{A\ MAX}$ = Motion hours per year

$O_{P\ MAX}$ = Motion hours per year at P_{MAX}

I_C = Loading index where:

$$I_C = \frac{P_{MEDIA} \cdot O_{A\ MAX}}{P_{MAX} \cdot O_{A\ MIN}}$$

where:

P_{MEDIA} = Average power deliverable from the engine in $O_{A\ MAX}$ running hours per year

$O_{A\ MIN}$ = 1000 hours for '**light duty'** operating profile

3000 hours for '**medium duty'** operating profile

For proceeding in the type approval, the parameters above declared by the Manufacturer are not to be less than the minimum ones provided for the operating profile in Tab 1.

For all the engines presenting power not superior than 2000 kW for which the approval of light duty and medium duty operating profile is demanded the control regarding crankshaft (Pt C, Ch 1, App. 1 of TASNEEFMIL) may be replaced by a running test of 100 hours in cycles purposed by:

a) 8 hours at P_{MAX} e n_{MAX}

b) 30 min at 90% of P_{MAX}

c) 30 min at 70% of P_{MAX}

d) 30 min at 50% of P_{MAX}

e) 30 min at 25% of P_{MAX}

Partial loads in items b), c), d) and e) are to be achieved along the nominal curve (theory) of the propeller considered in quadratic function of rounds engine.

During the running test the parameters listed in Pt C, Ch 1, Sec 2 [4.3.4] of TASNEEFMIL are to be noticed and recorded; at the end of the running test the crankshaft is to be dismantled and submitted to visual survey and non-destructive controls by the Surveyor in charge.

The running test mentioned above will be valid for the type test for engines admitted to alternative test in place of what indicated in Pt C, Ch. 1, Sec 2, [4.3.2] items a), b), c) and d) of TASNEEFMIL.

Light duty and **medium duty** operating profiles are to reported this inscription in the approval and testing certificates.

1.5 Ambient reference conditions

The power of engines listed in [1.1.1] items (a), (b) and (c) is to be referred to the following conditions:

- barometric pressure = 0,1 MPa
- relative humidity = 60%
- ambient air temperature = 45°C
- sea water temperature (and temperature at inlet of sea water cooled charge air cooler) = 32°C.

In case of vessels assigned with a restricted navigation notation, different temperatures may be accepted by Tasneef.

The engine Manufacturer is not expected to provide the above ambient conditions at a test bed. The rating is to be adjusted according to a recognised standard accepted by Tasneef (e.g. ISO 3046-1).

2 Design and construction

2.1 Materials and welding

2.1.1 The requirements given in Pt C, Ch 1, Sec 2, [2.1] of TASNEEFMIL apply.

2.2 Crankshaft

2.2.1 Check of the scantling

The check of crankshaft strength is to be carried out in accordance with Pt C, Ch 1 of TASNEEFMIL.

2.3 Carter

2.3.1 The requirements given in Pt C, Ch 1, Sec 2 of TASNEEFMIL apply.

2.4 Overpressure indicators in cylinder

2.4.1 Every engine cylinder with a diameter greater than 230 mm is to be provided with a means for signalling a prearranged overpressure in the cylinder itself.

2.5 Scavenge manifolds

2.5.1 Relief valves

Scavenge spaces in open connection to the cylinders are to be fitted with explosion relief valves in accordance with Pt C, Ch 1, Sec 2 of TASNEEFMIL.

2.6 Systems

2.6.1 General

In addition to the requirements of the present sub-article, those given in Sec 9 are to be satisfied.

Flexible hoses in the fuel and lubricating oil system are to be limited to the minimum and are to be of type approved. For vessels with Length **L**≤15 m, non-metallic piping systems may be accepted as long as fireproof and approved in accordance with ISO 7840 type A1 standard.

Connections of such pipes to engines are to be executed with pressure boundaries.

Unless otherwise stated in Sec 9, propulsion engines are to be equipped with external connections for standby pumps for:

- fuel oil supply;
- lubricating oil and cooling water circulation.

2.6.2 Fuel oil system

Relief valves discharging back to the suction of the pumps or other equivalent means are to be fitted on the delivery side of the pumps.

In fuel oil systems for propulsion machinery, filters are to be fitted and arranged so that an uninterrupted supply of filtered fuel oil is ensured during cleaning operations of the filter equipment, except when otherwise stated in Sec 9.

a) All external high pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors are to be protected with a shielded piping system capable of containing fuel from a high pressure line failure. A shielded pipe incorporates an outer pipe into which the high pressure fuel pipe is placed forming a permanent assembly. The shielded piping system is to include a means for collection of leakages and arrangements are to be provided for an alarm to be given in the event of a fuel line failure. If flexible hoses are used for shielding purposes, these are to be approved by Tasneef.

   When in fuel oil return piping the pulsation of pressure with peak to peak values exceeds 2 MPa, shielding of this piping is also required as above.

b) For vessels classed for restricted navigation or length **L**< 20 m, the requirements under a) may be relaxed at Tasneef's discretion.

2.6.3 Lubricating oil system

Efficient filters are to be fitted in the lubricating oil system when the oil is circulated under pressure.

In such lubricating oil systems for propulsion machinery, filters are to be arranged so that an uninterrupted supply of filtered lubricating oil is ensured during cleaning operations of the filter equipment, except when otherwise stated in Sec 9.

Relief valves discharging back to the suction of the pumps or other equivalent means are to be fitted on the delivery side of the pumps.

The relief valves may be omitted provided that the filters can withstand the maximum pressure that the pump may develop.

Where necessary, the lubricating oil is to be cooled by means of suitable coolers.

2.6.4 Charge air system

The requirements relevant to design, construction, arrangement, installation, tests and certification of exhaust gas turbochargers are given in Pt C, Ch 1, Sec 14 of TASNEEFMIL.

2.7 Starting air system

2.7.1 The requirements given in [3.1] apply.

2.8 Control and monitoring

2.8.1 General

In addition to those of this item, the general requirements given in Chapter 3 apply.

2.8.2 Alarm

The lubricating oil system of diesel engines with a power equal to or in excess of 37 kW is to be fitted with alarms to give audible and visual warning in the event of an appreciable reduction in pressure of the lubricating oil supply.

2.8.3 Governors of main and auxiliary engines

Each engine, except the auxiliary engines for driving electric generators for which [2.8.5] applies, is to be fitted with a speed governor so adjusted that the engine does not exceed the rated speed by more than 15%.

2.8.4 Overspeed protective devices of main and auxiliary engines

In addition to the speed governor, each:

- main propulsion engine having a rated power of 220kW and above, which can be declutched or which drives a controllable pitch propeller, and
- auxiliary engine having a rated power of 220kW and above, except those for driving electric generators, for which [2.8.6]

applies, is to be fitted with a separate overspeed protective device so adjusted that the engine cannot exceed the rated speed by more than 20%; arrangements are to be made to test the overspeed protective device.

Equivalent arrangements may be accepted subject to special consideration by Tasneef in each case.

The overspeed protective device, including its driving mechanism or speed sensor, is to be independent of the governor.

2.8.5 Governors for auxiliary engines driving electric generators

The requirements given in Pt C, Ch 1, Sec 2 of TASNEEFMIL apply.

2.8.6 Overspeed protective devices of auxiliary engines driving electric generators

In addition to the speed governor, auxiliary engines of rated power equal to or greater than 220 kW driving electric generators are to be fitted with a separate overspeed protective device, with a means for manual tripping, adjusted so as to prevent the rated speed from being exceeded by more than 15%.

This device is to automatically shut down the engine.

2.8.7 Use of electronic governors

The requirements given in Pt C, Ch 1, Sec 2, of TASNEEFMIL apply.

2.8.8 Summary tables

Diesel engines, installed in vessels where notations concerning automation are not required, are to be equipped with monitoring equipment as detailed in Tab 2 e Tab 3 of Pt C, Ch 1, Sec 2 of TASNEEFMIL.

For vessels with length **L**≤15 m, the acceptance of a reduction in the monitoring equipment required in Tab 2 and Tab 3 may be considered by Tasneef.

The alarms are to be visual and audible.

The indicators are to be fitted at a normally attended position (on the engine or at the local control station).

3 Arrangement and installation

3.1 Starting arrangements

3.1.1 Mechanical air starting

The requirements given in Pt C, Ch 1, Sec 2, [3.1.1] of TASNEEFMIL apply.

3.1.2 Electrical starting

The requirements given in Pt C, Ch 1, Sec 2, [3.1.2] of TASNEEFMIL apply.

In vessels with length **L**≤15 m and with two internal combustion engines only one battery is acceptable for each engine,

providing that is possible starting each engine with either of the two batteries.

3.2 Turning gear

Each engine is to be provided with hand-operated turning gear; where deemed necessary, the turning gear is to be both hand and mechanically-operated.

The turning gear engagement is to inhibit starting operations.

3.3 Trays

3.3.1 Trays fitted with means of drainage are to be provided in way of the lower part of the crankcase and, in general, in way of the parts of the engine, where oil is likely to spill in order to collect the fuel oil or lubricating oil dripping from the engine.

3.4 Exhaust gas system

3.4.1 In addition to the requirements given in Sec 9, the exhaust system is to be efficiently cooled or insulated in such a way that the surface temperature does not exceed 220°C (see also Sec 1, [3.7]).

4 Type tests, material tests, workshop inspection and testing, certification

4.1 Type tests - General

4.1.1 For light duty and medium duty engines the requirements given in Pt C, Ch 1, Sec 2, of TASNEEFMIL with the appropriate changes in [1.4] apply.

4.2 Material and non-destructive tests

4.2.1 Material tests

Engine components are to be tested in accordance with Pt C, Ch 1, Sec 2 of TASNEEFMIL and in compliance with the requirements of Part D.

Magnetic particle or dye-penetrant tests are required for the parts listed in Tab 4 and are to be effected in positions mutually agreed upon by the Manufacturer and Tasneef Surveyor, where experience shows defects are most likely to occur

4.2.2 Hydrostatic tests

Parts of engines under pressure are to be hydrostatically tested at the test pressure specified for each part in Pt C, Ch 1, Sec 2 of TASNEEFMIL. The following parts of auxiliaries

which are necessary for operation of engines as per [1.1.1] items a), b) and c):

- cylinders, cylinder covers, coolers and receivers of independent air compressors;
- water, oil and air coolers (tube bundles or coils, shells and heads) not fitted on the engine and filters;
- independently driven lubricating oil, fuel oil and water pumps;
- pressure pipes (water, lubricating oil, fuel oil, and compressed air pipes), valves and other fittings are to be subjected to hydrostatic tests at 1,5 times the maximum working pressure, but not less than 0,4 MPa.

4.3 Workshop inspections and testing

4.3.1 General

In addition to the type test, diesel engines are to be subjected to works trials, which are to be witnessed by the Surveyor except where an Alternative Inspection Scheme has been granted or where otherwise decided by Tasneef on a case by case basis.

Testing programme, testing reports and certificates issued by Tasneef are reported in Pt C, Ch 1, Sec 2, [4.5] of TASNEEFMIL.

4.3.2 Light duty e medium duty engines

Overloaded test at 110% of maximum power is not required for light duty and medium duty engines.

SECTION 3 PRESSURE VESSELS

1 General

1.1 Principles

1.1.1 Scope of the Rules

The pressure vessels, associated piping systems and fittings shall be of a design and construction adequate for the service for which they are intended and shall be so installed and protected as to reduce to a minimum any danger to persons on board.

The design is to have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

1.2 Definitions

1.2.1 Pressure vessel

Pressure vessel is a welded or seamless container used for the containment of fluids at a pressure above or below the ambient pressure and at any temperature. Fluid power cylinders in hydraulic or pneumatic plants are also considered pressure vessels.

1.3 Applicable standard

1.3.1 The requirements given in Pt C, Ch 1, Sec 3 of TASNEEFMIL apply.

SECTION 4 GAS TURBINES

1 General

1.1 Application

1.1.1 Propulsion turbines and turbines for essential services

The requirements of this Section apply to:

a) all propulsion turbines;

b) turbines intended for auxiliary services essential for safety and navigation.

1.1.2 Turbines for auxiliary generators

In addition to the requirements contained in this Section, auxiliary turbines driving electric generators are to comply with the applicable requirements of Chapter 2.

1.1.3 Type approval

Turbines intended for propulsion and essential services are to be of type approved by Tasneef.

1.2 Definition of rated power

1.2.1 Rated power is the maximum constant power that the turbine can develop at constant speed in the range of air inlet temperature between 0°C and 35°C. This power is to be considered with 0 intake and exhaust losses and with an air relative humidity of 60%.

1.3 Documentation to be submitted

1.3.1 For propulsion turbines and turbines intended for driving machinery for essential services, the plans listed in Tab 1 are to be submitted.

The listed constructional plans are to be complete with all dimensions and are to contain full indication of types of materials employed.

2 Design and Construction

2.1 General

As to materials, strength analysis, details of the design and construction and all the other aspects the requirements given in Pt C, Ch 1, Sec 5, [2] of TASNEEFMIL apply.

3 Arrangement and installation

3.1 General

The requirements given in Pt C, Ch 1, Sec 5, of TASNEEFMIL apply.

4 Material tests, workshop inspection and testing, certification

4.1 General

The requirements given in Pt C, Ch 1, Sec 5, of TASNEEFMIL apply.

SECTION 5 GEARING

1 General

1.1 Application

1.1.1 Unless otherwise specified, the requirements of this section apply to:

- reduction and/or reverse gears intended for propulsion plants with a transmitted power of 220 kW and above;
- other reduction and step-up gears with a transmitted power of 110 kW and above, intended for essential service auxiliary machinery.

Some departure from the requirements of this Section may be accepted by Tasneef in cases of gears fitted to vessels having a restricted navigation notation.

Alternative calculations based on a recognized standard may be submitted by the manufacturer of the gears and will be given special consideration by Tasneef.

1.2 Documentation to be submitted

1.2.1 Documents

Before starting construction, all plans, specifications and calculations listed in Pt C, Ch 1, Sec 6 of Rules for Merchant Ships are to be submitted. The data listed in this Rules are to be submitted with plans.

2 Design of gears – Construction, arrangements and trials

2.1 General

Gearings are to be designed, constructed and tested in compliance with the requirements given in Pt C, Ch 1, Sec 6 of Rules for Merchant Ships considering the attenuations listed below.

2.2 Light duty e medium duty gears

2.2.1 For gears intended for light duty and medium duty operating profiles, as defined in Sec 2, [1.4], inferior coefficients than the ones provided in Pt C, Ch 1, Sec 6 of Rules for Merchant Ships (Tab 2) may be adopted in damage stability calculation.

For such gears, in addition to what provided in the previous article [1.2], at the moment of the requirement of the design approval the Manufacturer is to declare the maximum power P_{MAX} transferable from the reduction gear, the reference operating and the parameters below which are not to be less than the minimum ones listed in Tab 1:

$O_{A\ MAX}$ = Running hours per year (as declared by the Manufacturer)

$O_{P\ MAX}$ = Running hours per year at P_{MAX} (of system)

I_C = Load index

where:

$$I_C = \frac{P_{MEDIA} \cdot O_{A\ MAX}}{P_{MAX} \cdot O_{A\ MIN}}$$

where:

P_{MEDIA} = Average power transferable from the gear in $O_{A\ MAX}$ employment hours per year

$O_{A\ MIN}$ = 1000 hours for **light duty** operating profile

3000 hours for **medium duty** operating profile

TBO = time between two main overhaul, in number of running hours

2.2.2 The length rolling bearings is to be calculate in accordance with ISO 281-1 referring all the material and lubricating features.

The calculation coefficient L_{h10a23} is to refer to the distribution of loads in time provided by the reference operating profile.

The length rolling bearings expressed through the coefficient Lh10a23 is to be in accordance with values listed in Tab 2.

2.2.3 The shaft of pinions and wheels are to be measured in accordance with Pt C, Ch 1, Sec 6, [3.4.2]; otherwise a direct calculation contemplating at the same time static and fatigue stresses and assuming the values of safety coefficients may be accepted by Tasneef:

- Safety coefficient as regards the yield limit = 2,0
- Safety coefficient as regards the alternate bending fatigue limit:
  - = 1,1 for **light duty** operating profile
  - = 1,2 for **medium duty** operating profile

Gears approved for **light duty** and **medium duty** operating profile may reproduce this inscription in the approval documents.

Table 1 – Use limits

Operating profile	$O_{A\ MAX}$	$O_{P\ MAX}$	I_C
LIGHT DUTY	≥ 1000	≥ 100	≥ 0,4

MEDIUM DUTY	≥ 3000	≥ 750	≥ 0,6
Note: Parameters are defined in [2.2.1]			

Table 2 – Calculation coefficients

Operating profile	K_A	S_H	S_F	L_{h10a23} (following ISO 281-1)
LIGHT DUTY	1,1	1,0	1,1	≥ 5000 h
MEDIUM DUTY	1,2	1,0	1,2	≥ 15000 h

SECTION 6 MAIN PROPULSION SHAFTING

1 General

1.1 Application

1.1.1 This Section applies to shafts, couplings, clutches and other shafting components transmitting power for main propulsion.

For shafting components in engines, turbines, gears and thrusters, see Sec 2, Sec 4, Sec 5, Sec 6 and Sec 11, respectively; for propellers, see Sec 7.

1.2 Documentation to be submitted

1.2.1 The Manufacturer is to submit to Tasneef the documents listed in Pt C, Ch 1, Sec 7 of TASNEEFMIL.

Plans of power transmitting parts and shaft liners listed in Tab 1 are to include the relevant material specifications.

2 Design and construction

2.1 General

2.1.1 Shafts are to be designed and constructed in accordance with Pt C, Ch 1, Sec 7 of TASNEEFMIL.

In case of shafts driving surface propellers, increases to the diameter estimated by this Rules can be requested by Tasneef.

Lower diameters than the ones estimated by this Rules can be accepted, provided that they are justify by the result of direct estimation FEM, to agree with Tasneef, which are demonstrated to have adequate strength and scantling with special reference to fatigue resistance.

3 Arrangement and installation

3.1 General

3.1.1 The installation is to be carried out according to the instructions of the component Manufacturer or approved documents, when required.

3.1.2 The installation of stern tubes and/or associated non-shrunk bearings is subject to approval of procedures and materials used.

3.1.3 The joints between liner parts are not to be located in way of supports and sealing glands.

Metal liners are to be shrunk on to the shafts by pre-heating or forced on by hydraulic pressure with adequate interference.

Dowels, screws or other means of securing the liners to the shafts are not acceptable.

3.2 Protection of propeller shaft against corrosion

3.2.1 The propeller shaft surface between the propeller and the stern tube, and in way of propeller nut, is to be suitably protected in order to prevent any entry of sea water, unless the shaft is made of austenitic stainless steel.

3.3 Shaft alignment

In the case of propulsion shafting with turbines, direct coupled engines or bearings with offsets from a reference line, the relevant shaft alignment calculation is to be submitted for approval.

Tasneef may also require the above calculation in the case of special arrangements.

The alignment of the propulsion machinery and shafting and the spacing and location of the bearings are to be such as to ensure that the loads are compatible with the material used and the limits prescribed by the Manufacturer.

The calculation is to take into account thermal, static and dynamic effects; the results are to include the reaction forces of bearings, bending moments, shear stresses and other parameters (such as gap and sag of each flanged coupling or jacking loads) and instructions for the alignment procedure. The alignment is to be checked on board by a suitable measurement method.

4 Material tests, workshop inspection and testing, certification

4.1 General

4.1.1 The requirements given in Pt C, Ch 1, Sec 7, of TASNEEFMIL apply.

SECTION 7 PROPELLERS

1 General

1.1 Application

1.1.1 Propulsion propellers

The requirements of this Section apply to propellers of any size and type intended for propulsion. They include fixed and controllable pitch propellers, including those ducted in fixed nozzles.

1.1.2 Manoeuvring thrusters propellers

For manoeuvring thrusters propellers see Sec 11.

1.2 Definitions

1.2.1 Solid propeller

A solid propeller is a propeller (including hub and blades) cast in one piece.

1.2.2 Built-up propeller

A built-up propeller is a propeller cast in more than one piece.

In general, built up propellers have the blades cast separately and fixed to the hub by a system of bolts and studs.

1.2.3 Controllable pitch propellers

Controllable pitch propellers are built-up propellers which include in the hub a mechanism to rotate the blades in order to have the possibility of controlling the propeller pitch in different service conditions.

1.2.4 Nozzle

A nozzle is a circular structural casing enclosing the propeller.

1.2.5 Ducted propeller

A ducted propeller is a propeller installed in a nozzle.

1.2.6 Skewed propellers

Skewed propellers are propellers whose blades have a skew angle other than 0.

1.2.7 Highly skewed propellers and very highly skewed propellers

Highly skewed propellers are propellers having blades with skew angle between 25° and 50°. Very highly skewed propellers are propellers having blades with skew angle exceeding 50°.

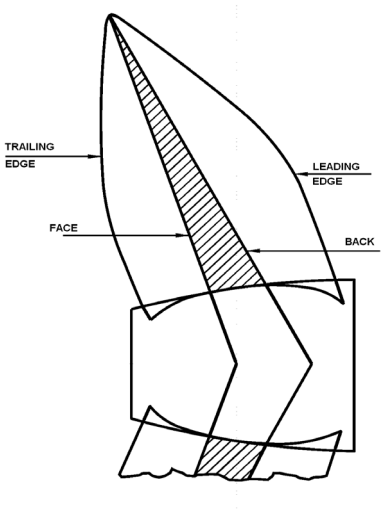
1.2.8 Leading edge

The leading edge of a propeller blade is the edge of the blade at side entering the water while the propeller rotates (see Fig 1).

1.2.9 Trailing edge

The trailing edge of a propeller blade is the edge of the blade opposite the leading edge (see Fig 1).

Figure 1 – Leading and trailing ledge



1.2.10 Developed area ratio

Developed area ratio is the ratio of the total blade developed area to the area of the ring included between the propeller diameter and the hub diameter.

1.3 Documentation to be submitted

1.3.1 General

For solid propellers documents listed in Pt C, Ch 1, Sec 8 of TASNEEFMIL are to be submitted.

For controllable pitch propellers documents listed in this Rules are to be submitted for approval.

All listed plans are to be constructional plans complete with all dimensions and are to contain full indication of types of materials employed.

1.3.2 Special propellers

For very highly skewed propellers and propellers of unusual design, in addition to the documents above, a detailed hydrodynamic load and stress analysis is to be submitted.

2 Design and construction

2.1 General

2.1.1 Design and construction are to be in accordance with the requirements given in Pt C, Ch 1, Sec 8, of TASNEEFMIL.

2.1.2 The approval of propellers plans is not required for vessels with length **L**≤15 m.

The design is under the responsibility of the designer who is to submit, through documentation, a direct calculation verifying the blade strength where result that at least 8 securities at the minimum breaking pressure of the material traction are assured.

For these vessels testing by Tasneef i9s not required, but a certificate attesting the internal testing of the propeller and its material is to be presented.

3 Arrangement and installation

3.1 Fitting of propeller on the propeller shaft

3.1.1 The connection between propeller and shaft is to be achieved in accordance with Pt C, Ch 1, Sec 8 of TASNEEFMIL.

4 Testing and certification

4.1 General

4.1.1 For vessels with length **L**>15 m, the requirements given in Pt C, Ch 1, Sec 8, of TASNEEFMIL apply.

SECTION 8 SHAFT VIBRATIONS

1 General

1.1 Application

1.1.1 The requirements of this Section apply to the shafting of the following installations:

- propulsion systems with prime movers developing 220 kW or more;
- other systems with internal combustion engines developing 110 kW or more and driving auxiliary machinery intended for essential services.

1.1.2 Exemptions

The requirements of this Section may be relaxed in cases where satisfactory service operation of similar installations is demonstrated.

1.2 Submission of documentation

1.2.1 As the analysis of the vibration behaviour of systems is part of their design, the relevant documentation, as listed in Pt C, Ch 1, Sec 9, of TASNEEFMIL is to be promptly submitted for approval.

2 Design of systems in respect of vibrations

2.1 Principle

2.1.1 General

a) Special consideration shall be given to the design, construction and installation of propulsion machinery systems so that any mode of their vibrations shall not cause undue stresses in these systems in the normal operating ranges.

b) Calculations are to be carried out for all the configurations of the system likely to have any influence on the torsional, bending or axial vibrations.

c) Where torsional and axial vibrations may be coupled (e.g. due to helical gears), the effect of such vibrations is to be investigated.

2.1.2 Vibration levels

Systems are to have torsional, bending and axial vibrations both in continuous and in transient running acceptable to the Manufacturers, and in accordance with the requirements of Pt C, Ch 1, Sec 9 of TASNEEFMIL.

Where vibrations are found to exceed the limits stated in this Section, the designer or the builder of the plant is to propose corrective actions, such as:

- operating restrictions, provided that the owner is informed, or
- modification of the plant.

2.1.3 Condition of components

Systems are to be designed considering essential components in a non-ideal condition. In particular, the following conditions are to be considered:

- propulsion engine: cylinder malfunction;
- flexible coupling: possible variation of the stiffness or damping characteristics due to heating or ageing;
- vibration damper: possible variation of the damping coefficient.

2.2 Modifications of existing plants

2.2.1 Where substantial modifications of existing plants, such as:

- change of the running speed or power of the engine,
- replacement of an essential component of the system (propeller, flexible coupling, damper) by one of different characteristics, or
- connection of a new component,

are carried out, new vibration analysis is to be submitted for approval.

3 Torsional vibrations

3.1 General

3.1.1 The torsional vibration torques (or stresses) calculated in the various components of the installation are additional to those resulting from the mean power transmitted by such components.

Where the scantling formulae given in Pt C, Ch 1, Sec 7, and App 1 of TASNEEFMIL, the vibratory torques are not to be taken into account unless otherwise stated.

3.2 Documentation to be submitted

3.2.1 The documents and information listed in Pt C, Ch 1, Sec 9, of TASNEEFMIL are to be submitted for approval.

3.3 Calculation principles - Permissible limits for torsional vibration

3.3.1 The requirements given in Pt C, Ch 1, Sec 9, of TASNEEFMIL apply.

4 Bending vibrations

4.1 General

4.1.1 The provisions of this Article apply to the bending vibrations of propulsion systems having a transmitted power in excess of 1000 KW:

- having a **L/D** ratio exceeding the following value:

$$10\left(\ln\frac{2}{D}\right) + D^2$$

where:

L : Span between the aft bearings of the propeller shaft, in m

D : Diameter of the propeller shaft, in m

- fitted with bearings located outboard the hull (brackets), or o
- fitted with cardan shafts.

4.2 Documentation to be submitted

4.2.1 The documents and information listed in Pt C, Ch 1, Sec 9, [4.2] of TASNEEFMIL are to be submitted.

4.3 Calculation principles - Criteria for acceptance of the bending vibration levels

4.3.1 The requirements given in Pt C, Ch 1, Sec 9, of TASNEEFMIL apply.

4.4 Bending vibration measurements

4.4.1 General

a) Tasneef may require bending vibration measurements in the following cases:

- where the calculations indicate the possibility of dangerous critical speeds in the operating speed range,
- where the accuracy of some data is not deemed sufficient, or
- where restricted speed ranges need to be verified.

b) Where measurements are required, a comprehensive report including the analysis of the results, method of measurement and the type of tools and the location of points of measurement (where points of measurements are) is to be submitted to Tasneef.

SECTION 9 PIPING SYSTEMS

1 General

1.1 Application

1.1.1 General requirements applying to all piping systems are contained in:

- Art [2] for their design and construction
- Art [3] for the welding of steel pipes and for the bending of pipes
- Art [4] for their arrangement and installation
- Art [15] for their certification, inspection and testing.

Specific requirements for vessel piping systems and machinery piping systems are given in Articles [5] to [14].

1.2 Documentation to be submitted

1.2.1 Documents

The documents and information listed in Tab 1 and Tab 2 of Pt C, Ch 1, Sec 10 of TASNEEFMIL are to be submitted.

1.3 Definitions

1.3.1 Piping and piping systems

a) Piping includes pipes and their connections, flexible hoses and expansion joints, valves and their actuating systems, other accessories (filters, level gauges, etc.) and pump casings.

b) Piping systems include piping and all the interfacing equipment such as tanks, pressure vessels, heat exchangers, pumps and centrifugal purifiers, but do not include boilers, turbines, internal combustion engines and reduction gears

Note : The equipment other than piping is to be designed in accordance with the relevant Sections of Chapter 1.

1.3.2 Design pressure

a) The design pressure of a piping system is the pressure considered by the manufacturer to determine the scantling of the system components. It is not to be taken less than the maximum working pressure expected in this system or the highest setting pressure of any relief valve or relief device, whichever is the greater

b) The design pressure of a piping system located on the low pressure side of a pressure reducing valve where no relief valve is provided is not to be less than the maximum pressure on the high pressure side of the pressure reducing valve.

c) The design pressure of a piping system located on the delivery side of a pump or a compressor is not to be less than the setting pressure of the relief valve for displacement pumps or the maximum pressure resulting from the operating (head capacity) curve for centrifugal pumps, whichever is the greater.

1.3.3 Design temperature

The design temperature of a piping system is the maximum temperature of the medium inside the system.

1.3.4 Flammable oils

Flammable oils include fuel oils, lubricating oils, thermal oils and hydraulic oils.

1.3.5 Length L

Unless otherwise specified, length **L** of the vessel is the length of measurement defined in Pt B.

1.4 Symbols and units

1.4.1 The following symbols and related units are commonly used in this Section. Additional symbols, related to some formulae indicated in this Section, are listed wherever it is necessary.

p : Design pressure, in MPa,

T : Design temperature, in °C,

t : Rule required minimum thickness, in mm,

D : Pipe external diameter, in mm.

1.5 Class of piping system

1.5.1 Purpose of the classes of piping systems

Piping systems are subdivided into three classes, denoted as class **I**, class **II** and class **III**, for the purpose of acceptance of materials, selection of joints, heat treatment, welding, pressure testing and the certification of fittings.

1.5.2 Definitions of the classes of piping systems

Classes I, II e III are defined in Tab 1.

Table 1

Media conveyed by the piping system	CLASS I	CLASS II	CLASS III
Fuel oil **(1)**	p>1,6 o T>150	other **(2)**	p≤0,7 e T≤60
Flammable Hydraulic oil **(5)**	p>1,6 o T>150	other **(2)**	p≤0,7 e T≤60
Lubricating oil	p>1,6 o T>150	other **(2)**	p≤0,7 e T≤60
Other flammable media: • heated above flashpoint, or • having flashpoint <60°C and liquefied gas	without special safeguards **(3)**	without special safeguards **(3)**	
Air, gases, water, non-flammable hydraulic oil **(4)**	p>4 o T>300		p≤1,6 e T≤200
Open-ended pipes (drains, overflows, vents, exhaust gas lines)			irrespective of T

(1) Valves under static pressure on fuel oil tanks belong to class II.

(2) Pressure and temperature conditions other than those required for class I and class III.

(3) Safeguards for reducing the possibility of leakage and limiting its consequences, e.g. pipes led in positions where leakage of internal fluids will not cause a potential hazard or damage to surrounding areas which may include the use of pipe ducts, shielding, screening, etc.

(4) Valves and fittings fitted on the vessel side and collision bulkhead belong to class II.

(5) Steering gear piping belongs to class I irrespective of p and T.

Note 1: p : Design pressure, as defined in [1.3.2], in MPa.

Note 2: T : Design temperature, as defined in [1.3.3], in °C.

2 General requirements for design and construction

2.1 Materials

2.1.1 General

Materials to be used in piping systems are to be suitable for the medium and the service for which the piping is intended.

2.1.2 Use of metallic materials

a) Metallic materials are to be used in accordance with Pt C, Ch 1, Sec 10 of TASNEEFMIL.

b) Materials for class I and class II piping systems are to be manufactured and tested in accordance with the appropriate requirements of Part D.

c) Materials for class III piping systems are to be manufactured and tested in accordance with the requirements of acceptable national or international standards or specifications.

d) Mechanical characteristics required for metallic materials are specified in Part D.

2.1.3 Use of non-metallic materials

Non metallic materials may be used for piping system of class III, in accordance with App 2 of Pt C, Ch 1, of TASNEEFMIL. The use of plastics for other systems or in other conditions will be given special consideration.

a) Plastics intended for piping systems dealt with in this Section are to be of a of type approved by Tasneef.

b) Use of rubber pipes is generally permitted in vessels with length not superior to 15 m.

c) Conditions about their use are specified in standards regarding individual system.

2.2 Measurements of pipes

2.2.1 For the measurements of pipes, admissible stresses, joints and protection against exceeding pressure, the requirements given in Pt C, Ch 1, Sec 10, of TASNEEFMIL apply.

2.3 Flexible hoses and expansion joints

2.3.1 General

Use of flexible pipes and expansion joints, both of metallic and non-metallic material is admitted under conditions indicated in Pt C, Ch 1, Sec 10, [2.6] of TASNEEFMIL

2.4 Valves and accessories

2.4.1 General

a) Valves and accessories are normally to be constructed in accordance with a recognized standard.

Valves and accessories in piping system are to be compatible with pipes to which they are connected as

regarding their strength (see [1.3.2] for design pressure) and are to be suitable for operating effectually at the maximum service temperature expected during the service.

In other case they are to be approved by Tasneef, when installed:

- in a piping system of Class I; or
- in a piping system of Class II with a diameter superior than con 100 mm; or
- on the broadside, the collision bulkhead or underboard on fuel oil tanks.

b) Interception valves are to be placed where necessary to isolate pumps, pressure vessels, etc from the rest of pipings when necessary and, in particular:

- to permit the interception of a duplicate component without interrupting the circulation of fluid;
- for inspection and repairing scope.

2.4.2 Valves and accessories design

a) Materials used in valves are to satisfy the provisions given in [2.1].

b) Connections between valves and accessories are to satisfy the provisions given in [2.2].

c) All the valves and accessories are to be designed as to prevent the possible loss of covers and gaskets when driving.

d) Valves are to be designed as to close with clockwise rotation of the hand-wheel.

e) Valves are to be provided with indicators showing whether they are open or closed, except when it is readily understandable.

2.4.3 Valves with remote control

a) All valves with remote control are to be designed also for being controlled manually on the spot.

b) Remote and on spot control devices are to be independent. In order to this the possibility of executing the local control through a manual pump will be given special consideration by Tasneef.

c) In case of valves which are to be provided for local control, according to the Rules, the opening and closing of valves through manual control on spot are not to render non-operating the remote control device.

d) Loss of energy in the remote control device of valves are not to cause unwanted changes in the position of valves.

2.5 Sea inlets and overboard discharges

2.5.1 General

Except where expressly stated in Article [7], the requirements of this sub-article do not apply to scuppers and sanitary discharges.

2.5.2 Design of sea inlets and overboard discharges

a) All inlets and discharges in the shell plating are to be fitted with efficient and accessible arrangements for preventing the accidental admission of water into the vessel.

b) Sea inlets and overboard discharges are to be fitted with valves complying with [2.4] and [2.5.3].

c) Machinery space main and auxiliary sea inlets and discharges in connection with the operation of machinery are to be fitted with readily accessible valves between the pipes and the shell plating or between the pipes and fabricated boxes attached to the shell plating. The valves may be controlled locally and are to be provided with indicators showing whether they are open or closed.

d) Sea inlets are to be so designed and arranged as to limit turbulence and to avoid the admission of air due to motion of the vessel.

e) Sea inlets are to be fitted with gratings complying with [2.5.4].

f) Provisions are to be made for clearing sea inlet gratings.

g) Sea chests are to be suitably protected against corrosion.

2.5.3 Valves

a) Sea inlet and overboard discharge valves are to be secured:

- directly on the shell plating, or
- on sea chests built on the shell plating, with scantlings in compliance with Part B, or
- on extra-reinforced and short distance pieces (see Pt C, Ch 1, Sec 10 of TASNEEFMIL) attached to the shell.

b) The bodies of the valves and distance pieces are to have a spigot passing through the plating without projecting beyond the external surface of such plating or of the doubling plates and stiffening rings, if any.

c) Valves are to be secured by means of:

- bolts screwed through the plating with a countersunk head, or
- studs screwed in heavy pads themselves secured to the hull or chest plating, without penetration of the plating by the stud holes.

d) The use of butterfly valves will be specially considered by Tasneef. In any event, butterfly valves not fitted with flanges are not to be used for water inlets or overboard discharges unless provisions are made to allow disassembling at sea of the pipes served by these valves without any risk of flooding.

e) The materials of the valve bodies and connecting pieces are to comply with Pt C, Ch 1, Sec 10 of TASNEEFMIL.

f) Vessel side valves serving piping systems made of plastics are to comply with Pt C, Ch 1, Sec 10 of TASNEEFMIL.

2.5.4 Gratings

a) Gratings are to have a free flow area not less than twice the total section of the pipes connected to the inlet.

b) When gratings are secured by means of screws with a countersunk head, the tapped holes provided for such screws are not to pass through the plating or doubling plates outside distance pieces or chests.

c) Screws used for fixing gratings are not to be located in the corners of openings in the hull or of doubling plates.

d) In case of big sea inlets, screws used for fixing gratings are to be blocked and protected against corrosion.

e) When gratings are cleared by use of compressed air or steam devices, the chests, distance pieces and valves of sea inlets and outlets thus arranged are to be so constructed as to withstand the maximum pressure to which they may be subjected when such devices are operating.

2.6 Control and monitoring

2.6.1 General

a) Local indicators are to be provided for at least the following parameters:

- pressure, in pressure vessels, at pump or compressor discharge, at the inlet of the equipment served, on the low pressure side of pressure reducing valves;
- temperature, if necessary, in fuel tanks or lubricating oil and pressure vessels;
- levels in tanks liquids and pressure vessels.

b) Safeguards are to be provided where an automatic action is necessary to restore acceptable values for a faulty parameter.

c) Automatic controls are to be provided where it is necessary to maintain parameters related to piping systems at a preset value.

2.6.2 Level gauges

Level gauges used in flammable oil systems are to be of type approved by Tasneef and are subject to the following:

- Their breaking or the overfilling of the tanks are not to allow the loss of liquid fuel. The use of glass cylindrical gauges is prohibited. Tasneef may permit the use of oil-level gauges with flat glasses and self-closing valves between the gauges and fuel tanks:
- their glasses are to be made of heat-resistant material and efficiently protected against shocks.

The above level gauges are to be maintained in the proper condition to ensure their continued accurate functioning in service.

On vessels of less than 500 tons gross tonnage:

- cylindrical gauges may be used provided they are fitted with self-closing valves at their lower end as well as at their upper end if the latter is below the maximum liquid level.
- in the case of tanks not subject to filling by power pumps, with the exception of fuel oil service tanks, the valves need not be of the self-closing type. Such valves are, however, to be readily accessible and instruction plates are to be fitted adjacent to them specifying that they are to be kept closed
- in vessels with length **L**≤15 m level indicators in plastic pipe may be accepted provided they are equipped with automatic cocks on both the two extremities.

3 Welding of steel piping - Bending of pipes

3.1 Application

3.1.1 The requirements given in Pt C, Ch 1, Sec 10, of TASNEEFMIL apply.

4 Arrangement and installation of piping systems

4.1 General

4.1.1 Unless otherwise specified, piping and pumping systems covered by the Rules are to be permanently fixed on shipboard.

4.2 Location of liquid storage tanks and piping system components

4.2.1 Flammable oil systems

Location of liquid storage tanks and piping system components conveying flammable fluids under pressure is to comply with [4.10].

4.2.2 Piping systems with open ends

Attention is to be paid to the requirements for the location of open-ended pipes on board vessels having to comply with the provisions of [4.5].

4.2.3 Pipe lines located inside liquid storage tanks

a) The passage of pipes through liquid storage tanks, when permitted, normally requires special arrangements such as reinforced thickness or tunnels, in particular for:

- bilge pipes
- ballast pipes
- scuppers and sanitary discharges
- air, sounding and overflow pipes
- fuel oil pipes.

b) Junctions of pipes inside tanks are to be made by welding or flange connections. See also [2.2.1].

4.2.4 Overboard discharges

Overboard discharges are to be so located as to prevent any discharge of water into the lifeboats while they are being lowered.

4.2.5 Piping and electrical apparatus

As far as possible, pipes are not to pass near switchboards or other electrical apparatus.

If this requirement is impossible to satisfy, gutterways or masks are to be provided wherever deemed necessary to prevent projections of liquid or steam on live parts.

4.3 Passage through watertight bulkheads or decks

4.3.1 Penetration of watertight bulkheads and decks

a) Where penetrations of watertight bulkheads and internal decks are necessary for piping and ventilation, arrangements are to be made to maintain the watertight integrity.

b) Lead or other heat sensitive materials are not to be used in piping systems which penetrate watertight subdivision bulkheads or decks, where deterioration of such systems in the event of fire would impair the watertight integrity of the bulkhead or decks.

This applies in particular to the following systems:

- bilge system
- ballast system
- scuppers and sanitary discharge systems.

c) Where bolted connections are used when passing through watertight bulkheads or decks, the bolts are not to be screwed through the plating. Where welded connections are used, they are to be welded on both sides of the bulkhead or deck.

d) Penetrations of watertight bulkheads or decks by plastic pipes are to comply with Pt C, Ch 1, App 2 of TASNEEFMIL.

4.3.2 Passage through the collision bulkhead

a) A maximum of two pipes may pass through the collision bulkhead below the freeboard deck, unless otherwise justified.

Such pipes are to be fitted with suitable valves operable from above bulkhead deck and the valve chest is to be secured at the bulkhead inside the fore peak.

Such valves may be fitted on the after side of the collision bulkhead provided that they are readily accessible under all service conditions. All valves are to be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable.

b) The remote operation device of the valve referred to in a) is to include an indicator to show whether the valve is open or shut.

4.4 Independence of lines

4.4.1 As a general rule, bilge and ballast lines are to be entirely independent and distinct from lines conveying lubricating oil and fuel oil, with the exception of:

- pipes located between collecting boxes and pump suctions;
- pipes located between pumps and overboard discharges;
- pipes supplying compartments likely to be used alternatively for ballast, fuel oil, provided such pipes are fitted with blind flanges or other appropriate change-over devices, in order to avoid any mishandling.

4.5 Prevention of progressive flooding

4.5.1 Principle

a) In order to comply with the subdivision and damage stability requirements of Pt B, Ch 3, Sec 3, provision is to be made to prevent any progressive flooding of a dry compartment served by any open-ended pipe, in the event that such pipe is damaged or broken in any other compartment by collision or grounding.

b) For this purpose, if pipes are situated within assumed flooded compartments, arrangements are to be made to ensure that progressive flooding cannot thereby extend to compartments other than those assumed to be flooded for each case of damage. However, Tasneef may permit minor progressive flooding if it is demonstrated that its effects can be easily controlled and the vessel's safety is not impaired. Refer to Pt B, Ch 3, Sec 3.

4.5.2 Extent of damage

For the definition of the assumed transverse extent of damage, reference is to be made to Pt B, Ch 3, Sec 3.

4.5.3 Piping arrangement

a) The assumed transverse extent of damage is not to contain any pipe with an open end in a compartment located outside this extent, except where the section of such pipe does not exceed 50 cm^2.

Note: Where several pipes are considered, the limit of 50 cm^2 applies to their total section.

b) Where the provisions of a) cannot be fulfilled, and after special examination by Tasneef, pipes may be situated within the assumed transverse extent of damage penetration provided that:

- either a closable valve operable from above the bulkhead deck is fitted at each penetration of a watertight subdivision and secured directly on the bulkhead, or

- a closable valve operable from above the bulkhead deck is fitted at each end of the pipe concerned, the valves and their control system being inboard of the assumed extent of damage, or
- the liquid storage tanks to which the pipe concerned leads are regarded in the damage stability calculations as being flooded when damage occurs in a compartment through which the pipe passes.

c) Valves required to be operable from above the bulkhead deck are to be fitted with an indicator to show whether the valve is open or shut.

d) Where the valve is remote controlled by other than mechanical means, and where the remote control system is located,

even partly, within the assumed extent of damage penetration, this system is to be such that the valve is automatically closed by loss of power.

e) Air and overflow pipes are to be so arranged as to prevent the possibility of flooding of other tanks in other watertight compartments in the event of any one tank being flooded.

This arrangement is to be such that in the range of positive residual righting levers beyond the angle of equilibrium stage of flooding, the progressive flooding of tanks or watertight compartments other than that flooded does not occur.

4.6 Provision for expansion

4.6.1 General

Piping systems are to be so designed and pipes so fixed as to allow for relative movement between pipes and the vessel's structure, having due regard to:

- the temperature of the fluid conveyed
- the coefficient of thermal expansion of the pipes material
- the deformation of the vessel's hull.

4.6.2 Fitting of expansion devices

All pipes subject to thermal expansion and those which, due to their length, may be affected by deformation of the hull, are to be fitted with expansion pieces or loops.

4.7 Supporting of the pipes

4.7.1 General

Unless otherwise specified, the fluid lines referred to in this Section are to consist of pipes connected to the vessel's structure by means of collars or similar devices.

4.7.2 Arrangement of supports

Manufacturer are to take care that:

a) The arrangement of supports and collars is to be such that pipes and flanges are not subjected to abnormal bending stresses, taking into account their own mass, the metal they are made of, and the nature and characteristics of the fluid they convey, as well as the contractions and expansions to which they are subjected.

b) Heavy components in the piping system, such as valves, are to be independently supported.

4.8 Protection of pipes

4.8.1 Protection against shocks

Pipes passing through cargo holds and tweendecks are to be protected against shocks by means of strong casings.

4.8.2 Protection against corrosion and erosion

a) Pipes are to be efficiently protected against corrosion, particularly in their most exposed parts, either by selection of their constituent materials, or by an appropriate coating or treatment.

b) The layout and arrangement of sea water pipes are to be such as to prevent sharp bends and abrupt changes in section as well as zones where water may stagnate. The inner surface of pipes is to be as smooth as possible, especially in way of joints. Where pipes are protected against corrosion by means of galvanising or other inner coating, arrangements are to be made so that this coating is continuous, as far as possible, in particular in way of joints.

c) If galvanised steel pipes are used for sea water systems, the water velocity is not to exceed 3 m/s.

d) If copper pipes are used for sea water systems, the water velocity is not to exceed 2 m/s.

e) Arrangements are to be made to avoid galvanic corrosion.

4.8.3 Protection against frosting

Pipes are to be adequately insulated against cold wherever deemed necessary to prevent frost.

This applies specifically to pipes passing through refrigerated spaces and which are not intended to ensure the refrigeration of such spaces.

4.8.4 Protection of high temperature pipes and components

a) All pipes and other components where the temperature may exceed 220°C are to be efficiently insulated. Where necessary, precautions are to be taken to protect the insulation from being impregnated with flammable oils.

b) Particular attention is to be paid to lagging in way of flanges.

4.9 Valves and accessories

4.9.1 General

Cocks, valves and other accessories are generally to be arranged so that they are easily visible and accessible for

manoeuvring, control and maintenance. They are to be installed in such a way as to operate properly.

4.9.2 Valves and accessories

a) In machinery spaces and tunnels, the cocks, valves and other accessories of the fluid lines referred to in this Section are to be placed:

- above the floor; or
- when this is not possible, immediately under the floor, provided provision is made for their easy access and control in service.

b) Control-wheels of low inlet valves are to rise at least 0,45 m above the lowest floor.

4.9.3 Flexible hoses and expansion joints

a) Flexible hoses are to be so arranged as to be clearly visible and always accessible.

b) Flexible hoses and expansion joints are to be as short as possible.

c) The radius of curvature of flexible pipes are not to be lower than the minimum recommended by the Manufacturer.

d) The adjoined pipes are to be suitably aligned, supported, guided and anchored.

e) Valves of interception are to be arranged so that to allow the interception of flexible pipes which carry inflammable liquids and compressed air.

f) Expansion joints are to be protected against over-extension and over-compression.

g) Where there is risk of external damages, flexible pipes and expansion joints of the bellows type are to be provided of an adequate protection.

4.9.4 Thermometers

Thermometers and other temperature-detecting elements in fluid systems under pressure are to be provided with pockets built and secured so that the thermometers and detecting elements can be removed while keeping the piping under pressure.

4.9.5 Pressure gauges

Pressure gauges and other similar instruments are to be fitted with an isolating valve or cock at the connection with the main pipe.

4.9.6 Nameplates

a) Accessories such as cocks and valves on the fluid lines referred to in this Section are to be provided with nameplates indicating the apparatus and lines they serve except where, due to their location on board, there is no doubt as to their purpose.

b) Nameplates are to be fitted at the upper part of air and sounding pipes.

4.10 Additional arrangements for flammable fluids

4.10.1 General

The requirements in [4.10.3] and [4.10.4] apply to:

- fuel oil systems, in all spaces;
- lubricating oil systems, in machinery spaces;
- other flammable oil systems, in locations where means of ignition are present.

4.10.2 Prevention of flammable oil leakage ignition

a) As far as practicable, parts of the fuel oil and lubricating oil systems containing heated oil under pressure exceeding 0,18 MPa are to be placed above the platform or in any other position where defects and leakage can readily be observed.

The machinery spaces in way of such parts are to be adequately illuminated.

b) No flammable oil tanks are to be situated where spillage or leakage therefrom can constitute a hazard by falling on:

- hot surfaces, exhaust manifolds, silencers,
- electrical equipment,
- air intakes,
- other sources of ignition.

c) Parts of flammable oil systems under pressure exceeding 0,18 MPa such as pumps, filters and heaters are to comply with the provisions of b) above.

d) Flammable oil lines are not to be located immediately above or near units of high temperature, exhaust manifolds, silencers and other equipment required to be insulated in Sec 1, [3.7.1]. boilers, steam pipelines, exhaust manifolds, silencers or other equipment required to be insulated in Sec 1, [3.7.1]. As far as practicable, flammable oil lines are to be arranged far from hot surfaces, electrical installations or other sources of ignition and to be screened or otherwise suitably protected to avoid oil spray or oil leakage onto the sources of ignition. Precautions are to be taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces.

e) Any relief valve of fuel oil and lubricating oil systems is to discharge to a safe position, such as an appropriate tank.

4.10.3 Provisions for flammable oil leakage containment

a) Tanks used for the storage of flammable oils together with their fittings are to be so arranged as to prevent spillages due to leakage or overfilling.

b) Drip trays with adequate drainage to contain possible leakage from flammable fluid systems are to be fitted:

- under independent tanks;
- under purifiers and any other oil processing equipment;
- under pumps, heat exchangers and filters;
- under valves and all accessories subject to oil leakage;
- surrounding internal combustion engines.

c) The height of drip trays is to suit the amount of potential oil spillage.

d) Where drain pipes are provided for collecting leakages, they are to be led to an appropriate drain tank.

4.10.4 Drain tank

a) The drain tank is not to form part of an overflow system and is to be fitted with an overflow alarm device.

b) In vessels required to be fitted with a double bottom, appropriate precautions are to be taken when the drain tank is constructed in the double bottom, in order to avoid flooding of the machinery space where drip trays are located, in the event of accidentally running aground.

4.10.5 Valves

All valves and cocks forming part of flammable oil systems are to be capable of being operated from readily accessible positions and, in machinery spaces, from above the working platform.

4.10.6 Level switches

Level switches fitted to flammable oil tanks are to be contained in a steel or other fire-resisting enclosure.

5 Bilge systems

5.1 Principle

5.1.1 General

An efficient bilge pumping system shall be provided, capable of pumping from and draining any watertight compartment other than a space permanently appropriated for the carriage of fresh water, water ballast, fuel oil or liquid cargo and for which other efficient means of pumping are to be provided, under all practical conditions. Efficient means shall be provided for draining water from insulated holds.

Bilge pumping system is not intended at coping with water ingress resulting from structural or main sea water piping damage.

5.1.2 Availability of the bilge system

The bilge system is to be able to work while the other essential installations of the vessel, especially the fire-fighting installations, are in service.

5.1.3 Bilge and ballast systems

The arrangement of the bilge and ballast pumping system shall 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.

5.2 Design of bilge systems

5.2.1 General

a) The bilge pumping system is to consist of pumps connected to a bilge main line so arranged as to allow the draining of all spaces mentioned in [5.1.1] through bilge branches, distribution boxes and bilge suctions, except for some small spaces where individual suctions by means of hand pumps may be accepted as stated in [5.4.3] and [5.4.4].

b) If deemed acceptable by Tasneef, bilge pumping arrangements may be dispensed with in specific compartments provided the vessel's safety is not impaired.

5.2.2 Number and distribution of bilge suctions

a) Draining of watertight spaces is to be possible, when the vessel is on an even keel and either is upright or has a list of up to 5°, by means of at least:

- two suctions in machinery spaces, including one branch bilge suction and one direct suction and, in addition, for spaces containing propulsion machinery, one emergency bilge suction;
- one suction in other spaces.
- See also [5.4].

b) Bilge suctions are to be arranged as follows:

- wing suctions are generally to be provided except in the case of short and narrow compartments when a single suction ensures effective draining in the above conditions;
- in the case of compartments of unusual form, additional suctions may be required to ensure effective draining under the conditions mentioned in item a).

c) In all cases, arrangements are to be made such as to allow a free and easy flow of water to bilge suctions.

5.2.3 Prevention of communication between spaces - Independence of the lines

a) Bilge lines are to be so arranged as to avoid inadvertent flooding of any dry compartment.

b) Bilge lines are to be entirely independent and distinct from other lines except where permitted in [4.4].

5.3 Draining of machinery spaces

5.3.1 General

Where all the propulsion machinery, boilers and main auxiliaries are located in a single watertight space, the

bilge suctions are to be distributed and arranged in accordance with the provisions of [5.3.5].

5.3.2 Branch bilge suction

The branch bilge suction is to be connected to the bilge main.

5.3.3 Direct suction

The direct suction is to be led direct to an independent power bilge pump and so arranged that it can be used independently of the main bilge line.

The use of ejectors for pumping through the direct suction will be given special consideration.

5.3.4 Emergency bilge suction

a) The emergency bilge suction is to be led directly from the drainage level of the machinery space to a main circulating (or cooling) pump and fitted with a non-return valve.

b) In vessels where, in the opinion of Tasneef, the main circulating (or cooling) pump is not suitable for this purpose, the emergency bilge suction is to be led from the largest available independent power driven pump to the drainage level of the machinery space. Such a pump is not to be a bilge pump. Its capacity when the emergency suction is operating is to be at least equal to the required capacity of each bilge pump as determined in [5.5.4].

c) The emergency bilge suction is to be located at the lowest possible level in the machinery spaces.

5.3.5 Number and distribution of suctions in propulsion machinery spaces

a) In propulsion machinery spaces, bilge suctions are to include:

- where the bottom of the space, bottom plating or top of the double bottom slope down to the centreline by more than 5°, at least two centreline suctions, i.e. one branch bilge suction and one direct suction, or
- where the bottom of the space is horizontal or slopes down to the sides, at least two suctions, i.e. one branch bilge suction and one direct suction, on each side,
- and one emergency bilge suction.

b) If the tank top is of a particular design or shows discontinuity, additional suctions may be required.

c) Where the propulsion machinery space is located aft, suctions can be provided in each side of the aft and in the space itself except where not practicable due to the shape of the space, on each side at the aft end of the space.

d) In electrically propelled vessels, provision is to be made to prevent accumulation of water under electric generators and motors.

5.3.6 Number and distribution of suctions in auxiliary compartments

In auxiliary compartments, bilge suctions are to include:

- branch pipes in the aft end on the central zone when the raising of the bottom to sides is superior than 5° or to the aft end from both sides in other cases;
- one direct suction.

5.4 Draining of dry spaces other than machinery spaces

5.4.1 General

Except where otherwise specified, bilge suctions are to be branch bilge suctions, i.e. suctions connected to a bilge main.

5.4.2 Draining of cofferdams

a) All cofferdams are to be provided with suction pipes led to the bilge main.

b) Where cofferdams are divided by longitudinal watertight bulkheads or girders into two or more parts, a single suction pipe led to the aft end of each part is acceptable.

5.4.3 Draining of fore and aft peaks

a) Where the peaks are not used as liquid storage tanks and bilge suctions are not fitted, drainage of both peaks may be effected by hand pump suction provided that the suction lift is well within the capacity of the pump and in no case exceeds 7 m.

b) Except where permitted in [4.3.2], the collision bulkhead is not to be pierced below the freeboard deck.

5.4.4 Draining of spaces above fore and aft peaks

a) Provision is to be made for the drainage of the chain lockers and watertight compartments above the fore peak tank by hand or power pump suctions.

b) Steering gear compartments or other small enclosed spaces situated above the aft peak tank are to be provided with suitable means of drainage, either by hand or power pump bilge suctions. However, in the case of rudder stock glands located below the summer load line, the bilge suctions of the steering gear compartment are to be connected to the main bilge system.

c) If the compartments referred to in b) above are adequately isolated from the adjacent tweendecks, they may be drained by scuppers discharging to the tunnel (or machinery space in the case of vessels with machinery aft) and fitted with self-closing cocks situated in well-lighted and visible positions provided that it is considered in damage stability calculations.

5.4.5 Draining of tunnels

a) Tunnels are to be drained by means of suctions connected to the main bilge system. Such suctions are generally to be located in wells at the aft end of the tunnels.

b) Where the top of the double bottom, in the tunnel, slopes down from aft to forward, an additional

suction is to be provided at the forward end of this space.

5.5 Bilge pumps

5.5.1 Number and arrangement of pumps

a) At least two power pumps connected to the main bilge system are to be provided, one of which may be driven by the propulsion machinery.

b) Each pump may be replaced by a group of pumps connected to the bilge main, provided their total capacity meets the requirements specified [5.5.4].

c) Alternative arrangements, such as the use of a hand pump in lieu of a power pump, will be given special consideration by Tasneef.

5.5.2 Use of ejectors

One of the pumps may be replaced by a hydraulic ejector connected to a high pressure water pump and capable of ensuring the drainage under similar conditions to those obtained with the other pump.

5.5.3 Use of bilge pumps for other duties

a) Bilge pumps may be used for other duties, such as fire, general service, sanitary service or ballast provided that:

- such duties are of intermittent nature
- any failure of the piping systems connected to the bilge pumps does not render the bilge system inoperable
- pumps are immediately available for bilge duty when necessary.

b) The use of bilge pumps for fire duty is to comply with the provisions of Ch 4, Sec 6.

5.5.4 Capacity of the pumps

a) Each power bilge pump is to be capable of pumping water through the required main bilge pipe at a speed of not less than 2 m/s.

b) The capacity of each pump or group of pumps is not to be less than:

$$\mathbf{Q} = 0{,}00565\ \mathbf{d}^2$$

where:

Q : Minimum capacity of each pump or group of pumps, in m^3/h,

d : Internal diameter, in mm, of the bilge main as defined in [5.6.1].

Note : For vessels of less than 35 m in length:

- the speed of water to be considered for calculating the capacity may be reduced to 1,22 m/s
- the capacity of each pump or group of pumps is not to be less than $Q = 0{,}00345\ d^2$.

c) If the capacity of one of the pumps or one of the groups of pumps is less than the Rule capacity, the deficiency may be compensated by an excess capacity of the other pump or group of pumps; as a rule, such deficiency is not permitted to exceed 30% of the Rule capacity.

d) The capacity of hand pumps is to be based on one movement once a second.

e) Where an ejector is used in lieu of a driven pump, its suction capacity is not to be less than the required capacity of the pump it replaces.

5.5.5 Choice of the pumps

a) Bilge pumps are to be of the self-priming type. Centrifugal pumps are to be fitted with efficient priming means, unless an approved priming system is provided to ensure the priming of pumps under normal operating conditions.

b) Circulating or cooling water pumps connected to an emergency bilge suction need not be of the self-priming type.

c) Sanitary, ballast and general service pumps may be accepted as independent power bilge pumps if fitted with the necessary connections to the bilge pumping system.

d) Hand pumps are to have a maximum suction height not exceeding 7,30 m and to be operable from a position located above the load waterline.

5.5.6 Connection of power pumps

a) Bilge pumps and other power pumps serving essential services which have common suction or discharge are to be connected to the pipes in such a way that:

- compartments and piping lines remain segregated in order to prevent possible intercommunication
- the operation of any pump is not affected by the simultaneous operation of other pumps.

b) The isolation of any bilge pump for examination, repair or maintenance is to be made possible without impeding the operation of the remaining bilge pumps.

5.5.7 Electrical supply of submersible pump motors

a) Where submersible bilge pumps are provided, arrangements are to be made to start their motors from a convenient position above the bulkhead deck.

b) Where an additional local-starting device is provided at the motor of a permanently installed submersible bilge pump, the circuit is to be arranged to provide for the disconnection of all control wires therefrom at a position adjacent to the starter installed on the deck.

5.6 Size of bilge pipes

5.6.1 Bilge main line

a) The diameter of the bilge main is to be calculated according to the following formula:

$$d = 25 + 1,68\sqrt{L(B + D)}$$

where:

d : The internal diameter of the bilge main, in mm,

L : Length of the vessel is the length measured between perpendiculars taken at the extremities of the deepest subdivision load line, in m,

B : Breadth of the vessel is the extreme width from outside of frame to outside of frame at or below the deepest subdivision load line, in m

D : Moulded depth of the vessel to the bulkhead deck, in m.

b) In no case is the actual internal diameter to be:

- more than 5 mm smaller than that obtained from the formula given in a), or
- less than 60 mm

5.6.2 Distribution box branch pipes

The cross-section of any branch pipe connecting the bilge main to a bilge distribution box is not to be less than the sum of the cross-sections required for the two largest branch suctions connected to this box. However, this cross-section need not exceed that of the bilge main.

5.6.3 Branch bilge suction pipes

The internal diameter, in mm, of pipes situated between distribution boxes and suctions in machinery spaces is not to be less than the diameter given by the following formula (a smaller actual diameter may be accepted, as specified in [5.6.1] item b):

$$d_1 = 25 + 2,16\sqrt{L_1(B + D)}$$

where:

B e **D** : as defined in [5.6.1]

$\mathbf{L_1}$: Length of the compartment, in m.

$\mathbf{d_1}$: is not to be less than 50 mm and need not exceed 100 mm.

5.6.4 Direct suctions other than emergency suctions

a) Direct suctions are to be suitably arranged and those in a machinery space are to be of a diameter not less than that required for the bilge main.

b) In vessels having separate machinery spaces of small dimensions, the size of the direct suctions need not exceed that given in [5.6.3] for branch bilge suctions.

5.6.5 Emergency suctions in machinery spaces

a) The diameter of emergency bilge suction pipes is to be the same as the diameter of the pump inlet.

b) Where the emergency suction is connected to a pump other than a main circulating or cooling pump, the suction is to be the same diameter as the main inlet of the pump.

5.6.6 Bilge suctions from tunnels

Bilge suction pipes to tunnel wells are not to be less than 50 mm.

5.6.7 Scuppers in aft spaces

Any scupper provided for draining aft spaces and discharging to the tunnel is to have an internal diameter not less than 35 mm.

5.7 Bilge for vessels of less than 15 m in length

5.7.1 General

a) Bilge system is to be capable of removing water from all the compartments of the vessel not intended for containing liquids. A solution realized with a pump connected to a bilge main with suctions from various spaces, or the one providing a pump in each compartment can be adopted. In every case a supply system is to be provided.

b) In the first solution at least a second fixed pump, also manual, that can be operated from a position easily accessible over the waterline and connected to a main is to be provided. The capacity is to be enough to run out all the compartments. One of the two pumps is to be independent from the propulsion engine.

c) In the second solution at least a manual and portable pump and arrangements permitting suction from all the compartments is to be provided.

5.7.2 Pumps

a) Pumps set in action mechanically are to be of selfpriming type and may be driven both from a propulsion engine and from an auxiliary one.

b) The range of manual pumps is to be based on a movement per second.

c) Pumps, if electric, are to be in compliance with standard ISO 8849. Electric connections are to be waterproof and where a switch is subject to sprinklings of water is to be watertight in accordance with standard ISO 12216 standard 2.

5.7.3 Bilge main

If arranged, a bilge main is to have an internal diameter **d**, in mm, not less than:

$$\mathbf{d} = 0,85\,\mathbf{L} + 25$$

The pump connected to the bilge main is to have a range **Q**, in m^3/h not inferior to the value:

$$\mathbf{Q} = 0,0058\,\mathbf{d^2}$$

In case of bilge pumps arranged in every compartment the range of each pump **Q**, in m^3/h is to be not less than:

$$\mathbf{Q} = 0,27\,\mathbf{L_0}$$

being $\mathbf{L_0}$ the length, in m, of the compartment to exhaust.

5.7.4 Arrangements

Suction pipes are to be arranged so that:

- Each pump may operate in an independent way
- Pumps have not any contact with liquid tanks;
- Pumps are provided, in their extremities or in the pump itself with non-return valves where necessary to avoid that bilge water goes to a watertight compartment to another.

5.7.5 Materials

a) Pipes are in general to be metallic; however non-metallic pipes can be arranged at the discretion of Tasneef, referring to their features and materials used.

b) For spaces with low fire risk neoprene pipes with a metallic spiral may be used, whereas for spaces with high fire risk pipes of non-metallic material homologated as fireproof in accordance with standard ISO 7840:1994 Type A1 or A2 may be used.

5.8 Bilge accessories

5.8.1 Drain valves on watertight bulkheads

a) The fitting of drain valves or similar devices is not permitted on the collision bulkhead.

b) On other watertight bulkheads, the fitting of drain valves or similar devices is permitted unless practical alternative draining means exist. Such valves are to be easily accessible at all times and operable from above the freeboard deck. Means indicating whether the valves are open or closed are to be provided.

5.8.2 Screw-down non-return valves

a) Accessories are to be provided to prevent intercommunication of compartments or lines which are to remain segregated from one another. For this purpose, non-return devices are to be fitted:

- on the pipe connections to bilge distribution boxes or to the alternative valves, if any;
- on direct and emergency suctions in machinery spaces;
- on the suctions of pumps which also have connections from the sea or from compartments normally intended to contain liquid;
- on flexible bilge hose connections;
- on the suctions of water bilge ejectors;
- at the open end of bilge pipes passing through deep tanks;
- in compliance with the provisions for the prevention of progressive flooding, if applicable.

b) Screw-down and other non-return valves are to be of a recognised type which does not offer undue obstruction to the flow of water.

5.8.3 Mud boxes

In machinery spaces and shaft tunnels, termination pipes of bilge suctions are to be straight and vertical and are to be led to mud boxes so arranged as to be easily inspected and cleaned.

The lower end of the termination pipe is not to be fitted with a strum box.

5.8.4 Strum boxes

a) In compartments other than machinery spaces and shaft tunnels, the open ends of bilge suction pipes are to be fitted with strum boxes or strainers having holes not more than 10 mm in diameter. The total area of such holes is to be not less than twice the required cross-sectional area of the suction pipe.

b) Strum boxes are to be so designed that they can be cleaned without having to remove any joint of the suction pipe.

5.8.5 Bilge wells

a) The wells provided for draining the various compartments are to be made of steel plate and their capacity is not to be less than 0,15 m^3. In small compartments, smaller cylindrical wells may be fitted.

b) Bilge wells are to comply with the relevant provisions of Part B.

5.9 Materials

5.9.1 All bilge pipes used in or under fuel storage tanks or machinery spaces, including spaces in which oil-settling tanks or fuel oil pumping units are situated, shall be of steel or other suitable material non-sensitive to heat.

5.10 Bilge piping arrangement

5.10.1 Passage through double bottom compartments

Bilge pipes are not to pass through double bottom compartments. If such arrangement is unavoidable, the parts of bilge pipes passing through double bottom compartments are to have greater thickness, fitted with welded joints or strong flange joints.

5.10.2 Provision for expansion

Where necessary, bilge pipes inside tanks are to be fitted with expansion bends. Sliding joints are not permitted for this purpose.

5.10.3 Connections

Connections used for bilge pipes passing through tanks are to be welded joints or reinforced welded flange connections.

5.10.4 Access to valves and distribution boxes

All distribution boxes and manually operated valves in connection with the bilge pumping arrangement shall be in positions which are accessible under ordinary circumstances.

Hand-wheels of valves controlling emergency bilge suctions are to rise at least 0,45 m above the manoeuvring floor.

6 Ballast systems

6.1 Design and arrangement of ballast systems

Where a ballast system is provided this is to be achieved in accordance with the provisions given in Pt C, Ch 1, Sec 10, [7] of TASNEEFMIL.

7 Scuppers and sanitary discharges

7.1 Application

a) This Article applies to:

- scuppers and sanitary discharge systems, and
- discharges from sewage tanks.

b) Discharges in connection with machinery operation are dealt with in [2.5] of this Section.

c) For vessels with Length L ≤ 20 m Tasneef may consider solutions which are not in accordance with the provisions of this paragraph.

d) In particular in these vessels, where provided with a cockpit, this is to be empty and selfcleaning. Bottom is to be at a load waterline as to assure the selfcleaning of the cockpit.

The cockpit is to be provided with scuppers having a total surface in accordance with standard ISO DIS 11812 for design category A.

Possible opening giving access to the spaces under the cockpit are to be provided with closing means of strength construction, arranged in permanent way, watertight to bad weather and having a coaming not less than 100 mm.

7.1.1 Arrangement

a) Discharging crossing plating, both from spaces under the bulkhead and from the interior of superstructures and deckhouses settled on the mentioned deck, are to be provided with efficient and accessible systems to avoid water to go inside.

b) In general every single discharging is to have at least an automatic non-return valve with an active closing system to place on the bulkhead.

c) However, where the vertical distance between the waterline design and the interior ledge of the discharging pipes is superior than 0,01 **L**, discharging may provide two automatic non-return valves without active closing system, on condition that the inner valve is always accessible for controls in service conditions.

d) Where such vertical distance is superior than 0.02 **L**, an only automatic non-return valve without active closing system may be accepted.

e) Means for the active manoeuvre of valves are to be easily accessible and provided with an indicator to show whether the valve is open or shut.

f) Valves on scuppers coming from watertight compartment to bad weather, including in damage stability calculation, are to be manoeuvring from the operating compartment.

g) In guarded machinery spaces, sea inlets and main and auxiliary discharges connected with the machinery working may be controlled locally. Such controls are to be easily accessible and provided with an indicator to show whether the valve is open or shut.

h) In not guarded machinery spaces, sea inlets and main and auxiliary discharges connected with the machinery working may be manoeuvring from the operating compartment.

i) Scuppers coming from superstructures and deckhouses not provided with watertight doors to bad weather are to be lead outboard.

j) Every panting arrangements and valves required are to be on suitable flexible material. Valves in cast iron or similar material are not accepted.

7.1.2 Thickness of pipes

a) Thickness of scupper pipes and discharge pipes leading to the bilge or draining tanks is not to be smaller than the one requested [2.2].

b) Thickness of scupper pipes and discharge pipes leading to the panting is not to be smaller than the one listed in Tab 2 column 1 for piping system provided with valve and column 2 for piping system not provided with valve.

c) Tasneef may permit in its opinion scuppers with a thickness not superior then the planting thickness affected by the crossing.

Table 2

External diameter of pipe d, in mm	**Reinforced thickness (mm)**	**Standard thickness (mm)**
d ≤ 80	**7,00**	**4,50**
155	**9,25**	**4,5**
180	**10,00**	**5,00**
220	**12,50**	**5,80**
230 ≤ d	**12,50**	**6,00**

8 Air, sounding and overflow pipes

8.1 Air pipes

8.1.1 Principle

Air pipes are to be fitted to all liquid storage tanks, double bottoms, cofferdams, tunnels and other compartments which are not fitted with alternative ventilation

arrangements, in order to allow the passage of air or liquid so as to prevent excessive pressure or vacuum in the tanks or compartments, in particular in those which are fitted with piping installations. Their open ends are to be so arranged as to prevent the free entry of sea water in the compartments.

8.1.2 Number and position of air pipes

a) Air pipes are to be so arranged and the upper part of compartments so designed that air or gas likely to accumulate at any point in the compartments can freely evacuate.

b) Air pipes are to be fitted opposite the filling pipes and/or at the highest parts of the compartments, the vessel being assumed to be on an even keel.

c) In general, two air pipes are to be fitted for each compartment, except in small compartments, where only one air pipe may be accepted. When the top of the compartment is of irregular form, the position of air pipes will be given special consideration by Tasneef.

d) Where only one air pipe is provided, it is not to be used as a filling pipe.

8.1.3 Location of open ends of air pipes

a) Air pipes of double bottom compartments, tunnels, deep tanks and other compartments which can come into contact with the sea or be flooded in the event of hull damage are to be led to above the bulkhead deck or the freeboard deck.

Note: In vessels not provided with a double bottom, air pipes of small cofferdams or tanks not containing fuel oil or lubricating oil may discharge within the space concerned.

b) Air pipes of liquid storage tanks intended to be pumped up are to be led to the open above the bulkhead deck or the freeboard deck.

c) Air pipes other than those of fuel oil tanks, or tanks which can be exhausted or filled by sea, may be led to enclosed cargo spaces situated above the bulkhead deck, provided that such spaces are fitted with scuppers discharging overboard, which are capable of draining all the water which may enter through the air pipes without giving rise to any water accumulation.

d) Air pipes may discharge on the side of a superstructure on condition that their outlet is at least 0,02 L high over any waterline where the inclination of the vessel is an angle of 15°, or 0,02 L over the higher waterline in every overflowing phases resulting from calculation about the stability in overflowing.

e) The air pipe of the scupper tank is to be led to above freeboard deck.

f) The location of air pipes for flammable oil tanks is also to comply with [8.1.7].

g) Satisfactory closing devices are to be arranged, permanently connected to the openings of air pipes, as to avoid the free entrance of water in the space at issue, except for tanker pipes o tanks provided with connections for the reciprocal enlargement.

8.1.4 Height of air pipes

a) All the air pipes extending to open decks are to be height , from deck to the point where water can entry, of at least 450 mm, when deck isles than 0,05 L over the design waterline, and than 300 mm over all the other decks.

b) Where these heights may interfere with the working of the vessel, generally not lower than 300 mm or 150 mm respectively, a lower height may be approved, provided Tasneef is satisfied that this is justified by the closing arrangements and other circumstances. Satisfactory means which are permanently attached are to be provided for closing the openings of the air pipes.

c) The height of air pipes may be required to be increased on vessels for the purpose of compliance with buoyancy calculations.

d) On open decks air pipes are to finish goose necked, or equivalent way, and are to be provided with adequate devices to the water sea re-entering.

8.1.5 Special arrangements for air pipes of flammable oil tanks

a) Air and overflow pipes and relief valves of fuel oil are to discharge to a position on the open deck where there is no risk of fire or explosion from the emergence of oils and vapour. The open ends are to be fitted with wire gauze diaphragms made of corrosion resistant material and readily removable for cleaning and replacement. The clear area of such diaphragms is not to be less than the cross-sectional area of the pipe.

b) Air pipes of lubricating or hydraulic oil storage tanks not subject to flooding in the event of hull damage may be led to machinery spaces, provided that in the case of overflowing the oil cannot come into contact with electrical equipment, hot surfaces or other sources of ignition.

c) The location and arrangement of vent pipes for fuel oil service, settling and lubrication oil tanks are to be such that in the event of a broken vent pipe there is no risk of ingress of seawater or rainwater.

d) Air pipes of fuel oil service, settling and lubrication oil tanks likely to be damaged by impact forces are to be adequately reinforced.

e) Where seawater or rainwater may enter fuel oil service, settling and lubrication oil tanks through broken air pipes, arrangements such as water traps with:

- automatic draining; or
- alarm for water accumulation shall be provided.

8.1.6 Construction of air pipes

a) Where air pipes liquid storage tanks extend above the freeboard deck or superstructure deck, the exposed parts of the pipes are to be of substantial

construction, with a minimum wall thickness of at least:

- 6,0 mm, for pipes of 80 mm or smaller external diameter;
- 8,5 mm, for pipes of 165 mm or greater external diameter.
- Intermediate minimum thickness may be determined by linear interpolation.

b) Air pipes with height exceeding 900 mm are to be additionally supported.

c) In each compartment likely to be pumped up, and where no overflow pipe is provided, the total cross-sectional area of air pipes is not to be less than 1,25 times the cross-sectional area of the corresponding filling pipes.

d) The internal diameter of air pipes is not to be less than 50 mm, except for tanks of less than 2 m^3.

e) In vessels with Length L≤15 m, where the refilling occurred only for gravity, the internal diameter of air pipes is not to be less than 15 mm. Pipe may be non-metallic as long as homologated by Tasneef in accordance with standard ISO 7840 A1 or A2.

8.1.7 Strength requirements

Air pipes arranged in the first quarter ahead of the vessel length are to be of strength construction and, if arranged in position particularly exposed to sea strokes, supported by three small brackets welded to the deck.

8.2 Sounding pipes

8.2.1 Principle

a) Sounding devices are to be fitted to liquid storage tanks as well as to all compartments which are not readily accessible at all times.

b) For compartments normally intended to contain liquids, the following systems may be accepted in lieu of sounding pipes:

- a level gauge of an approved type efficiently protected against shocks, or
- a remote level gauging system of an approved type, provided an emergency means of sounding is available in the event of failure affecting such system.

8.2.2 Position of sounding pipes

Sounding pipes are to be located as close as possible to suction pipes.

8.2.3 Termination of sounding pipes

a) As a general rule, sounding pipes are to end above the bulkhead deck or the freeboard deck in easily accessible places and are to be fitted with efficient, permanently attached, metallic closing appliances.

b) In machinery spaces and tunnels, where the provisions of a) cannot be satisfied, short sounding pipes led to readily accessible positions above the floor and fitted with efficient closing appliances may be accepted. In vessels required to be fitted with a double bottom, such closing appliances are to be of the self-closing type.

8.2.4 Special arrangements for sounding pipes of flammable oil tanks

a) Where sounding pipes are used in flammable (except lubricating) oil systems, they are to terminate in the open air, where no risk of ignition of spillage from the sounding pipe might arise. In particular, they are not to terminate in passenger or crew spaces. As a general rule, they are not to terminate in machinery spaces. However, where Tasneef considers that this requirement is impracticable, it may permit termination in machinery spaces on condition that the following provisions are satisfied:

1. in addition, an oil-level gauge is provided meeting the provisions of [2.6.2];
2. the sounding pipes terminate in locations remote from ignition hazards unless precautions are taken, such as the fitting of effective screens, to prevent the fuel oil in the case of spillage through the terminations of the sounding pipes from coming into contact with a source of ignition;
3. the terminations of sounding pipes are fitted with self-closing blanking devices and with a small diameter self-closing control cock located below the blanking device for the purpose of ascertaining before the blanking device is opened that fuel oil is not present. Provision is to be made so as to ensure that any spillage of fuel oil through the control cock involves no ignition hazard.

b) For lubricating oil and fuel oil leakage tanks less than 2 m^3, the oil-level gauge mentioned in a.1 and the control cock mentioned in a.3 need not be provided on condition that the sounding pipes are fitted with appropriate means of closure.

c) Short sounding pipes may be used for tanks other than double bottom tanks without the additional closed level gauge provided an overflow system is fitted.

8.2.5 Closing appliances

a) Self-closing appliances are to be fitted with cylindrical plugs having counterweights such as to ensure automatic closing.

b) Closing appliances not required to be of the self-closing type may consist of a metallic screw cap secured to the pipe by means of a chain or a shut-off valve.

8.2.6 Construction of sounding pipes

a) Sounding pipes are normally to be straight. If it is necessary to provide bends in such pipes, the curvature is to be as small as possible to permit the ready passage of the sounding apparatus.

b) The sounding arrangement of compartments by means of bent pipes passing through other compartments will be given special consideration by

Tasneef. Such an arrangement is normally accepted only if the compartments passed through are cofferdams or are intended to contain the same liquid as the compartments served by the sounding pipes.

c) Bent portions of sounding pipes are to have reinforced thickness and be suitably supported.

d) The internal diameter of sounding pipes is not to be less than 32 mm.

e) Doubling plates are to be placed under the lower ends of sounding pipes in order to prevent damage to the hull. When sounding pipes with closed lower ends are used, the closing plate is to have reinforced scantlings.

8.3 Overflow pipes

8.3.1 Principle

Overflow pipes are to be fitted to liquid storage tanks:

- which can be filled by pumping and are designed for a hydrostatic pressure lower than that corresponding to the height of the air pipe, or
- where the cross-sectional area of air pipes is less than that prescribed in [8.1.6] item d).

8.3.2 Design of overflow systems

a) Overflow pipes are to be led:

- either outside,
- or, in the case of fuel oil or lubricating oil, to an overflow tank of adequate capacity or to a storage tank having a space reserved for overflow purposes.

b) Where tanks containing the same or different liquids are connected to a common overflow system, the arrangement is to be such as to prevent any risk of:

- intercommunication between the various tanks due to movements of liquid when emptying or filling, or due to the inclination of the vessel;
- overfilling of any tank to another assumed flooded due to hull damage.

For this purpose, overflow pipes are to be led to a high enough point above the deepest load waterline or, alternatively, non-return valves are to fitted where necessary.

c) Arrangements are to be made so that a compartment cannot be flooded from the sea through the overflow in the event of another compartment connected to the same overflow main being bilged. To this end, the openings of overflow pipes discharging overboard are as a rule to be placed above the deepest load waterline and are to be fitted where necessary with non-return valves on the plating, or, alternatively, overflow pipes from tanks are to be led to a point above the deepest load waterline.

d) Where deep tanks which can be used to contain liquid or dry cargo or fuel oil are connected to a common overflow system, arrangements are to be made so that liquid or vapours from other compartments cannot enter such tanks when carrying dry cargo.

8.3.3 Overflow tanks

a) Overflow tanks are to have a capacity sufficient to receive the delivery of the pumps for at least 10 minutes.

b) Overflow tanks are to be fitted with an air pipe complying with [8.1] which can be used as the flowing pipe of the same tank. which may serve as an overflow pipe for the same tank. When the vent pipe reaches a height exceeding the design head of the overflow tank, suitable means are to be provided to limit the actual hydrostatic head on the tank Such means are to discharge to a position which is safe at the discretion of Tasneef.

c) An alarm device is to be provided to give warning when the oil reaches a predetermined level in the tank, or alternatively, a sight-flow glass is to be provided in the overflow pipe to indicate when any tank is overflowing. Such sight-flow glasses are only to be placed on vertical pipes and in readily visible positions.

8.3.4 Specific requirements for construction of overflow pipes

a) The internal diameter of overflow pipes is not to be less than 50 mm.

b) In each compartment which can be pumped up, the total cross-sectional area of overflow pipes is not to be less than 1,25 times the cross-sectional area of the corresponding filling pipes.

c) The cross-sectional area of the overflow main is not to be less than the aggregate cross-sectional area of the two largest pipes discharging into the main.

8.4 Constructional requirements applying to sounding, air and overflow pipes

8.4.1 Materials

a) Sounding, air and overflow pipes are to be made of steel or any other material approved for the application considered.

b) Exposed parts of sounding, air and overflow pipes are to be made of approved metallic materials.

8.4.2 Minimum thickness of steel pipes

The minimum thickness of sounding, air and overflow steel pipes is given in Tab 3.

Tab 3

External diameter (mm)	Minimum wall thickness (mm)
Up to 168,3	4,5
177,8	5
193,7	5,4
219,1	5,9

More than 244,5	6,3

9 Cooling systems

9.1 Application

9.1.1 This article applies to all cooling systems using the following cooling media:

- sea water;
- fresh water;
- lubricating oil.

Air cooling systems will be given special consideration.

9.2 Principle

9.2.1 General

Sea water and fresh water cooling systems are to be so arranged as to maintain the temperature of the cooled media (lubricating oil, hydraulic oil, charge air, etc.) for propulsion machinery and essential equipment within the manufacturers' recommended limits during all operations, including starting and manoeuvring, under the inclination angles and the ambient conditions specified in Sec 1.

9.2.2 Availability of the cooling system

The cooling system is to be so designed that, in the event of one essential component being inoperative, the cooling of propulsion machinery is maintained. Partial reduction of the propulsion capability may be accepted, however, when it is demonstrated that the safe operation of the vessel is not impaired.

9.3 Design of sea water cooling systems

9.3.1 General

a) Sea water cooling of the propulsion engines, auxiliary engines and other essential equipment is to be capable of being supplied by two different means.

b) Where required, standby pumps are not to be connected to the sea inlet serving the other sea water pumps, unless permitted under [9.7.1] item b).

9.3.2 Centralized cooling systems

a) In the case of centralized cooling systems, i.e. systems serving a group of propulsion engines and/or auxiliary engines, reduction gears, compressors and other essential equipment, the following sea water pumps are to be arranged:

- one main cooling water pump, which may be driven by the engines, of a capacity sufficient to provide cooling water to all the equipment served,
- one independently driven standby pump of at least the same capacity.

b) Where the cooling system is served by a group of identical pumps, the capacity of the standby pump needs only to be equivalent to that of each of these pumps.

c) Ballast pumps or other suitable sea water pumps of appropriate capacity may be used as standby pumps, provided arrangements are made against overpressure in the cooling system.

d) In vessels having one or more propulsion engines, each with an output not exceeding 375 kW, the independent standby pump may be replaced by a complete spare pump of appropriate capacity ready to be connected to the cooling circuit.

e) In cases of centralized cooling systems serving only a group of auxiliary engines, the second means of cooling may consist of a connection to a cooling water pump serving the propulsion plant, provided such pump is of sufficient capacity to provide cooling water to both propulsion plant and auxiliary engines.

9.3.3 Individual cooling of propulsion engines

a) Individual cooling systems of propulsion engines are to include at least:

- one main cooling water pump, which can be driven by the engine;
- one independently driven standby pump, where the output of the engine does not exceed 375 kW, the following arrangements may be accepted:
- one main cooling water pump, which can be driven by the engine;
- one spare pump of appropriate capacity ready to be connected to the cooling circuit.

b) Where, in vessels having more than one engine per propeller or having several propellers, each engine is served by its own cooling circuit, the second means requested in [9.3.1] is to be provided, consisting of:

- a connection to an independently driven pump, such as a ballast pump or any other suitable,
- sea water pump of sufficient capacity provided arrangements against overpressure in the cooling system are made (see [9.7.4] b).
- or a complete spare pump identical to those serving the engines and ready to be connected to the cooling circuit.

  This second means may be omitted, however, when safety justifications are provided as regards the propulsion and manoeuvring capabilities of the vessel with one cooling circuit disabled.

9.3.4 Individual cooling of auxiliary engines

Where each auxiliary engine is served by its own cooling circuit, no second means of cooling is required.

9.3.5 Cooling of other essential equipment

a) The second means of cooling required in [9.3.1] for essential equipment may consist of a connection to a ballast pump or other suitable sea water pump of sufficient capacity, provided arrangements are made against overpressure in the cooling system. (see [9.7.4] item b).

b) However, where such essential equipment is duplicate, this second means may be omitted when safety justifications are provided as regards the propulsion and manoeuvring capabilities of the vessel with the cooling circuit of one set of equipment disabled.

9.3.6 Cooling systems for vessels with length L≤15 m

a) Propulsion engines are to be cooled by sea water or fresh water in closed circuit through the arrangement of suitable sea water cooling.

b) In addition to the main cooling pump of the propulsion engine which can be put in function by the engine itself, a supply pump is to be arranged. In case the vessel is provided with double propulsion engine, each of them provided with its own cooling water circulation pump, supply pump is not requested.

c) Cooling pipe is in general to be metallic and corrosion proof. (stainless steel pumps are not admitted). Non metallic flexible pipes may be accepted (for example neoprene reinforced with metallic turns) in preference of limited length, to connect suction and discharge pipes with engine ones.

d) A metallic valve easily accessible is to be arranged on sea inlets. On pipe of water entry a metallic filter easily dismantling is to be arranged next to the valve, in addition to the grating arranged on the sea inlets.

e) A thermometer controlling the cooling water temperature is to be arranged at the main driving seat and an optic and acoustic alarm continuously operative signalling possible temperature increases on the bridge.

9.4 Design of fresh water cooling systems

9.4.1 General

Fresh water cooling systems are to be designed according to the applicable requirements of [9.3].

9.4.2 Cooling systems

a) Fresh water cooling systems of essential equipment are to include at least:

- one main cooling water pump, which can be driven by the equipment;
- one independently driven standby pump.

b) The standby pump may be omitted provided an emergency connection to a suitable sea water system is fitted and arranged with a suitable change-over device. Provisions against overpressure in the cooling system are to be made.

c) The standby pump may also be omitted in the case of redundancy of the cooled equipment.

9.4.3 Expansion tanks

Fresh water expansion tanks are to be provided with at least:

- a de-aerating device;
- a water level indicator;
- a filling connection;
- a drain.

9.4.4 Detection of fuel oil or lubricating oil

A device is to be fitted in fresh water cooling systems comprising fuel oil or lubricating oil heat exchangers in order to detect any contamination of the water by fuel oil or lubricating oil.

9.5 Design of oil cooling systems

9.5.1 Oil cooling systems are to be designed, as applicable, for water cooling systems, in addition to the requirements stated for diesel engines in Sec 2:

- Low pressure or flow in connection with the water sea pump;
- Low pressure or flow in connection with the fresh water pump;
- Low level of the cooling water of the expansion tank.

9.6 Arrangement of cooling systems

9.6.1 Sea inlets

a) At least two sea inlets complying with [2.5] are to be provided for the cooling system, one for each means of cooling required in [9.3.1].

b) The two sea inlets may be connected by a cross-over supplying both main cooling pump and standby cooling pump.

c) When the second means of cooling is a spare pump, the two sea inlets are to be provided in any event, both serving the main cooling pump.

d) The sea inlets are to be low inlets, so designed as to remain submerged under all normal navigating conditions.

e) In general, one sea inlet is to be arranged on each side of the vessel.

f) One of the sea inlets may be that of the ballast pump or of the general service pump.

9.6.2 Coolers

a) Coolers are to be fitted with isolating valves at the inlets and outlets.

b) Coolers external to the hull (chest coolers and keel coolers) are to be fitted with isolating valves at the shell.

9.6.3 Filters

a) Where propulsion engines and auxiliary engines for essential services are directly cooled by sea water, both in normal service and in emergency operating conditions, filters are to be fitted on the suction of cooling pumps.

b) These filters are to be so arranged that they can be cleaned without interrupting the cooling water supply.

9.6.4 Pumps

a) Cooling pumps for which the discharge pressure may exceed the design pressure of the piping system are to be fitted with relief valves in accordance with [2.5] of Pt C, Sec 10 of TASNEEFMIL

b) Where general service pumps, ballast pumps or other pumps may be connected to a cooling system, arrangements are to be made, in accordance with [2.5], of Pt C, Sec 10 of TASNEEFMIL to avoid overpressure in any part of the cooling system.

9.6.5 Air venting

Cocks are to be installed at the highest points of the pipes conveying cooling water to the water jackets for venting air or gases likely to accumulate therein. In the case of closed fresh water cooling systems, the cock is to be connected to the expansion tank.

10 Fuel oil systems

10.1 Application

10.1.1 Scope

This Article applies to all fuel oil systems supplying any kind of installation.

10.2 Principle

10.2.1 General

a) Fuel oil systems are to be so designed as to ensure the proper characteristics (purity, viscosity, pressure) of the fuel oil supply to engines and boilers.

b) Fuel oil systems are to be so designed as to prevent:

- overflow or spillage of fuel oil from tanks, pipes, fittings, etc.
- fuel oil from coming into contact with sources of ignition
- overheating and seizure of fuel oil

c) Fuel oils used for engines and boilers are to have a flashpoint complying with the provisions of Sec 1.

10.2.2 Availability of fuel systems

a) Fuel oil systems are to be so designed that, in the event that any one essential auxiliary of such systems becomes inoperative, the fuel oil supply to boilers and engines can be maintained (see also [10.2.1- item a)]. Partial reduction of the propulsion capability may be accepted, however, when it is demonstrated that the safe operation of the vessel is not impaired.

b) Fuel oil tanks are to be so arranged that, in the event of damage to any one tank, complete loss of the fuel supply to essential services does not occur.

10.3 General

10.3.1 Arrangement of fuel oil systems

a) In vessels in which fuel oil is used, the arrangements for the storage, distribution and utilization of the fuel oil are to be such as to ensure the safety of the vessel and people on board.

b) The provisions in [4.10] are to be complied with.

10.3.2 Provision to prevent overpressure

Provisions are to be made to prevent overpressure in any oil tank or in any part of the fuel oil system. Any relief valve is to discharge to a safe position.

10.3.3 Ventilation

The ventilation of machinery spaces is to be sufficient under all normal conditions to prevent accumulation of oil vapours.

10.3.4 Access

Spaces where fuel oil is stored or handled are to be readily accessible.

10.4 Design of fuel oil tanks and bunkers

10.4.1 General

a) A system of pumps and piping for filling and transferring fuel oil is to be provided.

b) Provisions are to be made to allow the transfer of fuel oil from any storage, settling or service tank to another tank.

10.4.2 Filling system

a) Filling pipes of fuel oil tanks are to terminate on open deck or in filling stations isolated from other spaces and efficiently ventilated. Suitable coamings and drains are to be provided to collect any leakage resulting from filling operations.

b) Arrangements are to be made to avoid overpressure in the filling lines which are served by pumps on board. Where relief valves are provided for this purpose, they are to discharge to the overflow tank referred to in [8.3.3] or to other safe positions deemed satisfactory.

10.4.3 Independence of fuel oil transfer lines

The fuel oil transfer piping system is to be completely separate from the other piping systems of the vessel.

10.4.4 Transfer pumps

a) At least two means of transfer are to be provided.

One of these means is to be a power pump. The other may consist of:

- a standby pump,
- or, alternatively, an emergency connection to another suitable power pump.

Note: Where provided, purifiers may be accepted as means of transfer.

b) Where necessary, transfer pumps are to be fitted on their discharge side with a relief valve leading back to the suction of the pump or to any other place deemed satisfactory.

10.4.5 Filling and suction pipes

a) All suction pipes from fuel oil tanks and bunkers, including those in the double bottom, are to be provided with valves.

b) For storage tanks, filling pipes may also be used for suction purposes.

c) Where the filling pipes to fuel oil bunkers and tanks are not led to the upper part of the such bunkers and tanks, they are to be provided with non-return valves at their ends, unless they are fitted with valves arranged in accordance with the requirements stated in Pt C, Ch 1, Sec 10, [11.6.4] of TASNEEFMIL.

10.4.6 Heating and treatment of liquid fuel

Where liquid fuel requesting heating and/or purification and filtration treatments is used the related systems are to be achieved in accordance with the provisions given in Pt C, Ch 1, Sec 10, [11.7] and [11.8] of TASNEEFMIL.

10.5 Design of fuel supply systems

10.5.1 General

10.5 Design of fuel supply systems is to be achieved with the requirements given in Pt C, Cap 1, Sec 10, [11.9], [11.10], [11.11] of TASNEEFMIL.

10.6 Fuel and lubricating oil systems in vessels with L≤15 m

10.6.1 Fuel and lubricating oil systems are to be independent from any other on board circuit.

10.6.2 Pressure gauges to control oil pressure and an optic and acoustic alarm device continuously operating signalling the possible pressure reduction on the bridge are to be arranged on the lubricating circuit of propulsion engines.

10.6.3 All the pieces composing the system are to be capable to endure, for at least 2,5 minutes, to the free combustion of fuel used without loss of liquid or vapour.

10.6.4 A supplying fuel pumps for the engine, driven by the engine itself or by an independent engine is to be arranged; in the last case the pump is to be arranged inside the machinery space. A pump, also manual, for decanting the possible deposits to service tanks and for disembarking fuel is to be provided, when such operations can not be made because of serious reasons.

10.6.5 If the vessel is provided with only one propulsion engine a double filter on the fuel supplying system is required.

Filters are to be arranged so that the opening for cleaning is permitted without interrupting the fuel supplying to the engine. If the propulsion system is composed by two or more engines provided with their own filter, a second filter is not required, provided that a spare part complete filter ready accessible and easily replaceable is present on.

10.6.6 If the vessel is provided with only one propulsion engine a second reserve supplying pump is required. If the vessel is provided with a propulsion equipment with two engines, each of them provided with its own fuel supplying pump driven by the engine itself, a second reserve pump is not required.

10.6.7 The vessel is to be provided with at least two main fuel tanks and the fuel supplying system is to be arranged so that any tanks may be excluded and the engine may be supplied with the other.

10.6.8 Where the vessel is provided with two engines the possibility to supply engines independently from any or other tanks is not required provided that the vessel is able to sail and steer in safety with only one engine operating.

10.6.9 In vessels of modest size (**L**<10 m) used in limited sailing, only one fuel tank may be accepted at the discretion of Tasneef.

10.6.10 The piping system connecting tanks with engines is to be provided with an interception valve on the tank with both on spot control and remote control that can be operated from outside the space where tanks are settled and a valve arranged in proximity to the engine where tanks are arranged outside the engine space.

This last valve may be omitted when the engine space is not open to personnel during service.

11 Lubricating oil system

11.1 Application

11.1.1 This Article applies to lubricating oil systems serving diesel engines, steam and gas turbines, reverse and reduction gears, clutches and controllable pitch propellers.

It also applies to separate oil systems intended for the cooling of engine pistons.

11.2 Principle

11.2.1 General

a) Lubricating oil systems are to be so designed as to ensure reliable lubrication of the engines, turbines and other equipment, including electric motors, intended for propulsion:

- over the whole speed range, including starting, stopping and manoeuvring;
- for all the inclinations angles stated in Sec 1.

b) Lubricating oil systems are to be so designed as to ensure sufficient heat transfer and appropriate filtration of the oil.

c) Lubricating oil systems are to be so designed as to prevent oil from entering into contact with sources of ignition.

11.2.2 Availability

a) Lubricating oil systems are to be so designed that, in the event that any one pump is inoperative, the lubrication of the engines and other equipment is maintained.

Partial reduction of the propulsion capability may be accepted, however, when it is demonstrated that the safe operation of the vessel is not impaired.

b) An emergency lubricating system, such as a gravity system, is to be provided to ensure sufficient lubrication of equipment which may be damaged due to a failure of the pump supply.

11.3 Design of lubricating oil systems for diesel engines and other equipments

11.3.1 General

Lubricating oil systems are to be achieved in accordance with the provisions given Pt C, Ch 1, Sec 10, [12], of TASNEEFMIL.

12 Hydraulic systems

12.1 Application

12.1.1 Hydraulic installations intended for essential services

Unless otherwise specified, this Article applies to all hydraulic power installations intended for essential services, including:

- actuating systems of controllable pitch propellers and clutches;
- actuating systems of thrusters;
- actuating systems of steering gear;
- actuating systems of lifting appliances;
- manoeuvring systems of stern, bow and side doors and bow visors;
- starting systems of diesel engines and gas turbines;
- remote control of valves.

12.2 Design of hydraulic systems

12.2.1 General

Oil lubricating systems are to be achieved with the provisions given in Pt C, Ch 1, Sec 10, [13] of TASNEEFMIL.

13 Compressed air systems

13.1 Application

13.1.1 This Article applies to compressed air systems intended for essential services, and in particular to:

- starting of engines,
- control and monitoring.

13.2 Principle

13.2.1 General

a) Compressed air systems are to be so designed that the compressed air delivered to the consumers:

- is free from oil and water,
- does not have an excessive temperature.

b) Compressed air systems are to be so designed as to prevent overpressure in any part of the systems.

13.2.2 Availability

a) Compressed air systems are to be so designed that, in the event of failure of one air compressor or one air receiver intended for starting, control purposes or other essential services, the air supply to such services can be maintained.

b) The compressed air system for starting main engines and auxiliary engines for essential services is to be so arranged that it is possible to ensure the initial charge of air receiver(s) without the aid of a power source outside the vessel.

13.3 Design of air systems

13.3.1 General

Pneumatic systems of starting air system and the control ones are to be achieved with the provisions given in Pt C, Ch 1, Sec 10, [16] of TASNEEFMIL.

14 Exhaust gas systems

14.1 General

14.1.1 Application

This Article applies to:

- exhaust gas pipes from engines and gas turbines
- smoke ducts from boilers and incinerators.

14.1.2 Principle

Exhaust gas systems are to be so designed as to:

- limit the risk of fire
- prevent gases from entering manned spaces
- prevent water from entering engines.

14.2 Design of exhaust systems

14.2.1 General

Exhaust systems are to be so arranged as to minimize the intake of exhaust gases into manned spaces, air conditioning systems and engine intakes.

14.2.2 Limitation of exhaust line surface temperature

a) Exhaust gas pipes and silencers are to be either water cooled or efficiently insulated where:

- their surface temperature may exceed 220°C, or
- they pass through spaces of the vessel where a temperature rise may be dangerous.

b) The insulation of exhaust systems is to comply with the provisions of Sec 1, [3.7.1].

14.2.3 Limitation of pressure losses

Exhaust gas systems are to be so designed that pressure losses in the exhaust lines do not exceed the maximum values permitted by the engine manufacturers.

14.2.4 Intercommunication of engine exhaust gas lines

Exhaust gas from different engines is not to be led to a common exhaust main, exhaust gas boiler or economizer, unless each exhaust pipe is provided with a suitable isolating device.

14.2.5 Exhaust gas pipe terminations

a) Where exhaust pipes are led overboard close to the load waterline, means are to be provided to prevent water from entering the engine or the vessel.

b) Where exhaust pipes are water cooled, they are to be so arranged as to be self-draining overboard.

14.3 Materials

14.3.1 General

Materials of exhaust gas pipes and fittings are to be resistant to exhaust gases and suitable for the maximum temperature expected.

14.3.2 Use of plastic

The use of non-metallic materials may be accepted in water cooled systems in accordance with the provisions of App 2 in Pt C, Ch 1,of TASNEEFMIL and in particular for what indicated in 14.3.3 following.

14.4 Exhaust gas pipes in vessels with L≤ 15 m

14.4.1 In case of piping systems with cooling water injection pipes in non-metallic material may be accepted subject to the following :

- exhaust gas are to be cooled along the pipes length through injection so that temperature do not go over the one admitted for the material.;
- material is to be proof against the corrosion caused by the fuel used, fuel products and water sea;
- such features are to be considered suitable by Tasneef on the grounds of technical documents to submit at the examination.

14.4.2 The use of rubber pipes is admitted under the conditions listed above and on condition that the overflow planting is settled at least 300 mm over the load waterline.

An inferior position may be accepted, but not less than 100 mm, on condition that provisions pledging an equivalent safety, in the opinion of Tasneef adopted.

For example arranging additional bilge systems with alarm signalling the water presence or dividing appropriately the affected area so that reducing flooding spaces.

14.5 Arrangement of exhaust piping systems

14.5.1 Provision for thermal expansion

a) Exhaust pipes and smoke ducts are to be so designed that any expansion or contraction does not cause abnormal stresses in the piping system, and in particular in the connection with engine turboblowers.

b) The devices used for supporting the pipes are to allow their expansion or contraction.

14.5.2 Provisions for draining

a) Drains are to be provided where necessary in exhaust systems, and in particular in exhaust ducting below exhaust gas boilers, in order to prevent water flowing into the engine.

b) Where exhaust pipes are water cooled, they are to be so arranged as to be self-draining overboard.

14.5.3 Flexible hoses

The use of flexible hoses in water cooled exhaust systems will be given special consideration by Tasneef.

14.5.4 Silencers

Engine silencers are to be so arranged as to provide easy access for cleaning and overhaul.

15 Certification, inspection and testing of piping systems

15.1 Application

15.1.1 For the certification and workshop inspection and testing programme to be performed on:

- the various components of piping systems,
- the materials used for their manufacture.

The requirements given in Pt C, Ch 1, Sec 10, [19] of TASNEEFMIL apply.

On board testing is dealt with in Sec 15.

SECTION 10 STEERING GEAR

1 General

1.1 Application

1.1.1 Scope

Unless otherwise specified, the requirements of this Section apply to the steering gear systems of all mechanically propelled vessels, and to the steering mechanism of thrusters used as means of propulsion.

1.1.2 Cross references

In addition to the those provided in this Section, steering gear systems are also to comply with the requirements of: Sec 13 as regards sea trials, and Pt B, Ch 7, Sec 1, as regards the rudder and the rudder stock.

1.2 Documentation to be submitted

1.2.1 Documents to be submitted for all steering gear

Before constructions, all plans and specifications listed in Tab 1 of Pt C, Ch 1, Sec 11 of TASNEEFMIL are to be submitted for approval to Tasneef.

1.3 Definitions

1.3.1 Main steering gear

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 vessel under normal service conditions.

1.3.2 Steering gear power unit

Steering gear power unit is:

- in the case of electric steering gear, an electric motor and its associated electrical equipment
- in the case of electro hydraulic steering gear, an electric motor and its associated electrical equipment and connected pump
- in the case of other hydraulic steering gear, a driving engine and connected pump.

1.3.3 Auxiliary steering gear

Auxiliary steering gear is the equipment other than any part of the main steering gear necessary to steer the vessel in the event of failure of the main steering gear but not including the tiller, quadrant or components serving the same purpose.

1.3.4 Power actuating system

Power actuating system is the hydraulic equipment provided for supplying power to turn the rudder stock, comprising a steering gear power unit or units, together with the associated pipes and fittings, and a rudder actuator. The power actuating systems may share common components or components serving the same purpose.

1.3.5 Rudder actuator

Rudder actuator is the component which directly converts hydraulic pressure into mechanical action to move the rudder.

1.3.6 Steering gear control system

Steering gear control system is the equipment by which orders are transmitted from the navigation bridge to the steering gear power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables.

1.3.7 Maximum ahead service speed

Maximum ahead service speed is the greatest speed which the vessel is designed to maintain in service at sea at the deepest seagoing draught.

1.3.8 Maximum astern speed

Maximum astern speed is the speed which it is estimated the vessel can attain at the designed maximum astern power at the deepest seagoing draught.

1.3.9 Maximum working pressure

Maximum working pressure is the maximum expected pressure in the system when the steering gear is operated to comply with the provisions of Pt C, Ch 1, Sec 11 of TASNEEFMIL.

2 Design and construction

2.1 General

2.1.1 For the measurement of all component, for electric and hydraulic systems connected, for alarms , the provisions given in Pt C, Ch 1, Sec 11, of TASNEEFMIL apply, with the following changes:

a) the main machinery is to be put in function by mechanical energy if the diameter of the rudder stock is more than 120 mm;

b) the auxiliary machinery is to be put in function by mechanical energy if such diameter is more than 230 mm;

c) hydraulic systems for main and auxiliary control machinery are to be independent from the other hydraulic systems on the vessel.

2.2 Provisions for vessels with Length L≤24 m

2.2.1 Organs of government with remote control with cable

Organs of remote control government with cable are to be constructed and measured in accordance with:

- tiller is to present: height hub **h** ≥$\mathbf{D_T}$, in mm;
- thickness **t** ≥ 0,4 $\mathbf{D_T}$ **,** in mm**;**
- section modulus **Z**, in cm 3, near the hub connection not less than the value
- 0,15 $\mathbf{D_T}^3$ 10^{-3} (**a** – **b**)/**a ,**
- where $\mathbf{D_T} = \mathbf{D_{TF}}/\mathbf{K}$,
- **a** length, in mm, of tiller measured from the axis to the connection point between rudder rope and tiller,
- **b** = 0,5 $\mathbf{D_T}$ + **t**, in mm,
- $\mathbf{D_{TF}}$**, K** defined in Pt B, Ch 7, Sec 1.

The connection between tiller and stock is to be square section type, or cylindrical or conical with key, and the hub stock is to be bolted:

- The hub pins are to present a diameter $\mathbf{d_b}$ in mm, not less than the value given from the relation: $\mathbf{d_b}$ = 0,4 $\mathbf{D_T}$/ 2 $\mathbf{n}^{0,5}$,
- where **n** is the number of bolts in each hub side.

The key connection is to present rounded edges, length in mm, equal to thickness **t** of the hub, thickness, in mm equal to

0,17 $\mathbf{D_T}$ and section, in mm^2, equal to 0,25 $\mathbf{D_T}^2$

The rudder rope connected with the tiller is to present the breaking load **CR**, in kN, not less than 0,053 $\mathbf{D_T}^3$ /**a.**

2.2.2 Organs of government with hydraulic and electrohydraulic remote control

Organs of government with hydraulic and electrohydraulic remote control are to satisfy the provisions given in [2.1] with the following changes:

- Pipings of hydraulic systems are in general to be metallic and of adequate thickness at the exercise pressure; alternately flexible pipes (also non-metallic) with metallic fittings of high pressure type homologated by Tasneef or other recognized companies may be used.

2.2.3 Auxiliary systems

Arrangement of an auxiliary systems is not required in the following cases:

- there are two rudders or two executive control systems capable of operate independently from each other even with one out of use;
- it is possible to control the vessel using other devices, independent from the main control system provided in the vessel. The acceptance of this arrangement is subordinated to the success of sea trials which demonstrate that the alternative system gives warrants of sufficient manoeuvrability and reliability at navigation speed.

2.2.4 Particular organs of government

Particular organs of government will be specially considered by Tasneef on a case by case basis.

Features and performances are to be defined in accordance with the Administration on the understanding that they will warrant adequate evolving capacities.

The measurement of every part of the rudder organs of government is to be executed with the strength obtained by calculation.

3 Arrangement and installation - Certification, inspection and testing

3.1 General

The requirements given in Pt C, Ch 1, Sec 11, of TASNEEFMIL apply.

SECTION 11 THRUSTERS

1 General

1.1 Application

1.1.1 The requirements of this Section apply to the following types of thrusters:

- transverse thrusters intended for manoeuvring developing power equal to 500 kW or more;
- thrusters intended for propulsion and steering developing power equal to 220 kW or more; for power less than 220 kW the requirements apply only to the propeller and relevant shaft.

1.1.2 Thrusters developing power less than that indicated in [1.1.1] are to be built in accordance with sound marine practice and tested as required in [3.1.1] to the satisfaction of the Surveyor.

1.2 Definitions

1.2.1 Thruster

Thruster is a tubed propeller in a rotating nozzle or in a special transversal tunnel on the vessel, or a water-jet propeller.

A thruster may present propulsion, manoeuvrable and control functions, or any combination of these functions.

Propulsion propellers tubed in fixed nozzles are not to be considered thrusters (see Sec 7, [1.1.1]).

1.2.2 Transverse thruster

A transverse thruster is an athwartship thruster developing a thrust in a transverse direction for manoeuvring purposes.

1.2.3 Azimuth thruster

An azimuth thruster is a thruster which has the capability to rotate of 360° as to develop thrust in any direction.

1.2.4 Water-jet

A water-jet is equipment constituted by a tubular casing (or duct) enclosing an impeller. The shape of the casing is such as to enable the impeller to produce a water-jet of such intensity as to give a positive thrust.

Water-jets may have means for deviating the jet of water in order to provide a steering function.

1.2.5 Continuous duty thruster

A continuous duty thruster is a thruster which is designed for continuous operation, such as a propulsion thruster.

1.2.6 Intermittent duty thrusters

An intermittent duty thruster is a thruster designed for operation at full power for a period not exceeding 1 hour, followed by operation at reduced rating for a limited period of time not exceeding a certain percentage of the hours in a day and a certain (lesser) percentage of the hours in a year. In general, athwartship thrusters are intermittent duty thrusters.

1.3 Thrusters intended for propulsion

1.3.1 In general, at least two azimuth thrusters are to be fitted in vessels where these are the sole means of propulsion.

Single azimuth thruster installations will be specially considered by Tasneef on a case by case basis.

Single water-jet installations are permitted.

1.4 Documentation to be submitted

1.4.1 Plans to be submitted for athwartship thrusters and azimuth thrusters

For the following thrusters, all plans listed in Tab 1 of Pt C, Ch 1, Sec 12 of TASNEEFMIL are to be submitted:

- intended for propulsion and steering;
- intended for manoeuvring developing power equal to 500 kW or more,.

The plans listed in Tab 1 are to be submitted. Plans as per item 6 of Tab 1 are also to be submitted for thrusters developing power less than 500 kW.

1.4.2 Plans to be submitted for water-jets

All plans listed in Tab 2 of Pt C, Ch 1, Sec 12 of TASNEEFMIL are to be submitted.

1.4.3 Additional data to be submitted

The data and documents listed in Tab 3 of this Rules are to be submitted by the manufacturer together with the plans.

2 Design and Construction

2.1 General

2.1.1 The requirements given in PT C, Ch 1, Sec 12, [2] of TASNEEFMIL apply.

3 Testing and certification

3.1 General

3.1.1 The requirements given in Pt C, Ch 1, Sec 12, [3] of TASNEEFMIL apply.

SECTION 12 TURBOCHARGERS

1 General

1.1 Application

1.1.1 These requirements apply to turbochargers fitted on diesel engines listed in Sec 2, [1.1.1] a), b) e c) having a power equal or more than 1000 kW.

1.1.2 Turbochargers not included in [1.1.1] are to be designed and constructed according to sound marine practice and delivered with internal manufacturer certificate relevant to the bench running test as per Pt C, Ch 1, Sec 14, [4] of TASNEEFMIL and the hydrostatic test as [4] in these Rules.

1.1.3 In the case of special types of turbochargers, Tasneef reserves the right to modify the requirements of this Section, demand additional requirements in individual cases and require that additional plans and data be submitted.

2 Design, construction, arrangements and installation – Tests and trials

2.1 Applications

2.1.1 Requirements given in Pt C, Ch 1, Sec 14 of TASNEEFMIL apply.

SECTION 13 TESTS ON BOARD

1 General

1.1 Application

1.1.1 This Section covers shipboard tests, both at the moorings and during sea trials. Such tests are additional to the workshop tests required in the other Sections of this Chapter.

For vessels with Length L≤ 15 m, the duration and the modality of trials may be reduced or modified case by case, at the discretion of Tasneef unless otherwise stated by the Administration.

1.2 Purpose of shipboard tests

1.2.1 Shipboard tests are intended to demonstrate that the main and auxiliary machinery and associated systems are functioning properly, in particular in respect of the criteria imposed by the Rules. The tests are to be witnessed by a Surveyor from Tasneef.

1.3 Documentation to be submitted

1.3.1 A comprehensive list of the shipboard tests intended to be carried out by the shipyard is to be submitted to Tasneef.

For each test, the following information is to be provided:

- scope of the test
- parameters to be recorded.

2 General requirements for shipboard tests

2.1 Trials at the moorings

2.1.1 Trials at the moorings are to demonstrate the following:

a) satisfactory operation of the machinery in relation to the service for which it is intended;

b) quick and easy response to operational commands;

c) safety of the various installations, as regards:

- the protection of mechanical parts
- the safeguards for personnel;

d) accessibility for cleaning, inspection and maintenance.

Where the above features are not deemed satisfactory and require repairs or alterations, Tasneef reserves the right to require the repetition of the trials at the moorings, either wholly or in part, after such repairs or alterations have been carried out.

2.2 Sea trials

2.2.1 Scope of the tests

Sea trials are to be conducted after the trials at the moorings and are to include the following:

a) demonstration of the proper operation of the main and auxiliary machinery, including monitoring, alarm and safety systems, under realistic service conditions;

b) check of the propulsion capability when one of the essential auxiliaries becomes inoperative;

c) detection of dangerous vibrations by taking the necessary readings when required;

d) checks either deemed necessary for vessel classification or requested by the interested parties and which are possible only in the course of navigation in open sea.

2.2.2 Exemptions

Exemption from some of the sea trials may be considered by Tasneef in the case of vessels having a sister vessel for which the satisfactory behaviour in service is demonstrated.

Such exemption is, in any event, to be agreed upon by the interested parties and is subject to the satisfactory results of trials at the moorings to verify the safe and efficient operation of the propulsion system.

3 Shipboard tests for machinery

3.1 Conditions of sea trials

3.1.1 Displacement of the vessel

Except in cases of practical impossibility, or in other cases to be considered individually, the sea trial is to be carried out with the vessel at the maximum loading conditions as far as practicable.

3.1.2 Power of the machinery

a) The power developed by the propulsion machinery in the course of the sea trials is to be as close as possible to the power for which classification has been requested. In general, this power is not to exceed the maximum continuous power or in

accordance with the possible operating profile assigned to the vessel, the weakest component of the propulsion system can be operated. In cases of diesel engines and gas turbines, it is not to exceed the maximum power for which the engine type concerned has been approved.

b) Where the rotational speed of the shafting is different from the design value, thereby increasing the stresses in excess of the maximum allowable limits, the power developed in the trials is to be suitably modified so as to confine the stresses within the design limits.

3.1.3 Determination of the power and rotational speed

a) The rotational speed of the shafting is to be recorded in the course of the sea trials, preferably by means of a continuous counter.

b) In general, the power is to be determined by means of torsiometric readings, to be effected with procedures and instruments deemed suitable by Tasneef.

As an alternative, for reciprocating internal combustion engines and gas turbines, the power may be determined by measuring the fuel consumption and on the basis of the other operating characteristics, in comparison with the results of bench tests of the prototype engine.

Other methods of determining the power may be considered by Tasneef on a case by case basis.

3.2 Navigation and manoeuvring tests

3.2.1 Speed trials

a) The vessel speed is to be determined in accordance with Tasneef.

b) The vessel speed is to be determined as the average of the speeds taken in not less than two pairs of runs in opposite directions.

3.2.2 Astern trials

a) The ability of the machinery to reverse the direction of thrust of the propeller in sufficient time, and so to bring the vessel to rest within reasonable distance from maximum ahead service speed, shall be demonstrated and recorded.

b) The stopping times, vessel headings and distances recorded on trials shall be available on board for the use of the Master or designated personnel. Beyond that the results of trials to determine the ability of vessels having multiple propellers to navigate and manoeuvre with one or more propellers inoperative, shall be available on board.

c) Where the vessel is provided with supplementary means for manoeuvring or stopping, the effectiveness of such means shall be demonstrated and recorded as referred to in paragraphs a) and b).

For electric propulsion systems, see [3.5].

3.3 Trials of diesel engines

3.3.1 General

The scope of the trials of diesel engines may be expanded in consideration of the special operating conditions.

3.3.2 Main propulsion engines driving fixed propellers

Trials of main propulsion engines driving fixed propellers are to include the following tests:

a) operation at rated engine speed n0,, for at least 4 hours;

b) operation at engine speed corresponding to normal continuous cruise power for at least 2 hours (if such cruise is not established at planning stage the greater among 75% of classification power or the lower gliding power if applicable shall be considered);

c) operation at engine speed n = 1,032 n0;

Note: The test in c) is to be performed only where permitted by the engine adjustment (see Sec 2, [4.5.3], Note 1) and generally is not required for vessels with light duty or medium duty operating profile.

d) operation at minimum load speed;

e) starting and reversing manoeuvres;

f) operation in reverse direction of propeller rotation at a minimum engine speed of n = 0,7n0; for ten minutes,

Note: The test in f) may be performed during the dock or sea trials,

g) tests of the monitoring, alarm and safety systems;

h) for engines fitted with independently driven blowers, emergency operation of the engine with one blower inoperative.

3.3.3 Main propulsion engines driving controllable pitch propellers or reversing gears

a) The scope of the trials for main propulsion engines driving controllable pitch propellers or reversing gears is to comply with the relevant provisions of [3.3.2].

b) Engines driving controllable pitch propellers are to be tested at various propeller pitches.

3.3.4 Engines driving generators for propulsion

Trials of engines driving generators for propulsion are to include the following tests:

a) operation at 100% power (rated power) for at least 4 hours;

b) operation at normal continuous cruise power for at least 2 hours;

c) operation at 110% power for 30 minutes;

d) operation in reverse direction of propeller rotation at a minimum engine speed 70% of the rated propeller speed for 10 minutes;

e) starting manoeuvres;

f) tests of the monitoring, alarm and safety systems.

Note: The above tests a) to f) are to be performed at rated speed with a constant governor setting. The powers refer to the rated electrical powers of the driven generators.

3.3.5 Engines driving auxiliaries

a) Engines driving generators or important auxiliaries are to be subjected to an operational test for at least 4 hours. During the test, the set concerned is required to operate at its rated power for at least 2 hours.

b) It is to be demonstrated that the engine is capable of supplying 100% of its rated power and, in the case of shipboard generating sets, account is to be taken of the times needed to actuate the generator's overload protection system.

3.4 Tests of gas turbines

3.4.1 Main propulsion turbines

Main turbines are to be subjected during dock trials and subsequent sea trials to the following tests:

- operation at rated rpm for at least 3 hours
- vessel reversing manoeuvres.

During the various operations, the pressures, temperatures and relative expansion are not to assume magnitudes liable to endanger the safe operation of the plant.

During the trials all safety, alarm, shut-off and control systems associated to the turbine are to be tested or properly simulated.

3.4.2 Auxiliary turbines

Turbines driving electric generators or auxiliary machines are to be run for at least 4 hours at their rated power and for 30 minutes at 110% of rated power.

During the trials all safety, alarm, shut-off and control systems associated to the turbine are to be tested or properly simulated.

3.5 Tests of electric propulsion system

3.5.1 Dock trials

a) The dock trials are to include the test of the electrical production system, the power management and the load limitation.

b) A test of the propulsion plant at a reduced power, in accordance with dock trial facilities, is to be carried out. During this test, the following are to be checked:

- electric motor rotation speed variation;
- functional test, as far as practicable (power limitation is to be tested with a reduced value);
- protection devices;
- monitoring and alarm transmission including interlocking system.

c) Prior to the sea trials, an insulation test of the electric propulsion plant is to be carried out.

3.5.2 Sea trials

Testing of the performance of the electric propulsion system is to be effected in accordance with an approved test program.

This test program is to include at least:

a) speed rate of rise;

b) endurance test:

- 4 hours at 100% rated output power;
- 2 hours at the maximum continuous output power normally used at sea;
- 10 minutes at maximum astern running power.

c) Check of the crash astern operation in accordance with the sequence provided to reverse the speed from full ahead to full astern, in case of emergency. During this test, all necessary data concerning any effects of the reversing of power on the generators are to be recorded, including the power and speed variation.

d) Test of functionality of electric propulsion, when manoeuvring and during the vessel turning test.

e) Test of power management performance: reduction of power due to loss of one or several generators to check, in each case, the power limitation and propulsion availability.

3.6 Tests of gears

3.6.1 Tests during sea trials

During the sea trials, the performance of reverse and/or reduction gearing is to be verified, both when running ahead and astern.

In addition, the following checks are to be carried out:

- check of the bearing and oil temperature
- detection of possible gear hammering, where required (see Pt C, Ch 1, Sec 9, of TASNEEFMIL)
- test of the monitoring, alarm and safety systems.

3.6.2 Check of the tooth contact

a) Prior to the sea trials, the tooth surfaces of the pinions and wheels are to be coated with a thin layer of suitable coloured compound. Upon completion of the trials, the tooth contact is to be inspected. The contact marking is to appear uniformly distributed without hard bearing at the ends of the teeth and without preferential contact lines. The tooth contact is to comply with Tab 1.

b) The verification of tooth contact at sea trials by methods other than that described above will be given special consideration by Tasneef.

c) In the case of reverse and/or reduction gearing with several gear trains mounted on roller bearings, manufactured with a high standard of accuracy and having an input torque not exceeding 20 000 N·m, the check of the tooth contact may be reduced at Tasneef discretion.

Such a reduction may also be granted for gearing which has undergone long workshop testing at full load and for which the tooth contact has been checked positively.

In any case, the teeth of the gears are to be examined by the Surveyor after the sea trials. Subject to the results, additional inspections or re-examinations after a specified period of service may be required.

For vessels with Length L≤24 m Tasneef may derogate from control requirement regarding tooth contact.

Tab 1 : Tooth contact for gears

Heat treatment and machining	Percentage of tooth contact	
	across the whole face width	of the tooth working depth
quenched and tempered, cut	70	40
• quenched and tempered, shaved or ground • surface-hardened	90	40

3.7 Tests of main propulsion shafting and propellers

3.7.1 Shafting alignment

Where alignment calculations are required to be submitted in pursuance of Sec 6, [3.3.1], the alignment conditions are to be checked on board as follows:

a) shafting installation and intermediate bearing position, before and during assembling of the shafts:

- optical check of the relative position of bushes after fitting;
- check of the flanged coupling parameters (gap and sag);
- check of the centring of the shaft sealing glands.

b) engine (or gearbox) installation, with floating vessel:

- check of the engine (or gearbox) flanged coupling parameters (gap and sag)
- check of the crankshaft deflections before and after the connection of the engine with the shaft line, by measuring the variation in the distance between adjacent webs in the course of one complete revolution of the engine.

Note: The vessel is to be in the loading conditions defined in the alignment calculations

c) load on the bearings:

- check of the intermediate bearing load by means of jack-up load measurements
- check of the bearing contact area by means of coating with an appropriate coloured compound.

3.7.2 Shafting vibrations

Torsional, bending and axial vibration measurements are to be carried out where required by Sec 6.

The type of the measuring equipment and the location of the measurement points are to be specified.

3.7.3 Bearings

The temperature of the bearings is to be checked under the machinery power conditions specified in [3.1.2].

3.7.4 Stern tube sealing gland

The stern tube oil system is to be checked for possible oil leakage through the stern tube sealing gland.

3.7.5 Propellers

a) For controllable pitch propellers, the functioning of the system controlling the pitch from full ahead to full astern position is to be demonstrated. It is also to be checked that this system does not induce any overload of the engine.

b) The proper functioning of the devices for emergency operations is to be tested during the sea trials.

3.8 Tests of piping systems

3.8.1 Functional tests

During the sea trials, piping systems serving propulsion and auxiliary machinery, including the associated monitoring and control devices, are to be subjected to functional tests at the rated power of the machinery. Operating parameters (pressure, temperature, consumption) are to comply with the values recommended by the equipment manufacturer.

3.8.2 Performance tests

Tasneef reserves the right to require performance tests, such as flow rate measurements, should doubts arise from the functional tests.

3.9 Tests of steering gear

3.9.1 General

a) The steering gear is to be tested during the sea trials under the conditions stated in [3.1] in order to demonstrate, to the Surveyor's satisfaction, that the applicable requirements of Sec 10 are fulfilled.

b) For controllable pitch propellers, the propeller pitch is to be set at the maximum design pitch approved for the maximum continuous ahead rotational speed.

3.9.2 Tests to be performed

Tests of the steering gear are to include:

a) functional test of the main and auxiliary steering gear with demonstration of the performances required;

b) test of the steering gear power units, including transfer between steering gear power units;

c) test of the isolation of one power actuating system, checking the time for regaining steering capability;

d) test of the hydraulic fluid refilling system;

e) test of the alternative power supply;

f) test of the steering gear controls, including transfer of controls and local control,

g) test of the means of communication between the navigation bridge, the engine room and the steering gear compartment;

h) test of the alarms and indicators;

i) where the steering gear design is required to take into account the risk of hydraulic locking, a test is to be performed to demonstrate the efficiency of the devices intended to detect this.

Note 1: Tests d) to i) may be carried out either during the mooring trials or during the sea trials.

Note 2 Azimuth thrusters are to be subjected to the above tests, as far as applicable.

4 Inspection of machinery after sea trials

4.1 General

a) For all types of propulsion machinery, those parts which have not operated satisfactorily in the course of the sea trials, or which have caused doubts to be expressed as to their proper operation, are to be disassembled or opened for inspection. Machinery or parts which are opened up or disassembled for other reasons are to be similarly inspected.

b) Should the inspection reveal defects or damage of some importance, Tasneef may require other similar machinery or parts to be opened up for inspection.

c) An exhaustive inspection report is to be submitted to Tasneef for information.

4.2 Diesel engines

a) In general, for all diesel engines, the following items are to be verified:

- the deflection of the crankshafts, by measuring the variation in the distance between adjacent webs in the course of one complete revolution of the engine;
- the cleanliness of the lubricating oil filters.

b) In the case of propulsion engines for which power tests have not been carried out in the workshop, some parts, agreed upon by the interested parties, are to be disassembled for inspection after the sea trials.

APPENDIX 1 PLASTIC PIPES

1 General

1.1 Application

1.1.1 These requirements are applicable to all piping systems with parts made of rigid plastic.

1.2 Use of plastic pipes

1.2.1 Plastic may be used in piping systems in accordance with the provisions of Sec 9, provided the following requirements are complied with.

1.2.2 Plastic pipes are to be of type approved by Tasneef.

1.3 Definitions

1.3.1 Plastic

Plastic includes both thermoplastic and thermosetting plastic materials without reinforcement, such as PVC and reinforced plastic pipes (FRP).

1.3.2 Piping systems

Piping systems includes the pipes, fittings, joints and any internal or external liners, coverings and coatings required to comply with the performance criteria.

1.3.3 Joints

Joints include all pipe assembling devices or methods, such as adhesive bonding, laminating, welding, etc.

1.3.4 Fittings

Fitting include bends, elbows, fabricated branch pieces, etc, made of plastic materials.

1.3.5 Nominal pressure

Nominal pressure is the maximum permissible working pressure.

1.3.6 Design pressure

Design pressure is the maximum working pressure which is expected under operations conditions or the highest set pressure of any relief valve or pressure relief device of the system, if fitted.

1.3.7 Fire endurance

Fire endurance is the capability of piping system to perform its intended function, i.e. maintain its strength and integrity for a period of time while exposed to fire.

2 Design, arrangement and certification of plastic piping systems

2.1 General

2.1.1 The requirements given in TASNEEFMIL Pt C, Cap 1, Appendix 2 apply.

Part C

Machinery, Systems and Fire Protection

Chapter 2
ELECTRICAL INSTALLATIONS

SECTION 1 GENERAL

1 Application

1.1 General

1.1.1 The requirements of this Chapter apply to electrical installations on vessels. In particular, they apply to the components of electrical installations for:

- primary essential services
- secondary essential services
- services for habitability.

The other parts of the installation are to be so designed as not to introduce any risks or malfunctions to the above services.

1.1.2 Tasneef may consider modified the requirements for installations not exceeding either 50 V or 50 kW total generator capacity and vessel with length L≤20 m or restricted navigation.

1.2 References to other regulations and standards

1.2.1 Tasneef may refer to other regulations and standards when deemed necessary. These include the IEC publications, notably the IEC 60092 series.

1.2.2 When referred to by Tasneef, publications by the International Electrotechnical Commission (IEC) or other internationally recognized standards, are those currently in force at the date of agreement for vessel classification. Documentation to be submitted

2 Document to be submitted

2.1.1 The documents listed in Pt C, Ch 2, Sezc1,Tab 1 of TASNEEFMIL are to be submitted The list of documents requested is to be intended as guidance for the complete set of information to be submitted, rather than an actual list of titles.

Tasneef reserves the right to request the submission of additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the system, equipment or components.

Unless otherwise agreed with Tasneef, documents for approval are to be sent in triplicate.

In any case, Tasneef reserves the right to require additional copies when deemed necessary.

3 Definitions

3.1 General

Unless otherwise stated, the terms used in this Chapter have the definitions laid down by the IEC standards.

The definitions given in the following requirements also apply.

3.2 Essential services

3.2.1 Essential services are those services essential for propulsion and steering, and the vessel's safety, and services to ensure minimum comfortable conditions of habitability.

3.3 Primary essential services

3.3.1 Primary essential services are those which need to be in continuous operation to maintain propulsion and steering, as for example:

- steering gear;
- pumps for controllable pitch propellers;
- Supplying fuel pumps, cooling pulverizes pumps, lubricating oil pumps and cooling water pumps for main and auxiliary machinery and turbines necessary for propulsion;
- azimuth thrusters which are the sole means for propulsion/steering with lubricating oil pumps, cooling water pumps;
- electrical equipment for electric propulsion plant with lubricating oil pumps and cooling water pumps;
- electric generators and associated power sources supplying the above equipment;
- hydraulic pumps supplying the above equipment;
- viscosity control equipment for heavy fuel oil;
- Control, monitoring and safety devices/systems for equipment for primary essential services;
- speed regulators dependent on electrical energy for main or auxiliary engines necessary for propulsion.

The main lighting system for those parts of the vessel normally accessible to and used by personnel is also considered a primary essential service.

3.4 Secondary essential services

3.4.1 Secondary essential services are those services which need not necessarily be in continuous operation to maintain propulsion and steering but which are necessary for maintaining the vessel's safety, as for example:

- Windlasses
- Fuel oil transfer pumps and fuel oil treatment equipment
- Lubrication oil transfer pumps and lubrication oil treatment equipment
- Preheaters for heavy fuel oil
- Sea water pumps
- Starting air and control air compressors
- Bilge, ballast and heeling pumps
- Fire pumps and other fire-extinguishing medium pumps
- Ventilation fans for machinery spaces
- Navigation lights, aids and signals
- Internal safety communication equipment
- Fire detection and alarm systems
- Electrical equipment for watertight closing appliances
- Electric generators and associated power supplying the above equipment
- Hydraulic pumps supplying the above equipment
- Control, monitoring and safety devices/systems for equipment for secondary essential services.

3.4.2 Services for habitability are those which need to be in operation to maintain the vessel's minimum comfort conditions for people on board.

Examples of equipment for maintaining conditions of habitability:

- Cooking
- Heating
- Domestic refrigeration
- Mechanical ventilation
- Sanitary and fresh water
- Electric generators and associated power sources supplying the above equipment.

3.5 Safety voltage

3.5.1 A voltage which does not exceed 50 V a.c. r.m.s. between conductors, or between any conductor and earth, in a circuit isolated from the supply by means such as a safety isolating transformer.

3.5.2 A voltage which does not exceed 50 V d.c. between conductors or between any conductor and earth in a circuit isolated from higher voltage circuits.

3.6 Low-voltage systems

3.6.1 Alternating current systems with rated voltages greater than 50 V r.m.s. up to 1000 V r.m.s. inclusive and direct current systems with a maximum instantaneous value of the voltage under rated operating conditions greater than 50 V up to 1500 V inclusive.

3.7 High-voltage systems

3.7.1 Alternating current systems with rated voltages greater than 1000 V r.m.s. and direct current systems with a maximum instantaneous value of the voltage under rated operating conditions greater than 1500 V.

3.8 Basic insulation

3.8.1 Insulation applied to live parts to provide basic protection against electric shock.

Note: Basic insulation does not necessarily include insulation used exclusively for functional purposes.

3.9 Supplementary insulation

3.9.1 Independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of a failure of basic insulation.

3.10 Double insulation

3.10.1 Insulation comprising both basic insulation and supplementary insulation.

3.11 Reinforced insulation

3.11.1 A single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation.

Note: The term "single insulation system" does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

3.12 Earthing

3.12.1 The earth connection to the general mass of the hull of the vessel in such a manner as will ensure at all times an immediate discharge of electrical energy without danger.

3.13 Normal operational and habitable condition

3.13.1 A condition under which the vessel as a whole, the machinery, services, means and aids ensuring propulsion, ability to steer, safe navigation, fire and flooding safety, internal and external communications and signals, means of escape, and emergency boat winches, as well as the designed comfortable conditions of habitability are in working order and functioning normally.

3.14 Emergency condition

3.14.1 A condition under which any services needed for normal operational and habitable conditions are not in working order due to failure of the main source of electrical power.

3.15 Main source of electrical power

3.15.1 A source intended to supply electrical power to the main switchboard for distribution to all services necessary for maintaining the vessel in normal operational and habitable condition.

3.16 Dead vessel condition

3.16.1 The condition under which the main propulsion plant and auxiliaries are not in operation due to the absence of power.

Note: Dead vessel condition is a condition in which the entire machinery installation, including the power supply, is out of operation and the auxiliary services such as compressed air, starting current from batteries etc., for bringing the main propulsion into operation and for the restoration of the main power supply are not available.

3.17 Main generating station

3.17.1 It is the space in which the main source of electrical power is situated.

3.18 Main switchboard

3.18.1 It is a switchboard which is directly supplied by the main source of electrical power and is intended to distribute electrical energy to the vessel's services.

3.19 Emergency switchboard

3.19.1 A switchboard which in the event of failure of the main electrical power supply system is directly supplied by the emergency source of electrical power or the transitional source of emergency and is intended to distribute electrical energy to the emergency services.

3.20 Emergency source of electrical power

3.20.1 A source of electrical power, intended to supply the emergency switchboard in the event of failure of the supply from the main source of electrical power.

3.21 Section boards

3.21.1 A switchgear and controlgear assembly which is supplied by another assembly and arranged for the distribution of electrical energy to other section boards or distribution boards.

3.22 Distribution board

3.22.1 A switchgear and controlgear assembly arranged for the distribution of electrical energy to final sub-circuits.

3.23 Hazardous areas

3.23.1 Areas in which an explosive atmosphere is present, or may be expected to be present due to the presence of vapours, gases, flammable dusts or explosives in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

3.23.2 Hazardous areas are classified in zones based upon the frequency and the duration of the occurrence of explosive atmosphere.

3.23.3 Hazardous areas for explosive gas atmosphere are classified in the following zones:

- Zone 0: an area in which an explosive gas atmosphere is present continuously or is present for long periods
- Zone 1: an area in which an explosive gas atmosphere is likely to occur in normal operation
- Zone 2: an area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur, is likely to do only infrequently and will exist for a short period only.

3.24 Certified safe-type equipment

3.24.1 Certified safe-type equipment is electrical equipment of a type for which a national or other appropriate authority has carried out the type verifications and tests necessary to certify the safety equipment with regard to explosion hazard when used in an explosive gas atmosphere.

3.25 Environmental categories

3.25.1 Electrical equipment is classified into environmental categories according to the temperature range, vibration levels, and resistance to chemically active substances and to humidity.

The designation of the environmental categories is indicated by the EC Code in Tab 2 of Pt C, Ch 2, Sec 1 of TASNEEFMIL.

The first characteristic numeral indicates the temperature range in which the electrical equipment operates satisfactorily, as specified in Tab 3 of Pt C, Ch 2, Sec 1 of TASNEEFMIL.

The second characteristic numeral indicates the vibration level in which the electrical equipment operates satisfactorily, as specified in Tab 4 Pt C, Ch 2, Sec 1 of TASNEEFMIL.

3.25.2 The tests for verifying the additional and supplementary letters and the characteristic numeral of the environmental categories are defined in Pt C, Ch 3, Sec 6 of TASNEEFMIL.

SECTION 2 GENERAL DESIGN REQUIREMENTS

1 Ambient conditions

1.1 General

1.1.1 The electrical components of installations are to be designed and constructed to operate satisfactorily under the environmental conditions on board.

In particular, the conditions shown in the tables in this Article are to be taken into account.

Note : The environmental conditions are characterized by:

- one set of variables including climatic conditions (e.g. ambient air temperature and humidity), biological conditions, conditions dependent upon chemically active substances (e.g. salt mist) or mechanically active substances (e.g. dust or oil), mechanical conditions (e.g. vibrations or inclinations) and conditions dependent upon electromagnetic noise and interference, and
- another set of variables dependent mainly upon location on vessels, operational patterns and transient conditions.

1.2 Ambient air temperatures

1.2.1 For vessels classed for unrestricted navigation, the ambient air temperature ranges shown in Tab 1 are applicable in relation to the various locations of installation.

1.2.2 Where electrical equipment is installed within environmentally controlled spaces other than machinery spaces, the ambient temperature for which the equipment is to be suitable may be reduced from 45° and maintained at a value not less than 35° provided:

- the equipment is not for use for emergency services and is located outside the machinery space(s)
- temperature control is achieved by at least two cooling units so arranged that in the event of loss of one cooling unit, for any reason, the remaining unit(s) is (are) capable of satisfactorily maintaining the design temperature
- the equipment is able to be initially set to work safely up to a 45° ambient temperature until such time as the lower ambient temperature is achieved; the cooling equipment is to be rated for a 45 ° ambient temperature
- audible and visual alarms are fitted, at a continually manned control station, to indicate any malfunction of the cooling units.

1.2.3 In accepting an ambient temperature less than 45° it is to be ensured that electrical cables are adequately rated throughout their length for the maximum ambient temperature to which they are exposed.

1.2.4 The equipment used for cooling and maintaining the lower ambient temperature is to be classified for a secondary essential service.

1.3 Humidity

1.3.1 For vessels classed for unrestricted service, the humidity ranges shown in Tab 2 are applicable in relation to the various locations of installation.

Table 1: Ambient air temperature

Location	Temperature range, in °C	
Enclosed spaces	+ 5	+ 45
Inside consoles or fitted on combustion engines and similar	+ 5	+ 55
Exposed decks	- 25	+ 45

Table 2 : Humidity

Location	Humidity
General	95% at 55 °C
Air conditioned areas	Different values may be considered on a case by case basis

1.4 Cooling water temperatures

1.4.1 The temperatures shown in Tab 3 are applicable to vessels classed for unrestricted service.

Table 3 : Water temperature

Coolant	Temperature range, in °C	
Sea water	0	+ 32

1.5 Salt mist

1.5.1 The applicable salt mist content in the air is to be 1 mg/m^3.

1.6 Inclinations

1.6.1 The inclinations applicable are those shown in Tab 4.

Tasneef may consider deviations from these angles of inclination taking into consideration the type, size and service conditions of the vessel.

1.7 Vibrations

1.7.1 In relation to the location of the electrical components, the vibration levels given in Tab 5 are to be assumed.

1.7.2 The natural frequencies of the equipment, their suspensions and their supports are to be outside the frequency ranges specified.

Where this is not possible using a suitable constructional technique, the equipment vibrations are to be dumped so as to avoid unacceptable amplifications.

2 Quality of power supply

2.1 General

2.1.1 All electrical components are to be so designed and manufactured that they are capable of operating satisfactorily under the variations of voltage, frequency and harmonic distortion of the power supply specified from [2.2] to [2.4].

2.2 A.c. distribution systems

2.2.1 For alternating current components the voltage and frequency variations of power supply shown in Tab 6 are to be assumed.

Table 4 : Inclination of vessel

Type of machinery, equipment or component	Angles of inclination, in degrees **(1)**			
	Athwartship		Athwartship	
	static	dynamic **(3)**	static	dynamic **(4)**
Machinery and equipment relative to main electrical power installation	15	22,5	5	7,5
Machinery and equipment relative to the emergency power installation and crew and passenger safety systems of the vessel (e.g. emergency source of power, emergency fire pumps, etc.)	22,5	22.5	10	10
Switchgear and associated electrical and electronic components and remote control systems **(2)**	22,5	22,5	10	10

(1) Athwartship and fore-and-aft angles may occur simultaneously in their most unfavourable combination.

(2) No undesired switching operations or functional changes may occur up to an angle of inclination of 45°.

(3) The period of dynamic inclination may be assumed equal to 10 s.

(4) The period of dynamic inclination may be assumed equal to 5 s.

Table 5 : Vibration levels

Location	Frequency range Hz	Displacement amplitude mm	Acceleration amplitude g
Machinery spaces, command and control stations, accommodation spaces, exposed decks, cargo spaces	from 2,0 to 13,2 from 13,2 to 100	1,0 -	- 0,7
On air compressors, on diesel engines and similar	from 2,0 to 25,0 from 25,0 to 100	1,6 -	- 4,0
Masts	from 2,0 to 13,2 from 13,2 to 50	3,0 -	- 2,1

2.3 D.c. distribution systems

2.3.1 For direct current components voltage variations of power supply shown in Tab 7 are to be assumed.

Table 6 : Voltage and frequency variations of power supply in a.c.

Parameter	Variations	
	Continuous	Transient
Voltage	+ 6% - 10%	± 20% (recovery time: 1,5 s)
Frequency	± 5%	± 10% (recovery time: 5 s)

Table 7 : Voltage variations of power supply in d.c.

Parameters	Variations
Voltage tolerance (continuous)	± 10%
Voltage cyclic variation	5%
Voltage ripple (a.c. r.m.s. over steady d.c. voltage)	10%

2.3.2 For direct current components supplied by electrical battery the following voltage variations are to be assumed:

- +30% to -25% for components connected to the battery during charging (see Note 1)
- +20% to -25% for components not connected to the battery during charging.

Note 1: Different voltage variations as determined by the charging/discharging characteristics, including ripple voltage from the charging device, may be considered.

2.3.3 Any special system, e.g. electronic circuits, which cannot operate satisfactorily within the limits shown in Tab 6 and Tab 7 is not to be supplied directly from the system but by alternative means, e.g. through stabilised supply.

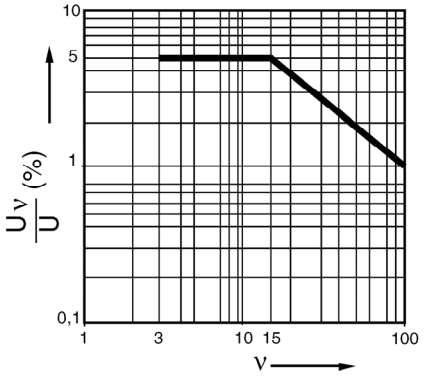
2.4 Harmonic distortions

2.4.1 For components intended for systems without substantially static converter loads and supplied by synchronous generators, it is assumed that the total voltage harmonic distortion does not exceed 5%, and the single harmonic does not exceed 3% of the nominal voltage.

2.4.2 For components intended for systems fed by static converters, and/or systems in which the static converter load predominates, it is assumed that:

- the single harmonics do not exceed 5% of the nominal voltage up to the 15th harmonic of the nominal frequency, decreasing to 1% at the 100th harmonic (see Fig 1), and that
- the total harmonic distortion does not exceed 10%.

Figure 1



2.4.3 Higher values for the harmonic content (e.g. in electric propulsion plant systems) may be accepted on the basis of correct operation of all electrical devices.

3 Electromagnetic susceptibility

3.1.1 For electronic type components such as sensors, alarm panels, automatic and remote control equipment, protective devices and speed regulators, the conducted and radiated disturbance levels to be assumed are those given in Chapter 3.

Note 1: See also IEC Publication 60533 - "Electromagnetic Compatibility of Electrical and Electronic Installations in Ships and of Mobile and Fixed Offshore Units".

4 Materials

4.1 General

4.1.1 In general, and unless it is adequately protected, all electrical equipment is to be constructed of durable, flame-retardant, moisture-resistant materials which are not subject to deterioration in the atmosphere and at the temperatures to which they are likely to be exposed. Particular consideration is to be given to sea air and oil vapour contamination.

Note 1: The flame-retardant and moisture-resistant characteristics may be verified by means of the tests cited in IEC Publication 60092-101 or in other recognized standards.

4.1.2 Where the use of incombustible materials or lining with such materials is required, the incombustibility characteristics may be verified by means of the test cited in IEC Publication 60092-101 or in other recognized standards.

4.2 Insulating materials for windings

4.2.1 Insulated windings are to be resistant to moisture, sea air and oil vapour unless special precautions are taken to protect insulators against such agents.

4.2.2 The insulation classes given in Tab 8 may be used in accordance with IEC Publication 60085.

Table 8: Insulation Classes

Class	Maximum continuous operating temperature °C
A	105
E	120
B	130
F	155
H	180

4.3 Insulating materials for cables

4.3.1 See also Sec 9 of this Chapter.

5 Construction

5.1 General

5.1.1 All electrical apparatus is to be so constructed as not to cause injury when handled or touched in the normal manner.

5.1.2 The design of electrical equipment is to allow accessibility to each part that needs inspection or adjustment, also taking into account its arrangement on board.

5.1.3 Enclosures are to be of adequate mechanical strength and rigidity.

5.1.4 Enclosures for electrical equipment are generally to be of metal; other materials may be accepted for accessories such as connection boxes, socket-outlets, switches and luminaries.

Other exemptions for enclosures or parts of enclosures not made of metal will be specially considered by Tasneef.

5.1.5 Cable entrance are not to impair the degree of protection of the relevant enclosure (see Pt C, Ch 2, Sec 3, Tab 2 of TASNEEFMIL).

5.1.6 All nuts and screws used in connection with current-carrying parts and working parts are to be effectively locked.

5.1.7 All equipment is generally to be provided with suitable, fixed terminal connectors in an accessible position for convenient connection of the external cables.

5.2 Degree of protection of enclosures

5.2.1 Electrical equipment is to be protected against the ingress of foreign bodies and water.

The minimum required degree of protection, in relation to the place of installation, is generally that specified in Pt C, Ch 2, Sec 3, Tab 2 of TASNEEFMIL.

5.2.2 The degrees of protection are to be in accordance with:

- IEC Publication No. 60529 for equipment in general
- IEC Publication No. 60034-5 for rotating machines.

5.2.3 For cable entries see [5.1.5].

6 Protection against explosion hazard

6.1 Protection against explosive gas or vapour atmosphere hazard

6.1.1 Electrical equipment intended for use in areas where explosive gas or vapour atmospheres may occur (e.g. oil tankers, liquefied gas carriers, chemical tankers, etc.), is to be of a "safe type" suitable for the relevant flammable atmosphere and for shipboard use.

6.1.2 The following “certified safe type” equipment is considered:

- intrinsically-safe: Ex(ia) - Ex(ib)
- flameproof: Ex(d)
- increased safety: Ex(e)
- pressurised enclosure: Ex(p)
- encapsulated: Ex(m)
- sand filled: Ex(q)
- special protection: Ex(s)
- oil-immersed apparatus (see Note 1): Ex(o)

Note 1: Only when required by the application.

6.1.3 Other equipment complying with types of protection other than those in [6.1.2] may be considered by Tasneef, such as:

- simple electrical apparatus and components (e.g. thermocouples, photocells, strain gauges, junction boxes, switching devices), included in intrinsically-safe circuits not capable of storing or generating electrical power or energy in excess of limits stated in the relevant rules
- electrical apparatus specifically designed and certified by the appropriate authority for use in Zone 0 or specially tested for Zone 2 (e.g. type “n” protection)

- equipment the type of which ensures the absence of sparks and arcs and of “hot spots” during its normal operation
- pressurised equipment
- equipment having an enclosure filled with a liquid dielectric, or encapsulated.

6.2 Protection against combustible dust hazard

6.2.1 Electrical appliances intended for use in areas where a combustible dust hazard may be present are to be arranged with enclosures having a degree of protection and maximum surface temperature suitable for the dust to which they may be exposed.

Note: Where the characteristics of the dust are unknown, the appliances are to have a degree of protection IP6X. For most dusts a maximum surface temperature of 200°C is considered adequate.

SECTION 3 SYSTEM DESIGN

1 Supply systems and characteristics of the supply

1.1 Supply systems

1.1.1 The following distribution systems may be used:

a) on d.c. installations:

- two-wire insulated
- two-wire with one pole earthed

b) on a.c. installations:

- three-phase three-wire with neutral insulated
- three-phase three-wire with neutral directly earthed or earthed through an impedance
- three-phase four-wire with neutral directly earthed or earthed through an impedance
- single-phase two-wire insulated
- single-phase two-wire with one phase earthed.

1.1.2 Distribution systems other than those listed in [1.1.1] (e.g. with hull return, three-phase four-wire insulated) will be considered by Tasneef on a case by case basis.

1.1.3 For vessels with composite hull the requirements given in Pt C, Ch 1, Sec 2 of the Rules regarding vessels in different material than steel, are also to apply.

Table 1: Maximum voltages for various vessel services

Use		Maximum voltage, in V
For permanently installed and connected to fixed wiring	Power equipment Heating equipment (except in accommodation spaces) Cooking equipment Lighting Space heaters in accommodation spaces Control **(1)**, communication (including signal lamps) and instrumentation equipment	1000 500 500 250 250 250
For permanently installed and connected by flexible cable	Power and heating equipment, where such connection is necessary because of the application (e.g. for moveable cranes or other hoisting gear)	1000
For socket-outlets supplying	Portable appliances which are not hand-held during operation (e.g. refrigerated containers) by flexible cables	1000
	Portable appliances and other consumers by flexible cables	250
	Equipment requiring extra precaution against electric shock where an isolating transformer is used to supply one appliance (2).	250
	Equipment requiring extra precaution against electric shock with or without a safety transformer (2).	50

(1) For control equipment which is part of a power and heating installation (e.g. pressure or temperature switches for starting/stopping motors), the same maximum voltage as permitted for the power and heating equipment may be used provided that all components are constructed for such voltage. However, the control voltage to external equipment is not to exceed 500 V.

(2) Both conductors in such systems are to be insulated from earth.

1.2 Maximum voltages

1.2.1 The maximum voltages for both alternating current and direct current low-voltage systems of supply for the vessel's services are given in Tab 1.

1.2.2 Voltages exceeding those shown will be specially considered in the case of specific systems.

2 Sources of electrical power

2.1 General

2.1.1 Electrical installations are to be such that:

a) All electrical auxiliary services necessary for maintaining the vessel in normal operational and habitable conditions will be assured without recourse to the emergency source of electrical power.

b) Electrical services essential for safety will be assured under various emergency conditions.

c) When a.c. generators are involved, attention is to be given to the starting of squirrel-cage motors connected to the system, particularly with regard to the effect of the magnitude and duration of the transient voltage change produced due to the maximum starting current and the power factor. The voltage drop due to such starting current is not to cause any motor already operating to stall or have any adverse effect on other equipment in use.

2.2 Main source of electrical power

2.2.1 A main source of electrical power is to be provided, of sufficient capability to supply all electrical auxiliary services necessary for maintaining the vessel in normal operational and habitable conditions and for the preservation of the cargo without recourse to the emergency source of electrical power.

2.2.2 For vessels propelled by electrical power and having two or more constant voltage propulsion generating sets which constitute the source of electrical energy for the vessel's auxiliary services, see Sec 13.

2.2.3 The main source of electrical power is to consist of at least two generating sets.

The capacity of these generating sets is to be such that in the event of any one generating set being stopped it will still be possible to supply those services necessary to provide:

a) normal operational conditions of propulsion and safety [2.2.4];

b) minimum comfortable conditions of habitability (see Sec 1, [3.4.2]);

Such capacity is, in addition, to be sufficient to start the largest motor without causing any other motor to stop or having any adverse effect on other equipment in operation.

2.2.4 Those services necessary to provide normal operational conditions of propulsion and safety include primary and secondary essential services.

For the purpose of calculating the capacity necessary for such services, it is essential to consider which of them can be expected to be in use simultaneously.

For a duplicated service, one being supplied electrically and the other non-electrically (e.g. driven by the main engine), the electrical capacity is not included in the above calculation.

2.2.5 The services in [2.2.4] do not include:

- thrusters not forming part of the main propulsion
- refrigerators for air conditioning.

2.2.6 Further to the provisions above, the generating sets shall be such as to ensure that with any one generator or its primary source of power out of operation, the remaining generating sets shall be capable of providing the electrical services necessary to start the main propulsion plant from a "dead vessel" condition.

2.2.7 The emergency source of electrical power may be used for the purpose of starting from a "dead vessel" condition if its capability either alone or combined with that of any other source of electrical power is sufficient to provide at the same time those services required to be supplied in accordance with the provisions of [3.6.3] items a), b), c), d)

2.2.8 The arrangement of the vessel's main source of electrical power shall be such that essential services can be maintained regardless of the speed and direction of rotation of the main propulsion machinery or shafting.

2.2.9 Generators driven by the propulsion plant (shaft generators) which are intended to operate at constant speed (e.g. a system where vessel speed and direction are controlled by varying propeller pitch) may be accepted as forming part of the main source of electrical power if, in all sailing and manoeuvring conditions including the propeller being stopped, the capacity of these generators is sufficient to provide the electrical power to comply with [2.2.3] and all further requirements, especially those of [2.2.6]. They are to be not less effective and reliable than the independent generating sets.

2.2.10 Generators and generator systems, having the vessel's propulsion machinery as their prime mover but not forming part of the vessel's main source of electrical power (see Note 1) may be used whilst the vessel is at sea to supply electrical services required for normal operational and habitable conditions, provided that:

a) there are sufficient and adequately rated additional generators fitted, which constitute the main source of electrical power required by [2.2.1], meeting the provisions of [2.2.8];

b) arrangements are fitted to automatically start one or more of the generators constituting the main source of electrical power required by [2.2.1], in compliance with [3.4.5] and also in the event of frequency variations exceeding ± 10% of the limits specified below;

c) within the declared operating range of the generators and/or generator systems, the specified limits for the voltage variations in IEC 60092-301 (see Note 3) and the frequency variations in Table 6 of Sec 2 can be met;

d) the short-circuit current of the generator and/or generator system is sufficient to trip the generator/generator system circuit-breaker taking into account the selectivity of the protective devices for the distribution system;

e) where considered appropriate, load shedding arrangements are fitted to meet the requirements of [3.4.6], [3.4.7] and [3.4.8];

f) on vessels having remote control of the propulsion machinery from the navigating bridge, means are provided or procedures are in place so as to ensure that supplies to essential services are maintained during manoeuvring conditions in order to avoid a blackout situation (see Note 4).

Note 1: Such generator systems are those whose operation does not meet the requirements of IEC 60092-201, paragraph 6.2.3.

Note 2: IEC 60092-201 Electrical installations in ships - part 201: System design - General

Note 3: IEC 60092-301 Electrical installations in ships - part 301: Equipment - Generators and motors.

Note 4: A 'blackout situation' means that the main and auxiliary machinery installations, including the main power supply, are out of operation but the services for bringing them into operation (e.g. compressed air, starting current from batteries etc.) are available.

2.2.11 Where transformers, converters or similar appliances constitute an essential part of the electrical supply system, the system is to be so arranged as to ensure the same continuity of supply as stated in this sub-article.

This may be achieved by arranging at least two three-phase or three single-phase transformers supplied, protected and installed as indicated in Fig 1, so that with any one transformer not in operation, the remaining transformer(s) is (are) sufficient to ensure the supply to the services stated in [2.2.3].

Each transformer required is to be located as a separate unit with separate enclosure or equivalent, and is to be served by separate circuits on the primary and secondary sides. Each of the primary and secondary circuits is to be provided with switchgears and protection devices in each phase.

Suitable interlocks or a warning label are to be provided in order to prevent maintenance or repair of one single-phase transformer unless both switchgears are opened on their primary and secondary sides.

2.2.12 For vessels intended for operation with periodically unattended machinery spaces, see Part F, Chapter 3 of this Rules.

2.2.13 For starting arrangements for main generating sets, see Ch 1, Sec 2, [3.1].

2.2.14 For vessels with Length **L**≤ 20 m, the substitution of one of the main generator with a storage battery, adequate to supply primary services, is permitted when the following conditions are satisfy:

- the presumed duration of the longer realizable mission is no more than 12 hours;
- the battery capacity is sufficient to ensure the primary services running for a period of time not less than 1,2 times the presumed duration of the longer realizable mission, with a minimum of 6 hours.

2.3 Emergency source of electrical power

2.3.1 A self-contained emergency source of electrical power shall be provided.

2.3.2 Provided that 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.

Exceptionally is understood to mean conditions, while the vessel is at sea, such as:

a) blackout situation ;

b) dead vessel situation;

c) routine use for testing;

d) short-term parallel operation with the main source of electrical power for the purpose of load transfer.

Unless otherwise instructed by Tasneef, the emergency generator may be used during lay time in port for the supply of the vessel mains, provided the requirements of [2.4] are complied with.

2.3.3 The electrical power available shall 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.

2.3.4 The emergency source of electrical power shall be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the services stated in [3.6.3] for the period specified, if they depend upon an electrical source for their operation.

2.3.5 The transitional source of emergency electrical power, where required, is to be of sufficient capacity to supply at least the services stated in [3.6.7] for half an hour, if they depend upon an electrical source for their operation.

2.3.6 An indicator shall be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of emergency electrical power referred to in [2.3.13] and [2.3.14] are being discharged.

2.3.7 If the services which are to be supplied by the transitional source receive power from an accumulator battery by means of semiconductor convertors, means are to be provided for supplying such services also in the event of failure of the convertor (e.g. providing a bypass feeder or a duplication of convertor).

2.3.8 Where electrical power is necessary to restore propulsion, the capacity of the emergency source shall be sufficient to restore propulsion to the vessel in conjunction to other machinery as appropriate, from a dead vessel condition within 30 min after blackout.

For the purpose of this requirement only, the dead vessel condition and blackout are both understood to mean a condition under which the main propulsion plant, boilers and auxiliaries are not in operation and in restoring the propulsion, no stored energy for starting the propulsion plant, the main source of electrical power and other essential auxiliaries is to be assumed available. It is assumed that means are available to start the emergency generator at all times.

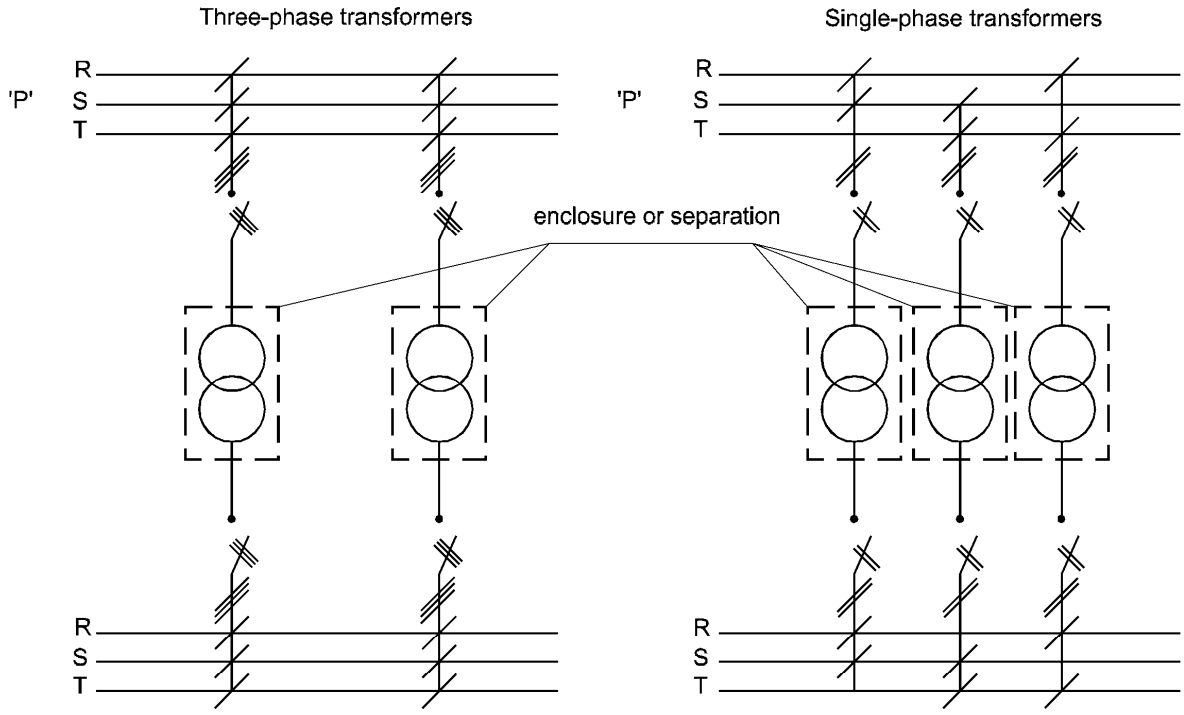
The emergency generator and other means needed to restore the propulsion are to have a capacity such that the necessary propulsion starting energy is available within 30 minutes of blackout/dead vessel condition as defined above. Emergency generator stored starting energy is not to be directly used for starting the propulsion plant, the main source of electrical power and/or other essential auxiliaries (emergency generator excluded).

2.3.9 Provision shall be made for the periodic testing of the complete emergency system and shall include the testing of automatic starting arrangements, where provided.

2.3.10 For starting arrangements for emergency generating sets, see Ch 1, Sec 2, [3.1].

2.3.11 The emergency source of electrical power may be either a generator or an accumulator battery which shall comply with the requirements of [2.3.12] or [2.3.13], respectively.

Figure 1



2.3.12 Where the emergency source of electrical power is a generator, it shall be:

a) driven by a suitable prime mover with an independent supply of fuel, having a flashpoint (closed cup test) of not less than 43°C;

b) started automatically upon failure of the main source of electrical power supply to the emergency switchboard unless a transitional source of emergency electrical power in accordance with (c) below is provided; where the emergency generator is automatically started, it shall be automatically connected to the emergency switchboard; those services referred to in [3.6.7] shall then be connected automatically to the emergency generator; and

c) provided with a transitional source of emergency electrical power as specified in [2.3.14] unless an emergency generator is provided capable both of supplying the services mentioned in that paragraph and of being automatically started and supplying the required load as quickly as is safe and practicable subject to a maximum of 45 s.

2.3.13 Where the emergency source of electrical power is an storage battery it shall be capable of:

a) carrying the emergency electrical load without recharging while maintaining the voltage of the

battery throughout the discharge period within 12% above or below its nominal voltage;

b) automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and

c) immediately supplying at least those services specified in [3.6.7].

2.3.14 The transitional source of emergency electrical power where required by [2.3.12] (item c) shall consist of an storage battery which shall operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be so arranged as to supply automatically in the event of failure of either the main or the emergency source of electrical power for half an hour at least the services in [3.6.7] if they depend upon an electrical source for their operation.

2.4 Emergency electrical system in vessels with L≤ 20 m

2.4.1 An emergency electrical source is to be provided in a suitable position as to be used in emergency, outside the propulsion machinery space and the main source of electrical energy generation.

Such source is not admitted to be one of the starting batteries defined in [2.4.2].

The emergency electrical source is to be capable of supplying simultaneously at least the following services for a 6 hours period:

- emergency lighting
- navigation lights and other lights established in the "Convention on the International Regulations for Preventing Collisions at Sea" in force
- radio systems
- the internal communication systems required during emergency
- fire detection and alarm system
- the non-continuous duty of the lamp for daytime signs, of the vessel hoot, of the manual control alarms and of internal signalling requested in emergency.

2.4.2 One of the two storage batteries required for the propulsion machinery and auxiliaries starting is admitted to be used also for other services.

2.4.3 For vessels having length **L** ≤ 15 m the emergency electrical source can be provided by a battery pack different form those in [2.4.2] and with enough capacity to feed for three hours the following services:

- navigation lights
- radio systems
- fire detection and alarm systems
- non-continuous duty of the signal lamp and vessel hoot.

2.5 Use of the emergency generator in port

2.5.1 The use of the emergency generator in port is admitted under the conditions established in TASNEEFMIL Pt C, Ch 2, Sec 3, [2.4].

3 Distribution

3.1 Earthed distribution systems

3.1.1 System earthing is to be effected by means independent of any earthing arrangements of the non-current-carrying parts.

3.1.2 Means of disconnection are to be fitted in the neutral earthing connection of each generator so that the generator may be disconnected for maintenance or insulation resistance measurements.

3.1.3 Generator neutrals may be connected in common, provided that the third harmonic content of the voltage wave form of each generator does not exceed 5%.

3.1.4 Where a switchboard is split into sections operated independently or where there are separate switchboards, neutral earthing is to be provided for each section or for each switchboard. Means are to be provided to ensure that the earth connection is not removed when generators are isolated.

3.1.5 Where for final sub-circuits it is necessary to locally connect a pole (or phase) of the sub-circuits to earth after the protective devices (e.g. in automation systems or to avoid electromagnetic disturbances), provision (e.g. d.c./d.c. convertors or transformers) is to be made such that current unbalances do not occur in the individual poles or phases.

3.2 Insulated distribution systems

3.2.1 Every insulated distribution system, whether primary or secondary (see Note 1), for power, heating or lighting, shall be provided with a device capable of continuously monitoring the insulation level to earth (i.e. the values of electrical insulation to earth) and of giving an audible and visual indication of abnormally low insulation values (see Sec 15).

Note: A primary system is one supplied directly by generators. Secondary systems are those supplied by transformers or convertors.

3.3 Distribution systems with hull return

3.3.1 Where the hull return system is used, if permitted, all final sub-circuits, i.e. all circuits fitted after the last protective device, shall be two-wire.

The hull return is to be achieved by connecting to the hull one of the busbars of the distribution board from which the final sub-circuits originate.

3.4 General requirements for distribution systems

3.4.1 The distribution system is to be such that the failure of any single circuit will not endanger or impair primary essential services and will not render secondary essential services inoperative for longer periods.

3.4.2 No common switchgear (e.g. contactors for emergency stop) is to be used between the switchboard's busbars and two primary non duplicated essential services.

3.4.3 Where the main source of electrical power is necessary for propulsion and steering of the vessel, the system shall be so arranged that the electrical supply to equipment necessary for propulsion and steering and to ensure the vessel's safety will be maintained or immediately restored in the case of loss of any one of the generators in service.

3.4.4 Where the electrical power is normally supplied by more than one generator set simultaneously in parallel operation, provision of protection, including automatic disconnection of sufficient non-essential services and if necessary secondary essential services and those provided for habitability, are to be made to ensure that, in case of loss of any of these generating sets, the remaining ones are kept in operation to permit propulsion and steering and to ensure safety.

3.4.5 Where the electrical power is normally supplied by one generator, provision are to be made, upon loss of power, for automatic starting and connecting to the main switchboard of stand-by generator(s)of sufficient capacity with automatic restarting of the essential auxiliaries, in sequential operation if required. Starting and connection to the main switchboard of one generator is to be as rapid as possible, preferably within 30 seconds after loss of power.

Where prime movers with longer starting time are used, this starting and connection time may be exceeded upon approval from Tasneef.

3.4.6 Load shedding or other equivalent arrangements are to be provided to protect the generators against sustained overload.

3.4.7 The load shedding is to be automatic.

3.4.8 The non-essential services, service for habitable conditions may be shed and, where necessary, additionally, the secondary essential services, sufficient to ensure the connected generator set or generator sets are not overloaded.

3.5 Main distribution of electrical power

3.5.1 Where the main source of electrical power is necessary for propulsion of the vessel, the main busbar is to be divided into at least two parts which are normally to be connected by circuit breakers or other approved means such as circuit breakers without tripping mechanisms or disconnecting links or switches by means of which busbars can be split safely and easily.

The connection of generating sets and associated auxiliaries and other duplicated equipment is to be equally divided between the parts as far as practicable, so that in the event of damage to one section of the switchboard the remaining parts are still supplied.

3.5.2 Two or more units serving the same consumer (e.g. main and standby lubricating oil pumps) are to be supplied by individual separate circuits without the use of common feeders, protective devices or control circuits.

This requirement is satisfied when such units are supplied by separate cables from the main switchboard or from two independent section boards.

3.5.3 A main electric lighting system which shall provide illumination throughout those parts of the vessel normally accessible to and used by (passengers or) crew shall be supplied from the main source of electrical power.

3.6 Emergency distribution of electrical power

3.6.1 The emergency switchboard shall be supplied during normal operation from the main switchboard by an interconnector feeder which shall be adequately protected at the main switchboard against overload and short-circuit and which is to be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power.

Where the system is arranged for feedback operation, the interconnector feeder is also to be protected at the emergency switchboard at least against short-circuit.

3.6.2 In order to ensure ready availability of the emergency source of electrical power, arrangements shall be made where necessary to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that power shall be available to the emergency circuits.

3.6.3 The emergency source of electrical power shall be capable of supplying simultaneously at least the following services for the periods specified hereafter, if they depend upon an electrical source for their operation:

a) for a period of 3 hours, emergency lighting at every muster and embarkation station and over the sides

b) for a period of 18 hours, emergency lighting:

   1) in all service and accommodation alleyways, stairways and exits;

2) in the machinery spaces and main generating stations including their control positions;

3) in all control stations, machinery control rooms, and at each main and emergency switchboard;

4) at all stowage positions for firemen's outfits;

5) at the steering gear;

6) at the fire pump referred to in (e) below, at the sprinkler pump, if any, at the emergency bilge pump, if any, and at the starting positions of their motors; and

c) for a period of 18 hours:

1) the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force and

2) radio installations;

d) for a period of 18 hours:

1) all internal communication equipment as required in an emergency [3.6.4];

2) the fire detection and fire alarm systems; and

3) intermittent operation of the daylight signalling lamp, the vessel's whistle, the manually operated call points and all internal signals (see [3.6.5]) that are required in an emergency, unless such services have an independent supply for the period of 18 hours from an storage battery suitably located for use in an emergency;

e) for a period of 18 hours: one of the fire pumps required by the relevant provisions of Chapter 4, if dependent upon the emergency generator for its source of power;

f) for the period of time required in Pt C, Ch 1, Sec11, [2], of TASNEEFMIL, the steering gear where it is required to be so supplied.

Such periods of time may be reduced by Tasneef in relation to the mission maximum time provided for the vessel, referring also to the maximum autonomy of the vessel.

3.6.4 Internal communication equipment required in an emergency generally includes:

a) the means of communication between the navigating bridge and the steering gear compartment,

b) the means of communication between the navigating bridge and the position in the machinery space or control room from which the engines are normally controlled.

3.6.5 Internal signals required in an emergency generally include:

a) general alarm,

b) watertight door indication.

3.6.6 The transitional source of emergency electrical power, where required, shall supply for half an hour at least the following services if they depend upon an electrical source for their operation:

a) the lighting required by [3.6.3](item a, b, c1); for this transitional phase, the required emergency electric lighting, in respect of the machinery space and the accommodation and service spaces may be provided by permanently fixed, individual, automatically charged, relay operated accumulator lamps; and

b) all services required by [3.6.3] (item d1, d2, d4) unless such services have an independent supply for the period specified from an storage battery suitably located for use in an emergency.

3.7 Shore supply

3.7.1 Where arrangements are made for supplying the electrical installation from a source on shore or elsewhere, a suitable connection box is to be installed on the vessel in a convenient location to receive the flexible cable from the external source.

3.7.2 Permanently fixed cables of adequate rating are to be provided for connecting the box to the main switchboard.

3.7.3 Where necessary for systems with earthed neutrals, the box is to be provided with an earthed terminal for connection between the shore's and vessel's neutrals or for connection of a protective conductor.

3.7.4 The connection box is to contain a circuit-breaker or a switch-disconnector and fuses. The shore connection is to be protected against short-circuit and overload; however, the overload protection may be omitted in the connection box if provided on the main switchboard.

3.7.5 Means are to be provided for checking the phase sequence of the incoming supply in relation to the vessel's system.

3.7.6 The cable connection to the box is to be provided with at least one switch-disconnector on the main switchboard.

3.7.7 The shore connection is to be provided with an indicator at the main switchboard in order to show when the cable is energised.

3.7.8 At the connection box a notice is to be provided giving full information on the nominal voltage and frequency of the installation.

3.7.9 The switch-disconnector on the main switchboard is to be interlocked with the generator circuit-breakers in order to prevent its closure when any generator is supplying the main switchboard unless special provisions to the satisfaction of Tasneef are taken to permit safe transfer of electrical load.

3.7.10 Adequate means are to be provided to equalise the potential between the hull and the shore when the electrical installation of the vessel is supplied from shore.

3.8 Supply of motors

3.8.1 A separate final sub-circuit is to be provided for every motor required for an essential service (and for every motor rated at 1 kW or more).

3.8.2 Each motor is to be provided with controlgear ensuring its satisfactory starting.

Depending on the capacity of the generating plant or the cable network, it may be necessary to limit the starting current to an acceptable value.

Direct on line starters are accepted if the voltage drop does not exceed 15% of the network voltage.

3.8.3 Efficient means are to be provided for the isolation of the motor and its associated control gear from all live poles of the supply. Where the control gear is mounted on or adjacent to a switchboard, a disconnecting switch in the switchboard may be used for this purpose.

Otherwise, a disconnecting switch within the control gear enclosure or a separate enclosed disconnecting switch is to be provided.

3.8.4 Where the starter or any other apparatus for disconnecting the motor is remote from the motor itself, one of the following is to be arranged:

a) provision for locking the circuit disconnecting switch in the OFF position; or

b) an additional disconnecting switch fitted near the motor; or

c) provision such that the fuses in each live pole or phase can be readily removed and retained by persons authorised to have access to the motor.

3.9 Specific requirements for special power services

3.9.1 For the supply and characteristics of the distribution of the following services see the requirements listed:

- Steering gear: Ch 1, Sec 10, [2];
- Fire-extinguishing and detecting systems: Ch 4, Sec 4 e 7;
- Permanently installed submergible bilge pump: Ch 1, Sec 9, [5.5.7];
- Ventilation fans: Chapter 4,
- Fuel pumps: Ch 1, Sec 9; [10]
- Pumps discharging overboard above the lightest water line Ch 1, Sec 9.

3.10 Power supply to heaters

3.10.1 Each heater rated more than 16A is to be connected to a separate final circuit.

3.11 Power supply to lighting installations

3.11.1 Final sub-circuits for lighting supplying more than one lighting point and for socket-outlets are to be fitted with protective devices having a current rating not exceeding 16 A.

3.12 Special lighting services

3.12.1 In spaces such as:

- main and large machinery spaces
- large galleys
- passageways
- stairways leading to boat-decks
- public spaces;

there is to be more than one final sub-circuit for lighting such that failure of any one circuit does not reduce the lighting to an insufficient level.

3.12.2 Where the emergency installation is required, one of the circuits in [3.12.1] may be supplied from the emergency source of power.

3.13 Navigation lights

3.13.1 Navigation lights are to be connected separately to a distribution board specially reserved for this purpose.

Signalling lights may be connected to the navigation light distribution board, or to a separate distribution board.

3.13.2 The navigation light distribution board is to be supplied from two alternative circuits, one from the main source of power and one from the emergency source of power; see also [3.6].

The transfer of supply is to be practicable from the bridge, for example by means of a switch.

3.13.3 Each navigation light is to be controlled and protected in each insulated pole by a double-pole switch and a fuse or, alternatively, by a double-pole circuit-breaker, fitted on the distribution board referred to in [3.13.1].

3.13.4 Where there are double navigation lights, i.e. lights with two lamps or where for every navigation light a spare is also fitted, the connections to such lights may run in a single cable provided that means are foreseen in the distribution board to ensure that only one lamp or light may be supplied at any one time.

3.13.5 Each navigation light is to be provided with an automatic indicator giving audible and/or visual warning in the event of failure of the light. If an audible device alone is fitted, it is to be connected to a separate source of supply from that of the navigation lights, for example an storage battery.

If a visual signal is used connected in series with the navigation light, means are to be provided to prevent the extinction of the navigation light due to the failure of the visual signal.

A minimum level of visibility is to be assured in the case of use of dimmer devices.

3.13.6 In vessels with Length **L**≤ 20 m the navigation light board and the second supply line are not requested.

Supply is to be derived from the emergency source.

3.14 General emergency alarm system

3.14.1 An electrically operated bell or klaxon or other equivalent warning system installed in addition to the vessel's whistle or siren, for sounding the general emergency alarm signal, is to be driven from the fore bridge, is to be continuously supplied by an electrical emergency source.

3.14.2 The system is to be powered by means of two circuits, one from the vessel's main supply and the other from the emergency source of electrical power required by [2.3] and [3.6].

3.14.3 The system is to be capable of operation from the navigation bridge and, except for the vessel’s whistle, also from other strategic points.

Note: Other strategic points are taken to mean those locations, other than the navigation bridge, from where emergency situations are intended to be controlled and the general alarm system can be activated. A fire control station should normally be regarded as strategic points.

3.14.4 The alarm is to continue to function after it has been triggered until it is manually turned off.

3.14.5 The alarm system is to be audible throughout all the accommodation and normal crew working spaces.

3.15 Control and indication circuits

3.15.1 For the supply of automation systems, comprising control, alarm and safety system, see the requirements of Chapter 3.

3.15.2 Control and indicating circuits relative to primary essential services are to be branched off from the main circuit in which the relevant equipment is installed. Equivalent arrangements may be accepted by Tasneef

3.15.3 Control and indicating circuits relative to secondary essential services and to non-essential services may be supplied by distribution systems reserved for the purpose to the satisfaction of Tasneef.

3.16 Power supply to the speed control systems of main propulsion engines

3.16.1 Electrically operated speed control systems of main engines are to be fed from the main source of electrical power.

3.16.2 Where more than one main propulsion engine is foreseen, each speed control system is to be provided with an individual supply by means of separate wiring from the main switchboard or from two independent section boards.

Where the main busbars are divided into two sections, the governors are, as far as practicable, to be supplied equally from the two sections.

3.16.3 In the case of propulsion engines which do not depend for their operation on electrical power, i.e. pumps driven from the main engine, the speed control systems are to be fed both from the main source of electrical power and from an storage battery for at least 15 minutes or from a similar supply source.

Such battery may also be used for other services such as automation systems, where foreseen.

3.17 Power supply to the speed control systems of generator sets

3.17.1 Each electrically operated control and/or speed control system of generator sets is to be provided with a separate supply from the main source of electric power and from an storage battery for at least 15 minutes or from a similar supply source.

3.17.2 The wiring supplying the main source of electrical power is to be from the main switchboard or from independent section boards.

Where the main busbars are divided into two sections, the governors are, as far as practicable, to be supplied from the sections to which the relevant generators are connected.

4 Degrees of protection of the enclosures

4.1 General

4.1.1 The minimum required degree of protection for electrical equipment, in relation to the place of installation, is generally that specified in Pt C, Ch 2, Sec 3, Tab 2. of TASNEEFMIL.

4.1.2 Equipment supplied at nominal voltages in excess of 500 V and accessible to non-authorised personnel (e.g. equipment not located in machinery spaces or in locked compartments under the responsibility of the vessel’s officers) is to have a degree of protection against touching live parts of at least IP4X.

4.1.3 In addition to the requirements of this sub-article, equipment installed in spaces with an explosion hazard is also subject to the provisions of Pt C, Ch 2, Sec 2, [6] of TASNEEFMIL.

4.1.4 The enclosures of electrical equipment for the monitoring and control of watertight doors which are situated below the bulkhead deck are to provide suitable protection against the ingress of water.

In particular, the minimum required degree of protection is to be:

- IPX7 for electric motors, associated circuits and control components
- IPX8 for door position indicators and associated circuit components
- IPX6 for door movement warning signals.

Note: The water pressure testing of the enclosures protected to IPX8 is to be based on the pressure that may occur at the location of the component during flooding for a period of 36 hours.

5 Diversity (demand) factors

5.1 General

5.1.1 The cables and protective devices of final sub-circuits are to be rated in accordance with their connected load.

5.1.2 Circuits supplying two or more final sub-circuits are to be rated in accordance with the total connected load subject, where justifiable, to the application of a diversity (demand) factor.

5.1.3 A diversity (demand) factor may be applied provided that the known or anticipated operating conditions in a particular part of an installation are suitable for the application of diversity.

6 Electrical protection

6.1 General

6.1.1 Electrical installations including engines, generators, measuring instruments, pilot lamps and controlling circuits, are to be protected against accidental overcurrents including short-circuit as to indicated in Pt C, Ch 2, Sec 3, [7] of TASNEEFMIL.

7 System components

7.1 General

7.1.1 The components of the electrical system are to be dimensioned such as to withstand the currents that can pass through them during normal service without their rating being exceeded.

7.1.2 The components of the electrical system are to be designed and constructed so as to withstand for the admissible duration the thermal and electrodynamic stresses caused by possible overcurrents, including short-circuit.

8 Electrical cables

8.1 General

8.1.1 All electrical cables and wiring external to equipment shall be at least of a flame-retardant type, in accordance with IEC Publication 60332-1.

8.1.2 In addition to the provisions of [9.1.1], when cables are laid in bundles, cable types are to be chosen in compliance with IEC Publication 60332-3 Category A, or other means (see Sec 12 [7]) are to be provided such as not to impair their original flame-retarding properties.

8.1.3 Where necessary for specific applications such as radio frequency or digital communication systems, which require the use of particular types of cables, Tasneef may permit the use of cables which do not comply with the provisions of [8.1.1] and [].

8.1.4 Cables which are required to have fire-resisting characteristics are to comply with the requirements stipulated in IEC Publication 60331.

8.2 Cables choice

Cables are to respond to the provisions given in Pt C, Ch 2, Sec 3, [9] of TASNEEFMIL.

9 Electrical installations in hazardous areas

9.1 General

9.1.1 In hazardous areas (e.g.: storage batteries rooms, paint lockers) cables and electrical equipment are to be in accordance with the requirements given in Pt C, Ch 2, Sec 3, [10] of TASNEEFMIL.

SECTION 4 ROTATING MACHINES

1 Constructional and operational requirements for generators and motors

1.1 General

1.1.1 Generators and motors are to be constructed and tested in accordance with requirements given in Pt C, Ch 2, Sec 4 of TASNEEFMIL.

1.1.2 For vessels with Length **L**≤20 m, a test certificate made in internal factory or independent laboratory may be accepted; the mark C.E.I. applied on the nameplate may replace such test documents.

SECTION 5 TRANSFORMERS

1 Constructional and operational requirements

1.1 General

1.1.1 Transformers are to respect the provisions given in Pt C, Ch 2, Sec 5 of TASNEEFMIL; they are to be submitted to all tests listed in Tab 2 of the above-mentioned Rules.

1.1.2 For vessels with Length **L**≤20 m, a test certificate made in internal factory or independent laboratory may be accepted; the mark C.E.I. applied on the nameplate may replace such test documents.

SECTION 6 SEMICONDUCTOR CONVERTORS

1 Constructional and operational requirements

1.1 General

1.1.1 Semiconductor converters are to respect the provisions given in pt C, Ch 2, Sec6 of TASNEEFMIL; they are to be submitted to all tests listed in Tab 2 of the above-mentioned Rules

1.1.2 For vessels with Length **L**≤20 m, a test certificate made in internal factory or independent laboratory may be accepted; the mark C.E.I. applied on the nameplate may replace such test documents.

SECTION 7 STORAGE BATTERIES AND CHARGERS

1 Constructional and operational requirements

1.1 General

1.1.1 Storage batteries for fixed installation and charges are to respect the provisions given in Pt C, Ch 2, Sec 7 of TASNEEFMIL; they are to be submitted to all tests listed in Tab 1 of the above-mentioned Rules.

1.1.2 For vessels with Length **L**≤20 m, a test certificate made in internal factory or independent laboratory may be accepted; the mark C.E.I. applied on the nameplate may replace such test documents.

SECTION 8 SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

1 Constructional and operational requirements

1.1 General

1.1.1 Main and emergency boards, section boards and distribution boards are to respect the provisions given in Pt C, Ch 2, Sec 8 of TASNEEFMIL; they are to be submitted to all tests of the above-mentioned Rules.

1.1.2 For vessels with Length **L**≤20 m, a test certificate made in internal factory or independent laboratory may be accepted; the mark C.E.I. applied on the nameplate may replace such test documents.

The electrical board may be arranged in the main control station rather than in generators room and unsupplied of handrail.

Devices verifying the isolation state are not required in vessels provided with electrical safety voltage system.

SECTION 9 CABLES

1 Constructional requirements

1.1 General

1.1.1 Cables and internal wiring are to be constructed following standards given in Pt C, Ch 2, Sec 9 of TASNEEFMIL.

1.1.2 In vessels with Length **L**≤20 m cables relating to electrical safety voltage pipings are admitted not to be totally in conformity with TASNEEFMIL standards, providing that they satisfy the following conditions:

- external round shape
- the core (most insulator conductor) in case of unipolar cable or the group of cores in case of multipolar cables, are to be protected by one or more protective sheathes
- insulating and sheathes materials are to be taken from the ones provided in IEC standards of TC 18 or other standards relating to electrical cables for shipping use
- not spreading flames or fireproofs (as necessary) in according to the standard requirements.

SECTION 10 MISCELLANEOUS EQUIPMENT

1 Application

1.1 General

1.1.1 The miscellaneous equipment described in this section are:

- Switchgear and controlgear
- Protection devices
- Lighting fittings
- Accessories
- Plug-and-socket connections
- Heating and cooking appliances
- Cable trays/protective casings made of plastics materials Equipments listed in the previous 1.1.1 are to respect standards given in Pt C, Ch 2, Sec 10 of TASNEEFMIL.

1.1.2 For vessels with Length **L**≤20 m equipments not totally in conformity with standards of these Rules may be accepted by Tasneef if believed adequate for safety and for the sea ambient.

SECTION 11 LOCATION

1 General

1.1 Location

1.1.1 The degree of protection of the enclosures and the environmental categories of the equipment are to be appropriate to the spaces or areas in which they are located; see Pt C, Ch 2, Sec 3, Tab 2 e Tab 3 and Sec 2, [5.2.2] of TASNEEFMIL.

1.2 Areas with a risk of explosion

1.2.1 Except where the installation of equipment for explosive gas atmosphere is provided for by the Rules, electrical equipment is not to be installed where flammable gases or vapours are liable to accumulate; see Sec 3, [9].

2 Main electrical system

2.1 Location in relation to the emergency system

2.1.1 The arrangement of the emergency electrical system is to be such that a fire or other casualty in spaces containing the emergency source of electrical power, associated converting equipment, if any, the emergency switchboard and the emergency lighting switchboard will not render inoperative the main electric lighting system and the other primary essential services.

2.2 Main switchboard

2.2.1 The main switchboard shall be so placed relative to one main generating station that, as far as is practicable, the integrity of the normal electrical supply may be affected only by a fire or other casualty in one space.

2.2.2 An environmental enclosure for the main switchboard, such as may be provided by a machinery control room situated within the main boundaries of the space, is not to be considered as separating switchboards from generators.

2.2.3 The main generating station is to be situated within the machinery space, i.e. within the extreme main transverse watertight bulkheads which bound the machinery space.

2.2.4 Any bulkhead between the extreme main transverse watertight bulkheads is not regarded as separating the equipment in the main generating station provided that there is access between the spaces.

2.2.5 The main switchboard is to be located as close as practicable to the main generating station, within the same machinery space and the same vertical and horizontal A60 fire boundaries.

In vessels with Length L≤20 m, the main electrical board may be arranged in the main control station.

2.2.6 Where essential services for steering and propulsion are supplied from section boards, these and any transformers, convertors and similar appliances constituting an essential part of the electrical supply system are also to satisfy the above provisions.

2.2.7 A non-required subdivision bulkhead, with sufficient access, located between the switchboard and generators, or between two or more generators, is not to be considered as separating the equipment.

3 Emergency electrical system

3.1 Spaces for the emergency source

3.1.1 The emergency source of electrical power, associated transforming equipment, if any, transitional source of emergency power, emergency switchboard and emergency lighting switchboard shall be located above the uppermost continuous deck and shall be readily accessible from the open deck.

They shall not be located forward of the collision bulkhead.

3.1.2 The spaces containing the emergency source of electrical power, associated transforming equipment, if any, the transitional source of emergency electrical power and the emergency switchboard are not to be contiguous to the boundaries of machinery spaces of Category A or those spaces containing the main source of electrical power, associated transforming equipment, if any, and the main switchboard.

Where this is not practicable, the contiguous boundaries are to be Class A60.

3.2 Location in relation to the main electrical system

3.2.1 The location of the emergency source of electrical power, associated transforming equipment, if any, the transitional source of emergency power, the emergency switchboard and the emergency lighting switchboard in relation to the main source of electrical power, associated transforming equipment, if any, and the main switchboard shall be such as to ensure to the satisfaction of Tasneef 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.

3.2.2 The arrangement of the main electrical system is to be such that a fire or other casualty in spaces containing the main source of electrical power, associated converting equipment, if any, the main switchboard and the main lighting switchboard will not render inoperative the emergency electric lighting system and the other emergency services other than those located within the spaces where the fire or casualty has occurred.

3.3 Emergency switchboard

3.3.1 The emergency switchboard shall be installed as near as is practicable to the emergency source of electrical power.

3.3.2 Where the emergency source of electrical power is a generator, the emergency switchboard shall be located in the same space unless the operation of the emergency switchboard would thereby be impaired.

3.4 Emergency battery

3.4.1 No storage battery fitted in accordance with the provisions of Sec 3, [2.3] shall be installed in the same space as the emergency switchboard.

3.4.2 Storage batteries fitted in accordance with the provisions of Sec 3, [2.3] and connected to a charging device of power of 2 kW or less may be accepted in the same space as the emergency switchboard but outside the emergency switchboard to the satisfaction of Tasneef.

4 Distribution boards

4.1 Distribution boards for cargo spaces and similar spaces

4.1.1 Distribution boards containing multiple switches for the control of power and lighting circuits in bunkers and cargo spaces are to be situated outside such spaces.

4.2 Distribution board for navigation lights

4.2.1 The distribution board for navigation lights is to be placed in an accessible position on the bridge.

5 Cable runs

5.1 General

5.1.1 Cable runs are to be selected so as to be as far as practicable accessible, with the exception of single cables, situated behind walls or ceilings constructed of incombustible materials, supplying lighting fittings and socket-outlets in accommodation spaces, or cables enclosed in pipes or conduits for installation purposes.

5.1.2 Cable runs are to be selected so as to avoid action from condensed moisture and from dripping of liquids.

5.1.3 Connection and draw boxes are to be accessible.

5.1.4 Cables are generally not to be installed across expansion joints.

Where this is unavoidable, however, a loop of cable of length proportional to the expansion of the joint is to be provided (see Ch 2, Sec 12, [7.2.2] of Pt C of TASNEEFMIL).

5.2 Location of cables in relation to the risk of fire and overheating

5.2.1 Cables and wiring serving essential or emergency power, lighting, internal communications or signals are, so far as is practicable, to be routed clear of galleys, laundries, machinery spaces of Category A and their casings and other high fire risk areas, except for supplying equipment in those spaces.

5.2.2 When it is essential that a circuit functions for some time during a fire and it is unavoidable to carry the cable for such a circuit through a high fire risk area (e.g. cables connecting fire pumps to the emergency switchboard), the cable is to be of a fire-resistant type or adequately protected against direct exposure to fire.

5.2.3 Main cable runs (see Note 1) and cables for the supply and control of essential services are, as far as is practicable,

to be kept away from machinery parts having an increased fire risk (see Note 2) unless:

- the cables have to be connected to the subject equipment,
- the cables are protected by a steel bulkhead or deck, or
- the cables in that area are of the fire-resisting type.

Note 1: Main cable runs are for example:

- cable runs from generators and propulsion motors to main and emergency switchboards;
- cable runs directly above or below main and emergency switchboards, centralised motor starter panels, section

boards and centralised control panels for propulsion and essential auxiliaries.

Note 2: Machinery, machinery parts or equipment handling combustibles are considered to present an increased fire risk.

5.2.4 Cables and wiring serving essential or emergency power, lighting, internal communications or signals are to be arranged, as far as practicable, 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.

5.2.5 Cables are to be arranged as remote as possible from sources of heat such as hot pipes, resistors, etc. Where installation of cables near heat sources cannot be avoided, and where there is consequently a risk of damage to the cables by heat, suitable shields are to be installed, or other precautions to avoid overheating are to be taken, for example use of ventilation, heat insulation materials or special heat-resisting cables.

5.3 Location of cables in relation to electromagnetic interference

5.3.1 For the installation of cables in the vicinity of radio equipment or of cables belonging to electronic control and monitoring systems, steps are to be taken in order to limit the effects of unwanted electromagnetic interference (see Ch 3, Sec 5).

5.4 Services with a duplicate feeder

5.4.1 In the case of essential services requiring a duplicate supply (e.g. steering gear circuits), the supply and associated control cables are to follow different routes which are to be as far apart as practicable, separated both vertically and horizontally.

5.5 Emergency circuits

5.5.1 Cables supplying emergency circuits are not to run through spaces containing the main source of electrical power, associated transforming equipment, if any, the main switchboard and the main lighting switchboard, except for cables supplying emergency equipment located within such spaces (see [3.2.2]).

6 Storage batteries

6.1 General

6.1.1 Batteries are to be located where they are not exposed to excessive heat, extreme cold, spray, steam or other conditions which would impair performance or accelerate deterioration. They are to be installed in such a way that no damage may be caused to surrounding appliances by the vapours generated.

6.1.2 Storage batteries are to be suitably housed, and compartments (rooms, lockers or boxes) used primarily for their accommodation are to be properly constructed and efficiently ventilated so as to prevent accumulation of flammable gas.

6.1.3 Starter batteries are to be located as close as practicable to the engine or engines served.

6.1.4 Storage batteries shall not be located in sleeping quarters except where hermetically sealed to the satisfaction of Tasneef.

6.1.5 Lead-acid batteries and alkaline batteries are not to be installed in the same compartment (room, locker, box), unless of valve-regulated sealed type.

6.2 Large vented batteries

6.2.1 Batteries connected to a charging device of power exceeding 2 kW, calculated from the maximum obtainable charging current and the nominal voltage of the battery (hereafter referred to as "large batteries") are to be installed in a room assigned to batteries only.

Where this is not possible, they may be arranged in a suitable locker on deck.

6.2.2 Rooms assigned to large batteries are to be provided with mechanical exhaust ventilation.

Natural ventilation may be employed for boxes located on open deck.

6.2.3 The provisions of [6.2.1] and [6.2.2] also apply to several batteries connected to charging devices of total power exceeding 2 kW calculated for each one as stated in [6.2.1].

6.3 Moderate vented batteries

6.3.1 Batteries connected to a charging device of power between 0,2 kW and 2 kW calculated as stated in [6.2.1] (hereafter referred to as "moderate batteries") are to be arranged in the same manner as large batteries or placed in a box or locker in suitable locations such as machinery spaces, storerooms or similar spaces. In machinery spaces and similar well-ventilated compartments, these batteries may be installed without a box or locker provided they are protected from falling objects, dripping water and condensation where necessary.

6.3.2 Rooms, lockers or boxes assigned to moderate batteries are to be provided with natural ventilation or mechanical exhaust ventilation, except for batteries installed without a box or locker (located open) in well-ventilated spaces.

6.3.3 The provisions of [6.3.1] and [6.3.2] also apply to several batteries connected to charging devices of total power between 0,2 kW and 2 kW calculated for each one as stated in [6.2.1].

6.4 Small vented batteries

6.4.1 Batteries connected to a charging device of power less than 0,2 kW calculated as stated in [6.2.1] (hereafter referred to as "small batteries") are to be arranged in the same manner as moderate or large batteries, or without a box or locker, provided they are protected from falling objects, or in a box in a ventilated area.

6.4.2 Boxes for small batteries may be ventilated only by means of openings near the top to permit escape of gas.

6.5 Ventilation

6.5.1 The ventilation of battery compartments is to be independent of ventilation systems for other spaces.

6.5.2 The quantity of air expelled (by natural or forced ventilation) for compartments containing vented type batteries is to be at least equal to:

$$\mathbf{Q} = 110\ \mathbf{I}\ \mathbf{n}$$

where:

Q : quantity of air expelled, in litres per hour;

I : maximum current delivered by the charging equipment during gas formation, but not less than one quarter of the maximum obtainable charging current in amperes;

n : number of cells in series.

6.5.3 The quantity of air expelled (by natural or forced ventilation) for compartments containing valve-regulated sealed batteries is to be at least 25% of that given in [6.5.2].

6.5.4 Ducts are to be made of a corrosion-resisting material or their interior surfaces are to be painted with corrosion resistant paint.

6.5.5 Adequate air inlets (whether connected to ducts or not) are to be provided near the floor of battery rooms or the bottom of lockers or boxes (except for that of small batteries).

Air inlet may be from the open air or from another space (for example from machinery spaces).

6.5.6 Exhaust ducts of natural ventilation systems:

a) are to be run directly from the top of the compartment to the open air above (they may terminate in the open or in well ventilated spaces)

b) are to terminate not less than 90 cm above the top of the battery compartment

c) are to have no part more than 45° from the vertical

d) are not to contain appliances (for example for barring flames) which may impede the free passage of air or gas mixtures Where natural ventilation is impracticable or insufficient, mechanical exhaust ventilation is to be provided.

6.5.7 In mechanical exhaust ventilation systems:

a) electric motors are to be outside the exhaust ducts and battery compartment and are to be of safe type if installed within 3 m from the exhaust of the ventilation duct

b) fans are to be so constructed and of a material such as to render sparking impossible in the event of the impeller touching the fan casing

c) steel or aluminium impellers are not to be used

d) the system is to be interlocked with the charging device so that the battery cannot be charged without ventilation (trickle charge may be maintained)

e) a temperature sensor is to be located in the battery compartment to monitor the correct behaviour of the battery in cases where the battery element is sensitive to temperature.

6.5.8 For natural ventilation systems for deck boxes:

a) holes for air inlet are to be provided on at least two opposite sides of the box

b) the exhaust duct is to be of ample dimensions

c) the duct is to terminate at least 1,25 m above the box in a goose-neck or mushroom-head or the equivalent;

d) the degree of protection is to be in accordance with Pt C, Ch 2, Sec 3, Tab 2 of TASNEEFMIL.

6.5.9 In vessels with Length **L**≤20 m, in case of natural ventilation, the air range to discharge is considered achieved when the section, in cm^2, of the ventilation pipes is not less than the one indicated in Tab 1, relating to the battery nature and to the charge power.

Table 1

Charge power (W) (1)	Minimum section for natural ventilation [cm^2]		
	Lead	Alkaline	Sealed
2000	160	240	To consider case by case
1500	120	180	
1000	80	160	
500	40	60	

(1) Charge power is calculated as product of the maximum possible charge stream for the battery nominal pressure

SECTION 12 INSTALLATIONS

1 General

1.1 Protection against injury or damage caused by electrical equipment

1.1.1 All electrical equipment is to be so installed as not to cause injury when handled or touched in the normal manner.

1.1.2 All electrical equipment is to be installed in such a way that live parts cannot be inadvertently touched, unless supplied at safety voltage.

1.1.3 For protective earthing as a precaution against indirect contact, see [2].

1.1.4 Equipment is to be installed so as not to cause, or at least so as to reduce to a minimum, electromagnetic interference.

1.2 Protection against damage to electrical equipment

1.2.1 Electrical equipment is to be so placed that as far as practicable it is not exposed to risk of damage from water, steam, oil or oil vapours.

1.2.2 The air supply for internal ventilation of electrical equipment is to be as clean and dry as practicable; cooling air for internal ventilation is not to be drawn from below the floor plates in engine and/or boiler rooms.

1.2.3 Equipment is to be so mounted that its enclosing arrangements and the functioning of the built-in equipment will not be affected by distortions, vibrations and movements of the vessel's structure or by other damage liable to occur.

1.2.4 If electrical fittings, not of aluminium, are attached to aluminium, suitable provision is to be made to prevent galvanic corrosion.

1.3 Accessibility

1.3.1 Equipment is to be so installed that sufficient space is available for inspection and maintenance as required for all its parts.

2 Earthing of non-current carrying parts

2.1 General

2.1.1 The requirements given in Pt C, Ch 2, Sec 12, [2] of TASNEEFMIL apply.

For vessels with hull in composite material the provisions given in Pt C, Ch 1, Sec 2 of Rules for hull in different material than steel, apply in addition.

3 Rotating machines

3.1 General

3.1.1 Pt C, Ch 2, Sez 12, [3] of TASNEEFMIL apply.

4 Semiconductor convertors

4.1 Semiconductor power convertors

4.1.1 Naturally air-cooled semiconductor convertors are to be installed such that the circulation of air to and from the stacks or enclosures is not impeded and that the temperature of the cooling inlet air to convertor stacks does not exceed the ambient temperature for which the stacks are specified.

5 Vented type storage batteries

5.1 General

5.1.1 The requirements given in Pt C, Ch 2, Sec 12, [5] of TASNEEFMIL apply.

6 Switchgear and controlgear assemblies

6.1 General

6.1.1 The requirements given in Pt C, Ch 2, Sec 2, [6] of TASNEEFMIL apply.

7 Cables

7.1 General

7.1.1 The requirements given in Pt C, Ch 2, Sec 12, [7] of TASNEEFMIL apply.

8 Various appliances

8.1 General

8.1.1 The requirements given in Pt C, Ch 2, Sec 12, [8] of TASNEEFMIL apply.

SECTION 13 ELECTRIC PROPULSION PLANT

1 General

1.1 Applicable standards

1.1.1 The requirements given in Pt C, Ch 2, Sec 14 of TASNEEFMIL apply.

SECTION 14 TESTING

1 General

1.1 Application

1.1.1 Before a new installation, or any alteration or addition to an existing installation, is put into service, the electrical equipment is to be tested in accordance with [3], [4] and [5] of Pt C, Ch 2, Sec 15 of TASNEEFMIL to the satisfaction of the Surveyor in charge.

1.2 Insulation-testing instruments

1.2.1 Insulation resistance may be measured with an instrument applying a voltage of at least 500 V. The measurement will be taken when the deviation of the measuring device is stabilised.

Note: Any electronic devices present in the installation are to be disconnected prior to the test in order to prevent damage.

2 Type approved components

2.1.1 The following components are to be type tested or type approved or in accordance with [2.1.2]:

- electrical cables (internal wiring of equipment excluded)
- transformers
- electric motors
- electrical convertors for primary essential services
- switching devices (circuit-breakers, contactors, etc.) and overcurrent protective devices (fuses excluded)
- sensors, alarm panels, electronic protective devices, automatic and remote control equipment, actuators, safety devices for installations intended for essential services (steering, controllable pitch propellers, propulsion machinery, etc.),
- electronic speed regulators for main or auxiliary engines
- computers used for tasks essential to safety.

2.1.2 Case by case approval based on submission of adequate documentation and execution of tests may also be granted at the discretion of Tasneef.

2.1.3 For vessels with Length **L**≤15 m, except for electrical cables, homologated components for the products in [2.1.1], are not required. A declaration by the Manufacturer attesting the suitability of the product to work in sea environment will be satisfactory.

Part C

Machinery, Systems and Fire Protection

Chapter 3
AUTOMATION

SECTION 1 GENERAL REQUIREMENTS

1 General

1.1 Field of application

1.1.1 The following requirements apply to automation systems, installed on all vessels, intended for essential services as defined in Ch 2, Sec 1. They also apply to systems required in Chapter 1 and Chapter 2, installed on all vessels.

1.1.2 This chapter is intended to avoid that failures or malfunctions of automation systems associated with essential and non-essential services cause danger to other essential services.

1.1.3 Requirements for unattended machinery spaces and for additional notations are specified in Part F Ch 1 of this Rules.

1.2 Applicable standards

1.2.1 For definitions, documents to be submitted to the examination, ambient and supply conditions, materials and construction the requirements given in Pt C, Ch 3, Sec 1, of TASNEEFMIL are valid.

SECTION 2 DESIGN REQUIREMENTS

1 General

1.1.1 All control systems essential for the propulsion, control and the vessel's safety shall be independent or designed such that failure of one system does not degrade the performance of another system.

1.1.2 Controlled systems are to have manual operation.

Failure of any part of such systems shall not prevent the use of the manual override.

1.1.3 Automation systems are to have constant performance.

1.1.4 Safety functions are to be independent of control and monitoring functions.

As far as practicable, control and monitoring functions are also to be independent.

1.1.5 Control, monitoring and safety systems are to have self-check facilities. In the event of failure, an alarm is to be activated.

In particular, failure of the power supply of the automation system is to generate an alarm.

1.1.6 When a computer based system is used for control, alarm or safety systems, it is to comply with the requirements of Sec 3.

2 Applicable standards

2.1.1 Control, alarm and safety systems are to respect the provisions given in Pt C, Ch 3, Sec 2, of TASNEEFMIL.

SECTION 3 COMPUTER BASED SYSTEMS

1 General requirements

1.1 General

1.1.1 The characteristics of the system are to be compatible with the intended applications, under normal and abnormal process conditions. The response time for alarm function is to be less than 5 seconds.

1.1.2 When systems under control are required to be duplicated and in separate compartments, this is also to apply to control elements within computer based systems.

1.1.3 As a rule, computer based systems intended for essential services are to be type approved.

2 Applicable standards

2.1.1 Hardware, software, connection of data communication, man-machine interface, integrated systems and test on systems are to respect the provisions given in Pt C, Ch 3, Sec 3, of TASNEEFMIL.

SECTION 4 CONSTRUCTIONAL REQUIREMENTS

1 General

1.1 General

1.1.1 Automation systems are to be so constructed as:

- to withstand the environmental conditions the environmental conditions, as defined in Ch 2, Sec 2, [1], in which they operate
- to have necessary facilities for maintenance work.

1.2 Materials

1.2.1 Materials are generally to be of the flame-retardant type.

1.2.2 Connectors are to be able to withstand standard vibrations, mechanical constraints and corrosion conditions as given in Sec 6.

1.3 Component design

1.3.1 Automation components are to be designed to simplify maintenance operations. They are to be so constructed as to have:

- easy identification of failures
- easy access to replaceable parts
- easy installation and safe handling in the event of replacement of parts (plug and play principle) without impairing the operational capability of the system, as far as practicable
- facility for adjustment of set points or calibration
- test point facilities, to verify the proper operation of components.

1.4 Ambient and supply conditions

1.4.1 The environmental and supply conditions are specified in Pt C, Ch 3, Sec 1 of TASNEEFMIL. Specific environmental conditions are to be considered for air temperature and humidity, vibrations, corrosion from chemicals and mechanical or biological attacks.

2 Applicable standards

2.1.1 Electric and electronic systems, pneumatic systems, oil-pressure systems and automation consoles are to respect the provisions given in Pt C, Ch 3, Sec 4, of TASNEEFMIL.

SECTION 5 INSTALLATION REQUIREMENTS

1 General

1.1.1 Automation systems are to be installed taking into account:

- the maintenance requirements (test and replacement of systems or components)
- the influence of EMI. The IEC 60533 standard is to be taken as guidance
- the environmental conditions corresponding to the location in accordance with Ch 2, Sec 2.

1.1.2 Control stations are to be arranged for the convenience of the operator.

1.1.3 Automation components are to be properly fitted. Screws and nuts are to be locked, where necessary.

2 Applicable standards

2.1.1 Sensors and components, cables, pipes and automation consoles are to respect the provisions given in Pt C, Ch 3, Sec 5 of TASNEEFMIL.

SECTION 6 TESTING

1 General

1.1 General

1.1.1 Automation systems are to be tested for type approval, acceptance or commissioning, when required.

Testing are to be carried out under the supervision of a Surveyor of Tasneef.

1.1.2 The type testing homologation conditions for electrical, control and instrumentation equipment, computers and peripherals are described in [2].

1.1.3 Automation systems are to be inspected at works, according to the requirements of [3], in order to check that the construction complies with the Rules.

1.1.4 Automation systems are to be commissioned when installed on board and prior to sea trials, to verify their performance and adaptation on site, according to [2].

2 Type approval

2.1 Applicable standards

2.1.1 For the approval of the hardware and software types the requirements given in Pt C, Ch 3, Sec 6, [2] of TASNEEFMIL apply.

3 Acceptance testing - commissioning

3.1 Applicable standards

3.1.1 The requirements given in Pt C, Ch 3, Sec 6, [3] and [4] of TASNEEFMIL.

Part C

Machinery, Systems and Fire Protection

Chapter 4
FIRE PROTECTION, DETECTION AND EXTINCTION

SECTION 1 GENERAL

1 Alternative designs

1.1.1 The requirements contained in this Chapter are, except where expressly otherwise stated, of prescriptive nature.

However fire safety design and arrangements may deviate from such requirements, provided that the criteria are duly complied with to the satisfaction of Tasneef.

2 Exemptions

2.1.1 Tasneef may, if it considers that the sheltered nature of the vessel's mission are such as to render the application of any specific requirements of this Chapter unreasonable or unnecessary, exempt from those requirements these vessels, unless otherwise stated by the Administration.

3 Documentation to be submitted

3.1.1 Documents indicated in Tab 1 of Pt C, Cap 4, Sec 1 of TASNEEFMIL are to submit to Tasneef from all those concerned.

4 Products of type approved

4.1.1 Materials, equipments, systems for the fire-fighting protection (listed in Pt C, Ch 4, Sec 1, [1.5] of TASNEEFMIL), are to be of type approved in advance by Tasneef, except in particular cases where acceptance may be given for individual vessels on the bases of adequate documents, detailed testing or by request of the Administration

5 Definitions

5.1 Accommodation spaces

5.1.1 Accommodation spaces are those spaces used for public spaces, corridors, stairs, lavatories, cabins, offices, sickbay, pantries containing no cooking appliances and similar spaces.

5.2 A class divisions

5.2.1 A class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:

a) they are constructed of steel or other equivalent material;

b) they are suitably stiffened;

c) they are insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature, within the time listed below:

- Class "A-60" ..... 60 min
- Class "A-30" ..... 30 min
- Class "A-15" ..... 15 min
- Class "A-0" ..... 0 min

d) They are so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test;

e) Tasneef shall require a test of a prototype bulkhead or deck in accordance with the "Fire Test Procedures Code" (see[5.13]), or alternative procedure at its discretion, to ensure that it meets the above requirements for integrity or temperature rise.

5.2.2 The products indicated in Tab 1 may be installed without testing or approval:

5.3 Atriums

5.3.1 Atriums are public spaces within a single main vertical zone spanning three or more open decks.

5.4 B class divisions

5.4.1 B class divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

a) they are constructed of approved non-combustible materials and all materials entering into the construction and erection of "B" class divisions are non-combustible, with the exception that combustible veneers may be permitted provided they meet the other appropriate requirements of this Chapter;

b) they have an insulation value such that the average temperature of the unexposed side will not rise more than 140° C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225° C above the original temperature, within the time listed below:

- Class "B-15" ..... 15 min
- Class "B-0" ..... 0 min

c) they are so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test;

d) Tasneef shall require a test of a prototype division in accordance with the Fire Test Procedures Code (see [5.13]) or alternative procedure at the discretion of Tasneef to ensure that it meets the above requirements for integrity or temperature rise.

5.5 Bulkhead deck

5.5.1 Bulkhead deck is the uppermost deck up to which the transverse watertight bulkheads are carried.

Table 1

Classification	Product description
Class “A-0” bulkhead	A steel bulkhead with dimensions not less than the minimum dimensions given below: • thickness of plating: 4 mm • stiffeners 60 x 60 x 5 mm spaced at 600 mm or structural equivalent
Class “A-0” deck	A steel deck with dimensions not less than the minimum dimensions given below: • thickness of plating: 4 mm • stiffeners 95 x 65 x 7 mm spaced at 600 mm or structural equivalent

5.6 Central control station

5.6.1 Central control station is a control station in which the following control and indicator functions are centralized:

a) fixed fire detection and alarm systems

b) automatic sprinklers, fire detection and alarm systems

c) fire door indicator panels

d) fire door closures

e) watertight door indicator panels

f) watertight door closures

g) ventilation fans

h) general/fire alarms

i) communication systems including telephones, and

Note: The communication systems referred to are only those required by this Chapter.

j) microphones to public address system.

5.7 “C” class divisions

“C” class divisions are constructed of approved non-combustible materials. They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise.
Combustible veneers are permitted provided they meet the requirements of this Chapter.

5.8 Combustible material

5.8.1 Combustible material is any material other than a non-combustible material.

5.9 Continuous B class ceilings and linings

5.9.1 Continuous B class ceilings or linings are those B class ceilings or linings which terminate at an A or B class division.

5.10 Continuously manned central control stations

5.10.1 A continuously manned central control station is a central control station which is continuously manned by a responsible member of the crew.

5.11 Control stations

5.11.1 Control stations are those spaces in which the vessel’s radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment is centralized.

5.12 Deadweight

5.12.1 The deadweight is the difference in tonnes between the displacement of a vessel in water of a specific gravity of 1,025 at the load waterline corresponding to the assigned draft, and the lightweight and dry vessel displacement.

5.13 Fire Test Procedures Code

5.13.1 “Fire Test Procedures Code” means the “International Code for Application of Fire Test Procedures”, as adopted by the Maritime Safety Committee of the IMO by Resolution MSC.61 (67), as may be amended by the IMO.

5.14 Flashpoint

5.14.1 Flashpoint is the temperature in degrees Celsius (closed cup test) at which a product will give off enough flammable vapour to be ignited, as determined by an approved flashpoint apparatus.

5.15 Helideck

5.15.1 Helideck is a purpose-built helicopter landing area located on a vessel including all structure, fire-fighting appliances and other equipment necessary for the safe operation of helicopters.

5.16 Helicopter facility

5.16.1 Helicopter facility is a helideck including any refuelling and hangar facilities.

5.17 Lightweight and dry vessel displacement

5.17.1 Lightweight and dry vessel displacement is the displacement of a vessel in tons without cargo, fuel, lubricating oil, ballast water, fresh water and feed water liquid storage tanks, consumable stores, and passengers and crew and their effects.

5.18 Low flame spread

5.18.1 Low flame spread means that the surface thus described will adequately restrict the spread of flame, this being determined in accordance with the “Fire Test Procedures Code”.

5.18.2 Non-combustible materials are considered as low flame spread. However, due consideration will be given by Tasneef to the method of application and fixing.

5.19 Machinery spaces

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

5.20 Machinery spaces of category A

Machinery spaces of category A are those spaces and trunks to such spaces which contain either:

a) internal combustion machinery used for main propulsion,

b) internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW, or

c) oil fuel unit, or any oil-fired equipment .

5.21 Non-combustible material

5.21.1 Non-combustible material is a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C, this being determined in accordance with the “Fire Test Procedures Code”.

5.21.2 In general, products made only of glass, concrete, ceramic products, natural stone, masonry units, common metals and metal alloys are considered as being non-combustible and may be installed without testing and approval.

5.22 Oil fuel unit

5.22.1 The oil fuel unit refers to any equipment used for the preparation and distribution of liquid fuel, heated or not to engines (including gas turbines) at pressure superior than 0,18 MPa.

5.23 Public spaces

5.23.1 Public spaces are those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

5.24 Rooms containing furniture and furnishings of restricted fire risk

5.24.1 Rooms containing furniture and furnishings of restricted fire risk are, for the purpose of Sec 6, [1.4], are those rooms containing furniture and furnishings of restricted fire risk (whether cabins, public spaces, offices or other types of accommodation) in which:

a) case furniture such as desks, wardrobes, dressing tables, bureaux, dressers, are constructed entirely of approved non-combustible materials, except that a combustible veneer not exceeding 2 mm may be used on the working surface of such articles;

b) free-standing furniture such as chairs, sofas, tables, are constructed with frames of non-combustible materials

c) draperies, curtains and other suspended textile materials have, qualities of resistance to the propagation of flame not inferior to those of wool of mass 0,8 kg/m^2, this being determined in accordance with the Fire Test Procedures Code (see [5.13]);

d) floor coverings have low flame spread characteristics

e) exposed surfaces of bulkheads, linings and ceilings have low flame-spread characteristics

f) upholstered furniture has qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the Fire Test Procedures Code (see [5.13]); and

g) bedding components have qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the Fire Test Procedures Code (see [5.13]).

5.25 Steel or other equivalent material

5.25.1 "Steel or other equivalent material" means any non-combustible material which, by itself or due to insulation provided, had structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g. steel alloy with appropriate insulation).

5.26 Service spaces

5.26.1 Service spaces are those spaces used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, storerooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces.

5.26.2 Main pantries and pantries containing cooking appliances may contain:

1. toasters, induction heaters, microwave ovens and similar appliances each of them with a maximum power of 5 kW;
2. electrically heated cooking plates and hot plates for keeping food warm each of them with a maximum power of 2 kW and a surface temperature not above 150°C;
3. water boilers, regardless of their electrical power;
4. coffee automats, and no-cooking appliances such as dish washers, water boilers, ice-cube machines, fridges without any restriction on their power.
5. A dining room containing such appliances should not be regarded as a pantry.

Spaces containing any electrically heated cooking plate or hot plate for keeping food warm with a power of more than 2 kW or toasters, induction heaters, microwave ovens and similar appliances each of them with power greater than 5 kW, are to be regarded, for the purpose of Sec 6, as galleys.

5.27 Standard fire test

5.27.1 Standard fire test is a test in which the specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve in accordance with the Fire Test Procedures Code (see [5.13]).

5.28 Weather decks

5.28.1 Weather deck is a deck which are completely exposed to the weather from above and from at least two sides.

5.29 Length L

5.29.1 Length **L** of the vessel is intended to be, except other indication, Length **L** in m of measuring as defined in Pt B of this Rules.

SECTION 2 PREVENTION OF FIRE AND EXPLOSION PROBABILITY OF IGNITION

1 Probability of ignition

1.1 Arrangements for fuel oil, lubrication oil and other flammable oils

1.1.1 Limitation in the use of oils as fuel

See Ch 1, Sec 1, [2.9]

1.1.2 Arrangements for fuel oil

See Ch 1, Sec 9, [10] and Pt F, Ch 1, Sec 1.

1.1.3 Arrangements for lubricating oil

See Ch 1, Sec 9, [11].

1.1.4 Arrangements for other flammable oils

See Ch 1, Sec 9.

1.1.5 Arrangements for oil fuel in periodically unattended machinery spaces

See Pt F, Ch 1, Sec 1.

1.2 Miscellaneous items of ignition sources and ignitability

1.2.1 Electric radiators

Electric radiators, if used, shall be fixed in position and so constructed as to reduce fire risks to a minimum.

No such radiators shall 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.

1.2.2 Waste receptacles

Waste receptacles shall be constructed of non-combustible materials with no openings in the sides or bottom.

1.2.3 Insulation surfaces against oil penetration

a) In spaces where penetration of oil products is possible, the surface of insulation shall be impervious to oil or oil vapours.

b) Materials used in machinery spaces are not normally to have properties increasing the fire potential of these rooms.

Neither combustible nor oil-absorbing materials are to be used as flooring, bulkhead lining, ceiling or deck in the control room, machinery spaces, shaft tunnel or rooms where oil tanks are located.

1.2.4 Primary deck coverings

Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of approved material which will not readily ignite, this being determined in accordance with the Fire Test Procedures Code (see Sec 1, [4.13]).

SECTION 3 PREVENTION OF FIRE AND EXPLOSION FIRE GROWTH POTENTIAL, SMOKE GENERATION POTENTIAL AND TOXICITY

1 Fire growth potential

1.1 Control of air supply and flammable liquid to the space

1.1.1 Closing appliances and stopping devices of ventilation

a) The main inlets and outlets of all ventilation systems shall be capable of being closed from outside the spaces being ventilated.

The means of closing shall be easily accessible as well as prominently and permanently marked and shall indicate whether the shut-off is open or closed.

Ventilation inlets and outlets located at outside boundaries are to be fitted with closing appliances as required above and need not comply with Sec 6, [5.3.1].

b) Power ventilation of accommodation spaces, service spaces, control stations and machinery spaces shall be capable of being stopped from an easily accessible position outside the space being served. This position should not be readily cut off in the event of a fire in the spaces served.

1.1.2 Means of control in machinery spaces

a) Means of control shall be provided for opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation, and closure of ventilator dampers.

b) Means of control shall be provided for stopping ventilating.

Controls provided for the power ventilation serving machinery spaces shall be grouped so as to be operable from two positions, one of which shall be outside such spaces. The means provided for stopping the power ventilation of the machinery spaces shall be entirely separate from the means provided for stopping ventilation of other spaces.

c) Means of control shall be provided for stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service pumps, thermal oil circulating pumps and oil separators (purifiers). However, d) needs not to apply to oily water separators.

d) The controls required in a) to c) e in Ch 1, Sec 9, [10.4.6] shall be located outside the space concerned, where they will not be cut off in the event of fire in the space they serve.

In machinery spaces of category A, controls to close off ventilation ducts and pipes are to be installed with due regard to the hot gases produced by a fire in the space concerned.

1.1.3 Additional requirements for means of control in periodically unattended machinery spaces

For periodically unattended machinery spaces, Tasneef shall give special consideration to maintaining the fire integrity of the machinery spaces, the location and centralization of the fire-extinguishing system controls, the required shutdown arrangements (e.g. ventilation, fuel pumps, etc.) and that additional fire-extinguishing appliances and other fire-fighting equipment and breathing apparatus may be required.

1.2 Fire protection materials

1.2.1 Use of non-combustible materials

a) Insulating materials

Insulating materials shall be non-combustible, except in refrigerated compartments of service spaces. Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings, for cold service systems need not be non-combustible, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame spread characteristics.

Cold service means refrigeration systems and chilled water piping for air conditioning systems.

b) Ceilings and linings

All ceilings and linings, draught stops and their supports are to be constructed in non-combustible material:

- in accommodation and service spaces and control stations for vessels where method IC is specified as referred to in Sec 6, [1.3] item b).
- in corridors and stairway enclosures serving accommodation and service spaces and control stations for vessels where methods IIC and IIIC are specified as referred to in Sec 6, [1.3] items c),d).

1.2.2 Use of combustible materials

a) General

Non-combustible bulkheads, ceilings and linings fitted in accommodation and service spaces may be faced with combustible materials, facings, mouldings, decorations and veneers provided such spaces are bounded by non-combustible bulkheads, ceilings and linings in accordance with the provisions of b) to d) below and [3].

b) Maximum calorific value of combustible materials

Combustible materials used on the surfaces and linings specified in a) shall have a calorific value (see Note 1) not exceeding 45 MJ/m^2 of the area for the thickness used. The requirements of this b) are not applicable to the surfaces of furniture fixed linings or bulkheads.

c) Total volume of combustible materials

Where combustible materials are used in accordance with the previous item a), they shall comply with the following requirements:

1. The total volume of combustible facings, mouldings, decorations and veneers in accommodation and service space shall not exceed a volume equivalent to 2,5 mm veneer on the combined area of the walls and ceiling linings.
2. Furniture fixed to linings, bulkheads or decks need not be included in the calculation of the total volume of combustible materials.
3. In the case of vessels fitted with an automatic sprinkler system complying with the provisions of Sec 11, the above volume may include some combustible material used for erection of C class divisions

d) Low flame-spread characteristics of exposed surfaces.

The following surfaces shall have low flame-spread characteristics in accordance with the Fire Test Procedures Code and other standards with the satisfaction of Tasneef:

- exposed surfaces in corridors and stairway enclosures and ceiling linings in accommodation and service spaces (except saunas) and control stations;
- surfaces and grounds in concealed or inaccessible spaces in accommodation and service spaces and control stations

Note: The gross calorific value measured in accordance with ISO Standard 1716: 1973 “Building Materials - Determination of Calorific Potential” should be quoted.

2 Smoke generation potential and toxicity

2.1 Paints, varnishes and other finishes

2.1.1 Paints, varnishes and other finishes used on exposed interior surfaces shall not be capable of producing excessive quantities of smoke and toxic products, this being determined in accordance with the Fire Test Procedures Code.

2.2 Primary deck coverings

2.2.1 Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of approved material which will not give rise to toxic or explosive hazards at elevated temperatures, this being determined in accordance with the Fire Test Procedures Code.

SECTION 4 SUPPRESSION OF FIRE AND EXPLOSION DETECTION AND ALARM

1 General requirements

1.1 Minimum number of detectors

1.1.1 A fixed fire detection and fire alarm system shall be provided in accordance with the provisions of Sec 4.

1.1.2 A fixed fire detection and fire alarm system and a sample extraction smoke detection system required in this regulation and other regulations in this part shall be of an approved type and comply with the requirements given in Sec 11.

1.1.3 Where a fixed fire detection and fire alarm system is required for the protection of spaces other than those specified in [4.1], at least one detector complying with the requirements given in Sec 11 shall be installed in each such space.

2 Initial and periodical test

2.1 General

2.1.1 The function of fixed fire detection and fire alarm systems required in the relevant sections of this chapter shall be tested under varying conditions of ventilation after installation.

2.1.2 The function of fixed fire detection and alarm systems shall be periodically tested to the satisfaction of Tasneef by means of equipment producing hot air at the appropriate temperature, or smoke or aerosol particles having the appropriate range of density or particle size, or other phenomena associated with incipient fires to which the detector is designed to respond.

3 Protection of machinery spaces

3.1 Installation

3.1.1 A fixed fire detection and fire alarm system shall be installed in:

a) periodically unattended machinery space;

In periodically unattended machinery space, a fixed fire detection and fire alarm system of type approved by Tasneef is to be installed. After installation this system is to be tested in different operating conditions of machinery and ventilation.

b) machinery spaces where:

- the installation of automatic and remote control systems and equipment has been approved in lieu of continuous manning of the space, and
- the main propulsion and associated machinery including sources of main electrical supply are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room.

The requirements of this item apply to machinery spaces of category A.

3.2 Design

3.2.1 Smoke detectors system shall be so designed and the detectors so positioned as to detect rapidly the onset of fire in periodically unattended machinery space and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures.

Except in spaces of restricted height and where their use is specially appropriate, detection systems using only thermal detectors are not permitted The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the navigating bridge and by a responsible engineer officer.

When the navigating bridge is unmanned, the alarm shall sound in a place where a responsible member of the crew is on duty.

4 Protection of accommodation and service spaces and control stations

4.1 General

4.1.1 Smoke detectors shall be installed in all stairways, corridors and escape routes within accommodation spaces, service spaces and control stations.

Consideration shall be given to the installation of special purpose smoke detectors within ventilation ducting.

In vessels with Length **L**≤20 m automatic fire detectors are required only for non attended spaces with high fire risk.

4.2 Smoke detectors

4.2.1 Accommodation and service spaces shall be protected by a fixed fire detection and fire alarm system and/or an automatic sprinkler, fire detection and fire alarm system as follows depending on a protection method adopted in accordance with Sec 6 [1.3].

a) Method IC A fixed fire detection and fire alarm system shall be so installed and arranged as to provide smoke detection in all corridors, stairways and escape routes within accommodation spaces.

b) Method IIC An automatic sprinkler fire detection and fire alarm system of approved type and in conformity with the requirements given in Sec 13 is to be installed, arranged and achieved as to protect accommodation spaces, galleys and other service spaces, except spaces not presenting high fire risk, as empty spaces, sanitary services, etc. Besides, a fixed fire detection and fire alarm system is to be arranged and achieved as to reveal smoke in every corridors, stairways and escapes located inside the accommodation spaces.

c) Method IIIC A fixed fire detection and fire alarm system shall be so installed and arranged as to detect the presence of fire in all accommodation spaces and service spaces, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc.

CO_2 rooms need not be protected by a smoke detection system or a sprinkler system.

5 Manually operated call point

5.1.1 In vessels with Length **L**>20 m manually operated call points respecting the requirements given in Sec 13 of Pt C, Ch 4 of TASNEEFMIL are to be arranged everywhere in accommodation spaces, service spaces and control stations.

One manually operated call point shall be located at each exit.

Manually operated call points shall be readily accessible in the corridors of each deck so that no part of the corridor is more than 20 m from a manual call point.

SECTION 5 SUPPRESSION OF FIRE CONTROL OF SMOKE SPREAD

1 Protection of control stations outside machinery spaces

1.1 General

1.1.1 Practicable measures shall be taken for control stations outside machinery spaces in order to ensure that ventilation, visibility and freedom from smoke are maintained, so that in the event of fire the machinery and equipment contained therein may be supervised and continue to function effectively.

Alternative and separate means of air supply shall be provided and air inlets of the two sources of supply shall be so disposed that the risk of both inlets drawing in smoke simultaneously is minimized.

At the discretion of Tasneef, such requirements need not apply to control stations situated on, and opening on to, an open deck, or where local closing arrangements would be equally effective

1.1.2 Equally effective local closing arrangements means that in the case of ventilators these are to be fitted with fire dampers or smoke dampers which are to be easily closed within the control station in order to maintain the absence of smoke in the event of fire.

2 Release of smoke from machinery spaces

2.1 Application

2.1.1 To machinery spaces of category A and to other machinery spaces, the requirements given in this Article [2] apply, where considered appropriated by Tasneef.

2.2 Arrangements to permit the release of smoke

2.2.1 Suitable arrangements shall be made to permit the release of smoke in the event of fire, from the space to be protected subject to the provision of Sec 6, [4.2.1]. The normal ventilation systems may be acceptable for this purpose.

2.3 Means of control

2.3.1 Means of control shall be provided for permitting the release of smoke and the controls shall be located outside the space concerned, where they will not be cut off in the event of fire in the space they serve.

3 Draught stops

3.1 General

Air spaces enclosed behind ceilings, panelling or linings shall be divided by close-fitting draught stops not more than 14 m apart, where required by Tasneef according to their extension.

In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., shall be closed at each deck.

SECTION 6 SUPPRESSION OF FIRE CONTAINMENT OF FIRE

1 Thermal and structural boundaries

1.1 Thermal and structural subdivision

1.1.1 Vessels are to be subdivided into spaces by thermal and structural divisions having regard to the fire risk of the space.

1.2 Methods of protection in accommodation area

1.2.1 One of the following methods of protection shall be adopted in accommodation and service spaces and control stations:

1) Method IC

The construction of internal divisional bulkheading of non-combustible B or C class divisions generally without the installation of an automatic sprinkler, fire detection and fire alarm system in the accommodation and service spaces, or

2) Method IIC

The fitting of an automatic sprinkler, fire detection and fire alarm system as required by item b) of Sec 4, [4.2.1],] for the detection and extinction of fire in all spaces in which fire might be expected to originate, generally with no restriction on the type of internal divisional bulkheading, or

3) Method IIIC

The fitting of a fixed fire detection and fire alarm system, as required by item c) of Sec 4, [4.2.1], in spaces in which a fire might be expected to originate, generally with no restriction on the type of internal divisional bulkheading, except that in no case must the area of any accommodation space or spaces bounded by an A or B class division exceed 50 m^2.

Consideration may be given by Tasneef to increasing this area for public spaces.

The area of public spaces may be permitted to be increased up to 75 m^2.

1.2.2 The requirements for the use of non-combustible materials in construction and insulation of the boundary bulkheads of machinery spaces, control stations, service spaces, etc., and the protection of stairway enclosures and corridors will be common to all three methods outlined in [1.2.1] above.

1.3 Bulkheads within accommodation area

1.3.1 General

Bulkheads required to be B class divisions shall extend from deck to deck and to the shell or other boundaries.

However, where continuous B class ceiling or lining is fitted on both sides of the bulkhead, the bulkhead may terminate at the continuous ceiling or lining.

1.3.2 Method IC

Bulkheads not required to be A or B class divisions, shall be at least C class construction.

1.3.3 Method IIC

There shall be no restriction on the construction of bulkheads not required by this or other Sections to be A or B class divisions except in individual cases where C class bulkheads are required in accordance with Tab 1.

1.3.4 Method IIIC

There shall be no restriction on the construction of bulkheads not required by this or other Sections to be A or B class divisions except that the area of any accommodation space or spaces bounded by a continuous A or B class division must in no case exceed 50 m^2 except in individual cases where C class bulkheads are required in accordance with Tab 1.

Consideration may be given by Tasneef to increasing this area for public space.

The area of public spaces may be permitted to be increased up to 75 m^2.

1.4 Fire integrity of bulkheads and decks

1.4.1 In addition to complying with the specific provisions for fire integrity of bulkheads and decks defined in other sections of this chapter, the minimum fire integrity of bulkheads and decks of vessels constructed in steel or light alloy shall be as prescribed in Tab 1 and 2 where:

(1) Control stations

Spaces containing emergency sources of power and lighting

Wheelhouse and chartroom

Spaces containing the vessel's radio equipment (radio rooms)

Spaces for fire-fighting extinction, control and fire-fighting alarm stations.

Control room for propulsion machinery when located outside the propulsion machinery space.

Spaces containing centralized fire alarm equipment.

(2) Corridors

Corridors and lobbies.

(3) Accommodation spaces

Spaces as defined in Sec 1, excluding corridors.

(4) Stairways

Interior stairways (other than those wholly contained within the machinery spaces), and enclosures thereto. In this connection, a stairway which is enclosed at only one level shall be regarded as part of the space from which it is not separated by a fire door.

(5) Service spaces (low risk)

Lockers and storerooms not having provisions for the storage of flammable liquids and having areas less than 4 m^2 and drying rooms and laundries.

(6) Machinery spaces of category A

Spaces defined in Sec 1.

(7) Other machinery spaces

Spaced as defined in Sec 1, excluding machinery spaces of category A.

(8) Open decks

Open deck spaces and enclosed promenades having no fire risk.

Air spaces (the space outside superstructures and deckhouses).

(9) Service spaces (high risk)

Galleys, pantries with cooking equipments, lights and paints lockers, tanks and storages having a surface equal or superior than 4 m^2 for the inflammable liquid tanks and workshops different from the ones in machinery spaces.

For vessels constructed in composite see Sec 8 [8]

1.4.2 The following requirements shall govern the application of Tab 1 and Tab 2:

a) Tab 1 and Tab 2 shall apply respectively, to the bulkheads and decks separating adjacent spaces.

b) For determining the appropriate fire integrity standards required for divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (Spaces) listed from (1) to (9).

Title of every categories is to consider as characteristic instead of restrictive. The number between brackets before the category correspond to the respective row or column in Tab 1 and 2.

1.4.3 Continuous B class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing, wholly or in part, to the required insulation and integrity of a division.

1.4.4 Portholes and windows on external limits constructed in steel or other equivalent material can be arranged.

Likewise, on such limits, doors constructed with materials on satisfaction of Tasneef may be arranged.

Table 1

SPACES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Control stations (1)	A-0 [c]	A-0	A-60	A-0	A-15	A-60	A-15	*	A-60
Corridors (2)		C	B-0	A-0 [a] B-0	B-0	A-60	A-0	*	A-0
Accommodation spaces (3)			C	A-0 [a] B-0	B-0	A-60	A-0	*	A-0
Stairways (4)				A-0 [a] B-0	A-0 [a] B-0	A-60	A-0	*	A-0
Service spaces (low risk) (5)					C	A-60	A-0	*	A-0
Machinery spaces of category A (6)						*	A-0	*	A-60
Other machinery spaces (7)							A-0 [d]	*	A-0
Open decks (10)								*	*
Service spaces (high risk) (9)								*	A-0 [b]

(1) Control stations
- Spaces containing emergency sources of power and lighting
- Wheelhouse and chartroom
- Spaces containing the vessel's radio equipment (radio rooms)
- Spaces for fire-fighting extinction, control and fire-fighting alarm stations.
- Control room for propulsion machinery when located outside the propulsion machinery space.
- Spaces containing centralized fire alarm equipment

(2) Corridors
- Corridors and lobbies.

(3) Accommodation spaces
- Spaces as defined in Sec 1, excluding corridors.

(4) Stairways
- Interior stairways (other than those wholly contained within the machinery spaces), and enclosures thereto. In this connection, a stairway which is enclosed at only one level shall be regarded as part of the space from which it is not separated by a fire door.

(5) Service spaces (low risk)
- Lockers and storerooms not having provisions for the storage of flammable liquids and having a surface less than 4 m^2 and drying rooms and laundries.

(6) Machinery spaces of category A
- Spaces defined in Sec 1.

(7) Other machinery spaces
- Spaced as defined in Sec 1, excluding machinery spaces of category A.

(8) Open decks
- Open deck spaces and enclosed promenades having no fire risk.
- Air spaces (the space outside superstructures and deckhouses).

(9) Service spaces (high risk)
- Galleys, pantries with cooking equipments, lights and paints lockers, tanks and storages having a surface equal or superior than 4 m^2, inflammable liquid tanks and workshops different from the ones in machinery spaces

Note 1: to be applied to Tab 1 and Tab 2, as appropriate

[a] For clarification as to which applies, see [1.5].

[b] Where spaces are of the same numerical category and letter " d" appears, a bulkhead or deck of the ratings shown in the tables is only required when the adjacent spaces are for a different purpose, e.g. in category (9). A galley next to a galley does not require a bulkhead but a galley next to a paint lockers requires an A-0 bulkhead.

[c] Bulkheads separating the wheelhouse, chartroom and radio room from each other may be B-0 rating.

[d] In machinery spaces of category (7) considered by Tasneef of low or no fire risk, fire stop insulation may be omitted.

[e] Regarding Method IIC and Method IIIC, bulkheads are not to satisfy any particular provision.

* Where an asterisk appears in the tables, the division is required to be of steel or other equivalent material but is not required to be of A class standard

Table 2

SPACE below	SPACE above								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Control stations (1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	*	A-0
Corridors (2)	A-0	*	*	A-0	*	A-60	A-0	*	A-0
Accommodation spaces (3)	A-60	A-0	*	A-0	*	A-60	A-0	*	A-0
Stairways (4)	A-0	A-0	A-0	*	A-0	A-60	A-0	*	A-0
Service spaces of minor fire risk (5)	A-15	A-0	A-0	A-0	*	A-60	A-0	*	A-0
Machinery spaces of category A (6)	A-60	A-60	A-60	A-60	A-60	*	A-60[d]	*	A-60
Other machinery spaces (7)	A-15	A-0	A-0	A-0	A-0	A-0	*	*	A-0
Open decks (8)	*	*	*	*	*	*	*	*	A-60 [b]
Service rooms of greater fire risk (9)	A-60	A-0	A-0	A-0	A-0	A-60	A-0	*	A-0
Note 1: The notes to Tab 1 apply to this table as appropriate.									

1.5 Protection of stairways, lift trunks in accommodation spaces, service spaces and control stations

1.5.1 Stairways which penetrate only a single deck shall be protected at a minimum at one level by at least B-0 class divisions and self-closing doors.

Lifts which penetrate only a single deck shall be surrounded by A-0 class divisions with steel doors at both levels.

Stairways and lift trunks which penetrate more than a single deck shall be surrounded by at least A-0 class divisions and be protected by self-closing doors at all levels.

Dumb-waiters are to be regarded as lifts.

1.5.2 On vessels having accommodation for 12 persons or less, where stairways penetrate more than a single deck and where there are at least two escape routes direct to the open deck at every accommodation level, the A-0 requirements of the above item [1.5.1] may be reduced to B-0.

2 Penetration in fire-resisting divisions and prevention of heat transmission

2.1 Penetrations in A class divisions

2.1.1 Where A class divisions are penetrated, such penetrations shall be tested in accordance with the Fire Test Procedures Code.

In the case of ventilation ducts [5.2.2] e [5.3.1] apply.

However, where a pipe penetration is made of steel or equivalent material having a thickness of 3 mm or greater and a length of not less than 900 mm (preferably 450 mm on each side of the division), and no openings, testing is not required.

Such penetrations shall be suitably insulated by extension of the insulation at the same level of the division.

2.2 Penetrations in B class division

2.2.1 Where B class divisions are penetrated for the passage of electrical cables, pipes, trunks, ducts, etc., or for the fitting of ventilation terminals, lighting fixtures and similar devices, arrangements shall be made to ensure that the fire resistance is not impaired, subject to the provisions of [5.3.1].

2.2.2 Pipes other than steel or copper that penetrate B class divisions shall be protected by either:

a) a fire tested penetration device, suitable for the fire resistance of the division pierced and the type of pipe used; or

b) a steel sleeve, having a thickness of not less than 1.8 mm and a length of not less than 900 mm for pipe diameters of 150 mm or more and not less than 600 mm for pipe diameters of less than 150 mm (preferably equally divided to each side of the division). The pipe shall be connected to the ends of the sleeve by flanges or couplings; or the clearance between the sleeve and the pipe shall not exceed 2,5 mm; or any clearance between pipe and sleeve shall be made tight by means of non-combustible or other suitable material.

2.3 Pipes penetrating A or B class divisions

2.3.1 Uninsulated metallic pipes penetrating A or B class divisions shall be of materials having a melting temperature which exceeds 950º C for A-0 and 850º C for B-0 class divisions.

2.4 Structural fire protection details

In approving structural fire protection details, Tasneef shall have regard to the risk of heat transmission at intersections and terminal points of required thermal barriers.

The insulation of a deck or bulkhead shall be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of A class standard having insulation of different values, the insulation with the higher value shall continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

3 Protection of openings in fire-resisting divisions

3.1 Doors in fire-resisting divisions

3.1.1 The fire resistance of doors shall be equivalent to that of the division in which they are fitted, this being determined in accordance with the Fire Test Procedures Code. Doors and door frames in A class divisions shall be constructed of steel.

Doors in B class divisions shall be non-combustible. Doors fitted in boundary bulkheads of machinery spaces of category A shall be reasonably gas-tight and self-closing. In vessels constructed according to method IC, Tasneef may permit the use of combustible materials in doors separating cabins from individual interior sanitary accommodation such as showers.

3.1.2 Doors required to be self-closing shall not be fitted with hold-back hooks. However, hold-back arrangements fitted with remote release devices of the fail-safe type may be utilized.

3.1.3 In corridor bulkheads, ventilation openings may be permitted in and under the doors of cabins and public spaces.

Ventilation openings are also permitted in B class doors leading to lavatories, offices, pantries, lockers and store rooms.

Except as permitted below, the openings shall be provided only in the lower part of a door. Where such opening is in or under a door the total net area of any such opening or openings shall not exceed 0,05 m^2. Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, and located below the sanitary unit is permitted where the cross sectional area of the duct does not exceed 0.05 m^2. Ventilation openings, except those under the door, shall be fitted with a grill made of non-combustible material

3.1.4 Watertight doors need not be insulated.

4 Protection of openings in machinery space boundaries

4.1 Application

4.1.1 The provisions of this Article [4] shall apply to machinery spaces of category A and, where Tasneef considers it desirable, to other machinery spaces.

4.2 Protection of openings in machinery space boundaries

4.2.1 The number of skylights, doors, ventilators, openings in funnels to permit exhaust ventilation and other openings to machinery spaces shall be reduced to a minimum consistent with the needs of ventilation and the proper and safe working of the vessel.

4.2.2 Skylights shall be of steel and shall not contain glass panels.

4.2.3 Means of control shall be provided for closing power-operated doors or actuating the release mechanism on doors other than power-operated watertight doors. The control shall be located outside the space concerned, where it will not be cut off in the event of fire in the space it serves.

4.2.4 Windows shall not be fitted in machinery space boundaries. However, this does not preclude the use of glass in control rooms within the machinery spaces.

5 Ventilation systems

5.1 Duct and dampers

5.1.1 Ventilation ducts shall be of non-combustible material. However short ducts, not generally exceeding 2 m in length and with a free sectional area (see Note 1) not exceeding 0,02 m^2 need not be non-combustible, subject to the following conditions:

a) the ducts are made of a material which has low flame spread characteristics

b) the ducts are only used at the end of the ventilation device; and

c) the ducts are not situated less than 600 mm, measured along the duct, from an opening in an A or B class division including continuous B class ceiling.

Flexible bellows of combustible material may be used for connecting fans to the ducting in the air conditioning room.

Note 1:The term "free-sectional area" means, even in the case of a pre-insulated duct, the area calculated on the basis of the inner diameter of the duct.

5.1.2 The following arrangements shall be tested in accordance with the Fire Test Procedures Code:

a) fire dampers, including relevant means of operation, and

b) duct penetrations through A class divisions. However, the test is not required where steel sleeves are directly joined to ventilation ducts by means of riveted or screwed flanges or by welding.

5.2 Arrangements of ducts

5.2.1 The ventilation systems for machinery spaces of category A, galleys may be not totally divided, each from the other, and from ventilation systems serving other spaces.

The introduction of air may be derived from a ventilation system serving other spaces. In any case, an automatic fire dampers is to be arranged in the ventilation duct of the galley, next to the ventilation unity.

The ventilation systems for machinery spaces of category A and galleys, shall not pass through accommodation spaces, service spaces or control stations unless they comply with the conditions specified below:

a) the ducts are constructed of steel having a thickness of at least 3 mm and 5 mm for ducts the widths or diameters of which are up to and including 300 mm and 760 mm and over. In the case of such ducts, the widths or diameters of which are between 300 mm and 760 mm having a thickness to be obtained by linear interpolation;

b) the ducts are suitably supported and stiffened;

c) the ducts are fitted with automatic fire dampers close to the boundaries penetrated, and

d) the ducts are insulated to A-60 standard from the machinery spaces, galleys, spaces to a point at least 5 m beyond each fire damper; or

e) the ducts are constructed of steel in accordance with the preceding items a) and b), and

f) the ducts are insulated to A-60 standard throughout the accommodation spaces, service spaces or control stations.

5.2.2 Ducts provided for ventilation to accommodation spaces, service spaces or control stations shall not pass through machinery spaces of category A, galleys unless they comply with:

a) the ducts, where they pass through a machinery space of category A, galley, are constructed of steel in accordance with items (a) and (b) of [5.2.1]

b) automatic fire dampers are fitted close to the boundaries penetrated; and

c) the integrity of the machinery space or galley; or

d) the ducts where they pass through a machinery space of category A or galley, are constructed of steel in accordance with items (a) and (b) of [5.2.1]; and

e) the ducts are insulated to A-60 standard within the machinery space or galley.

5.3 Details of duct penetration

5.3.1 Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 m^2 passes through A class bulkheads or decks, the opening shall be lined with a steel sheet sleeve having a thickness of at least 3 mm and a length of at least 200 mm, divided preferably into 100 mm on each side of the bulkhead or, in the case of the deck, wholly laid on the lower side of the decks pierced. Where the ventilation ducts with a free-sectional area exceeding 0,02 m^2 pass through A class bulkheads or decks, the opening shall be lined with a steel sheet sleeve. However, where such ducts are of steel construction and pass through a deck or bulkhead, ducts and sleeves shall comply with the following:

a) The sleeves shall have a thickness of at least 3 mm and a length of at least 900 mm. When passing through bulkheads, this length shall be divided preferably into 450 mm on each side of the bulkhead. These ducts, or sleeves lining such ducts, shall be provided with fire insulation. The insulation shall have at least the same fire integrity as the bulkhead or deck through which the duct passes; and

b) Ducts with a free cross-sectional area exceeding 0,075 m^2 shall be fitted with fire dampers in addition to the requirements of the preceding item a). The fire damper shall operate automatically but shall also be capable of being closed manually from both sides of the bulkhead or deck. The damper shall be provided with an indicator which shows whether the damper is open or closed. Fire dampers are not required, however, where ducts pass through spaces

surrounded by A class divisions, without serving those spaces, provided those ducts have the same fire integrity as the divisions which they pierce.

Fire dampers shall be easily accessible.

SECTION 7 SUPPRESSION OF FIRE FIRE - FIGHTING

1 Water supply systems

1.1 General

1.1.1 Vessel shall be provided with fire pumps, fire mains, hydrants and hoses complying as applicable with the requirements of this Section.

For vessels with Length **L**≤15 m a fire-fighting plumbing is not required.

1.2 Fire mains and hydrants

1.2.1 General

Materials readily rendered ineffective by heat shall not be used for fire mains and hydrants unless adequately protected. The use of diaphragm valves in which rubber membrane is fitted may be accepted providing that their efficiency would not be impaired in case of exposure to heat sources, this being demonstrated to the satisfaction of Tasneef.

The pipes and hydrants shall be so placed that the fire hoses may be easily coupled to them.

Suitable drainage provisions shall be provided for fire main piping.

Isolation valves shall be installed for all open deck fire main branches used for purposes other than fire-fighting.

1.2.2 Ready availability of water supply

Arrangements are to be such as to guarantee a ready availability water supply.

Immediate availability of water supply can be achieved either by automatic starting of at least one fire pump or by remote starting from the navigation bridge of at least one fire pump.

1.2.3 Diameter of the fire mains

The diameter of the fire main and water service pipes shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously.

1.2.4 In vessels with Length **L** more than 20 m, isolating valves to separate the section of the fire main within the machinery space containing the main fire pump shall be fitted in an easily accessible and tenable position outside the machinery spaces. The fire main shall be so arranged that when the isolating valves are shut all the hydrants of the vessel, except those in the machinery space referred to above, can be supplied by a fire pump outside the machinery space, through pipes not crossing this space.

Exceptionally a short part of the suction and delivery piping of the emergency pump is permitted to cross the machinery space if not practical to arrange such part outside the space and on condition that the fire main's integrity is preserved through the part closing in a muff in steel or insulated in Class A-60.

A valve shall be fitted to serve each fire hydrant so that any fire hose may be removed while the fire pumps are in operation.

1.2.5 Number and position of hydrants

The number and position of hydrants shall be such that at least two jets of water not emanating from the same hydrant, one of which shall be from a single length of hose, may reach any part of the vessel normally accessible to the passengers or crew while the vessel is being navigated.

Preserving the provisions of this paragraph, in machinery space of category A of vessels with Length superior than 20 m, at least two hydrants are to be provided that is, if the space is reduced, only one hydrant is request in the inside and the second one may be arranged next to this space access.

For vessels with Length **L**≤ 20 m hydrants may be located outside the spaces mentioned.

1.2.6 Pressure at hydrants

With the two pumps simultaneously delivering, through nozzles specified in [1.4.] the quantity of water specified in [1.2.3], through any adjacent hydrants, anywhere located, a minimum pressure of 0,25 MPa is to be maintained for all hydrants.

The maximum pressure at any hydrant shall not exceed that at which the effective control of a fire hose can be demonstrated.

In vessels with Length **L**≤ 20 m, pressure is to be such as to assure that the nozzles mentioned above may achieve streams of water to a distance superior than 8 m.

1.3 Fire pumps

1.3.1 Pumps accepted as fire pumps

Sanitary, ballast, bilge 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 fuel oil, suitable change-over arrangements are fitted.

The emergency fire pump mentioned in [1.3.3] may also be used for other suitable purposes subject to approval by Tasneef in each case.

1.3.2 Number of fire pumps

Vessels shall be provided with independently driven fire pumps as follows:

a) Vessels with length **L** > 20 m:

- at least 2, only one of these pumps is required to be independently driven

b) Vessels with length L ≤ 20 m:

- at least a power driven pump that is dragged by propulsion engines.

1.3.3 Arrangement of fire pumps and fire mains

a) In vessels with length L> 20 m unless the two main fire pumps, their sea suctions and the fuel supply or source of power for each pump are situated within compartments separated so that a fire in any one compartment will not render both fire pumps inoperable, an emergency fire pump is to be fitted.

b) In vessels with length L≤ 20 m the emergency fire pump can be hand-borrow pump, driven by an internal combustion engine, provided with suitable arrangements for the sea water suction and arranged so that to be readily usable and settled in a different space from the one where the main pump is arranged.

Such range power is not to be less than 15 m³/h.

1.3.4 Requirements for the space containing the emergency pump

a) Location and dimension of the space The space containing the fire pump shall not be contiguous to the boundaries of machinery spaces of category A or those spaces containing main fire pumps.

Where this is not practicable, the common bulkhead between the two spaces shall be insulated to a standard of structural fire protection equivalent to that required for a control station in Sec 6, [1.4].

The rooms where the pump and prime mover are installed are to have adequate space for maintenance work and inspections.

b) Access to the emergency fire pump No direct access shall be permitted between the machinery space and the space containing the emergency fire pump and its source of power. When this is impracticable, Tasneef may accept an arrangement where the access is by means of an airlock with the door of the machinery space being of A-60 class standard, and the other door being at least steel, both reasonably gas-tight, self-closing and without any hold back arrangements. Alternatively, the access may be through a watertight door capable of being operated from a space remote from the machinery space and the space containing the emergency fire pump and unlikely to be cut off in the event of fire in those spaces. In such cases a second means of access to the space containing the emergency fire pump and its source of power shall be provided.

When a single access to the emergency fire pump room is through another space adjoining a machinery space of category A or the spaces containing the main fire pumps, an A-60 class boundary is required between such other space and the machinery space of category A or the spaces containing the main fire pumps.

c) Ventilation of the emergency fire pump space Ventilation arrangements to the space containing the independent source of power for the emergency fire pump shall be such as to preclude, as far as practicable, the possibility of smoke from a machinery space fire entering or being drawn into that space.

Energy is to be provided from the emergency source in case where the space is mechanically ventilated.

d) Illumination of the space The room where the emergency fire pump prime mover is located is to be illuminated from the emergency source of supply.

1.3.5 Capacity of fire pumps

a) Total capacity of required fire pumps The required fire pumps shall be capable of delivering for fire-fighting purposes a quantity of water, at the pressure specified in [1.2.6], as follows:

- Vessels with Length **L** > 20 m:

not less than four thirds of that of each independent bilge pump, calculated in accordance with Ch C, Sec 9 where used for bilge exhaustion, but in any case not less than 25 m³/h for lengths L, included between 20 and 30 m, and not less than 35 m³/h for higher lengths.

However it is not necessary a total capacity superior than 180 m³/h in any vessels.

- Vessels with Length L ≤20 m: at least 15 m³/h.

b) Capacity of each fire pump Each of the required fire pumps (other than any emergency pump required in [1.3.3]) shall have a capacity not less than 80% of the total required capacity divided by the minimum number of required fire pumps but in any case not less than 15 m^3/h. Each such pump shall in any event be capable of delivering at least the two required jets of water. These fire pumps shall be capable of supplying the fire main system under the required conditions. Where more pumps than the minimum required pumps are installed, such additional pumps shall have a capacity of at least 15 m^3/h and shall be capable of delivering at least the two jets of water required in [1.2.5].

1.4 Fire hoses and nozzles

1.4.1 General requirements

a) Fire hoses shall be of non-perishable material approved by Tasneef and shall be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used.

Each hose shall be provided with a nozzle and the necessary couplings. Hoses specified in this Chapter as "fire hoses" shall, together with any necessary fittings and tools, be kept ready for use in conspicuous positions near the water service hydrants or connections.

Fire hoses shall have a length of 15 m, unless in vessels of limited length for which inferior lengths, established case by case by Tasneef, shall be sufficient.

b) Unless one hose and nozzle is provided for each hydrant in the vessel, there shall be complete interchangeability of hose couplings and nozzles.

c) All the nozzles arranged are to be of type approved, of double use (normal jets/ rainy jets) with a device for water interception. For vessels with Length L ≤ 20 m nozzles of not approved type may be accepted as long as considering suitable by Tasneef.

2 Portable fire extinguishers

2.1 Type and design

2.1.1 Portable fire extinguishers are to comply with the requirements of Sec 11.

In vessels with Length **L** ≤ 15 m portable fire extinguisher in conformity with other standards may be used if deemed suitable by Tasneef.

2.2 Arrangement of fire extinguishers

2.2.1 Accommodation spaces, service spaces and control stations shall be provided with portable fire extinguishers of appropriate types and in sufficient number to the satisfaction of Tasneef.

The number and the type of portable fire extinguishers required for the above-mentioned spaces are to be as follows:

- In accommodation spaces: at least 2 foam extinguishers or equivalent, but not less than one for each tweendeck.
- In the proximity of any electric switchboard or section board having a power of 20 kW and upwards: at least one CO_2 or powder extinguisher.
- In any service space where deep fat cooking equipment is installed: at least one foam extinguisher or equivalent.
- In the proximity of any paint or flammable product locker: at least one foam extinguisher or equivalent
- On the navigating bridge: one CO_2 extinguisher or equivalent.

2.2.2 For vessels with Length **L**≤ 15 m the following extinguisher are to be arranged:

- 1 foam extinguisher of 6 l or equivalent in the machinery spaces
- 1 powder extinguisher of 3 kg, in every accommodation
- 1 CO_2 extinguisher of at least 3 kg or a powder one of 3 kg next to the electrical board Where space sizes are such to not permit the presence of personnel or are not practicable, the foam extinguisher shall be arranged outside, next to the engine room.

2.2.3 One of the portable fire extinguishers intended for use in any space shall be stowed near the entrance to that space.

2.2.4 Carbon dioxide fire extinguishers shall not be placed in accommodation spaces. In control stations and other spaces containing electrical or electronic equipment or appliances necessary for the vessel's safety, fire extinguishers should be provided whose extinguishing media are neither electrically conductive nor harmful to the equipment and appliances.

2.2.5 Fire extinguishers shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of a fire, and in such a way that their serviceability is not impaired by the weather, vibration or other external factors. Portable fire extinguishers shall be provided with devices which indicate whether they have been used.

2.3 Spare charges

2.3.1 Spare charges shall be provided following the indications below.

For rechargeable and portable extinguishers present on board spare charges shall be provided for 10% of those, with a minimum of five charges; however the total number of charges is not necessary to be superior than the number of extinguishers present on board.

3 Fixed fire-extinguishing systems

3.1 Types of fixed fire-extinguishing systems

3.1.1 A fixed fire extinguishing system may be any of the following systems:

a) a fixed gas fire-extinguishing system complying with the provisions of Sec 11.

b) a fixed pressure water-spraying fire-extinguishing system complying with the provisions of Sec 11.

3.1.2 Where a fixed fire-extinguishing system not required by this chapter is installed, it shall meet the relevant requirements of this chapter to the satisfaction of Tasneef.

3.2 Closing appliances for fixed gas fire-extinguishing systems

3.2.1 Where a fixed gas fire-extinguishing system is used, openings which may admit air to or allow gas to escape from a protected space shall be capable of being closed from outside the protected space.

3.3 Storage rooms for fire-extinguishing medium

3.3.1 When the fire-extinguishing medium is stored outside a protected space, it shall be stored in a room which is located astern of the collision bulkhead and is used for no other purposes. Any entrance to such a storage room shall preferably be from the open deck and in any case shall be independent of the protected space. If the storage space is located below deck,

it shall be located no more than one deck below the open deck and shall be directly accessible by a stairway from the open deck.

Spaces which are located below deck or spaces where access from the open deck is not provided, shall be fitted with a mechanical ventilation system designed to take exhaust air from the bottom of the space and shall be sized to provide at least 6 air changes per hour. Access doors shall open outwards, and bulkheads and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and adjoining enclosed spaces, shall be gastight.

For the purpose of the application of the integrity Tab 1 and 2 of Sec 6 such storage rooms shall be treated as fire control stations.

3.4 Water pumps for other fire-extinguishing systems

3.4.1 Pumps, other than those serving the fire main, required for the provision of water for other fire-extinguishing systems required by this Chapter 4, their sources of power and their controls shall be installed outside the space or spaces protected by such systems and shall be so arranged that a fire in the space or spaces protected will not put any such system out of action.

4 Fire-extinguishing arrangements in machinery spaces

4.1 Machinery spaces arrangement

4.1.1 General

a) The arrangement of machinery spaces is to be such that safe storage and handling of flammable liquids is ensured.

b) The ventilation of machinery spaces shall be sufficient under all normal conditions to prevent accumulation of oil vapour.

All spaces where oil-consuming installations, settling tanks or daily service fuel tanks are located are to be easily accessible and well ventilated.

c) Where leakage of flammable liquids may occur during normal service or routine maintenance work, special arrangement is to be made to prevent these fluids from reaching other parts of the machinery where danger of ignition may arise.

d) Materials used in machinery spaces are not normally to have properties increasing the fire potential of these rooms.

Neither combustible nor oil-absorbing materials are to be used as flooring, bulkhead lining, ceiling or deck in the control room, machinery spaces, shaft tunnel or rooms where oil tanks are located.

Where penetration of oil products is possible, the surface of the insulation is to be impervious to oil or oil vapours.

4.2 Machinery spaces containing internal combustion machinery

4.2.1 Fixed fire-extinguishing systems

Machinery spaces of category A containing internal combustion machinery shall be provided with one of the fire-extinguishing systems required in [3.1].

4.2.2 Additional fire-extinguishing arrangements

a) There shall be at least one portable foam applicator unit complying with the provisions of Sec 11.

b) There shall be in each such space approved foam-type fire extinguishers, each of at least 45 l capacity or equivalent, sufficient in number to enable foam or its equivalent to be directed on to any part of the fuel and lubricating oil pressure systems, gearing and other fire hazards. In addition, there shall be provided a sufficient number of portable foam extinguishers or equivalent which shall be so located that no point in the space is more than 10 m walking distance from an extinguisher and that there are at least two such extinguishers in each such space. For smaller spaces, Tasneef may consider relaxing this requirement.

c) In vessels with Length L≤ 20 m extinguishers of 45 l may be substitute with portable foam ones, or

equivalent, in ratio of one extinguisher every 75 kW, or fraction, of power machinery exceeding 375 kW, is not necessary that the total number of the portable foam extinguishers of 9 l arranged in such space is more than 6.

d) There is to be at least one CO_2 or powder extinguisher in the proximity of any electric switchboard or section board having a power of 20 kW and upwards.

5 Fire-extinguishing arrangements in control stations, accommodation and service spaces

5.1 Sprinkler systems in passenger vessels

5.1.1 In vessels adopting Method IIC, specified in Sec 6, [1.2], an automatic sprinkler system with fire detection and alarm, according to item b) in Sec 4, [4.2]. is to be arranged

5.2 Spaces containing flammable liquid

5.2.1 Paint lockers and spaces containing flammable liquids shall be protected by:

a) a carbon dioxide system, designed to give a minimum volume of free gas equal to 40% of the gross volume of the protected space;

b) a dry powder system, designed for at least 0,5 kg powder//m^3;

c) a water spraying or sprinkler system, designed for 5 l/m^2·min. Water spraying systems may be connected to the fire main of the vessel; or

d) a system providing equivalent protection, as determined by Tasneef In any case, the system shall be operable from outside the protected space.

5.2.2 For lockers of a deck area of less than 4 m^2, which do not give access to accommodation spaces, a carbon dioxide portable fire extinguisher sized to provide a minimum volume of free gas equal to 40% of the gross volume of the space may be accepted in lieu of a fixed system. A discharge port shall be arranged in the locker to allow the discharge of the extinguisher without having to enter into the protected space. The required portable fire extinguisher shall be stowed adjacent to the port. Alternatively, a port or hose connection may be provided to facilitate the use of fire main water.

6 Fire-fighter's outfits

6.1 Types of fire-fighter's outfits

6.1.1 Fire-fighter's outfits shall comply with Sec 11.

6.2 Number of fire-fighter's outfits

6.2.1 All the vessels with Length **L**>40 m shall carry at least one fire-fighter's outfit.

6.3 Storage of fire-fighter's outfits

6.3.1 The fire-fighter's outfit shall be kept ready for use in an easily accessible location that is permanently and clearly marked.

SECTION 8 SUPPRESSION OF FIRE STRUCTURAL INTEGRITY

1 Material of hull, superstructures, structural bulkheads, decks and deckhouses

1.1 General

1.1.1 The hull, superstructure, structural bulkheads, decks and deckhouses of vessels considered in this Rules may be constructed of steel or other equivalent material as aluminium alloy or composite.

2 Structure of aluminium alloy

2.1 General

2.1.1 In cases where any part of the structure is of aluminium alloy, the following shall apply:

a) The insulation of aluminium alloy components of A or B class divisions, except structure which, at the discretion of Tasneef, is non-load-bearing, shall be such that the temperature of the structural core does not rise more than 200°C above the ambient temperature at any time during the applicable fire exposure to the standard fire test.

b) Special attention shall be given to the insulation of aluminium alloy components of columns, stanchions and other structural members required to support lifeboat and liferaft stowage, launching and embarkation areas, and A and B class divisions to ensure:

   1) that for such members supporting lifeboat and liferaft areas and A class divisions, the temperature rise limitation specified in the preceding item a) shall apply at the end of one hour, and

   2) that for such members required to support B class divisions, the temperature rise limitation specified in the preceding item a) shall apply at the end of half an hour.

c) With reference to item a) above:

   1) when spaces of categories 1 to 9 in Sec 6, [1.4], are located on top of aluminium decks, the deck does not need to be insulated from the upper side, provided it is protected by a not readily ignitable deck covering;

   2) a load-bearing division is a deck or bulkhead including stiffeners, pillars, stanchions and other structural members which, if eliminated, would adversely affect the designated structural strength of the vessel.

2.2 Vessels of Length L≤20 m

2.2.1 All the structural parts (shell plates, decks, structural elements in general) in aluminium alloy bounding the various spaces of the vessel, except for the ones bounding open decks, sanitary services and similar spaces, tanks, cofferdams and auxiliary machinery spaces with restricted or no fire risk as well as other spaces not containing combustible materials, are to be adequately insulated with non-combustible material, so that resulting equivalent to a structure in steel where exposed to at least half an hour standard fire test .

Such insulation may be omitted:

a) For the external planting, and related stiffeners, below the waterline underside such waterline; and

b) For the accommodation spaces and control stations, where such spaces fulfil the following conditions:

- all the case and free-standing furniture is to be of non-combustible material and possible padding and fittings are to be of a low flame spread material and reduced to the minimum;
- curtains, carpets and similar objects are to be in woollen or in other equivalent materials with low flame spread characteristics.

In accommodation spaces and control stations provided with an automatic pressure water-spraying system in conformity with the provisions given in Pt C, Ch 4, Sec 11 insulation may be omitted, independently from the material used.

2.2.2 On vessels of more than 500 tons gross tonnage the bulkheads in corridors are to be constructed by boundaries of Class B-0.

2.2.3 Internal stairways, and related stiffeners are to be in steel or aluminium alloy and the ones serving accommodation and service spaces and control stations are to be kept in enclosures of adequate material. A stairway serving only two between-decks shall be kept in enclosure in only one of the between-decks, and in case of low fire risk or special arrangements, also such enclosure shall be omitted.

3 Structure in composite material

3.1.1 In the main supporting loads structures constructed in combustible material, insulation, if requested, is to assure that, except for what provided below, during fire exposure, in standard test provided for composite materials in accordance with IMO or other tests agreed with Tasneef, temperature does not reach a limit where a structural deterioration such to reduce the capacity of supporting load before 30 minutes happen.

3.1.2 The final layer of the laminates, composing the internal surface of the vessel, of any structure in reinforced plastic is to be self extinguishing. The self extinguisher characteristic is to be verified through a test in accordance with ASTM D635 on samples having a surface treated with such self extinguisher resin.

During the test, the propagation of flame is not to be faster than a 6 cm/min.

The test is not required for vessels with measurement length **L** not more than 15 m and provided with accommodation arrangements permitting an on board overnight stay for no more than five people, or where such vessels perform journeys of no more than six miles far from ports.

3.1.3 Possible superficial treatments of internal surface through products (paints and similar) showing a limited attitude in propagating flames where arranged on combustible support are to be considered equivalent to the requirement in [3.1.2].

3.1.4 All the structural parts (shell plates, decks, structural elements in general) in reinforced plastic, except the ones bounding empty spaces or spaces without any fire risk, are to be submitted to a special fire test intended to verify that the fireproof is equivalent to the one of a boundary of class B-15.

For vessels with measurement length **L** not more than 15 m such test is not required.

3.1.5 The following boundaries, if realized in reinforced plastic, are to be submitted to a fire test attesting their equivalence to a boundary of class B-15 for the whole test duration (30 min):

- bulkheads and decks dividing accommodation and service spaces and control stations from spaces where propulsion machinery are installed;
- bulkheads and decks dividing control stations from accommodation and service spaces;
- the bulkheads of corridors serving accommodation and service spaces and control stations;
- bulkheads and decks of the stairway enclosures;
- for vessels with measurement length **L** equal or more than 20 m, bulkheads and the decks of galleys, of paints, lights and other inflammable materials lockers, next to accommodation and service spaces and control stations; such bulkheads are to extend from deck to deck.

For vessels with measurement length **L** not more than 15 m such test is not required.

3.1.6 The equivalence between the above mentioned boundaries and boundaries of class B-15 shall be verify by Tasneef through standard fire test on prototypes in reduced scale.

Such fire test is not required where reinforced plastic presents a thickness equal or more than 13 mm and its final layer (thickness not less than 1,5 mm) is self extinguisher.

3.1.7 Where boundaries above mentioned in [3.1.5] are achieved with reinforced insulated plastic, insulation is to be arranged in the side of the space with higher fire risk.

3.1.8 Internal stairways, and related stiffeners are to be in steel or other suitable material in accordance with Tasneef and the ones serving accommodations and service spaces and control stations are to be included in enclosures; a stairway serving only two between-decks shall be kept in enclosure in only one of the between-decks and in case of low fire risk or special arrangements, also such enclosure shall be omitted.

4 Materials of overboard fittings

4.1 General

4.1.1 Materials readily rendered ineffective by heat shall not be used for overboard scuppers, sanitary discharges, and other outlets which are close to the waterline and where the failure of the material in the event of fire would give rise to danger of flooding.

SECTION 9 ESCAPE

1 Means of escape

1.1 General requirements

1.1.1 In accommodation spaces and in spaces in which the crew is normally employed, other than machinery spaces, stairways and ladders shall be so arranged as to provide a safe and ready means of escape to the open deck and from this to the lifeboats and liferaft embarkations.

In particular, the following conditions are to be satisfy:

a) At all levels of accommodation there shall be provided at least two widely separated means of escape from each restricted space or group of spaces.

(1) Below the lowest open deck the main means of escape shall be a stairway and the second escape may be a trunk or a stairway.

(2) Above the lowest open deck the means of escape shall be stairways or doors to an open deck or a combination thereof.

b) Exceptionally Tasneef may dispense with one of the means of escape, considering type and settling of spaces and number of accommodated or in service person.

c) Corridors longer than 7 m are not admitted. A “dead corridor” is a corridor, or part of it, with only one means of escape.

d) The width and continuity of means of escape are to be adequate.

1.1.2 Except as provided in the following item 1.1.3, two means of escape shall be provided from each machinery space of category A.

In particular, one of the following provisions shall be complied with:

a) two sets of steel ladders as widely separated as possible leading to doors in the upper part of the space similarly separated and from which access is provided to the open deck. One of these ladders shall provide a non-stop fire-fighting protection, from the lower part of the space to a safe position outside the space.

However such protection is not to be required if a safe means of escape is provided from the lower part of this space, because of a special arrangement or the machinery space size. The protection is to be of steel material, insulated, if considered necessary at the discretion of Tasneef A and provided with a steel door with an automatic closing device in its lower part; or

b) a group of steel ladders leading to a door in the upper part of the space from which access is provided to the open deck and additionally, in the lower part of the space and in a position well separated from the group of ladders referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the open deck.

1.1.3 Tasneef may dispense from one of the means of escape required at item. vessels with length equal or superior than 20 m, considering the width and the arrangement of the superior part of such space. Generally power plant spaces of modest dimension (length equal or less than 5 m) and not guarded shall be provided of only one means of escape composed by a group of steel ladders.

1.1.4 Escape from machinery spaces other than those of category A is to be adequate considering type and settling of spaces and the fact it is normally or not guarded.

SECTION 10 HELICOPTER FACILITIES

1 General

1.1 Application

1.1.1 Where a helideck is provided for fire protections, the requirements given in Pt C, Ch 4, Sec 10 of TASNEEFMIL normally apply.

Tasneef reserves the right to apply attenuations to this rules regarding the helicopter operating methods.

1.1.2 Where helicopters land or conduct winching operations on an occasional or emergency basis on vessels without helidecks, fire-fighting equipment fitted in accordance with the requirements in Sec 7 may be used. This equipment shall be made readily available in close proximity to the landing or winching areas during helicopter operations.

SECTION 11 FIRE SAFETY SYSTEMS

1 General

1.1 Application

1.1.1 This Section applies to fire safety systems as required in the other sections of this Chapter.

1.2 Use of toxic extinguishing media

1.2.1 The use of a fire-extinguishing medium which, at the discretion of Tasneef , either by itself or under expected conditions of use gives off toxic gases, liquids and other substances in such quantities as to endanger persons shall not be permitted.

1.3 Information and instructions

1.3.1 Suitable indication plates are to be secured on any fire-fighting extinguishing system devices (valves, cocks, starters, etc.) requiring a manoeuvre for their actuation.

Such plates are to be of material resistant to corrosion by the marine environment and are to specify the main operations to be performed in the event of fire. Distribution valves are to be marked in order to clearly indicate the compartments to which the different piping branches are directed and are to be fitted with signs of open and closed position.

At each location of controls for gas fire-extinguishing systems there shall be clear instructions relating to the operation of the system having regard to the personnel's safety.

Instruction booklets or drawings clearly explaining the operating scheme of any fire-extinguishing system are to be provided located in conspicuous locations.

2 Personnel protection

2.1 Engineering specifications

2.1.1 Fire-fighter's outfit

Fire-fighter's outfit, where required, is to be in accordance with the requirements given in Pt C, Ch 4, Sec 13 of TASNEEFMIL.

3 Portable fire-extinguishing appliances

3.1 Engineering specifications

3.1.1 Engineering specifications of fire extinguisher and portable foam extinguisher are to be achieved as defined in Pt C, Ch 4, Sec 13 of TASNEEFMIL.

4 Fixed gas fire-extinguishing systems

4.1 Engineering specifications

4.1.1 Engineering specifications of fixed gas fire-extinguishing systems are to be in accordance with the requirements given in Pt C, Ch 4, Sec 13 of TASNEEFMIL.

In engine spaces where the presence of someone is permitted only with open doors, the delaying device may be omitted, being enough the only acoustic alarm announcing the discharge.

5 Fixed pressure water-spraying and water-mist fire-extinguishing systems

5.1 Engineering specifications

5.1.1 Engineering specifications of fixed pressure water-spraying and water-mist fire-extinguishing systems, where required, are to be in accordance with the requirements given in Pt C, Ch 4, Sec 13 of TASNEEFMIL.

6 Automatic sprinkler systems

6.1 Engineering specifications

6.1.1 Engineering specifications of automatic sprinkler systems, where required, are to be in accordance with the requirements given in Pt C, Ch 4, Sec 13 of TASNEEFMIL.

7 Fixed fire detection and fire alarm systems

7.1 Engineering specifications

7.1.1 Engineering specifications of fixed fire detection and fire alarm system are to be in accordance with requirements given in Pt C, Ch 4, Sec 13 of TASNEEFMIL.

8 Fixed emergency fire pump

8.1 Engineering specifications

The emergency fire pump shall be of a fixed independently driven power-operated type.

Where necessary to ensure priming, the emergency fire pump is to be of self-priming type.