Tasneef
هيئة الإمارات للتصنيف
Emirates Classification Society

Rules for the Classification of Floating Offshore Units at Fixed Locations and Mobile Offshore Drilling Units

Effective from 1 January 2024

Part C

Machinery, Systems and Fire Protection

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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 authorised 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 G overnments.

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 reinstatemen t. 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 th e 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 p art 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 certificati 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 seaw orthiness,

structural integrity, quality or fitness for a particular purpose or service of any Ship, structur e, 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 certifi cation 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, t he 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 st atutory 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 authorisation 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 of these Rules is the edition effective from 01 January 2015.

2. Effective date of the requirements

2.1 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.

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.

2.2 Item 5 below provides a summary of the technical changes from the preceding edition. In general, this list does not include those items to which only editorial changes have been made not affecting the effective date of the requirements contained therein.

3. Rule Variations and Corrigenda

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

4. Rule subdivision and cross-references

4.1 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.

5. Summary of amendments

Foreword

The date of entry into force of each new or amended item is shown in brackets after the number of the item concerned.

Part C
Machinery, Systems and Fire Protection

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MACHINERY

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CHAPTER 2
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Section 1 General

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CHAPTER 4
SAFETY SYSTEMS AND FIRE PROTECTION, DETECTION AND EXTINCTION

Section 1 Safety Systems

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CHAPTER 5
HYDROCARBON IMPORT AND EXPORT SYSTEMS

Section 1 General Requirements

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CHAPTER 6
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CHAPTER 7
RISK ANALYSIS

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Part C

Machinery , Systems and Fire Protection

Chapter 1

MACHINERY

SECTION 1 GENERAL REQUIREMENTS

SECTION 1 GENERAL REQUIREMENTS

1 General

1.1 Application

1.1.1 *(1/1/2022)*

Chapter 1 applies to the design, construction, installation and tests of machinery systems and associated equipment, boilers and pressure vessels and piping systems installed on board classed units.

The applicable requirements in Pt C, Ch 1 of the Rules for the Classification of Ships are to be complied with.

Part C
Machinery, Systems and Fire Protection

Chapter 2
ELECTRICAL INSTALLATIONS

SECTION 1 GENERAL

1 Application

1.1 General

1.1.1 *(1/1/2022)*

The requirements of this Chapter apply to electrical installations on floating offshore units. In particular, they apply to the components of electrical installations for:

- primary essential services
- secondary essential services
- essential services for special purposes connected with units specifically intended for such purposes
- 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.

The applicable requirements in Pt C, Ch 2 of the Rules for the Classification of Ships are to be complied with, except for Pt C, Ch 2, Sec 3 of the Rules for the Classification of Ships that is to be replaced by Sec 2 of this Chapter.

SECTION 2 SYSTEM DESIGN

1 System earthing

1.1 General requirements

1.1.1 Where an earthed system is used (e.g. to control and keep the system's voltage to earth within predictable limits),

a) it has to provide for a flow of current that will allow detection of an unwanted connection between the system conductors and earth, and will cause automatic disconnection of the power system from conductors with such undesired connections to earth,

b) the magnitude and duration of a potential earth fault current is not exceed the design capacity of any part of the electrical power supply system,

c) if it is divided into two or more sections, means for neutral earthing are to be provided for each section (see [1.1.2] and [1.1.3]).

1.1.2 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.

1.1.3 Means are to be provided to ensure that the earth connection is not removed when generators are isolated.

1.1.4 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%.

1.1.5 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.

1.1.6 Where a neutral isolated system is used, whether primary or secondary (see Note), for power, heating or lighting, it is to 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.

Note 1: A primary system is one supplied directly by generators.

Secondary systems are those supplied by transformers or convertors.

1.1.7 A neutral isolated system is to be used to supply to the emergency consumers, due to the need of ensuring their continuous operation. Other systems will be considered by the Society on a case by case basis.

1.1.8 AC uninterruptible power systems (UPS) are to have an isolated neutral.

1.1.9 For earthed systems, a protection device is to be provided for earth leakage monitoring and for alarm or automatic disconnection of such systems via earth leakage. These requirements also apply to those parts of any distribution system using cables not provided with a braid or other metallic covering, irrespective of whether the cables used are of a flexible type or are fixed.

1.1.10 The neutral and the protective conductor are not to be connected together, or combined in a single conductor, in a hazardous area. See also [1.3.5].

1.2 Neutral earthing methods

1.2.1 The selection of the method of treating the neutral e.g. directly earthed (TN system)[1] or impedance earthed or isolated (IT system)[2] is to be based, for a specific electrical power system, on technical and operational factors.

Note 1: The distribution system codes used have the following meanings:

First letter - Relationship of the power system to earth:

T = direct connection of one point to earth;

I = all live parts isolated from earth, or one point connected to earth through an impedance.

Second letter - Relationship of the exposed-conductive-parts of the installation to earth:

T = direct electrical connection of exposed-conductive-parts to earth, independently of the earthing of any point of the power system;

N = direct electrical connection of the exposed-conductive-parts to earthed point of the power system (in a.c. systems, the earthed point of the power system is normally the neutral point or, if a neutral point is not available, a phase conductor).

Subsequent letter(s) if any - Arrangement of neutral and protective conductors:

S = protective function provided by a conductor separate from the neutral or from the earthed line (or in a.c. systems earthed phase) conductor;

C = neutral and protective functions combined in a single conductor (PEN conductor).

Note 2: Although not intentionally connected to earth, the so called "unearthed" or "isolated" system is in fact capacitively earthed by the distributed capacitance to earth of the conductors throughout the system together with any interference suppression capacitors.

1.3 Neutral earthing for low voltage systems (≤ 1000 V)

1.3.1 The neutral point may either be directly connected to earth or through an impedance.

1.3.2 The earth loop impedance is to be low enough to permit the passage of a current at least three times the fuse rating for fuse protected circuits or one and a half times the tripping current of any excess current circuit breaker used to protect the circuit.

1.3.3 In the case of impedance earthing, the impedance is to be such that the earth fault current is slightly higher than the capacitive current of system. The maximum earth fault is to be limited to a maximum value (for example: 100 A per generator, 100 A per transformer).

1.3.4 Where loads are supplied phase to neutral, the systems is to be directly earthed.

1.3.5 If a power system with an earthed neutral is used, the type TN-S system, with separate neutral (N) and protective conductor (PE) throughout the system is to be used. A power system of type TN-C, having combined neutral and protective functions in a single conductor throughout the system, is not allowed in hazardous areas. See also [1.1.10].

1.4 Neutral earthing for high voltage systems (> 1000 V)

1.4.1 In general direct earthing is not be used for high voltage systems. Exceptions will be considered will be considered by the Society on a case by case basis.

1.4.2 Earthed neutral systems are to be provided with impedance in the neutral connection to earth or earthing transformer to limit the earth fault current to an acceptable value.

1.4.3 The prospective earth fault current is to be at least three times the values of current required to operate any earth fault protective devices.

1.4.4 The maximum earth fault is to be limited to a current that a generator normally can withstand for a prolonged time without damage to the core.

1.4.5 Efficient means are to be provided for detecting defects in the insulation of the system. For systems where the earth fault current exceeds 5 A, automatic tripping devices is recommended. Where the earth fault current does not exceed 5 A, an indicator may be provided as an alternative to an automatic tripping device.

1.5 Neutral earthing means

1.5.1 System earthing is to be effected by means independent of any earthing arrangements of the non-current carrying parts.

1.5.2 Earthing resistors are to be provided with insulation suitable for the phase-to-phase voltage of the systems to which they are connected.

1.5.3 They are to be designed to carry their rated fault current for at least 10 s in addition to any continuous loading, without any destructive effect to their component parts.

1.5.4 Earthing resistors are to be connected to the unit's structure or hull. In addition earthing resistors are to be connected together on the structure/hull side of the resistor, whereto also the protective earthing (PE) conductor of the distribution system is to be connected.

1.5.5 The means of connection are to be separate from that provided at the unit's structure for radio, radar and communications circuits in order to avoid interference.

1.5.6 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.

2 Supply systems

2.1 Distribution systems

2.1.1 The following distribution systems may be used in d.c.:

a) two-wire with one pole earthed but without structure or hull return system (TN system)

b) three-wire with middle wire earthed but without structure or hull return (TN system)

c) two-wire insulated (IT system).

2.1.2 The following distribution systems may be used in a.c.:

- three-phase three-wire insulated, or impedance earthed (IT system)
- three-phase three-wire with neutral earthed (TN system)
- three-phase four-wire with neutral earthed but without structure or hull return (TN system)
- single-phase two-wire insulated (IT systems)
- single-phase two-wire with one pole earthed (TN systems)
- single-phase two-wire with mid-point of system earthed for supplying lighting and socket-outlets (TN systems)
- single-phase three-wire with mid-point earthed but without structure or hull return (TN systems).

2.1.3 Distribution systems other than those listed in [2.1.1] and [2.1.2] will be considered by the Society on a case by case basis.

2.1.4 The hull return system of distribution is not to be used for power, heating or lighting.

2.1.5 The requirement of [2.1.4] does not preclude under conditions approved by the Society the use of:

a) impressed current cathodic protective systems,

b) limited and locally earthed systems (see Note 1), or

c) insulation level monitoring devices provided the circulation current does not exceed 30 mA under the most unfavourable conditions.

Note 1: Limited and locally earthed systems such as starting and ignition systems of internal combustion engines are accepted provided that any possible resulting current does not flow directly through any dangerous spaces.

2.2 Maximum voltages

2.2.1 The values of the standard and maximum voltages are given in Tab 1 and Tab 2.

In a.c. installation the maximum voltage is up to and including 35 kV.

Table 1 : Voltage for d.c. systems

Application	Nominal voltages V	Maximum voltages V
Power	110, 220, 600,750	1000
Cooking, heating	110, 220	500
Lighting and socket outlets	24, 110, 220,	500
Communication	6, 12, 24, 48, 110, 220	250
Supplies to lifeboats of similar craft	12, 24, 48	55
Instrumentation	24, 110, 220	250

Table 2 : Voltages for a.c. low voltage systems

Use		Maximum voltage, in V
For permanently installed and connected to fixed wiring	Power equipment	1000
	Heating equipment (except in accommodation spaces)	500
	Cooking equipment	500
	Lighting	250
	Space heaters in accommodation spaces	250
	Control **(1)**, communication (including signal lamps) and instrumentation equipment	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 distribution systems having rated voltage above 500 V, the control voltage is to be limited to 250 V, except when all control equipment is enclosed in the relevant control gear and the distribution voltage is not higher than 1000 V.

(2) Both conductors in such systems are to be insulated from earth.

2.2.2 Voltages exceeding those mentioned in [2.2.1] will be specially considered in the case of specific systems.

2.2.3 *(1/1/2022)*

For high voltage systems see Pt C, Ch 2, Sec 13 of the Rules for the Classification of Ships.

3 Sources

3.1 General

3.1.1 Electrical installations are to be such that:

a) All electrical auxiliary services necessary for maintaining the unit in normal operational and habitable conditions and for the preservation of the cargo 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) the voltage drop due to inrush current of e.g. large motors, transformers, capacitors and chokes, connected to the system will not cause any motor already operating to stall or have any adverse effect on other equipment in use.

d) the safety of personnel and unit from electrical hazards will be assured.

3.2 Main source of electrical power

3.2.1 A main source of electrical power is to be provided, of sufficient capability to supply all electrical auxiliary services necessary for maintaining the unit in normal operational and habitable conditions and for the preservation of

the cargo without recourse to the emergency source of electrical power.

3.2.2 For fixed units other sources of electrical power supply arrangements may be acceptable subject to approval by the Society.

3.2.3 For small installations where renewable sources of energy are used, for example photovoltaic cells or wind generators, stationary batteries are be provided to guarantee the distribution of the electrical power during the time without sun or wind. The appropriate battery autonomy will be considered by the Society on a case by case basis.

3.2.4 The main source of electrical power is to consist of at least two generating sets.

3.2.5 *(1/1/2022)*

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 and safety (see [3.2.6] and [3.2.7])

b) minimum comfortable conditions of habitability (see Pt C, Ch 2, Sec 1, [3.4.2] of the Rules for the Classification of Ships)

c) preservation of the cargo.

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.

3.2.6 Those services necessary to provide normal operational conditions of propulsion and safety include primary and secondary essential services.

3.2.7 It is not required that full operational conditions with maximum load are maintained with one generator being stopped.

3.2.8 For the purpose of calculating the capacity necessary for the services in [3.2.6], 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.

3.2.9 The services in [3.2.6] do not include refrigerators for air conditioning and, in case of mobile units, thrusters not forming part of the main propulsion or dynamic positioning systems.

3.2.10 Further to the provisions above, the generating sets are to be such as to ensure that with any one generator or its primary source of power out of operation, the remaining generating sets are capable of providing the electrical services necessary to start the main propulsion plant from a "dead unit" condition.

3.2.11 The emergency source of electrical power may be used for the purpose of starting from a "dead unit" 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 [5.1.1] (items a, b, c, d).

3.2.12 Where transformers, converters or similar appliances constitute an essential part of the electrical supply system required by [3.2.1], the system is to be so arranged as to ensure the same continuity of supply as stated in [3.2.5].

3.2.13 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 [3.2.5].

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 circuits is to be provided with switchgears and protection devices in each phase.

Each of the secondary circuits is to be provided with a multiple isolating switch.

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.

3.2.14 *(1/1/2022)*

For units intended for operation with periodically unattended machinery spaces, see Part F, Ch 3 of the Rules for the Classification of Ships.

3.2.15 Where the means for starting a main generator set from a power blackout condition is solely electrical and the emergency source of electrical power cannot be used for this purpose, the means for starting the generator set to be used for start-up from the power blackout condition are to be provided with starting arrangements at least equivalent to those required for starting an emergency generator set.

3.2.16 *(1/1/2022)*

For starting arrangements for main generating sets, see Pt C, Ch 1, Sec 2, [5.1] of the Rules for the Classification of Ships.

3.3 Emergency source of electrical power

3.3.1 A self-contained emergency source of electrical power shall be provided.

3.3.2 The electrical power available is to 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.

3.3.3 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 unit situation

c) routine use for testing

d) short-term parallel operation with the main source of electrical power for the purpose of load transfer.

3.3.4 The emergency source of electrical power may be used for the purpose of starting a main generator set from a power blackout 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 the emergency services required by [5.1.1].

3.3.5 For units where the main source of electrical power is located in two or more spaces which have their own systems, including power distribution and control systems, completely independent of the systems in the other spaces and such that a fire or other casualty in any one of the spaces will not affect the power distribution from the others, or to the services required by [5.1.1], the requirements of [3.3.1] may be considered satisfied without an additional emergency source of electrical power.

3.3.6 The emergency source of electrical power is to be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the services stated in [5.1.1] for the period specified, if they depend upon an electrical source for their operation.

3.3.7 The transitional source of emergency electrical power, where required, is to be of sufficient capacity to supply at least the services stated in [5.2.1] for half an hour, if they depend upon an electrical source for their operation.

3.3.8 An indicator is to 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 [3.3.14] and [3.3.15] are being discharged.

3.3.9 When battery backed light fittings are used, they are acceptable even if no indicator as per [3.3.8] is provided. Trip of supply to these emergency lighting has to give alarm at a manned position.

3.3.10 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).

3.3.11 The emergency source of electrical power may be either a generator or an accumulator battery which has to comply with the requirements of [3.3.11] or [3.3.13], respectively.

3.3.12 Where the emergency source of electrical power is a generator, it is to 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 is to be automatically connected to the emergency switchboard; those services referred to in [5.2.1] are then to be connected automatically to the emergency generator; and

c) provided with a transitional source of emergency electrical power as specified in [3.3.15] 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.

3.3.13 *(1/1/2022)*

For emergency generating set starting arrangements, see Pt C, Ch 1, Sec 2, [5.1.3] of the Rules for the Classification of Ships.

3.3.14 Where the emergency source of electrical power is an accumulator 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 [5.2.1].

3.3.15 The transitional source of emergency electrical power where required by [3.3.12] (item c) has to consist of an accumulator battery which has to 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 [5.2.1] if they depend upon an electrical source for their operation.

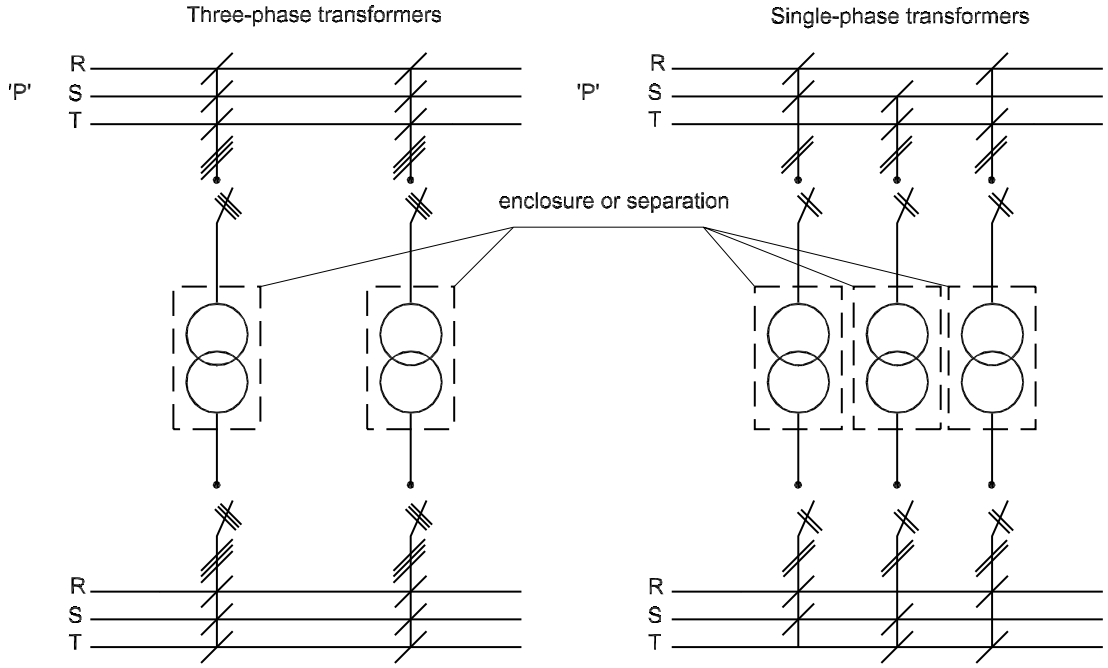
3.3.16 *(1/1/2022)*

A UPS system complying with Pt C, Ch 2, Sec 7, [3] of the Rules for the Classification of Ships is acceptable as a transitional source of emergency power.

3.3.17 During changeover from the main source of electrical power to the emergency source of electrical power, an uninterruptible power supply (UPS) system has to ensure uninterrupted duty for consumers which require continuous power supply, and for consumers which may malfunction upon voltage transients.

3.3.18 Provision is to be made for the periodic testing of the complete emergency system and it has to include the testing of automatic starting arrangements, where provided. Testing has also to cover load operation.

Figure 1



4 Distribution

4.1 General

4.1.1 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.

4.1.2 No common switchgear or auxiliary circuit (e.g. contacts for emergency stop) is to be used between the switchboard's busbars and two duplicated essential services or two primary non duplicated essential services.

4.2 Balance of loads

4.2.1 *(1/1/2022)*

Current-consuming units connected between an outer conductor and the middle wire are to be grouped in such a way that, under normal conditions, the load on the two halves of the system is balanced as far as possible within 15 % of their respective load at the individual distribution and section boards as well as the main switchboard. visual indication of abnormally low insulation values (see Pt C, Ch 2, Sec 15 of the Rules for the Classification of Ships).

4.2.2 For a.c. three- or four-wire systems, the current-consuming units are to be so grouped in the final circuits that the load on each phase will, under normal conditions, be balanced as far as possible within 15 % of their respective load at the individual distribution and section boards as well as the main switchboard.

4.3 Main distribution

4.3.1 A main electric lighting system which has to provide illumination throughout those parts of the unit normally accessible to and used by people is to be supplied from the main source of electrical power.

4.4 Emergency distribution

4.4.1 The emergency switchboard is to be supplied during normal operation from the main switchboard by an interconnector feeder which is to 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.

4.4.2 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.

4.4.3 In order to ensure ready availability of the emergency source of electrical power, arrangements are to be made where necessary to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that power is available to the emergency circuits.

5 Emergency services

5.1 Emergency services to be supplied by the emergency source

5.1.1 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, personnel lift cars and personnel lift trunks;

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

7) in all cargo pump-rooms

8) all lighting relative to helicopter operations and landing;

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 (see also [5.1.5]);

2) the external communication systems

d) for a period of 18 hours:

1) all internal communication equipment as required in an emergency [5.1.2]

2) the shipborne navigational equipment as required by SOLAS; where such provision is unreasonable or impracticable the Society may waive this requirement for units of less than 5000 tons gross tonnage

3) the fire detection and fire alarm systems

4) gas detection and gas alarm systems

5) emergency shutdown systems

6) intermittent operation of the daylight signalling lamp, the unit's whistle, the manually operated call points and all internal signals (see [5.1.3]) that are required in an emergency, unless such services have an independent supply for the period of 18 hours from an accumulator battery suitably located for use in an emergency

e) for a period of 18 hours:

1) one of the fire pumps, when required, if dependent upon the emergency generator for its source of power

2) emergency fire-fighting equipment operating on electric power

3) sufficient number of bilge and ballast pumps to maintain safe operations during emergency

4) all power-operated watertight door systems;

5) equipment, operating on electric power, at life-saving stations serving platform disembarkation;

6) equipment essential for the immediate safety of diving personnel;

7) equipment to be used in connection with the drilling process in case of an emergency (for example Blow Out Preventer systems);

8) all permanently installed battery chargers servicing equipment required to be powered from an emergency source;

9) any other emergency system.

5.1.2 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

c) the public address system.

5.1.3 *(1/1/2022)*

Internal signals required in an emergency generally include:

a) general alarm (see Pt C, Ch 2, Sec 1, [1.1.2] of the Rules for the Classification of Ships)

b) watertight door indication.

5.1.4 The Society may, if satisfied that an adequate standard of safety would be attained, accept a lesser period than the 18-hour period specified in [5.1.1] (item b to item e).

5.1.5 Navigation and obstruction signals and lights, which may be required for marking of offshore units, are to be provided with power for a period of 4 days without external power supply.

5.2 Emergency services to be supplied by the transitional source

5.2.1 The transitional source of emergency electrical power, where required, has to 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 [5.1.1](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 [5.1.1] (item d1, d3, d4, d5 and d6) unless such services have an independent supply for the period specified, from an accumulator battery suitably located for use in an emergency.

6 Users

6.1 General

6.1.1 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.

6.1.2 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.

6.1.3 Final circuits rated above 16 A have to supply not more than one appliance.

6.1.4 Final circuit for lighting in accommodation spaces may, as far as practicable, include socket-outlets.

6.1.5 Socket-outlets for systems above 250 V shall be rated not less than 16 A.

6.1.6 Where differing distribution systems supplying socket-outlets are in use, the socket-outlets and plugs are to be of such design that an incorrect connection cannot be made.

6.1.7 *(1/1/2022)*

For the supply and characteristics of the distribution of the following services see the requirements listed:

- Fire-extinguishing and detecting systems: Ch 4, Sec 1, [6]
- Permanently installed submergible bilge pump: Pt C, Ch 1, Sec 10, [6.7.7] of the Rules for the Classification of Ships
- Ventilation fans: Ch 4, Sec 2
- Fuel pumps: Pt C, Ch 1, Sec 10, [11] of the Rules for the Classification of Ships
- Pumps discharging overboard above the lightest water line and in way of the area of lifeboat and liferaft launching: Pt C, Ch 1, Sec 10, [5.2.4] of the Rules for the Classification of Ships.

6.1.8 All power circuits terminating in a bunker or cargo space are to be provided with a multiple-pole switch outside the space for disconnecting such circuits.

6.2 Motors

6.2.1 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).

6.2.2 Each motor above 1,0 kW 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.

6.2.3 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.

6.2.4 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

b) an additional disconnecting switch fitted near the motor

c) provision such that the fuses in each live pole or phase can be readily removed and retained by persons authorized to have access to the motor.

6.2.5 Unless automatic restarting is required, motor control circuits are to be designed so as to prevent any motor from unintentional automatic restarting after a stoppage due to over-current tripping or a fall in or loss of voltage, if such starting is liable to cause danger.

6.3 Heaters

6.3.1 Each heater is to be connected to a separate final circuit except that up to ten small heaters of total connected current rating not exceeding 16 A may be connected to a single final circuit.

6.4 Lighting installations

6.4.1 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.

6.4.2 Final circuits for lighting have not to supply appliances for heating and power, except that small galley equipment (e.g. toasters, mixers, coffee makers) and small miscellaneous motors (e.g. desk and cabin fans, refrigerators) and wardrobe heaters and similar items may be supplied.

6.4.3 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.

6.4.4 Where the emergency installation is required, one of the circuits in [6.4.3] may be supplied from the emergency source of power.

6.4.5 All lighting circuits terminating in a bunker or cargo space are to be provided with a multiple-pole switch outside the space for disconnecting such circuits.

6.4.6 For lighting in hazardous areas or spaces, switches are to be of the two-pole type and wherever practicable located in a non-hazardous area.

6.4.7 Discharge lamp luminaires of voltages above 250 V or installations including such lamps are to be provided with a multipole disconnecting switch in an accessible location. Such a switch is to be clearly marked and a warning note is to be placed nearby. Switches or other current-interrupting devices are not to be installed in the secondary circuit of transformers.

6.4.8 Disconnecting means of every searchlight is to be by a multipole disconnecting switch.

6.5 Navigation lights

6.5.1 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.

6.5.2 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.

6.5.3 The transfer of supply is to be practicable from the bridge, for example by means of a switch.

6.5.4 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 [6.5.1].

6.5.5 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.

6.5.6 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 accumulator (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.

6.6 General emergency alarm system

6.6.1 *(1/1/2022)*

For the application of this item [6.6], see Pt C, Ch 2, Sec 1, [1.1.2] of the Rules for the Classification of Ships.

6.6.2 An electrically operated bell or klaxon or other equivalent warning system installed in addition to the unit's whistle or siren, for sounding the general emergency alarm signal, is to comply with the requirements of this sub-article.

6.6.3 The general emergency alarm system is to be supplemented by either a public address system complying with the requirements in [6.7] or other suitable means of communication.

6.6.4 Entertainment sound system is to be automatically turned off when the general alarm system is activated.

6.6.5 The system is to be continuously powered and is to have an automatic change-over to a standby power supply in case of loss of normal power supply. An alarm is to be given in the event of failure of the normal power supply.

6.6.6 The system is to be powered by means of two circuits, one from the unit's main supply and the other from the emergency source of electrical power.

6.6.7 The system is to be capable of operation from the navigation bridge and, except for the unit's whistle, also from other strategic points.

Note 1: 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 or a cargo-process control station should normally be regarded as strategic points.

6.6.8 The alarm is to continue to function after it has been triggered until it is manually turned off or is temporarily interrupted by a message on the public address system.

6.6.9 The alarm system is to be audible throughout all the accommodation and normal crew working spaces.

6.6.10 The minimum sound pressure level for the emergency alarm tone in interior and exterior spaces is to be 80 dB (A) and at least 10 dB (A) above ambient noise levels occurring during normal equipment operation with the unit underway (in case of Mobile Units) in moderate weather.

6.6.11 In cabins without a loudspeaker installation, an electronic alarm transducer, e.g. a buzzer or similar, is to be installed.

6.6.12 The sound pressure level at the sleeping position in cabins and in cabin bathrooms is to be at least 75 dB (A) and at least 10 dB (A) above ambient noise levels.

6.6.13 For cables used for the general emergency alarm system, see [11.6].

6.7 Public address system

6.7.1 *(1/1/2022)*

For the application of this item [6.7], see Pt C, Ch 2, Sec 1, [1.1.2] of the Rules for the Classification of Ships.

6.7.2 The public address system is to be a loudspeaker installation enabling the broadcast of messages into all spaces where people on board are normally present.

6.7.3 The public address system is to be a loudspeaker installation enabling the broadcast of messages into all

spaces where people on board are normally present. In spaces such as under deck passageways, bosun's locker, hospital and pump rooms, the public address system is/may not be required.

6.7.4 Where the public address system is used to supplement the general emergency alarm system as per [6.6.3], it is to be continuously powered from the emergency source of electrical.

6.7.5 The system is to allow for the broadcast of messages from the navigation bridge and from other places on board the unit as deemed necessary.

6.7.6 The system is to be protected against unauthorized use.

6.7.7 The system is to be installed with regard to acoustically marginal conditions and not require any action from the addressee.

6.7.8 Where an individual loudspeaker has a device for local silencing, an override arrangement from the control station(s), including the navigating bridge, is to be in place.

6.7.9 With the unit underway (in case of Mobile Units) in normal conditions, the minimum sound pressure level for broadcasting emergency announcements is to be:

a) in interior spaces, 75 dB (A) and at least 20 dB (A) above the speech interference level

b) in exterior spaces, 80 dB (A) and at least 15 dB (A) above the speech interference level.

With respect to cabin/state rooms, the sound pressure level is to be attained as required inside such spaces during sea trials.

6.8 Combined general emergency alarm - public address system

6.8.1 *(1/1/2022)*

For the application of this item [6.8], see Pt C, Ch 2, Sec 1, [1.1.2] of the Rules for the Classification of Ships.

6.8.2 Where the public address system is the only means for sounding the general emergency alarm signal and the fire alarm, in addition to the requirements of [6.6] and [6.7], the following are to be satisfied:

- the system automatically overrides any other input system when an emergency alarm is required
- the system automatically overrides any volume control provided to give the required output for the emergency mode when an emergency alarm is required
- the system is arranged to prevent feedback or other interference
- the system is arranged to minimise the effect of a single failure so that the alarm signal is still audible (above ambient noise levels) also in the case of failure of any one circuit or component, by means of the use of:
  - multiple amplifiers
  - segregated cable routes to public rooms, alleyways, stairways and control stations
  - more than one device for generating electronic sound signal
  - electrical protection for individual loudspeakers against short-circuits.

6.9 Control and indication circuits

6.9.1 For the supply of automation systems, comprising control, alarm and safety system, see the requirements of Chapter 3.

6.9.2 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 the Society.

6.9.3 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 the Society.

6.10 Speed control systems of generator sets

6.10.1 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 accumulator battery for at least 15 minutes or from a similar supply source.

6.10.2 The wiring supplying the main source of electrical power is to be from the main switchboard or from independent section boards.

Where the main bus-bars 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.

7 Degrees of protection of the enclosures

7.1 General

7.1.1 The minimum required degree of protection for electrical equipment, in relation to the place of installation, is generally that specified in Tab 3.

7.1.2 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 unit's officers) is to have a degree of protection against touching live parts of at least IP4X.

7.1.3 *(1/1/2022)*

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 the Rules for the Classification of Ships.

7.1.4 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 1: 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 18 hours.

7.1.5 For electrical and electronic equipment installed in engine rooms protected by fixed water-based local application firefighting systems, see Ch 4, Sec 2, [5.2.2].

Table 3 : Minimum required degrees of protection

Condition in location	Example of location	Switchboard Control gear Motor starters	Generators	Motors	Transformers	Luminaires	Heating appliances	Cooking appliances	Socket outiets	Accessories (e.g. switches, connection boxes)
Danger of touching live parts only	Dry accommodation spaces Dry control rooms	I P 20	X **(1)**	I P 20	I P 20	I P 20	I P20	I P 20	I P 20	I P 20
Danger of dripping liquid and/for moderate mechanical damage	Control rooms, wheel-house, radio room	I P 22	X	I P 22	I P 22	I P 22	I P22	I P 22	I P 22	I P 22
	Engine and boiler rooms above floor	I P 22	I P 22	I P 22	I P 22	I P 22	I P22	I P 22	I P 44	I P 44
	Steering gear rooms	I P 22	I P 22	I P 22	I P 22	I P 22	I P22	X	I P 44	I P 44
	Emergency machinery rooms	I P 22	I P 22	I P 22	I P 22	I P 22	I P22	X	I P 44	I P 44
	General storerooms	I P 22	X	I P 22	I P 22	I P 22	I P22	X	I P 22	I P 44
	Pantries	I P 22	X	I P 22	I P 22	I P 22	I P22	I P 22	I P 44	I P 44
	Provision rooms	I P 22	X	I P 22	I P 22	I P 22	I P22	X	I P 44	I P 44
	Ventilation ducts	X	X	I P 22	X	X	X	X	X	X
Increased danger of liquid and/for mechanical damage	Bathrooms and/or showers	X	X	X	X	I P 34	I P44	X	I P 55	I P 55
	Engine and boiler rooms below floor	X	X	I P 44	X	I P 34	I P44	X	X	I P 55
	Closed fuel oil separator rooms	I P 44	X	I P 44	I P 44	I P 34	I P44	X	X	I P 55
	Closed lubricating oil separator rooms	I P 44	X	I P 44	I P 44	I P 34	I P44	X	X	I P 55
Increased danger of liquid and mechanical damage	Ballast pump rooms	I P 44	X	I P 44 **(2)**	I P 44 **(2)**	I P 34	I P44	X	I P 55	I P 55
	Refrigerated rooms	X	X	I P 44	X	I P 34	I P44	X	I P 55	I P 55
	Galleys and laundries	I P 44	X	I P 44	I P 44	I P 34	I P44	I P 44	I P 44	I P 44
	Public bathrooms and shower	X	X	I P 44	I P 44	I P 34	I P44	X	I P 44	I P 44

Condition in location	Example of location	Switchboard Control gear Motor starters	Generators	Motors	Transformers	Luminaires	Heating appliances	Cooking appliances	Socket outiets	Accessories (e.g. switches, connection boxes)
Danger of liquid spraying. Presence of cargo dust. Serious mechanical damage. Aggressive fumes	Shaft or pipe tunnels in double bottom	I P 55	X	I P 55	I P 55	I P 55	I P55	X	I P 56	I P 56
	Holds for general cargo	X	X	I P 55	X	I P 55	I P55	X	I P 56	I P 56
	Ventilation trunks	X	X	I P 55	X	X	X	X	X	X
Danger of liquid in massive quantities	Open decks	I P 56	X	I P 56	X	I P 55	I P56	X	I P 56	I P 56

(1) The symbol "X" denotes equipment which it is not advised to install.

(2) Electric motors and starting transformers for lateral thrust propellers located in spaces similar to ballast pump rooms may have degree of protection IP22.

8 Diversity (demand) factors

8.1 General

8.1.1 The cables and protective devices of final sub-circuits are to be rated in accordance with their connected load.

8.1.2 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.

8.1.3 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.

8.1.4 Where spare circuits are provided on a section or distribution board, an allowance for future increase in load is to be considered. The allowance is to be calculated on the assumption that each spare circuit requires not less than the average load on each of the active circuits of corresponding rating.

9 Electrical protection

9.1 General requirements for overcurrent protection

9.1.1 Electrical installations are to be protected against accidental overcurrents including short-circuit.

9.1.2 Devices provided for over-current protection shall be chosen according to the requirements, especially with regard to:

- overload;
- short-circuit;
- earth fault as appropriate.

9.1.3 The choice, arrangement and performance of the various protective devices are to provide complete and coordinated automatic protection in order to ensure as far as possible:

- continuity of service in the event of a fault, through coordinated and discriminative action of the protective devices
- elimination of the effects of faults to reduce damage to the system and the hazard of fire as far as possible.

Note 1: An overcurrent is a current exceeding the nominal current.

Note 2: A short-circuit is the accidental connection by a relatively low resistance or impedance of two or more points in a circuit which are normally at different voltages.

9.1.4 Devices provided for overcurrent protection are to be chosen according to the requirements, especially with regard to overload and short-circuit.

Note 1: Overload is an operating condition in an electrically undamaged circuit which causes an overcurrent.

9.1.5 Systems are to be such as to withstand the thermal and electrodynamic stresses caused by the possible overcurrent, including short-circuit, for the admissible duration.

9.2 Short-circuit currents

9.2.1 In calculating the maximum prospective short-circuit current, the source of current is to include the maximum number of generators which can be simultaneously connected (as far as permitted by any interlocking arrangements), and the maximum number of motors which are normally simultaneously connected in the system.

The maximum number of generators or transformers is to be evaluated without taking into consideration short-term parallel operation (e.g. for load transfer) provided that suitable interlock is foreseen.

9.2.2 Short-circuit current calculations are to be performed in accordance with a method recognised by the Society, such as that given in IEC 60363.

9.2.3 In the absence of precise data concerning the characteristics of generators, accumulator batteries and motors, the maximum short-circuit currents on the main busbars may be calculated as follows:

- for alternating current systems:

  $I_{ac} = 10\ I_{TG} + 3,5\ I_{TM}$

  $I_{pk} = 2,4\ I_{ac}$
- for direct current systems supplied by batteries:

  $I_p = K\ C_{10} + 6\ I_{TM}$

where:

I_p : Maximum short-circuit current

I_{ac} : r.m.s. value of the symmetrical component (at the instant T/2)

I_{pk} : Maximum peak value

I_{TG} : Rated current of all generators which can be connected simultaneously

C_{10} : Battery capacity in Ah for a discharge duration of 10 hours

K : Ratio of the short-circuit current of the batteries to C_{10}; (see Note 1)

I_{TM} : Rated current of all motors which are normally simultaneously connected in the system.

Note 1: For stationary batteries the following values may be assumed for guidance:

- vented lead-acid batteries: K = 8
- vented alkaline type batteries intended for discharge at low rates corresponding to a battery duration exceeding three hours: K = 15
- sealed lead-acid batteries having a capacity of 100 Ah or more or alkaline type batteries intended for discharge at high rates corresponding to a battery duration not exceeding three hours: K = 30.

9.3 Selection of equipment

9.3.1 Protective devices for short-circuit protection have to conform to the requirements of the IEC standards concerning circuit-breakers and fuses, but it is to be taken into account that the conditions of the unit installations may differ from the conditions foreseen in those publications, in particular with reference to:

- the short-circuit power factor in an a.c. system in a unit, which may be lower than that assumed as a basis for short-circuit rating of normal distribution circuit breakers;
- the sub-transient and transient component of the a.c. short-circuit current;
- the a.c. and d.c. decrement of short-circuit current.

As a consequence, the ratio between rated breaking capacity and the correlated making capacity of circuit-breakers corresponding to the normal conditions of distribution systems may be inadequate.

9.3.2 Equipment is to be chosen on the basis of its rated current and its making/breaking capacity.

9.3.3 In the selection of circuit-breakers with intentional short-time delay for short-circuit release, those of utilisation category B are to be used and they are to be selected also taking into account their rated short-time withstand current capacity (I_{cw}).

9.3.4 For circuit-breakers without intentional short-time delay for short-circuit release, circuit breakers of utilisation category A may be used and they are to be selected according to their rated service short-circuit breaking capacity (I_{cs}).

Note 1: For the purpose of these Rules, utilisation categories A and B are defined as follows:

- Utilisation category A: circuit-breakers not specifically intended for selectivity under short-circuit conditions with respect to other short-circuit protective devices in series on the load side, i.e. without an intentional short-time delay provided for selectivity under short-circuit conditions
- Utilisation category B: circuit-breakers specifically intended for selectivity under short-circuit conditions with respect to other short-circuit protective devices in series on the load side, i.e. with an intentional short-time delay (which may be adjustable) provided for selectivity under short-circuit conditions.

9.3.5 For duplicated essential services and non-essential services, circuit-breakers may be selected according to their ultimate short-circuit breaking capacity (I_{cu}).

9.3.6 Circuit-breakers of withdrawable type are required where they are not suitable for isolation.

9.3.7 For switches, the making/breaking capacity is to be in accordance with utilisation category AC-22 A or DC-22 A (in compliance with IEC 60947-3).

9.3.8 For fuse-switch disconnectors or switch-disconnector fuse units, the making/breaking capacity is to be in accordance with utilisation categories AC-23 A or DC-23 A (in compliance with IEC 60947-3).

9.4 Protection against short-circuit

9.4.1 Protection against short-circuit currents is to be provided by circuit- breakers or fuses.

9.4.2 The r.m.s. symmetrical breaking current for which the device is rated is to be not less than the r.m.s. value of the a.c. component of the prospective fault current at the point of installation, at the first half cycle.

9.4.3 The peak asymmetrical making current for which the device is rated is not to be less than the peak value of the prospective fault current at the point of installation, at the first half cycle, to account for maximum asymmetry.

9.4.4 Every protective device or contactor not intended for short-circuit interruption is to be adequate for the maximum short-circuit current liable to occur at the point of installation having regard to the time required for the short-circuit to be removed.

9.4.5 The use of a protective device not having a short-circuit breaking or making capacity at least equal to the maximum prospective short-circuit current at the point where it is installed is permitted, provided that it is backed up on the generator side by a fuse or by a circuit-breaker having at least the necessary short-circuit rating and not being the generator circuit-breaker.

9.4.6 The same fuse or circuit-breaker may back up more than one circuit-breaker where the circuits concerned do not involve essential services.

9.4.7 The short-circuit performance of the back-up arrangement is to be equal to the requirements of IEC 60947-2 for a single circuit-breaker having the same short-circuit performance category as the backed-up circuit-breaker and rated for the maximum prospective short-circuit level at the supply terminals of the arrangement.

9.4.8 Circuit-breakers with fuses connected to the load side may be used, provided the back-up fuses and the circuit-breakers are of coordinated design, in order to ensure that the operation of the fuses takes place in due time so as to prevent arcing between poles or against metal parts of the circuit-breakers when they are submitted to overcurrents involving the operation of the fuse.

9.4.9 When determining the performance requirements for the above-mentioned back-up protection arrangement, it is permissible to take into account the impedance of the various circuit elements of the arrangement, such as the impedance of a cable connection when the backed-up circuit-breaker is located away from the back-up breaker or fuse.

9.5 Continuity of supply and continuity of service

9.5.1 The protection of circuits is to be such that a fault in one service does not cause the loss of any essential services.

9.5.2 The protection of the emergency circuit is to be such that a failure in one circuit does not cause a loss of other emergency services.

Note 1: The continuity of supply for the primary essential services and the continuity of service for the secondary essential services are to be ensured.

The continuity of supply is the condition for which during and after a fault in a circuit, the supply to the healthy circuits (see circuit 3 in Fig 2) is permanently ensured.

The continuity of service is the condition for which after a fault in a circuit has been cleared, the supply to the healthy circuits (see circuit 3 in Fig 2) is re-established.

9.6 Protection against overload

9.6.1 Devices provided for overload protection are to have a tripping characteristic (overcurrent-trip time) adequate for the overload ability of the elements of the system to be protected and for any discrimination requirements.

9.6.2 The use of fuses for overload protection is not permitted for currents above 320 A and in high voltage installations.

9.7 Localisation of overcurrent protection

9.7.1 Short-circuit protection is to be provided for every non-earthed conductor.

9.7.2 Overload protection is to be provided for every non-earthed conductor; nevertheless, in insulated single-phase circuits or insulated three-phase circuits having substantially balanced loads, the overload protection may be omitted on one conductor.

9.7.3 Short-circuit and overload protective devices are not to interrupt earthed conductors, except in the case of multiple disconnection devices which simultaneously interrupt all the conductors, whether earthed or not.

9.7.4 Electrical protection is to be located as close as possible to the origin of the protected circuit.

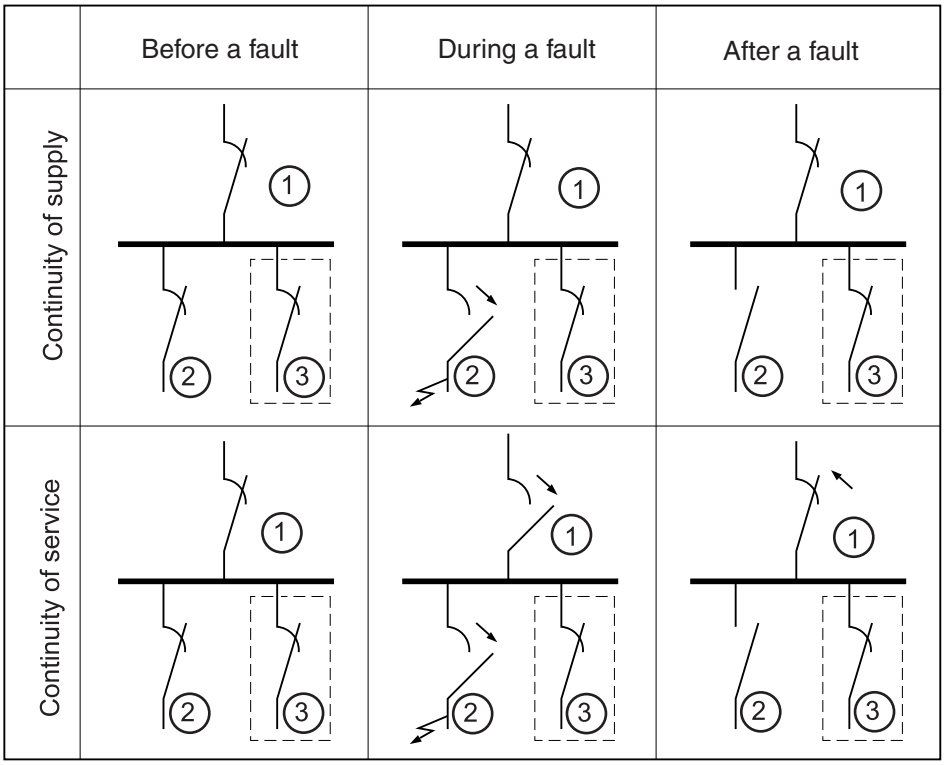
9.8 Protection of generators

9.8.1 Generators are to be protected against short-circuits and overloads by multipole circuit-breakers.

For generators not arranged to operate in parallel with a rated output equal to or less than 50 kVA, a multipole switch with a fuse in each insulated phase on the generator side may be accepted.

9.8.2 When multipole switch and fuses are used, the fuse rating is to be maximum 110% of the generator rated current.

Figure 2



9.8.3 Where a circuit-breaker is used:

a) the overload protection is to trip the generator circuit-breaker at an overload between 10% and 50%; for an overload of 50% of the rated current of the generator the time delay is not to exceed 2 minutes; however, the figure of 50% or the time delay of 2 minutes may be exceeded if the construction of the generator permits this

b) the setting of the short-circuit protection is to instantaneously trip the generator circuit-breaker at an overcurrent less than the steady short-circuit current of the generator. Short time delays (e.g. from 0,5 s to 1 s) may be introduced for discrimination requirements in "instantaneous" tripping devices.

9.8.4 For emergency generators the overload protection may, instead of disconnecting the generator automatically, give a visual and audible alarm in a permanently attended space.

9.8.5 After disconnection of a generator due to overload, the circuit-breaker is to be ready for immediate reclosure.

9.8.6 Generator circuit-breakers are to be provided with a reclosing inhibitor which prevents their automatic reclosure after tripping due to a short-circuit.

9.8.7 Generators having a capacity of 1500 kVA or above are to be equipped with a suitable protective device or system which, in the event of a short-circuit in the generator or in the supply cable between the generator and its circuit-breaker, will de-excite the generator and open the circuit-breaker (e.g. by means of differential protection).

9.8.8 *(1/1/2022)*

Arrangements are to be made to disconnect or reduce automatically the excess load when the generators are overloaded in such a way as to prevent a sustained loss of speed and/or voltage (see Pt C, Ch 2, Sec 2, Tab 6 of the Rules for the Classification of Ships). The operation of such device is to activate a visual and audible alarm.

9.8.9 When an overload is detected the load shedding system is to disconnect automatically, after an appropriate time delay, the circuits supplying the non-essential services and, if necessary, the secondary essential services in a second stage. A time delay of 5-20 s is considered acceptable.

9.8.10 Alternating current generators arranged to operate in parallel are to be provided with reverse-power protection.

The protection is to be selected in accordance with the characteristics of the prime mover.

The following values are recommended:

- 2-6% of the rated power for turbogenerators
- 8-15% of the rated power for diesel generators.

A fall of 50 % in the applied voltage shall not render the reverse power protection inoperative, although it may alter the amount of reverse power required to open the breaker.

The reverse-power protection may be replaced by other devices ensuring adequate protection.

9.8.11 Generators are to be provided with an undervoltage protection which trips the breaker if the voltage falls to 70% - 35% of the rated voltage.

For generators arranged for parallel operation, measures are to be taken to prevent the generator breaker from closing if the generator is not generating and to prevent the generator remaining connected to the busbars if voltage collapses.

The operation of the undervoltage release is to be instantaneous when preventing closure of the breaker, but it is to be delayed for selectivity purposes when tripping the breaker.

9.9 Protection of circuits

9.9.1 Each separate circuit is to be protected against short-circuit and against overload, unless otherwise specified in these Rules or where the Society may exceptionally otherwise permit.

9.9.2 Each circuit is to be protected by a multipole circuit-breaker or switch and fuses against overloads and short-circuits.

9.9.3 Cables in parallel formed of conductors of nominal cross-section not less than 50 mm^2 may be considered, from the point of view of protection, as a single cable.

9.9.4 Socket outlets for portable lamps and small domestic appliances are to be protected with 30 mA residual current devices (RCD) in distribution systems other then IT distribution system.

9.9.5 Circuits for lighting are to be disconnected on both non-earthed conductors; single-pole disconnection of final sub-circuits with both poles insulated is permitted only in accommodation spaces.

9.9.6 The protective devices of the circuits supplying motors are to allow excess current to pass during transient starting of motors.

9.9.7 Final sub-circuits which supply one consumer with its own overload protection (for example motors), or consumers which cannot be overloaded (for example permanently wired heating circuits and lighting circuits), may be provided with short-circuit protection only.

9.10 Protection of motors

9.10.1 Motors of rating exceeding 1 kW and all motors for essential services are to be protected individually against overload and short-circuit. The short-circuit protection may be provided by the same protective device for the motor and its supply cable (see [9.9.7]).

9.10.2 For motors intended for essential services, the overload protection may be replaced by an overload alarm.

9.10.3 The protective devices are to be designed so as to allow excess current to pass during the normal accelerating period of motors according to the conditions corresponding to normal use.

If the current/time characteristic of the overload protection device does not correspond to the starting conditions of a motor (e.g. for motors with extra-long starting period), provision may be made to suppress operation of the device during the acceleration period on condition that the short-circuit protection remains operative and the suppression of overload protection is only temporary.

9.10.4 For continuous duty motors, the protective gear is to have a time delay characteristic which ensures reliable thermal protection against overload.

The protective devices are to be adjusted so as to limit the maximum continuous current to a value within the range 105% - 120% of the motor's rated full load current.

9.10.5 For motors operational within hazardous areas, the necessary correct protection settings are to be selected in accordance with the prescriptions (if any) mentioned in the relevant safety certificates.

9.10.6 For intermittent duty motors, the current setting and the delay (as a function of time) of the protective devices are to be chosen in relation to the actual service conditions of the motor.

9.10.7 Where fuses are used to protect polyphase motor circuits, means are to be provided to protect the motor against unacceptable overload in the case of single phasing.

9.10.8 Motors rated above 1 kW are to be provided with:

- under-voltage protection, operative on the reduction or failure of voltage, to cause and maintain the interruption of power in the circuit until the motor is deliberately restarted or
- under-voltage release, operative on the reduction or failure of voltage, so arranged that the motor restarts automatically when power is restored after a power failure.

9.10.9 The automatic restart of a motor is not to produce a starting current such as to cause excessive voltage drop.

In the case of several motors required to restart automatically, the total starting current is not to cause an excessive voltage drop or sudden surge current; to this end, it may be necessary to achieve a sequence start.

9.10.10 The under-voltage protective devices are to allow the motor to be started when the voltage exceeds 85% of the rated voltage and are to intervene without fail when the voltage drops to less than approximately 20% of the rated voltage, at the rated frequency and with a time delay as necessary.

9.10.11 Under-voltage protection need not necessarily be provided for motors which have to be continuously available.

9.11 Protection of transformers

9.11.1 The primary winding side of power transformers is to be protected against short-circuit and overload by means of multipole circuit-breakers or switches and fuses.

9.11.2 Overload protection on the primary side may be dispensed with where it is provided on the secondary side or when the total possible load cannot reach the rated power of the transformer.

9.11.3 The protection against short-circuit is to be such as to ensure the selectivity between the circuits supplied by

the secondary side of the transformer and the feeder circuit of the transformer.

9.11.4 When transformers are arranged to operate in parallel, circuit breakers for secondary windings are to be provided as well as means to trip the circuit breaker on the secondary winding side when the corresponding circuit breaker on the primary side is open.

9.11.5 Where power can be fed into secondary windings, short-circuit protection is to be provided in the secondary connections too.

9.12 Protection of lighting circuits

9.12.1 Each lighting circuit is to be protected against overload and short-circuit by suitable devices.

9.13 Protection of storage batteries

9.13.1 Batteries are to be protected against overload and short-circuit by means of fuses or multipole circuit-breakers placed as near as practicable to the batteries or, where this is not possible, at a position adjacent to the battery compartment and double insulated cable is to be used.

Note 1: Two single core cables, each with two independent layers of insulation will meet the requirement of double insulated cable.

9.13.2 Overcurrent protection may be omitted for the circuit to engine starter motors when the current is so high that is impracticable to obtain short-circuit protection.

9.13.3 Emergency batteries supplying essential services are to have short-circuit protection only.

9.14 Protection of measuring instruments, pilot lamps and control circuits

9.14.1 Measuring circuits and devices (voltage transformers, voltmeters, voltage coils of measuring instruments, insulation monitoring devices etc.) and pilot lamps are to be protected against short-circuit by means of multipole circuit-breakers or fuses.

9.14.2 For circuits such as those of voltage regulators, where loss of voltage might have a serious consequence, over-current protection may be omitted. If over-current protection is omitted, means are to be provided to prevent risk of fire in the unprotected part of the installation.

9.14.3 The protective devices are to be placed as near as possible to the tapping from the supply.

9.14.4 The protection is to be adequate for the minimum cross-section of the protected circuits.

9.14.5 The secondary side of current transformers is not to be protected.

9.14.6 Control circuits and control transformers are to be protected against overload and short-circuit by means of multipole circuit-breakers or fuses on each pole not connected to earth.

9.14.7 Overload protection may be omitted for transformers with a rated current of less than 2 A on the secondary side.

9.14.8 The short-circuit protection on the secondary side may be omitted if the transformer is designed to sustain permanent short-circuit current.

9.14.9 Where a fault in a pilot lamp would impair the operation of essential services, such lamps are to be protected separately from other circuits such as control circuits.

Note 1: Pilot lamps connected via short-circuit-proof transformers may be protected in common with control circuits.

9.14.10 Circuits whose failure could endanger operation-are to be protected only against short-circuit.

9.15 Protection of power from external sources

9.15.1 Cables from external power sources to the main, or emergency switchboard shall be protected against overload and short-circuit by fuses or circuit breakers.

9.16 Protection of static or solid state devices

9.16.1 Appropriate protection is to be included in the static or solid-state devices for protection of the cells and to protect against the effects of internal short-circuits in the cells.

9.16.2 Protection of the distribution circuit which connects the static or solid state device to the source of power is to be given by means of a circuit-breaker whose tripping characteristics are selected to co-ordinate with melting characteristics of the fuses, if used, so as to ensure protection of the cells against all injurious over-currents.

10 Overvoltage protection

10.1 General

10.1.1 Generator and external power source circuits are to be provided with overvoltage protection, in order to prevent damages to the connected equipment.

10.1.2 Adequate precautions are to be taken in high-voltage a.c. systems to limit and/or cope with overvoltage due to switching etc. to ensure protection of a.c. machines.

11 Electrical cables

11.1 General

11.1.1 All electrical cables and wiring external to equipment are to be at least of a flame-retardant type, in accordance with IEC 60332-1.

11.1.2 *(1/1/2022)*

In addition to the provisions of [11.1.1], when cables are laid in bundles, cable types are to be chosen in compliance with IEC 60332-3-22 (Category A), or other means (see Pt C, Ch 2, Sec 12 of the Rules for the Classification of Ships)

are to be provided such as not to impair their original flame-retarding properties.

11.1.3 Where necessary for specific applications such as radio frequency or digital communication systems, which require the use of particular types of cables, the Society may permit the use of cables which do not comply with the provisions of [11.1.1] and [11.1.2].

11.1.4 Cables which are required to have fire-resisting characteristics are to comply with the requirements stipulated in [11.6].

11.2 Choice of insulation

11.2.1 The maximum rated operating temperature of the insulating material is to be at least 10°C higher than the maximum ambient temperature liable to occur or to be produced in the space where the cable is installed.

11.2.2 The maximum rated conductor temperature for normal and short-circuit operation, for the type of insulating compounds normally used for shipboard cables, is not to exceed the values stated in Tab 4. Special consideration will be given to other insulating materials.

11.2.3 PVC insulated cables are not to be used either in refrigerated spaces, or on decks exposed to the weather of units classed for unrestricted service.

11.2.4 Mineral insulated cables will be considered on a case by case basis.

11.3 Choice of protective covering

11.3.1 The conductor insulating materials are to be enclosed in an impervious sheath of material appropriate to the expected ambient conditions where cables are installed in the following locations:

- on decks exposed to the weather,
- in damp or wet spaces (e.g. in bathrooms),
- in refrigerated spaces,
- in machinery spaces and, in general,
- where condensation water or harmful vapour may be present.

11.3.2 *(1/1/2022)*

Where cables are provided with armour or metallic braid (e.g. for cables installed in hazardous areas), an overall impervious sheath or other means to protect the metallic elements against corrosion is to be provided; see Pt C, Ch 2, Sec 9, [1.5] of the Rules for the Classification of Ships.

11.3.3 An impervious sheath is not required for single-core cables installed in tubes or ducts inside accommodation spaces, in circuits with maximum system voltage 250 V.

11.3.4 In choosing different types of protective coverings, due consideration is to be given to the mechanical action to which each cable may be subjected during installation and in service.

If the mechanical strength of the protective covering is considered insufficient, the cables are to be mechanically protected (e.g. by an armour or by installation inside pipes or conduits).

11.3.5 Single-core cables for a.c. circuits with rated current exceeding 20 A are to be either non-armoured or armoured with non-magnetic material.

11.4 Cables in refrigerated spaces

11.4.1 Cables installed in refrigerated spaces are to have a watertight or impervious sheath and are to be protected against mechanical damage. If an armour is applied on the sheath, the armour is to be protected against corrosion by a further moisture-resisting covering.

11.5 Cables in areas with a risk of explosion

11.5.1 For cables in areas with a risk of explosion, see [12].

11.6 Electrical services required to be operable under fire conditions and fire-resistant cables

11.6.1 Electrical services required to be operable under fire conditions are as follows:

- Control and power systems to power-operated fire doors and status indication for all fire doors
- Control and power systems to power-operated watertight doors and their status indication
- Emergency fire pump
- Emergency lighting
- Fire and general alarms
- Fire and gas detection systems
- Fire-extinguishing systems and fire-extinguishing media release alarms
- Public address systems
- Remote emergency stop/shutdown arrangements for systems which may support the propagation of fire and/or explosion.

11.6.2 Where cables for services specified in [11.6.1] including their power supplies pass through high fire risk areas (see Note 1), other than those which they serve, they are to be so arranged that a fire in any of these areas does not affect the operation of the service in any other area. This may be achieved by either of the following measures:

a) Cables being of a fire-resistant type complying with IEC 60331-31 for cables of greater than 20 mm overall diameter, otherwise IEC 60331-21, are installed and run continuous to keep the fire integrity within the high fire risk area (see Fig 3).

b) At least two loops/radial distributions run as widely apart as is practicable and so arranged that in the event of damage by fire at least one of the loops/radial distributions remains operational.

Systems that are self monitoring, fail safe or duplicated with cable runs as widely separated as is practicable may be exempted.

Note 1:
a) For the purpose of application of this item [11.6], the definition of "high fire risk areas" is the following:

(1) Machinery spaces

(2) Spaces containing fuel treatment equipment and other highly flammable substances

(3) Galley and Pantries containing cooking appliances

(4) Laundry containing drying equipment

(5) Accommodation spaces of greater fire risk

(6) Spaces in which flammable liquids are stowed.

b) Fire-resistant type cables are to be easily distinguishable.

c) For special cables, requirements in the following standards may be used:

(1) IEC60331-23: Procedures and requirements - Electric data cables

(2) IEC60331-25: Procedures and requirements - Optical fibre cables.

11.6.3 Cables connecting fire pumps to the emergency switchboard are to be of a fire-resistant type where they pass through high fire risk areas.

11.7 Cables for submerged bilge pumps

11.7.1 Cables and their connections to such pumps are to be capable of operating under a head of water equal to their distance below the bulkhead deck. The cable is to be impervious-sheathed and armoured, is to be installed in continuous lengths from above the bulkhead to the motor terminals and is to enter the air bell from the bottom.

11.8 Internal wiring of switchboards and other enclosures for equipment

11.8.1 For installation in switchboards and other enclosures for equipment, single-core cables may be used without further protection (sheath).

Other types of flame-retardant switchboard wiring may be accepted at the discretion of the Society.

11.9 Current carrying capacity of cables

11.9.1 The current carrying capacity for continuous service of cables given in Tab 5 to Tab 9 is based on the maximum permissible service temperature of the conductor also indicated therein and on an ambient temperature of 45°C.

11.9.2 The current carrying capacity cited in [11.9.1] is applicable, with rough approximation, to all types of protective covering (e.g. both armoured and non-armoured cables).

11.9.3 Values other than those shown in Tab 5 to Tab 9 may be accepted provided they are determined on the basis of calculation methods or experimental values approved by the Society.

11.9.4 When the actual ambient temperature obviously differs from 45°C, the correction factors shown in Tab 10 may be applied to the current carrying capacity in Tab 5 to Tab 9.

11.9.5 Where more than six cables are bunched together in such a way that there is an absence of free air circulating around them, and the cables can be expected to be under full load simultaneously, a correction factor of 0,85 is to be applied.

Figure 3

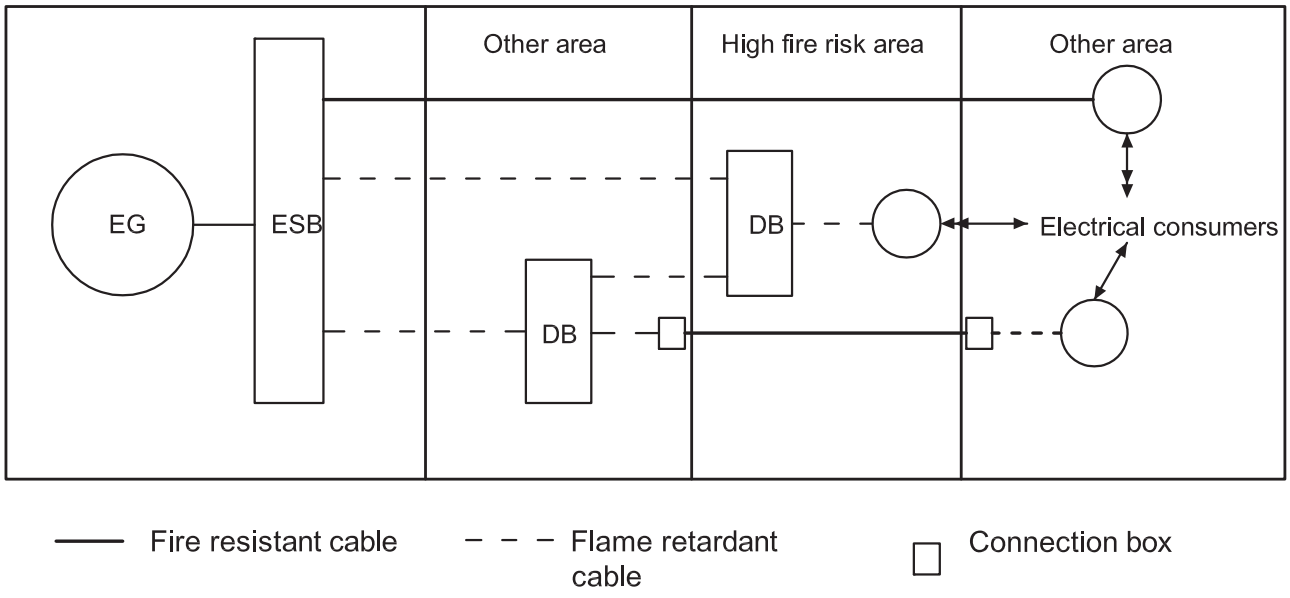


Table 4 : Maximum rated conductor temperature

Type of insulating compound	Abbreviated designation	Maximum rated conductor temperature, in °C	
		Normal operation	Short-circuit
a) Thermoplastic:			
- based upon polyvinyl chloride or copolymer of vinyl chloride and vinyl acetate	PVC/A	60	150
b) Elastomeric or thermosetting:			
- based upon ethylene-propylene rubber or similar (EPM or EPDM)	EPR	85	250
- based upon high modulus or hardgrade ethylene propylene rubber	HEPR	85	250
- based upon cross-linked polyethylene	XLPE	85	250
- based upon rubber silicon	S 95	95	350
- based upon ethylene-propylene rubber or similar (EPM or EPDM) halogen free	HF EPR	85	250
- based upon high modulus or hardgrade halogen free ethylene propylene rubber	HF HEPR	85	250
- based upon cross-linked polyethylene halogen free	HF XLPE	85	250
- based upon rubber silicon halogen free	HF S 95	95	350
- based upon cross-linked polyolefin material for halogen free cable **(1)**	HF 85	85	250
(1) Used on sheathed cable only			

Table 5 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 60°C (ambient temperature 45°C)

Nominal section mm^2	Number of conductors		
	1	2	3 or 4
1	8	7	6
1,5	12	10	8
2,5	17	14	12
4	22	19	15
6	29	25	20
10	40	34	28
16	54	46	38
25	71	60	50
35	87	74	61
50	105	89	74
70	135	115	95
95	165	140	116
120	190	162	133
150	220	187	154
185	250	213	175
240	290	247	203
300	335	285	235

Table 6 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 75°C (ambient temperature 45°C)

Nominal section mm^2	Number of conductors		
	1	2	3 or 4
1	13	11	9
1,5	17	14	12
2,5	24	20	17
4	32	27	22
6	41	35	29
10	57	48	40
16	76	65	53
25	100	85	70
35	125	106	88
50	150	128	105
70	190	162	133
95	230	196	161
120	270	230	189
150	310	264	217
185	350	298	245
240	415	353	291
300	475	404	333

Table 7 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 80°C (ambient temperature 45°C)

Nominal section mm^2	Number of conductors		
	1	2	3 or 4
1	15	13	11
1,5	19	16	13
2,5	26	22	18
4	35	30	25
6	45	38	32
10	63	54	44
16	84	71	59
25	110	94	77
35	140	119	98
50	165	140	116
70	215	183	151
95	260	221	182
120	300	255	210
150	340	289	238
185	390	332	273
240	460	391	322
300	530	450	371

Table 8 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 85°C (ambient temperature 45°C)

Nominal section mm^2	Number of conductors		
	1	2	3 or 4
1	16	14	11
1,5	20	17	14
2,5	28	24	20
4	38	32	27
6	48	41	34
10	67	57	47
16	90	77	63
25	120	102	84
35	145	123	102
50	180	153	126
70	225	191	158
95	275	234	193
120	320	272	224
150	365	310	256
185	415	353	291
240	490	417	343
300	560	476	392

Table 9 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 95°C (ambient temperature 45°C)

Nominal section mm^2	Number of conductors		
	1	2	3 or 4
1	20	17	14
1,5	24	20	17
2,5	32	27	22
4	42	36	29
6	55	47	39
10	75	64	53
16	100	85	70
25	135	115	95
35	165	140	116
50	200	170	140
70	255	217	179
95	310	264	217
120	360	306	252
150	410	349	287
185	470	400	329
240	570	485	399
300	660	560	462

11.9.6 Where a cable is intended to supply a short-time load for 1/2-hour or 1-hour service (e.g. mooring winches or bow or stern thruster propellers), the current carrying capacity obtained from Tab 5 to Tab 9 may be increased by applying the corresponding correction factors given in Tab 11.

In no case is a period shorter than 1/2-hour to be used, whatever the effective period of operation.

11.9.7 For supply cables to single services for intermittent loads (e.g. cargo winches or machinery space cranes), the current carrying capacity obtained from Tab 5 to Tab 9 may be increased by applying the correction factors given in Tab 12.

The correction factors are calculated with rough approximation for periods of 10 minutes, of which 4 minutes with a constant load and 6 minutes without load.

11.10 Minimum nominal cross-sectional area of conductors

11.10.1 In general the minimum allowable conductor cross-sectional areas are those given in Tab 13.

11.10.2 The nominal cross-sectional area of the neutral conductor in three-phase distribution systems is to be equal to at least 50% of the cross-sectional area of the phases, unless the latter is less than or equal to 16 mm^2. In such case the cross-sectional area of the neutral conductor is to be equal to that of the phase.

11.10.3 *(1/1/2022)*

For the nominal cross-sectional area of:

- earthing conductors, see Pt C, Ch 2, Sec 12, [2.3] of the Rules for the Classification of Ships
- earthing connections for distribution systems, see Pt C, Ch 2, Sec 12, [2.5] of the Rules for the Classification of Ships.

11.11 Choice of cables

11.11.1 The rated voltage of any cable is to be not lower than the nominal voltage of the circuit for which it is used.

11.11.2 The nominal cross-sectional area of each cable is to be sufficient to satisfy the following conditions with reference to the maximum anticipated ambient temperature:

- the current carrying capacity is to be not less than the highest continuous load carried by the cable
- the voltage drop in the circuit, by full load on this circuit, is not to exceed the specified limits
- the cross-sectional area calculated on the basis of the above is to be such that the temperature increases which may be caused by overcurrents or starting transients do not damage the insulation.

11.11.3 The highest continuous load carried by a cable is to be calculated on the basis of the power requirements and of the diversity factor of the loads and machines supplied through that cable.

11.11.4 When the conductors are carrying the maximum nominal service current, the voltage drop from the main or emergency switchboard busbars to any point in the installation is not to exceed 6% of the nominal voltage.

For battery circuits with supply voltage less than 55 V, this value may be increased to 10%.

For the circuits of navigation lights, the voltage drop is not to exceed 5% of the rated voltage under normal conditions.

Table 10 : Correction factors for various ambient air temperatures

Maximum conductor temperature, in °C	Correction factors for ambient air temperature of :										
	35°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C	75°C	80°C	85°C
60	1,29	1,15	1,00	0,82	-	-	-	-	-	-	-
75	1,15	1,08	1,00	0,91	0,82	0,71	0,58	-	-	-	-
80	1,13	1,07	1,00	0,93	0,85	0,76	0,65	0,53	-	-	-
85	1,12	1,06	1,00	0,94	0,87	0,79	0,71	0,61	0,50	-	-
95	1,10	1,05	1,00	0,95	0,89	0,84	0,77	0,71	0,63	0,55	0,45

Table 11 : Correction factors for short-time loads

½ -hour service		1-hour service		
Sum of nominal cross-sectional areas of all conductors in the cable, in mm²		Sum of nominal cross-sectional areas of all conductors in the cable, in mm²		Correlation factor
Cables with metallic sheath and armoured cables	Cables with non-metallic sheath and non-armoured cables	Cables with metallic sheath and armoured cables	Cables with non-metallic sheath and non-armoured cables	
up to 20	up to 75	up to 80	up to 230	1,06
21-41	76-125	81-170	231-400	1,10
41-65	126-180	171-250	401-600	1,15
66-95	181-250	251-430	601-800	1,20
96-135	251-320	431-600	-	1,25
136-180	321-400	601-800	-	1,30
181-235	401-500	-	-	1,35
236-285	501-600	-	-	1,40
286-350	-	-	-	1,45

Table 12 : Correction factors for intermittent service

Sun of nominal cross selectionel areas of all conductors in the cable, in mm²		Correction factor
Cables with metallic sheath and armoured cables	Cables without metallic sheath and non-amoured cables	
	S ≤ 5	1,10
	5 < S ≤ 8	1,15
	8 < S ≤ 16	1,20
S ≤ 4	16 < S ≤ 825	1,25
4 < S ≤ 7	25 < S ≤ 42	1,30
7 < S ≤ 17	42 < S ≤ 72	1,35
17 < S ≤ 42	72 < S ≤ 140	1,40
42 < S ≤ 110	140 < S	1,45
110 < S	-	1,50

12 Electrical installations in hazardous areas

12.1 Electrical equipment

12.1.1 No electrical equipment is to be installed in hazardous areas unless the Society is satisfied that such equipment is:

- essential for operational purposes,
- of a type which will not ignite the mixture concerned,
- appropriate to the space concerned, and
- appropriately certified for safe usage in the dusts, vapours or gases likely to be encountered.

12.1.2 *(1/1/2022)*

Where electrical equipment of a safe type is permitted in hazardous areas it is to be selected with due consideration to the following:

a) risk of explosive dust concentration; see Pt C, Ch 2, Sec 2, [6.2] of the Rules for the Classification of Ships:
   - degree of protection of the enclosure
   - maximum surface temperature

b) risk of explosive gas atmosphere; see Pt C, Ch 2, Sec 2, [6.1] of the Rules for the Classification of Ships:
   - explosion group
   - temperature class.

12.1.3 Where electrical equipment is permitted in hazardous areas, all switches and protective devices are to interrupt all poles or phases and, where practicable, to be located in a non-hazardous area unless specifically permitted otherwise.

Such switches and equipment located in hazardous areas are to be suitably labelled for identification purposes.

12.1.4 For electrical equipment installed in Zone 0 hazardous areas, only the following types are permitted:

- certified intrinsically-safe apparatus Ex(ia)
- simple electrical apparatus and components (e.g. thermocouples, photocells, strain gauges, junction boxes, switching devices), included in intrinsically-safe circuits of category "ia" not capable of storing or generating electrical power or energy in excess of limits stated in the relevant rules, and accepted by the appropriate authority
- equipment specifically designed and certified by the appropriate authority for use in Zone 0.

12.1.5 For electrical equipment installed in Zone 1 hazardous areas, only the following types are permitted:

- any type that may be considered for Zone 0
- certified intrinsically-safe apparatus Ex(ib)
- simple electrical apparatus and components (e.g. thermocouples, photocells, strain gauges, junction boxes, switching devices), included in intrinsically-safe circuits of category "ib" not capable of storing or generating electrical power or energy in excess of limits stated in the relevant rules, and accepted by the appropriate authority
- certified flameproof Ex(d)
- certified pressurised Ex(p)
- certified increased safety Ex(e)
- certified encapsulated Ex(m)
- certified sand filled Ex(q)
- certified specially Ex(s)
- through runs of cable.

Table 13 : Minimum nominal cross-sectional areas

Service	Nominal cross-sectional area	
	external wiring mm²	internal wiring mm²
Power, heating and lighting systems	1,0	1,0
Control circuits for power plant	1,0	1,0
Control circuits other than those for power plant	0,75	0,5
Control circuits for telecommunications, measurement, alarms	0,5	0,2

Service	Nominal cross-sectional area	
	external wiring mm^2	internal wiring mm^2
Telephone and bell equipment, not required for the safety of the unit or crew calls	0,2	0,1
Bus and data cables	0,2	0,1

12.1.6 For electrical equipment installed in Zone 2 hazardous areas, only the following types are permitted:

- any type that may be considered for Zone 1
- tested specially for Zone 2 (e.g. type "n" protection)
- pressurised, and accepted by the appropriate authority
- encapsulated, and accepted by the appropriate authority
- the type which ensures the absence of sparks and arcs and of "hot spots" during its normal operation (minimum class of protection IP55).

12.1.7 When apparatus incorporates a number of types of protection, it is to be ensured that all are suitable for use in the zone in which it is located.

12.2 Electrical cables

12.2.1 Electrical cables are not to be installed in hazardous areas except as specifically permitted or when associated with intrinsically safe circuits.

12.2.2 All cables installed in Zone 0, Zone 1 and weather exposed areas classified Zone 2 are to be sheathed with at least one of the following:

a) a non-metallic impervious sheath in combination with braiding or other metallic covering

b) a copper or stainless steel sheath (for mineral insulated cables only).

12.2.3 All cables installed in non-weather exposed Zone 2 areas are to be provided with at least a non-metallic external impervious sheath.

12.2.4 Cables of intrinsically safe circuits are to have a metallic shielding with at least a non-metallic external impervious sheath.

12.2.5 Cables associated with intrinsically safe circuits are to be used only for these circuits and are to be separated from other cables containing non-intrinsically-safe circuits (e.g. not laid together in the same cable bundle or pipe and not secured by the same fixing clip).

12.2.6 The circuits of a category "ib" intrinsically safe system are not to be contained in a cable associated with a category "ia" intrinsically safe system required for a hazardous area in which only category "ia" systems are permitted.

12.3 Electrical installations in battery rooms

12.3.1 *(1/1/2022)*

Only intrinsically safe apparatus and certified safe type lighting fittings may be installed in compartments assigned solely to large vented storage batteries; see Pt C, Ch 2, Sec 11, [6.2.1] of the Rules for the Classification of Ships.

The associated switches are to be installed outside such spaces.

Electric ventilator motors are to be outside ventilation ducts and, if within 3 m of the exhaust end of the duct, they are to be of an explosion-proof safe type. The impeller of the fan is to be of the non-sparking type.

Overcurrent protective devices are to be installed as close as possible to, but outside of, battery rooms.

Electrical cables other than those pertaining to the equipment arranged in battery rooms are not permitted.

Electrical equipment for use in battery rooms is to have minimum explosion group IIC and temperature class T1.

12.3.2 Standard marine electrical equipment may be installed in compartments assigned solely to valve-regulated sealed storage batteries.

12.3.3 *(1/1/2022)*

Where vented (see Note 1) type batteries replace valve-regulated sealed (see Note 2) types, the requirements of Pt C, Ch 2, Sec 11 of the Rules for the Classification of Ships are to be complied with.

Note 1: A vented battery is one in which the cells have a cover provided with an opening through which products of electrolysis and evaporation are allowed to escape freely from the cells to atmosphere.

Note 2: A valve-regulated battery is one in which cells are closed but have an arrangement (valve) which allows the escape of gas if the internal pressure exceeds a predetermined value.

12.4 Electrical equipment allowed in paint stores and in enclosed spaces leading to paint stores

12.4.1 Electrical equipment is to be installed in paint stores and in ventilation ducts serving such spaces only when it is essential for operational services

Certified safe type equipment permitted in Zone 1 hazardous areas.

Cables (through-runs or terminating cables) of armoured type or installed in metallic conduits are to be used.

12.4.2 The minimum requirements for certified safe type equipment are as follows:

- explosion group II B
- temperature class T3.

12.4.3 Switches, protective devices and motor control gear of electrical equipment installed in a paint store are to interrupt all poles or phases and are preferably to be located in a non-hazardous space.

12.4.4 In areas on open deck within 1m of inlet and exhaust ventilation openings or within 3 m of exhaust mechanical ventilation outlets, the electrical equipment permitted in Zone 2 hazardous areas may be installed.

Cables as specified in [12.4.1] are to be used.

12.4.5 The enclosed spaces giving access to the paint store may be considered as non-hazardous, provided that:

- the door to the paint store is a gas-tight door with self-closing devices without holding back arrangements
- the paint store is provided with an acceptable, independent, natural ventilation system ventilated from a safe area
- warning notices are fitted adjacent to the paint store entrance stating that the store contains flammable liquids.

Note 1: A watertight door may be considered as being gas-tight.

12.5 Electrical installations in stores for welding gas (acetylene) bottles

12.5.1 The following equipment may be installed in stores for welding gas bottles provided that it is of a safe type appropriate for Zone 1 area installation:

- lighting fittings
- ventilator motors where provided.

12.5.2 Electrical cables other than those pertaining to the equipment arranged in stores for welding gas bottles are not permitted.

12.5.3 Electrical equipment for use in stores for welding gas bottles is to have minimum explosion group IIC and temperature class T2.

12.6 Special ships

12.6.1 For installations in hazardous areas in:

- FSO (see Pt E, Ch 1, Sec 5);
- FPSO (see Pt E, Ch 2, Sec 5);
- PSRU (see Pt E, Ch 3, Sec 10);
- MODU (see Pt E, Ch 4, Sec 4);

13 Recording of the Type, Location and Maintenance Cycle of Batteries

13.1 Battery schedule

13.1.1 *(1/1/2022)*

Where batteries are fitted for use for essential and emergency services, a schedule of such batteries is to be compiled and maintained. The schedule, required in Pt C, Ch 2, Sec 1, Tab 1 of the Rules for the Classification of Ships, is to include at least the following information regarding the battery(ies):

- type and Manufacturer's type designation
- voltage and ampere-hour rating
- location
- equipment and/or system(s) served
- maintenance/replacement cycle dates
- date(s) of last maintenance and/or replacement
- for replacement batteries in storage, the date of manufacture and shelf life.

Note 1: Shelf life is the duration of storage under specified conditions at the end of which a battery retains the ability to give a specified performance.

Part C
Machinery, Systems and Fire Protection

Chapter 3
AUTOMATION

SECTION 1 GENERAL REQUIREMENTS

SECTION 1 GENERAL REQUIREMENTS

1 General

1.1 Field of application

1.1.1 *(1/1/2022)*

The following requirements apply to automation systems, installed on all units, intended for essential services as defined in Pt C, Ch 2, Sec 1 of the Rules for the Classification of Ships.

The applicable requirements in Pt C, Ch 3 of the Rules for the Classification of Ships are to be complied with.

Part C
Machinery, Systems and Fire Protection

Chapter 4
SAFETY SYSTEMS AND FIRE PROTECTION, DETECTION AND EXTINCTION

SECTION 1 SAFETY SYSTEMS

1 General

1.1 Purpose and application

1.1.1 The requirements of this Section provide general safety principles to protect personnel and to ensure the overall safety of the unit in case of hazardous events involving the production and process systems.

1.2 Documentation to be submitted

1.2.1 Reference is to be made to Section 2, item [1.4] and to Part E of these Rules, depending on the service notation assigned to the unit.

2 Fire and gas systems

2.1

2.1.1 Reference is to be made to the provisions laid down in Section 2, item [6] and in Part E of these Rules, depending on the service notation assigned to the unit.

3 Emergency shut down system

3.1

3.1.1 For units having the service notations **FPSO**, **FSRU** and **MODU**, reference is to be made to the relevant provisions laid down in Part E of these Rules.

SECTION 2 REQUIREMENTS FOR FIRE PROTECTION, DETECTION AND EXTINCTION

1 General

1.1 Purpose and application

1.1.1 The requirements of this Section 2, with the exception of items [3.5], [3.6] and [6] are not applicable for the purpose of classification, except for:

- units to which the Service Notation **MODU** is assigned; and
- units to which the Service Notations **FPSO** and **FSO** are assigned, where the Society carries out surveys relevant to fire protection statutory requirements on behalf of the Flag Administration.

In such cases, unless otherwise provided by the Flag Administration, fire protection statutory requirements as contained in this Section 2 are considered a matter of class and their compliance is verified by the Society for classification purposes.

1.1.2 *(1/7/2015)*

For units to which the Service Notation **FSRU** is assigned, the relevant fire protection requirements are set out in the IGC Code, with the additions given in Part E, Ch 3, Sec 11, Part E, Ch 3, Sec 12 and Part E, Ch 3, Sec 13, in lieu of those contained in this Section 2, and are not applicable for the purpose of the classification.

For units to which the Service Notation **FPU** is assigned, in addition to the requirements of this Section 2, the relevant fire protection requirements are set out in Part E, Ch 6, Sec 9 and, with the exception of item [3] of Part E, Ch 6, Sec 9, they are not applicable for classification purposes.

For these units, unless otherwise provided by the Flag Administration, the above applicable fire protection requirements are considered a matter of class, and their compliance is verified by the Society for classification purposes, where the Society carries out surveys on behalf of the Flag Administration.

1.1.3

For units to which the Service Notation **MOSU** is assigned, the relevant fire protection requirements are those set out in the SOLAS Convention for oil tankers.

For these units, unless otherwise provided by the Flag Administration, the above applicable fire protection requirements are considered a matter of class, and their compliance is verified by the Society for classification purposes, where the Society carries out surveys on behalf of the Flag Administration.

1.2 Risk analysis

1.2.1 When the proposed design of fire protection arrangements is alternative to the requirements set out in this Section, or it involves items for which specific provision are not given in this Section, it is to be demonstrated that such design provides an equivalent level of safety, or that the risk of the design has been made ALARP. The demonstration may be based on risk assessment techniques (refer to Part C, Ch 7 of these Rules).

1.3 Additional or alternative requirements

1.3.1 Additional or alternative requirements to those contained in this Section are given in Part E, depending on Service Notations to be assigned to the units under consideration.

1.3.2

Attention is to be also directed to the appropriate governmental authority in each case, as there may be additional requirements, depending on the size, type and intended service of the units as well as other particulars and details. Consideration are to be given to fire protection arrangements and fire extinguishing systems which comply with the published requirements of the governmental authority of the country in which the unit is to be registered.

1.4 Documentation to be submitted

1.4.1 The plans to be submitted to the Society for examination are those listed in Tab 1. Other documentation may be requested depending on the unit's characteristics (see item [1.3]).

1.4.2 The attention of the Interested Parties is drawn to possible additional details, provisions and requirements of Flag Administration set forth depending on the size, type and intended service of the units. Special consideration is to be given to arrangements for structural fire protection and to fire-extinguishing systems, which are to comply with the requirements of the Administration of the State in which the unit is registered.

Table 1 : Documentation to be submitted

No.	I/A **(1)**	Document **(2)**
1	A	Structural fire protection, showing the purpose of the various spaces of the units, the fire rating of bulkheads and decks, the means of closing of openings in "A" and "B" class divisions and the draught stops
2	A	Natural and mechanical ventilation systems (including ventilation systems serving hazardous spaces) showing: • position of vent inlets and outlets • penetrations on "A" class divisions • location of dampers • means of closing • arrangements of air conditioning rooms • location of fan controls • air changes per hour (where requirements for air changes per hour are set)
3	A	Means of escape
4	A	Fire and gas detection arrangements, including location of detectors and panels, electric diagrams and alarms
5	A	Fire pumps and fire main including pump head and capacity, hydrant and hose locations
6	A	Arrangement of fixed fire-extinguishing systems
7	A	Fire control plans **(3)**

(1) A : to be submitted for approval, in four copies I : to be submitted for information, in duplicate.

(2) Plans are to be schematic and functional and to contain all information necessary for their correct interpretation and verification such as:

- service pressures
- capacity and head of pumps and compressors, if any
- materials and dimensions of piping and associated fittings
- volumes of protected spaces
- surface areas of protected zones for automatic sprinkler and pressure water-spraying, low expansion foam and powder fire-extinguishing systems
- capacity, in volume and/or in mass, of vessels or bottles containing the extinguishing media or propelling gases, for gas, automatic sprinkler, foam and powder fire-extinguishing systems
- type, number and location of nozzles of extinguishing media for gas, automatic sprinkler, pressure water-spraying, foam and powder fire-extinguishing systems.

All or part of the information may be provided, instead of on the above plans, in suitable operating manuals or in specifications of the systems.

(3) The following items, as a minimum, are to be clearly shown on fire control plans:

- locations of fire control stations;
- various fire sections enclosed by various classes of fire divisions;
- arrangement of fire detectors and manual fire alarm stations;
- arrangement of combustible gas detectors;
- arrangement of hydrogen sulphide gas detectors;
- locations of respiratory protection equipment for hydrogen sulphide;
- general alarm actuating positions;
- arrangement of various fire-extinguishing appliances;
- locations of Fighter's Outfits;
- location of Helicopter Crash Kit;
- arrangement of water spray nozzles and sprinklers (if fitted);
- locations of emergency shutdown (such as oil fuel source shutdown, engine shutdown, etc) stations;
- the ventilating system including Fire dampers positions, Ventilating Fans control positions with indication of identification numbers of ventilating fans serving each section;
- arrangement of fire/watertight doors and their remote control positions;
- blowout preventer control positions;
- escape route and means of access to different compartments, decks, etc.;
- locations of Emergency Escape Breathing Devices (EEBD); and
- arrangement of emergency muster stations and life-saving appliances.

No.	I/A **(1)**	Document **(2)**
8	A	Electrical diagram of power control and position indication circuits for fire doors
9	I	General arrangement plan

(1) A : to be submitted for approval, in four copies I : to be submitted for information, in duplicate.

(2) Plans are to be schematic and functional and to contain all information necessary for their correct interpretation and verification such as:

- service pressures
- capacity and head of pumps and compressors, if any
- materials and dimensions of piping and associated fittings
- volumes of protected spaces
- surface areas of protected zones for automatic sprinkler and pressure water-spraying, low expansion foam and powder fire-extinguishing systems
- capacity, in volume and/or in mass, of vessels or bottles containing the extinguishing media or propelling gases, for gas, automatic sprinkler, foam and powder fire-extinguishing systems
- type, number and location of nozzles of extinguishing media for gas, automatic sprinkler, pressure water-spraying, foam and powder fire-extinguishing systems.

All or part of the information may be provided, instead of on the above plans, in suitable operating manuals or in specifications of the systems.

(3) The following items, as a minimum, are to be clearly shown on fire control plans:

- locations of fire control stations;
- various fire sections enclosed by various classes of fire divisions;
- arrangement of fire detectors and manual fire alarm stations;
- arrangement of combustible gas detectors;
- arrangement of hydrogen sulphide gas detectors;
- locations of respiratory protection equipment for hydrogen sulphide;
- general alarm actuating positions;
- arrangement of various fire-extinguishing appliances;
- locations of Fighter's Outfits;
- location of Helicopter Crash Kit;
- arrangement of water spray nozzles and sprinklers (if fitted);
- locations of emergency shutdown (such as oil fuel source shutdown, engine shutdown, etc) stations;
- the ventilating system including Fire dampers positions, Ventilating Fans control positions with indication of identification numbers of ventilating fans serving each section;
- arrangement of fire/watertight doors and their remote control positions;
- blowout preventer control positions;
- escape route and means of access to different compartments, decks, etc.;
- locations of Emergency Escape Breathing Devices (EEBD); and
- arrangement of emergency muster stations and life-saving appliances.

1.5 Type approved products

1.5.1 The following materials, equipment, systems or products in general used for fire protection are to be type approved by the Society, except for special cases for which the acceptance may be given for individual units on the basis of suitable documentation or ad hoc tests:

- Fire-resisting and fire-retarding divisions (bulkheads or decks) and associated doors
- Materials for pipes penetrating "A" or "B" class divisions (where they are not of steel or other equivalent material)
- Bulkhead or deck penetrations for electrical cables and ventilation systems passing through "A" or "B" class divisions
- Materials with low flame spread characteristic, including paints, varnishes and similar, when they are required to have such characteristic
- Non-combustible materials
- Non-readily igniting materials for primary deck coverings
- Fixed foam fire-extinguishing systems and associated foam-forming liquids
- Sprinkler heads for automatic sprinkler systems
- Nozzles for fixed pressure water-spraying fire-extinguishing systems for machinery spaces, boiler rooms and tank areas
- Sensing heads for automatic fire alarm and fire detection systems
- Fixed fire detection and fire alarm systems
- Explosive mixture detecting systems
- Portable explosive mixture detecting apparatus
- Fixed instruments for measuring the oxygen content for inert gas systems serving cargo tanks

- Portable instruments for measuring the oxygen content for inert gas systems serving cargo tanks
- Portable fire extinguishers
- Large capacity fire extinguishers
- Extinguishing media substitute for the foam in fire extinguishers
- Fire protective overalls
- Breathing apparatus
- Smoke helmets and smoke masks
- Electric safety lamps
- Lifelines
- Fire hoses
- Dual purpose nozzles for fire hoses
- Dry material substitute for sand in "sand receptacles"
- Fire dampers
- Portable foam applicators.

The Society may request type approval for other materials, equipment, systems or products required by the applicable provisions for units or installations of special types.

2 Definitions

2.1 General

2.1.1 In addition to the definitions given in Part A, Ch 1, the following also apply.

2.2 Accommodation spaces

2.2.1

Accommodation spaces are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, pantries containing no cooking appliances and similar spaces. Public spaces are those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

2.3 A class divisions

2.3.1 A class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:

- they are constructed of steel or other equivalent material;
- they are suitably stiffened;
- 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
- 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; and
- the Society will require a test of a prototype bulkhead or deck in accordance with the "Fire Test Procedures Code" (see [2.9]) to ensure that it meets the above requirements for integrity or temperature rise.

2.3.2 The products indicated in Tab 2 may be installed without testing or approval.

2.4 B class divisions

2.4.1 "B" class divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

- 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 Section;
- 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
- 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;
- the Society will require a test of a prototype division in accordance with the Fire Test Procedures Code (see [2.9]) to ensure that it meets the above requirements for integrity or temperature rise.

Table 2

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

2.5 C class divisions

2.5.1 C class divisions are those divisions constructed of approved non-combustible materials. They do not need to

meet either requirements relative to the passage of smoke and flame or limitations relative to the temperature rise. Combustible veneers are permitted provided they meet the requirements of this Section.

2.6 Cargo area

2.6.1 For the purpose of this Section, cargo area is that part of the unit that contains cargo handling and processing equipment, cargo tanks, slop tanks, cofferdams, ballast and void spaces adjacent to cargo tanks and also deck areas throughout the entire length and breadth of the part of the unit over the above-mentioned spaces.

2.7 Continuous B class ceilings or linings

2.7.1 Continuous "B" class ceilings or linings are those B class ceilings or linings which terminate at an A or B class division.

2.8 Control stations

2.8.1

Control stations are those spaces in which the unit's radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment or the dynamically positioning control system is centralized or where a fire-extinguishing system serving various locations is situated. In the case of a column-stabilized unit, a centralized ballast control station is a "control station". However, for purposes of the application of this Sec 2, the space where the emergency source of power is located is not considered as being a control station.

Cargo control rooms, production control rooms and any other location from which essential control for the unit's operation is centralized are to be considered as "control stations".

2.9 Fire Test Procedures Code

2.9.1 "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.

2.10 Fire Safety Systems Code

2.10.1 "Fire Safety Systems Code" means the "International Code for Fire Safety System", as adopted by the Maritime Safety Committee of the IMO by Resolution MSC.98(73), as may be amended by the IMO.

2.11 Enclosed spaces

2.11.1 Enclosed spaces are spaces bounded by floors, bulkheads and/or decks, which may have doors and/or windows.

2.12 Fuel oil unit

2.12.1 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 operating with oil at a pressure of more than 0,18 MPa.

Fuel oil unit includes any equipment used for the preparation and delivery of fuel oil, whether or not heated, to boilers (including inert gas generators) and engines (including gas turbines) at a pressure of more than 0,18 Mpa.

2.13 Hazardous areas

2.13.1 *(1/7/2022)*

For the purpose of machinery and electrical installations, hazardous areas are classified as in Pt E, Ch 4, Sec 5, [5.3.8] and [5.6.1] to [5.6.3].

Hazardous areas not covered (such as, but not limited to, well test equipment areas, helicopter fuel storage areas, acetylene cylinder storage areas, battery rooms, paint lockers, flammable gas or vapour vents and diverter line outlets) in Pt E, Ch 4, Sec 5, [5.3.8] and [5.6.1] to [5.6.3] are to be classified as in Pt C, Ch 2, Sec 1, [3.24] of the Rules for the Classification of Ships.

2.13.2 Hazardous areas are all those areas where, due to the possible presence of a flammable atmosphere arising from drilling operations, cargo operations or cargo storage, the use without proper consideration of machinery or electrical equipment may lead to fire hazard or explosion (see also Ch 2, Sec 1).

2.14 Low flame spread

2.14.1 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.

2.15 Machinery spaces

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

2.16 Machinery spaces of category A

2.16.1 Machinery spaces of category A are all spaces which contain internal combustion-type machinery used either:

- for main propulsion; or
- for other purposes where such machinery has in the aggregate a total power output of not less than 375 kW;

or which contain any oil fired boiler or fuel oil unit; and trunks to such spaces.

2.16.2 Spaces containing any oil fired equipment other than boilers, such as inert gas generators, incinerators, etc., are to be considered as machinery spaces of category A.

2.17 Non-combustible material

2.17.1 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 (see [2.9]).

2.17.2 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.

2.18 Semi-enclosed locations

2.18.1 Semi-enclosed locations are locations where natural conditions of ventilation are notably different from those on open decks due to the presence of structures such as roofs, windbreaks and bulkheads and which are so arranged that dispersion of gas may not occur.

2.19 Service spaces

2.19.1 Service spaces are those spaces used for galleys, pantries containing cooking appliances, lockers and store-rooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces.

2.19.2

a) A pantry containing no cooking appliances may contain:
   - toasters, induction heaters, microwave ovens and similar appliances each of them with a maximum power of 1 kW;
   - coffee automats without any restriction on their power; and
   - other non-cooking appliances such as dish washers, water boilers, ice-cube machines, fridges, etc, regardless of their power;

b) Pantries containing cooking appliances may contain appliances listed in a) and:
   - toasters, induction heaters, microwave ovens and similar appliances each of them with a maximum power of 5 kW;
   - 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;

c) A dining room containing such appliances is not to be regarded as a pantry.

d) Spaces containing any electrically heated cooking plate or hot plate for keeping food warm with a power of more than 2kW 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 this Section, as galleys.

2.20 Standard fire test

2.20.1 A 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 [2.9]).

2.21 SOLAS Convention

2.21.1 SOLAS Convention means the International Convention for the Safety of Life at Sea, 1974, as it may be amended.

2.22 Steel or other equivalent material

2.22.1 Where the words "steel or other equivalent material" occur, "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. aluminium alloy with appropriate insulation).

2.23 Tank area

2.23.1 The tank area is the portion of the unit where the cargo is stored or where loading and unloading operations are carried out.

2.24 Working spaces

2.24.1 Working spaces are those open or enclosed spaces containing equipment and processes, associated with unit operations which are not included in [2.15] and [2.16].

3 Structural fire protection

3.1 General

3.1.1 These requirements have been formulated principally for units with their hull superstructure, structural bulkheads, decks and deckhouses constructed of steel.

3.1.2 Units constructed of other materials may be accepted, on condition that, in the opinion of the Society, they provide an equivalent standard of safety.

3.1.3 In case of ship shaped units, the compliance with structural fire protection requirements set out in Chapter II-2, SOLAS Convention for tankers, instead of items [3.2] and [3.3], may be accepted by the Society upon case-by-case considerations.

3.2 Fire integrity of bulkheads and decks

3.2.1 In addition to complying with the specific provisions for fire integrity of bulkheads and decks in this item [3], the minimum fire integrity of bulkheads and decks is to be as prescribed in Tables 3 and 4.

a) Exterior boundaries of superstructures and deckhouses enclosing accommodation spaces, services spaces, control stations and machinery spaces including any overhanging decks which support such spaces, are to be constructed to "A-60" standard for the whole of the

portion which faces and is within 30 m of the centre of the rotary table.

For units that have a movable substructure the 30 m is to be measured with the substructure at its closest drilling position to the accommodation. The Society may accept equivalent arrangements.

b) Additional measures, such as increased fire rating of divisions, cofferdams or increased active fire protection, may be required by the Society, taking into account the results of the fire risk analysis, as per item [1.2].

In general, accommodation spaces, service spaces and control stations are not to be located adjacent to hazardous areas. However, where this is not practicable, a risk analysis, as per item [1.2], is to be performed to ensure that the level of fire protection and blast resistance of the bulkheads and decks separating these spaces from the hazardous areas are adequate for the likely hazard.

3.2.2 Spaces located in the cargo area which are used for cargo operation purposes (e.g. cargo hose lockers) may be exempted from the requirements set out in [3.2.1].

3.2.3 The following requirements govern application of the Tables:

Tables 3 and 4 apply, respectively, to bulkheads and decks separating adjacent spaces.

For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in Categories (a) to (k) below. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables:

a) "Control stations" are spaces as defined in [2.8].

b) "Corridors" means corridors and lobbies.

c) "Accommodation spaces" are spaces as defined in [2.2], excluding stairways, corridors, lavatories and pantries containing no cooking appliances.

d) "Stairways" are interior stairways, lifts and escalators (other than those wholly contained within machinery spaces) and enclosures thereto. In this connection, a stairway which is enclosed only at one level is to be regarded as part of the space from which it is not separated by a fire door.

e) "Service spaces (low risk)" are lockers, storerooms and working spaces in which flammable materials are not stored, drying rooms and laundries.

f) "Machinery spaces of Category A" are spaces as defined in [2.16].

g) "Other machinery spaces" are spaces as defined in [2.15], other than machinery spaces of Category A.

h) "Hazardous areas" are areas as defined in [2.13].

i) "Service spaces (high risk)" are lockers, storerooms and working spaces in which flammable materials are stored, galleys, pantries containing cooking appliances, paint rooms and workshops other than those forming part of the machinery space.

j) "Open decks" are open deck spaces, excluding hazardous areas.

k) "Sanitary and similar spaces" are communal sanitary facilities such as showers, baths, lavatories, etc., and isolated pantries containing no cooking appliances. Sanitary facilities which serve a space and have access only from that space are to be considered a portion of the space in which they are located.

3.2.4 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 provided they are tested in accordance with the Fire Test Procedures Code.

In approving structural fire protection details, the Society will pay due regard to the risk of heat transmission at intersections and terminal points of required thermal barriers.

The insulation of a deck or bulkhead is to 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 by a deck or a bulkhead of "A" class standard having insulation of different values, the insulation with the higher value is to continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

Table 3 : Fire integrity of bulkheads separating adjacent spaces

SPACES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	A-0 (d)	A-0	A-60	A-0	A-15	A-60	A-15	A-60 (e)	A-60	*	A-0
Corridors (2)		C	B-0	B-0 A-0 (b)	B-0	A-60	A-0	A-0 (e)	A-0	*	B-0
Accommodation spaces (3)			C	B-0 A-0 (b)	B-0	A-60	A-0	A-0 (e)	A-0	*	C
Stairways (4)				B-0 A-0 (b)	B-0 A-0 (b)	A-60	A-0	A-0 (e)	A-0	*	B-0 A-0 (b)
Service spaces (low risk) (5)					C	A-60	A-0	A-0	A-0	*	B-0
Machinery spaces of category A (6)						* (a)	A-0 (a)	A-60	A-60	*	A-0
Other machinery spaces (7)							A-0 (a) (c)	A-0	A-0	*	A-0
Hazardous areas (8)								-	A-0	*	A-0
Service spaces (high risk) (9)									A-0 (c)	*	A-0
Open decks (10)										-	*
Sanitary and similar spaces (11)											C

(to be applied to Tab 3 and Tab 4, as appropriate)

a) Where the space contains an emergency power source or components of an emergency power source adjoining a space containing a unit's service generator or the components of a unit's service generator, the boundary bulkhead or deck between those spaces is to be an "A-60" class division.

b) For clarification as to which note applies, see [3.3.1] and [3.3.2].

c) Where spaces are of the same numerical category and superscript [c] appears, a bulkhead or deck of the rating shown in the tables is only required when the adjacent spaces are used for different purposes, e.g. in Category (9). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.

d) Bulkheads separating the navigating bridge, chartroom and radio room from each other may be "B-0" rating.

e) A risk analysis is to be conducted in accordance with paragraph 9.3.1. In no case should the bulkhead or deck rating be less than the value indicated in the tables.

[*] Where an asterisk appears in the tables, the division is to be of steel or equivalent material, but need not be of "A" class standard. However, where a deck is penetrated for the passage of electrical cables, pipes and vent ducts, such penetrations are to be made tight to prevent the passage of flame and smoke.

Table 4 : Fire integrity of decks separating adjacent spaces

SPACES below	SPACE above										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0 (e)	A-0	*	A-0
Corridors (2)	A-0	*	*	A-0	*	A-60	A-0	A-0 (e)	A-0	*	*
Accommodation spaces (3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0 (e)	A-0	*	*
Stairways (4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0 (e)	A-0	*	A-0
Service spaces (low risk) (5)	A-15	A-0	A-0	A-0	*	A-60	A-0	A-0	A-0	*	A-0
Machinery spaces of category A (6)	A-60	A-60	A-60	A-60	A-60	* (a)	A-60	A-60	A-60	*	A-0
Other machinery spaces (7)	A-15	A-0	A-0	A-0	A-0	A-0 (a)	*(a)	A-0	A-0	*	A-0
Hazardous areas (8)	A-60 (e)	A-0 (e)	A-0 (e)	A-0 (e)	A-0	A-60	A-0	-	A-0	-	A-0
Service spaces (high risk) (9)	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0 (c)	*	A-0
Open decks (10)	*	*	*	*	*	*	*	-	*	-	*
Sanitary and similar spaces (11)	A-0	A-0	*	A-0	*	A-0	A-0	A-0	A-0	*	*
The notes to Tab 3 apply to this table, as appropriate.											

3.2.5 Special requirements for units with diving systems

Enclosed spaces for diving systems are to be separated from any other enclosed space by means of "A-60" divisions. Such spaces are not to be located adjacent to any hazardous area.

3.2.6 Windows, sidescuttles and skylights

a) Windows and sidescuttles , with the exception of navigating bridge windows, are to be of the non-opening type. Navigating bridge windows may be of the opening type provided the design permits rapid closure. The Society may permit windows and sidescuttles outside hazardous areas to be of the opening type.

b) Skylights or windows are not permitted in machinery space of category A boundaries.

c) Windows and sidescuttles in boundaries which are required to meet an "A-60" standard which face the drill floor area should be:

1) constructed to an "A-60" standard; or

2) protected by a water curtain; or

3) fitted with shutters of steel or equivalent material.

3.2.7 Fire resistance of doors

a) The fire resistance of doors is, as far as practicable, to be equivalent to that of the division in which they are fitted.

b) External doors in superstructures and deckhouses are to be constructed to at least "A-0" class standard and be self-closing, where practicable.

c) Self-closing doors in fire rated bulkheads are not to be fitted with hold-back hooks.

However, hold-back arrangements incorporating remote release fittings of the fail-safe type may be utilized.

3.3 Protection of accommodation spaces, service spaces and control stations

3.3.1

All bulkheads that are to be "A" class divisions should extend from deck to deck and to the deckhouse side or other boundaries.

3.3.2 Construction of B class divisions

All bulkheads required to be "B" class divisions are to extend from deck to deck and to the deckhouse side or other boundaries, unless continuous "B" class ceilings or linings are fitted on both sides of the bulkhead, in which case the bulkhead may terminate at the continuous ceiling or lining. In corridor bulkheads, ventilation openings may be permitted only in and under the doors of cabins, public spaces, offices and sanitary spaces. The openings are to be provided only in the lower half of the door. Where such an opening is in or under a door, the total net area of any such opening or openings is not to exceed 0,05 m^2. When such an opening is cut in a door it is to be fitted with a grille made of non-combustible material. Such openings are not to be provided in a door in a division forming a stairway enclosure.

3.3.3 Construction and arrangement of stairways

Stairs are to be constructed of steel or equivalent material.

Stairways which penetrate only a single deck are to be protected at least at one level by "A" or "B" class divisions and self-closing doors so as to limit the rapid spread of fire from one deck to another. Personnel lift trunks are to be protected by "A" class divisions. Stairways and lift trunks which penetrate more than a single deck are to be surrounded by "A" class divisions and protected by self-closing doors at all levels.

3.3.4 Draught stops

Air spaces enclosed behind ceilings, panelling or linings are to be divided by close fitting draught stops spaced not more than 14 m apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., are to be closed at each deck level.

3.3.5 Materials

- Except for insulation in refrigerated compartments, insulation material, pipe and vent duct lagging, ceilings, linings and bulkheads are to be of non-combustible material. Insulation of pipe fittings for cold service systems and vapour barriers and adhesives used in conjunction with insulation need not be non-combustible but they are to be kept to a minimum and their exposed surfaces are to have low flame spread characteristics. In spaces where penetration of oil products is possible, the surfaces of the insulation are to be impervious to oil or oil vapours.
- The framing, including grounds and the joint pieces of bulkheads, linings, ceilings and draught stops are to be of non-combustible material.
- All exposed surfaces in corridors and stairway enclosures and surfaces in concealed or inaccessible spaces in accommodation and service spaces and control stations are to have low flame spread characteristics. Exposed surfaces of ceilings in accommodation and service spaces and control stations are to have low flame spread characteristics.
- Bulkheads, linings and ceilings may have combustible veneers provided that the thickness of such veneers does not exceed 2 mm within any space other than corridors, stairway enclosures and control stations, where the thickness is not to exceed 1,5 mm. Alternatively, veneers which have a calorific value not exceeding 45 mJ/m^2 of the area for the thickness used may be accepted by the Society, irrespective of the thickness of those veneers.
- Primary deck coverings, if applied, are to be of approved material which will not readily ignite or give rise to toxic or explosive hazards at elevated temperatures, this being determined in accordance with the Fire Test Procedures Code.
- Paints, varnishes and other finishes used on exposed interior surfaces are not to offer an undue fire hazard in the judgement of the Society and are not to be capable of producing excessive quantities of smoke, this being determined in accordance with the Fire Test Procedures Code.

3.4 Ventilation systems - General requirements

3.4.1 Ventilation ducts are to be of non-combustible material. Short ducts, however, not generally exceeding 2 m in length and with a cross-sectional area not exceeding 0,02 m^2 need not be non-combustible, subject to the following conditions:

- the ducts are made of a material which has low flame spread characteristics;
- they are only used at the end of the ventilation device;
- they are situated not less than 600 mm, measured along the duct, from where it penetrates any "A" or "B" class division including continuous "B" class ceilings.

3.4.2

Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 m^2 passes through "A" class bulkhead or decks, the opening is to 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 deck pierced.

Where ventilation ducts with a cross-sectional area exceeding 0,02 m^2 pass through class "A" bulkheads or decks, the opening is to be lined with a steel sheet sleeve unless the ducts passing through the bulkheads or decks are of steel in the vicinity of penetrations through the deck or bulkhead; the ducts and sleeves at such places are to comply with the following:

a) The ducts or sleeves are to have a thickness of at least 3 mm and a length of at least 900 mm. When passing through bulkheads, this length is to be divided preferably into 450 mm on each side of the bulkhead. These ducts, or sleeves lining such ducts, are to be provided with fire insulation. The insulation is to have at least the same fire integrity as the bulkhead or deck through which the duct passes. Equivalent penetration protection may be provided to the satisfaction of the Society.

b) In addition to meeting the requirements of item a), ducts with a cross-sectional area exceeding 0,075 m^2, except those serving hazardous areas, are to be fitted with fire dampers. The fire dampers are to operate automatically but are also to be capable of being closed manually from both sides of the bulkhead or deck. Fire dampers are not required, however, where ducts pass through spaces surrounded by "A" class divisions, without serving those spaces, provided such ducts have the same fire integrity as the divisions which they pierce. The Society may, in special cases, permit operation from one side of a division only.

3.4.3

In general, ventilation systems for machinery spaces of category A, galleys and hazardous areas are to be separated from each other and from ventilation systems serving other spaces.

3.4.4 *(1/12013)*
Ducts provided for the ventilation of machinery spaces of Category A, galleys and hazardous areas are not to pass through accommodation spaces, service spaces or control stations. However, except for ducts serving hazardous areas passing through accommodation spaces, control stations and galleys, the Society may permit a relaxation from this requirement, on condition that the ducts are:

a) constructed of steel having a thickness of at least 3 mm for ducts of 300 mm in width or less and of at least 5 mm for ducts of 760 mm in width and over; in the case of ducts the width or diameter of which is between 300 mm and 760 mm, the thickness is to be obtained by interpolation;

b) suitably supported and stiffened;

c) fitted with automatic fire dampers close to the boundaries penetrated; and

d) insulated to "A-60" standard from the machinery spaces or galleys to a point at least 5 m beyond each fire damper; or

e) constructed of steel in accordance with a) and b); and

f) insulated to "A-60" standard throughout the accommodation spaces, service spaces or control stations.

3.4.5
Ducts provided for the ventilation of accommodation spaces, service spaces or control stations are not to pass through machinery spaces of Category A, galleys or hazardous areas. However, the Society may permit a relaxation from this requirement, except for ducts passing through hazardous areas, on condition that:

a) where they pass through a machinery space of Category A or a galley, the ducts are constructed of steel in accordance with [3.4.4] a) and b);

b) automatic fire dampers are fitted close to the boundaries penetrated; and

c) the integrity of the machinery space or galley boundaries is maintained at the penetrations; or

d) where they pass through a machinery space of Category A or a galley, the ducts are constructed of steel in accordance with [3.4.4] a) and b); and

e) they are insulated to "A-60" standard within the machinery space or galley.

3.4.6
Where they pass through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges are to be of equivalent fire integrity to "A" class divisions.

Each such exhaust duct is to be fitted with:

a) a grease trap readily removable for cleaning;

b) a fire damper located in the lower end of the duct which is automatically and remotely operated and, in addition a remotely operated fire damper located in the exhaust end of the duct;

c) arrangements, operable from within the galley, for shutting off the exhaust fans; and

d) fixed means for extinguishing a fire within the duct.

3.4.7 Ventilation ducts with a cross-sectional area exceeding 0,02 m^2 passing through "B" class bulkheads are to be lined with steel sheet sleeves of 900 mm in length divided preferably into 450 mm on each side of the bulkhead, unless the duct is of steel for this length.

3.4.8 The main inlets and outlets of all ventilation systems are to be capable of being closed from outside the spaces being ventilated. Relevant dampers are to be capable of being remotely closed.

3.4.9 Fire dampers and means for closing for ventilation openings fitted in accordance with [3.4] are to be:

a) easily accessible. Where they are placed behind ceilings or linings, these are to be provided with an inspection hatch on which a plate reporting the identification number of the fire damper or means of closing for ventilation openings is provided. The fire damper identification number is also to be placed on any remote controls required; and

b) provided with an indicator which shows their status (open or closed).

3.4.10 The following arrangements are to 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.

3.4.11 Power ventilation of accommodation spaces, service spaces, control stations, machinery spaces and hazardous areas is to be capable of being stopped from an easily accessible position outside the space being served. The accessibility of this position in the event of a fire in the spaces served is to be specially considered. The means provided for stopping the power ventilation serving machinery spaces or hazardous areas are to be entirely separate from the means provided for stopping ventilation of other spaces.

3.4.12 The ventilation of accommodation spaces and control stations is to be arranged in such a way as to prevent the ingress of flammable, toxic or noxious gases, or smoke from surrounding areas.

3.5 Ventilation systems in hazardous spaces

3.5.1 General *(1/7/2022)*

In addition to the requirements set out in [3.4], ventilation systems of hazardous spaces are to meet the following:

a) Hazardous enclosed spaces are to be ventilated; where mechanical ventilation is applied it is to be such that the hazardous enclosed spaces are maintained with underpressure in relation to the less hazardous spaces or areas and non-hazardous enclosed spaces are maintained in overpressure in relation to adjacent hazard locations.

b) Attention is to be given to ventilation inlet and outlet location and airflow in order to minimize the possibility of cross contamination. Inlets are to be located in non-hazardous areas as high and as far away from any hazardous area as practicable. Each air outlet is to be located in an outdoor area which, in the absence of the considered outlet, is of the same or lesser hazard than the ventilated space. Ventilation for hazardous areas is to be completely separate from that used for non-hazardous areas. Where passing through a more hazardous areas, the inlet ducts are also to have overpressure in relation to this area; where the ventilation duct passes through a hazardous area of a lower level, the ventilation duct is to have under pressure in relation to this area.

c) The arrangement of ventilation inlet and outlet openings within an hazardous space is to be such that the entire space is efficiently ventilated, giving special consideration to location of equipment which may release gas, and to spaces where gas may accumulate.

d) The outlet air from Zone 1 and Zone 2 spaces is to be led in separate ducts to outdoor locations. The internal spaces of such ducts belong to the same Zone as the inlet space. Air inlet ducts designed for constant relative underpressures are to be rigidly constructed to avoid air leaks. Fans are to be designed in accordance to [3.5.2] so as to reduce the risk that sparks may occur. Hazardous enclosed mud processing spaces are to be ventilated at a minimum rate of 12 air changes per hour. For the definition of Zone 1 and Zone 2 see Pt C, Ch 2, Sec 1, [3.24.3] of the Rules for the Classification of Ships.

e) Loss of mechanical ventilation in spaces whose classification is dependent on ventilation is to result in:

- immediate remedial action to restore ventilation
- isolation of ignition sources where ventilation can not be restored within a short time, or, immediately, if gas is detected during ventilation failure.

f) Inlet and outlet ventilation openings are to be fitted with metallic dampers provided with "open" and "closed" indication. These dampers are to be arranged in the open, in a readily accessible position.

3.5.2 Non-sparking fans

Fans and blowers are not to produce a source of vapour ignition in either the ventilated space or the ventilation system associated with the ventilated space. They are to be certified as non-sparking type in compliance with the following requirements. Item b) of this item applies also to ducts in way of fans and blowers.

a) Design criteria

- The air gap between the impeller and the casing is to be not less than 1/10 of the shaft diameter in way of the impeller bearing and in any case not less than 2 mm, but need not exceed 13 mm.
- Protective screens with square mesh of not more than 13 mm are to be fitted to the inlet and outlet of ventilation ducts to prevent objects entering the fan housing.
- The shafting penetration of motors driving fans through bulkheads and decks of dangerous spaces or through ventilation ducts is to be fitted with a gas-tight sealing device, of the oil-seal type or equivalent, deemed suitable by the Society.

b) Materials

- Except as indicated in the last line of the third bullet below, the impeller and the housing in way of the impeller are to be made of spark-proof materials which are recognised as such by means of an appropriate test to the satisfaction of the Society.
- Electrostatic charges, both in the rotating body and the casing, are to be prevented by the use of anti-static materials. Furthermore, the installation on board of ventilation units is to be such as to ensure their safe bonding to the hull.
- Tests may not be required for fans having the following material combinations:
  - impellers and/or housings of non-metallic material, due regard being paid to the elimination of static electricity
  - impellers and housings of non-ferrous materials
  - impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on which a ring of suitable thickness of non-ferrous material is fitted in way of the impeller
  - any combination of ferrous (including austenitic stainless steel) impellers and housings with not less than 13 mm design tip clearance.
- The following impeller and housing combinations are considered as sparking and therefore are not permitted:
  - impellers of an aluminium alloy or a magnesium alloy and a ferrous housing, regardless of tip clearance
  - housings made of an aluminium alloy or a magnesium alloy and a ferrous impeller, regardless of tip clearance
  - any combination of ferrous impeller and housing with less than 13 mm design tip clearance.

3.6 Ventilation systems in non-hazardous spaces located within Zone 1 and Zone 2

3.6.1 With reference to the provisions for electrical installations contained in Part E of these Rules, depending on the service notation assigned to the unit, any enclosed non-hazardous space which needs to be protected in overpressure in way of the adjacent Zone 1 and Zone 2 areas is to comply with the following provisions.

3.6.2 Ventilation openings are to be located in non-hazardous areas.

3.6.3 Alarms and isolation of ignition sources are to be initiated on detection of an explosive atmosphere adjacent

to the ventilation air inlets, in accordance with the shutdown philosophy for the unit or installation.

3.6.4 The ventilation system is to be suitable to maintain at least 50 Pa overpressure with respect to the external hazardous areas when all penetrations are closed and to maintain an outward air flow through all openings (single or multiple penetrations) of the enclosed space.

3.6.5 In order to check that the overpressure is maintained, either a pressure monitoring device or a flow monitoring device (or both) is to be used.

3.6.6 Failure of overpressure ventilation is to be alarmed at a manned location. Alarm delay to avoid spurious intervention is acceptable.

3.6.7 As far as the actions to be taken in consequence of the loss of overpressure are concerned, reference may be made to IEC 61892-7.

3.6.8 The space is to be purged and verified as gas-free before uncertified electrical equipment or other ignition sources are energised after loss of overpressure

4 Means of escape

4.1 General

4.1.1 Lifts are not to be considered as forming one of the required means of escape.

4.1.2 In general, stairs, corridors and doorways forming part of an escape path are to have a width of not less than 700 mm.

4.2 Means of escape within accommodation space, service spaces ,control stations

4.2.1

Within the accommodation spaces, service spaces and control stations the following requirements are to be applied:

a) In every general area which is likely to be regularly manned or in which personnel are accommodated, at least two separate escape routes are to be provided, situated as far apart as practicable, to allow ready means of escape to the open decks and embarkation stations.

   Exceptionally, the Society may permit only one means of escape, due regard being paid to the nature and location of spaces and to the number of persons who might normally be accommodated or employed there.

b) Stairways should normally be used for means of vertical escape; however, a vertical ladder may be used for one of the means of escape when the installation of a stairway is shown to be impracticable.

c) Every escape route is to be readily accessible and unobstructed and all exit doors along the route are to be readily.

   Dead-end corridors exceeding 7 m in length are not permitted.

d) for units to which the Service Notation **MODU** is assigned, in addition to the emergency lighting, the means of escape in accommodation areas, including stairways and exits, are to be marked by lighting or photoluminescent strip indicators placed not more than 300 mm above the deck at all points of the escape route, including angles and intersections. The marking is to enable personnel to identify the routes of escape and readily identify the escape exits. If electric illumination is used, it is to be supplied by the emergency source of power and it is to be so arranged that the failure of any single light or cut in a lighting strip will not result in the marking being ineffective. Additionally, escape route signs and fire equipment location markings are to be of photoluminescent material or marked by lighting. Such lighting or photoluminescent equipment is to be evaluated, tested and applied in accordance with the Fire Safety System Code. The application of this item to units to which the Service Notations **FPSO** and **FSO** are assigned will be considered by the Society taking into account the accommodation lay-out and number of personnel employed.

4.3 Means of escape within machinery spaces

4.3.1

Two means of escape are to be provided from every machinery space of Category A by one of the following:

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 is to located within a protected enclosure that satisfies tables 3 and 4, category (4), from the lower part of the space to a safe position outside the space. Self-closing fire doors of the same fire integrity standards should be fitted in the enclosure. The ladder should be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The enclosure should have minimum internal dimensions of at least 800 mm by 800 mm, and should have emergency lighting provisions; or

b) one steel ladder 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 ladder 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.

Exceptionally, the Society may consider arrangements different from those described in a) and b), above, due regard being paid to the nature and location of spaces and

to the number of persons who might normally be employed there.

4.3.2 From machinery spaces other than those of Category A, escape routes are to be provided to the satisfaction of the Society having regard to the nature and location of the space and whether persons are normally employed there.

4.4 Means of escape from other spaces of the unit

4.4.1 Working areas which are continuously or periodically manned are to comply with item [4.2.1] as far as practicable. In particular, it to be minimized the possibility that both escape routes are impaired by a single casualty.

4.4.2 Considerations are to be made, in order to ensure that, as far as practicable, in case of fire at the drill floor or at the cargo area at least one escape route to the embarkation position on the survival crafts is protected against radiation effects of the fire.

5 Active fire protection

5.1 Fire pumps, fire mains, hydrants and hoses

5.1.1 Fire pumps *(1/1/2023)*

a) There are to be at least two independently driven fire pumps. The pumps, their source of power and piping and valves are to be so arranged that a fire or flooding in any one compartment will not put all fire pumps out of action.

b) At least one of the required pumps is to be dedicated to fire-fighting duties and be available for such duties at all times.

c) The arrangements of the pumps, sea suctions and sources of power are to be such as to ensure that a fire in any one space would not put both the required pumps out of action. At least two water supply sources (sea chests, valves, strainers and pipes) are to be provided and so arranged that one supply source failure will not put all supply sources out of action.

For the self-elevating units, the following additional fire water supply measures are to be provided:

- water is to be supplied from sea water main filled by at least two submersible pumping systems. One system failure will not put the other system(s) out of function, and
- water is to be supplied from drill water system while unit lifting or lowering. Water stored in the drill water tank(s) is not less than 40 m^3 plus engine cooling water consumptions before unit lifting or lowering. Alternatively, water may be supplied from buffer tank(s) in which sea water stored is not less the quantity as the above mentioned.

d) The capacity of the required pumps is to be appropriate to the fire-fighting services supplied from the fire main. Where more pumps than required are installed, their capacity is to be to the satisfaction of the Society; in general, each fire pump is to have a capacity of at least 50 m^3/h. Higher capacity may be required by the Society depending on unit dimensions.

e) Each pump is to be able to maintain a pressure of at least 350 kPa at any hydrants with two 19 mm nozzles in action.

f) In addition, where a foam system is provided for protection of the helideck, the pump is to be capable of maintaining a pressure of 700 kPa at the foam installation and the water consumption used for the foam system is to be added to the pump capacity. If the water consumption for any other fire protection or fire-fighting purpose should exceed the rate of the helideck foam installation, this consumption is to be the determining factor in calculating the required capacity of the fire pumps.

g) Where either of the required pumps is located in a space not normally manned and, in the opinion of the Society, is relatively far removed from working areas, suitable provision is to be made for remote start-up of that pump and remote operation of associated suction and discharge valves.

h) Except as provided for in b), sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil.

i) Every centrifugal pump which is connected to the fire main is to be fitted with a non-return valve.

j) The sea section of fire pumps is to be provided with strainers and other suitable means for avoiding marine growth that may impair fire water system performance.

k) Relief valves are to be provided in conjunction with all pumps connected to the fire main if the pumps are capable of developing a pressure exceeding the design pressure of the fire main, hydrants and hoses. Such valves are to be so placed and adjusted as to prevent excessive pressure in the fire main system.

l) The status of the pumps is to be indicated at the central control station. Alarms are to be provided to indicate the intervention of any pump.

5.1.2 Fire main and connected piping

a) A fixed fire main is to be provided and be so equipped and arranged as to meet the requirements of this item [5.1.2] and item [5.1.3].

b) The diameter of the fire main and water service pipes is to be sufficient for the effective distribution of the maximum required discharge from the required fire pumps operating simultaneously.

c) With the required fire pumps operating simultaneously, the pressure maintained in the fire mains is to be to the satisfaction of the Society and be adequate for the safe and efficient operation of all equipment supplied therefrom.

d) The fire main is to, where practicable, be routed clear of hazardous areas and be arranged in such a manner as to make maximum use of any thermal shielding or physical protection afforded by the structure of the unit.

In this respect, the fire main is to be designed in such a way that any part of the drilling floor, tank area, storage area and areas of loading and discharge manifolds may be reached by water supplied by separated branch pipes.

e) The fire main is to be provided with isolating valves located so as to permit optimum utilization in the event of physical damage to any part of the main. Valves for dividing different branch pipes are to be located in a safe position near the accommodation areas.

Valves are also to be placed in a position readily accessible for operation. Where the isolating valves are remotely operated, they are to be capable of being manually opened as well.

f) The fire main is not to have connections other than those necessary for fire-fighting purposes.

g) All practical precautions consistent with having water readily available are to be taken to protect the fire main against freezing.

h) Materials readily rendered ineffective by heat are not be used for fire mains and hydrants unless adequately protected. The pipes and hydrants are to be so placed that the fire hoses may be easily coupled to them.

i) A cock or valve is to be fitted to serve each fire hose so that any fire hose may be removed while the fire pumps are operating.

5.1.3 Hydrants and fire hoses

a) The number and position of the hydrants are to be such that:

- at least two jets of water, not emanating from the same hydrant, one of which is to be from a single length of fire hose, may reach any part of the unit normally accessible to those on board while the unit is being navigated or is engaged in normal operations; and
- any part of drill floor and cargo area is to be reached by four streams of water (two couples fed by different branch pipes), two of which (one from each branch pipe) emanating from a single length of hose.

b) A hose is to be provided for every hydrant.

c) Fire hoses are to be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Their maximum length is to be to the satisfaction of the Society. Every fire hose is to be provided with a dual purpose nozzle (i.e. spray/jet type) and the necessary couplings. Fire hoses, together with any necessary fittings and tools, are to be ready for use at any time and are to be kept in conspicuous positions near the water service hydrants or connections.

d) Fire hoses are to have a length of at least 10 m, but not more than:

1) 15 m in machinery spaces;

2) 20 m in other spaces and open decks; and

3) 25 m for open decks on units with a maximum breath in excess of 30 m.

5.1.4 Nozzles

a) Dual purpose jet spray nozzles are to be fitted throughout the unit.

b) Standard nozzle sizes are to be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles may be permitted at the discretion of the Society.

c) For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.

d) For machinery spaces and exterior locations, the nozzle size is to be such as to obtain the maximum discharge possible from two jets at the pressure specified in [5.1.1] e) from the smallest pump, provided that a nozzle size greater than 19 mm does not need to be used.

5.1.5 International shore connection

a) The surface unit is to be provided with at least one international shore connection complying with SOLAS regulation II-2/10.1.7 and the Fire Safety System Code.

b) Facilities are to be available enabling such a connection to be used on any side of the unit.

5.2 Fire-extinguishing systems in machinery spaces and in spaces containing fired processes

5.2.1

a) In spaces where main or auxiliary oil fired boilers and other fired processes of equivalent thermal rating are situated, or in spaces containing fuel oil units or settling tanks, the unit is to be provided with the following:

1) One of the following fixed fire-extinguishing systems complying with SOLAS regulation II-2/10.4:

- a fixed gas fire-extinguishing system;
- a fixed high expansion foam installation;
- a fixed pressure water-spraying system.

Where the machinery space and spaces containing fired process systems are not entirely separate, or if fuel oil can drain from the latter spaces into the machinery space, the combined machinery space and fired process space are to be considered as one compartment.

2) At least two approved portable foam extinguishers or equivalent in each space containing a fired process and each space in which a part of the oil fuel installation is situated. In addition, at least one extinguisher of the same description with a capacity of 9 l for each burner, whereby the total capacity of the additional extinguisher or extinguishers need not exceed 45 l for any one space.

3) A receptacle containing at least 0,1 m^3 of sand, sawdust impregnated with soda, or other approved dry material in such quantity as may be required by the Society. An approved portable extinguisher may be provided as an alternative.

b) Spaces containing internal combustion machinery used either for main propulsion or for other purposes, when such machinery has a total power output of not less than

750 kW, are to be provided with the following arrangements:

1) one of the fixed arrangements required by a)1); and

2) one approved foam-type extinguisher of not less than 45 litres capacity or equivalent in every engine space and one approved portable foam extinguisher for each 750 kW of engine power output or part thereof. The total number of portable extinguishers so supplied is to be not less than two and need not exceed six;

c) The Society will give special consideration to the fire-extinguishing arrangements to be provided in spaces not fitted with fixed fire-extinguishing installations containing steam turbines which are separated from boiler rooms by watertight bulkheads. In any case, in proximity of the main switchboard and in proximity of any other electric panel or sub-panel of power not less than 20 kW a carbon dioxide portable extinguisher is to be provided.

d) Where, in the opinion of the Society, a fire hazard exists in any machinery space for which no specific provisions for fire-extinguishing appliances are prescribed in items a) to c), a number of approved portable fire extinguishers or other means of fire extinction are to be provided in, or adjacent to, that space to the satisfaction of the Society.

5.2.2

a) Machinery spaces of category A above 500 m^3 in volume are, in addition to the fixed fire-extinguishing system required in the previous item a), to be protected by an approved type of fixed water-based or equivalent local application fire-fighting system, based on international standards acceptable to the Society (see Note 1).

b) In the case of periodically unattended machinery spaces, the fire-fighting system is to have both automatic and manual release capabilities. In the case of continuously manned machinery spaces, the fire-fighting system is only required to have a manual release capability. The automatic activation of the system may be achieved by means of a detection system capable of reliably identifying the protected area. The possibility of false alarms is to be taken into consideration when designing such an arrangement.

Note 1: Refer to the Guidelines for the approval of fixed waterbased local application fire-fighting systems for use in category A (MSC/Circ. 913)

c) Fixed local application fire-fighting systems are to protect areas such as the following without the necessity of engine shutdown, personnel evacuation, or sealing of the spaces:

- the fire hazard portions of internal combustion machinery used for the unit's main propulsion and power generation;
- boiler fronts;
- the fire hazard portions of incinerators; and
- purifiers for heated fuel oil.

Other specific areas may be identified by the Society, considering the unit's characteristics.

d) Activation of any local application system is to give a visual and distinct audible alarm in the protected space and at continuously manned stations or other suitable locations to the satisfaction of the Society. The alarm is to indicate the specific system activated. The system alarm requirements described in this item are in addition to, and not a substitute for, the detection and fire alarm system required elsewhere in these Rules. Grouped visual and audible alarms, as well as indication of the activated zone, are to be provided in each protected space, in the engine control room, if any, and in the continuously manned stations or other suitable locations to the satisfaction of the Society.

5.3 Additional fire fighting requirements for periodically unattended machinery spaces

5.3.1 An approved fixed fire-extinguishing system is to be provided in units that are not required to have this provision by item [5.2].

5.3.2 Provision are to be made for immediate water delivery from the fire main system at a suitable pressure, due regard being paid to the possibility of freezing, either:

a) by remote starting arrangements for one of the main fire pumps. The starting positions is to be provided at strategic locations including the navigating bridge, or

b) by permanent pressurization of the fire main system, either

- by one of the main fire pumps; or
- by a dedicated pump for the purpose with automatic starting of one of the main fire pumps on reduction of the pressure.

5.3.3 Special consideration are to be made to maintain the fire integrity of the machinery spaces, to the location and centralization of the fire-extinguishing system controls and to the required shutdown arrangements (e.g., ventilation, fuel pumps, etc.); the Society may require additional fire-extinguishing appliances and other fire-fighting equipment and breathing apparatus, upon case by case considerations.

5.4 Fire-extinguishing systems for galley deep-fat cooking equipment

5.4.1

Deep-fat cooking equipment is to be fitted with the following:

a) an automatic or manual extinguishing system tested to an international standard acceptable to the Society (see Note 1);

b) a primary and backup thermostat with an alarm to alert the operator in the event of failure of either thermostat;

c) arrangements for automatically shutting off the electrical power upon activation of the extinguishing system;

d) an alarm for indicating operation of the extinguishing system in the galley where the equipment is installed; and

e) controls for manual operation of the extinguishing system which are clearly labelled for ready use by the crew.

Note 1: Refer to the recommendations by the International Organization for Standardization, in particular, Publication ISO 15371:2009 on Fire-extinguishing systems for protection of galley deep-fat cooking equipment.

5.5 Fire-extinguishing systems for service spaces containing flammable liquids

5.5.1 Paint lockers are to be protected by:

- a carbon dioxide system, designed to give a minimum volume of free gas equal to 40% of the gross volume of the protected space;
- a dry powder system, designed for at least 0,5 kg powder/m^3;
- a water-spraying or sprinkler system, designed for 5 l/m^2min. Water-spraying systems may be connected to the fire main of the unit; or
- a system providing equivalent protection, as determined by the Society.

In any case, the system is to be operable from outside the protected space.

5.5.2 Flammable liquid lockers are to be protected by an appropriate fire-extinguishing arrangement approved by the Society. However, areas or spaces intended for the storage of oxygen and acetylene cylinders are to be protected by a water spraying or sprinkler system, designed for 10 l/m^2/min. Water spraying systems may be connected to the fire main of the unit.

5.5.3 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 is to be arranged in the locker to allow the discharge of the extinguisher without having to enter the protected space. The required portable fire extinguisher is to be stowed adjacent to the port. Alternatively, a port or hose connection may be provided to facilitate the use of fire main water.

5.6 Additional fire-extinguishing systems on units to which the Service Notation MODU is assigned

5.6.1

Fixed fire extinguishing systems on drilling and areas.

The following arrangements are to be available:

- a fixed water spray system is to be provided to protect drilling area. The minimum water application rate is not less than 20,4 l/min·m^2, or
- at least two dual-purpose (jet/spray) fire monitors are to be installed to cover drilling and well test areas. The minimum capacity of each monitor is not less than 100m^3/h. The monitors may be operated either remotely or locally. Monitor arranged for local operation should be sited on an accessible protected position.

5.6.2 Fixed fire extinguishing systems on mud processing area

A suitable fixed foam system is to be provided. The system is to be capable of delivering foam solution at a rate of not less than 6,5 l/min m^2 (4,1 l/min m^2 for Aqueous Film Forming Foam or Film-Forming Fluoroprotein Foam) for 15 minutes. Alternatively, a gas fixed fire extinguishing system may be used for enclosed mud processing spaces.

5.7 Portable fire extinguishers in accommodation, service and working spaces

5.7.1

Except for the supplemental arrangements provided in item [5.6.2], the accommodation, service and working spaces are to be provided with approved portable fire extinguishers to the satisfaction of the Society. In this respect, the requirements of IMO MSC Circular 1275 are to be followed, as applicable.

5.7.2

Table 5 contains supplemental recommendations for number and distribution of additional portable fire extinguishers on mobile offshore drilling units. Where the recommendations in Table 5 differ from the guidance provided by IMO MSC Circular 1275, the provisions of Table 5 is to be followed. In all cases, the selection of the fire extinguishing medium should be based on the fire hazard for the space protected. The classes of portable fire extinguishers in the table are only for reference.

5.8 Miscellaneous items

5.8.1 General

Fire-extinguishing appliances are to be kept in good order and are to be available for immediate use at all times.

5.8.2 Fire-fighter's outfits

a) At least two fire-fighter's outfits and two sets of personal equipment, complying with Chapter 3 of the Fire Safety Systems Code, are to be provided, each with portable

instruments for measuring oxygen and flammable vapour concentrations acceptable to the Society.

b) Two spare charges are to be provided for each required breathing apparatus. Units that are equipped with suitably located means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus.

c) The firefighter's outfits are to be kept ready for use in an easily accessible location that is permanently and clearly marked. They are be stored in two or more widely separated locations.

d) The apparatus for recharging air cylinders, if provided, is to be at the satisfaction of the Society and complying with the following:
- have its power supplied from the emergency supply or be independently diesel-powered, or be so constructed or equipped that the air cylinders may be used immediately after recharging;
- be suitably located in a sheltered space above main deck level on the unit;
- have intakes for air compressors drawing from a source of clean air;
- the air should be filtered after compression to eliminate compressor oil contamination;
- have recharging capacity meeting the requirements of SOLAS regulation II-2/10.10.2.6.

Table 5 : Number and distribution of additional portable extinguishers

Type of space	Minimum number of extinguishers **(1)**	Class(es) of extinguisher(s)
Space containing the controls for the main source of electrical power	1; and 1 additional extinguisher suitable for electrical fires when main switchboards are arranged in the space	A and/or C
Cranes: With electric motors/hydraulics	0	
Cranes: With internal combustion engine	2 (1 in cab and 1 at exterior of engine compartment)	B
Drill floor	2 (1 at each exit)	C
Helideks	In accordance with Pt F, Ch 5, Sec 4	B
Machinery spaces of category A	In accordance with item [5.2]	B
Machinery spaces of category A which are periodically unattended	At each entrance in accordance with item [5.2] **(2)**	B
Main switchboards	2 in the vicinity	C
Mud pits, Mud processing areas	1 for each enclosed space (Travel distance to an extinguisher not to exceed 10 m for open space)	B

(1) Minimum size should be in accordance with paragraph 3.1.1 of chapter 4 of the FSS Code.

(2) A portable extinguisher provided for that space may be located outside near the entrance to that space. A portable fire extinguisher placed outside near the entrance to that space may also be considered as satisfying the provisions for the space in which it is located.

5.8.3 Arrangements in machinery and working spaces

a) Means are to be provided for stopping ventilating fans serving machinery and working spaces and for closing all doorways, ventilators, annular spaces around funnels and other openings to such spaces. These means are to be capable of being operated from outside such spaces in case of fire.

b) Machinery driving forced and induced draught fans, electric motor pressurization fans, fuel oil transfer pumps, fuel oil unit pumps and other similar fuel pumps is to be fitted with remote controls situated outside the space concerned so that it may be stopped in the event of a fire arising in the space in which it is located.

c) Every fuel oil suction pipe from a storage, settling or daily service tank situated above the double bottom is to be fitted with a cock or valve capable of being closed from outside the space concerned in the event of a fire arising in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel, valves are to be fitted on the tanks but control in the event of fire may be effected by means of an additional valve on the pipeline or lines outside the tunnel(s).

5.8.4 Storage of gas cylinders

Where more than one cylinder of oxygen and more than one cylinder of acetylene are carried simultaneously, such cylinders are to be arranged in accordance with the following:

a) Permanent piping systems for oxyacetylene systems are acceptable provided that they are designed having due regard to standards and codes of practice to the satisfaction of the Society.

b) Where two or more cylinders of each gas are intended to be carried in enclosed spaces, separate dedicated storage rooms are to be provided for each gas.

c) Storage rooms are to be constructed of steel, and be well ventilated and accessible from the open deck.

d) Provision is to be made for the expeditious removal of cylinders in the event of fire.

e) "NO SMOKING" signs are to be displayed in the gas cylinder storage rooms.

f) Where cylinders are stowed in open locations means are to be provided to:

- Protect cylinders and associated piping from physical damage;
- Minimize exposure to hydrocarbons; and
- Ensure suitable drainage.

g) Fire-extinguishing arrangements for the protection of areas or spaces where such cylinders are stored is to be to the satisfaction of the Society (see [5.5.2]).

5.8.5 Fire control plan

A fire control plan complying with the requirements of SOLAS Convention regulation II-2/15.2.4 is to be permanently exhibited.

Alternatively, at the discretion of the Society, the information required to be shown on the Fire control Plan may be set out in a booklet a copy of which is to be supplied to each officer, and one copy is to be available at all times on board in an accessible position. Plans and booklets are to be kept up to date, any alterations being recorded thereon as soon as practicable. Description in such plans and booklets are to be in the official language of the flag state. If the language is neither English nor French, a translation into one of those languages is to be included. In addition, instructions concerning the maintenance and operation of all the equipment and installations on board for the fighting and containment of fire are to be kept under one cover, readily available in an accessible position.

6 Fire and gas detection

6.1 Fire detection and alarm system

6.1.1 General

The installation and testing of fire detection systems is to be in accordance with this article and with Chapter 9 of the Fire Safety Systems Code.

Spaces having a fire risk, in principle, should be provided with an automatic fire detection and alarm system.

In selecting the type of detectors, their following features are to be taken into account:

a) capability to detect fire at the incipient stage;

b) ability to avoid spurious alarm and trips; and

c) suitability to the located environment.

The fire detection control panel is to be located at a manned control station and is to be capabale to indicate where fire has been detected.

6.1.2 Manual operated alarm system

Sufficient manual fire alarm stations are to be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point is to be located at each exit. Manually operated call points are to be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m from a manually operated call point. Measures are to be taken to prevent inadvertent operation of the manual call alarm system.

6.1.3 Accommodation and service spaces

An automatic fire detection and alarm system is to be provided in all accommodation and service spaces. Accommodation spaces and sleeping quarters are to be fitted with smoke detectors. Thermal detectors are to be fitted in galleys.

6.1.4 Machinery spaces and periodically unattended machinery spaces

a) Installation of a fire detection system

A fixed fire detection and fire alarm system should be installed in:

1) periodically unattended machinery spaces; and

2) machinery spaces where:

- the installation of automatic and remote control system and equipments has been approved in lieu of continuous manning of the spaces, and
- the main propulsion and associated machinery, including the main sources of electrical power, are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room.

b) Additional requirements

- Means are to be provided in case of fire:
  - in boiler air supply casings and exhausts (uptakes); and
  - in scavenging air belts of propulsion machinery

to detect fires and give alarms at an early stage, unless the Society considers this to be unnecessary in a particular case.

- Internal combustion engines of 2250 kW and above or having cylinders of more than 300 mm bore is to be provided with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices.

6.1.5 Electrical rooms and control stations

Smoke detectors are to be provided in all electrical rooms and control stations.

6.1.6 Drilling and mud processing areas

Flame or thermal detectors are to be installed in open drilling and/or mud processing areas.

Smoke detectors may be used in enclosed mud processing areas.

6.2 Gas detection and alarm

6.2.1 General *(1/1/2023)*

A fixed automatic gas detection and alarm system is to be provided to the satisfaction of the Society so arranged as to monitor continuously all enclosed spaces and other areas of the unit in which an accumulation of flammable gas may be expected to occur and capable of indicating at the main control stations, on the drill floor and at the required emergency control stations, by acoustic and visual means, the presence and location of an accumulation. The system is to be so designed to allow testing without interrupting other systems on board. The flammable gas detectors are to actuate the alarm at not more than 25% and at 60% of the lower explosive limit (LEL). At least two portable combustible gas detectors are to be provided, each capable of accurately measuring a concentration of flammable gas.

6.2.2 Additional requirements for units to which the Service Notation MODU is assigned *(1/1/2023)*

In addition to item [6.2.1], on units to which the Service Notation MODU is assigned the fixed automatic gas detection and alarm systems is to be arranged as to cover the following areas:

- Cellar deck;
- Drill floor;
- Ventilation intake of positive pressure driller's cabin;
- Mud pit area;
- Shale shaker area;
- Enclosed spaces containing the open components of mud circulation system from the bell nipple to the mud pits;
- Ventilation intakes of accommodation spaces;
- Ventilation intakes of enclosed machinery spaces contiguous to hazardous areas and containing internal combustion engines, boilers, or non-explosion proof electrical equipment;
- Air intakes to all combustion engines or machinery, including internal combustion engines, boilers, compressors or turbines, located outside of an enclosed machinery space;
- At each access door to accommodation spaces;
- Near other openings, including emergency egress, of accommodation spaces, regardless if these openings are fitted with self-closing and gastight closing appliances.

Fixed automatic gas detection and alarm systems are not required:

a) Near access doors to accommodation spaces where these form part of an air-lock which is provided with a gas detection and alarm system between the two doors of the air-lock;

b) Near emergency egress doors which are fitted with a mechanism to prevent use other than in an emergency (e.g. doors fitted with security seals acting as a deterrent but easily breakable in a real emergency);

c) Near other openings which are provided with closing appliances of non-opening type, e.g. bolted closed maintenance ways etc.

6.2.3 Gas analysing units of the sampling type

When the gas detection is performed by means of gas analysing units of the sampling type, the analysing units with non-explosion proof measuring equipment may be located in areas outside hazardous cargo areas, e.g. in cargo control room, navigation bridge or engine room when mounted on the forward bulkhead provided the following requirements are observed:

a) Sampling lines shall not run through gas safe spaces, except where permitted under e).

b) The gas sampling pipes shall be equipped with flame arresters. Sample gas is to be led to the atmosphere with outlets arranged in a safe location.

c) Bulkhead penetrations of sample pipes between safe and dangerous areas shall be of approved type and have same fire integrity as the division penetrated. A manual isolating valve shall be fitted in each of the sampling lines at the bulkhead on the gas safe side.

d) The gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc. shall be located in a reasonably gas tight enclosure (e.g. a fully enclosed steel cabinet with a gasketed door) which is to be monitored by its own sampling point. At gas concentrations above 30% LFL inside the enclosure the entire gas analysing unit is to be automatically shut down.

e) Where the enclosure cannot be arranged directly on the bulkhead, sample pipes shall be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and analysing units, and are to be routed on their shortest ways.

6.3 Hydrogen sulphide detection and alarm system

6.3.1

On units to which the Service Notation MODU is assigned a fixed automatic hydrogen sulphide gas detection and alarm system is to be provided to the satisfaction of the Society so arranged as to monitor continuously the following areas:

a) Drill area;

b) Mud processing area; and

c) Well test area.

The detectors are to be connected to an audible and visual alarm system with indicators in main control room. The system is clearly to indicate where gas has been detected.

Low level alarm set at 10 ppm and high level alarm set not higher than 300 ppm are to be designed. The high level alarm is to activate an evacuation alarm.

If the alarm at the main control point is unanswered within 2 min, the toxic gas (hydrogen sulphide) alarm and the helideck status light under Pr F, Ch 5, Sc 2 [4.3] is to be automatically activated.

6.4 Emergency escape breating devices

6.4.1

Emergency escape breathing devices (EEBDs) are to comply with the FSS Code. Spare emergency escape breathing devices are to be kept on board to the satisfaction of the Society.

6.4.2

Emergency escape breathing devices should be provided as follows:

a) in machinery spaces of category A containing internal combustion machinery used for main propulsion, EEBDs are to be positioned as follows:

- one EEBD in the engine control room, if located within the machinery space;
- one EEBD in workshop areas. If there is, however, a direct access to an escape way from the workshop, an EEBD is not required; and
- one EEBD on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).

Alternatively, a different number or location may be determined by the Society taking into consideration the layout and dimensions or the normal manning of the space.

b) For machinery spaces of category A other than those containing internal combustion machinery used for main propulsion, one EEBD is, as a minimum, to be provided on each deck or platform level near the escape ladder constituting the second means of escape from the space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).

c) For other machinery spaces, the number and location of EEBDs are to be determined by the Society.

6.5 Respiratory protection equipment for hydrogen sulphide

6.5.1

On units to which the Service Notation MODU is assigned:

a) a self-contained breathing apparatus (SCBA) positive-pressure/pressure-demand breathing equipment with full-face piece and rated for a minimum of 30 minutes is to be provided for each person in working areas where hydrogen sulphide may be encountered, and each person in other areas is to be provided with a SCBA rated for a minimum of 15 minutes, or

b) a positive-pressure/pressure-demand air line breathing equipment coupled with a SCBA equipped low pressure warning alarm and rated for a minimum of 15 minutes is to be provided for each person on board the unit

c) Breathing air supply line stations are to be provided at least in the following areas:

1) Living quarter;
2) Muster/evacuation area;
3) Drilling areas;
4) Mud processing areas; and
5) Other working areas.

6.6 Alarms and public address

6.6.1 General alarm

a) A general alarm system is to be provided and so installed as to be clearly perceptible in all parts of the unit. Alarm signal devices are to be provided which will produce a distinctive and strong note.

The signals used should be limited to: general emergency, toxic gas (hydrogen sulphide), combustible gas, fire alarm and abandon unit signals.

The signals given over the general alarm system should be supplemented by instructions over the public address system.

b) At least in the following spaces general alarm is to be capable of being operated:

1) Main control station;
2) Drilling console;
3) Navigating bridge (if any); and
4) Fire control station (if any).

6.6.2 Mud system level alarms

A suitable audible and visual alarm to indicate significant increase or decrease in the level of the contents of the mud pit is to be provided at the control station for drilling operations and at the mud pit. Equivalent means to indicate possible abnormal conditions in the drilling system may be considered by the Society.

6.6.3 Ventilation system alarm

See Part E, Ch 4, Sec 5, [5.3.8].

6.6.4 Public address

a) The public address system is to be a loudspeaker installation enabling the broadcast of messages into all spaces where personnel are normally present and muster stations. It is to allow for the broadcast of messages from navigation bridge, central control room, emergency response centre, engine control room, ballast control station, jacking control station and drilling console. It is to be installed with regard to acoustically marginal conditions and not require any action from the addressee. It is to be protected against unauthorized use.

b) The minimum sound pressure levels for broadcasting emergency announcements are to be:

1) In interior spaces 75dB(A) and at least 20dB(A) above the speech interference level; and

2) In exterior spaces 80dB(A) and at least 15dB(A) above the speech interference level.

Part C
Machinery, Systems and Fire Protection

Chapter 5

HYDROCARBON IMPORT AND EXPORT SYSTEMS

SECTION 1 GENERAL REQUIREMENTS

1 General

1.1 Application

1.1.1 The requirements of this Chapter apply to the systems intended to load, unload and transfer on board non processed hydrocarbons and transfer and unload processed hydrocarbons, including loading arms and hoses.

1.2 Documenation to be submitted

1.2.1 Documentation to be submitted

Tab 1 lists the plans, information, analysis, etc. which are to be submitted in addition to the information required in the other Parts of the Rules.

1.3 Additional information

1.3.1 The information listed in Tab 2 is also to be submitted.

Table 1 : Documents to be submitted

No.	I/A **(1)**	Document **(2)**
1	I	Characteristics of hydrocarbons to be handled
2	I	General arrangement plan, showing location of oil cargo tanks and fuel oil, ballast and other tanks
3	I	General arrangement plan, showing location of liquefied petroleum gas and natural gas cargo tanks and fuel oil, ballast and other tank
4	I	General layout of oil pump room with details of: • bulkhead penetrations • gas detection system • other alarms and safety arrangements
5	I	General layout of liquefied petroleum gas and natural gas compressor and pump rooms with details of: • bulkhead penetrations • gas detection system • other alarms and safety arrangements including ESD system
6	A	Diagram of oil piping system
7	A	Diagram of liquefied petroleum gas and natural gas piping system (liquid and vapor phase)
8	A	Details of liquefied gas pumps and cargo compressors
9	A	Loading and unloading operation description for liquefied petroleum gas and natural gases, including cargo tank filling limits
10	A	Constructional drawings of loading/unloading arms for liquefied petroleum gases and natural gases
11	A	Constructional drawings of transfer hoses for oil and for liquefied petroleum gases and natural gases

(1) A = to be submitted for approval in four copies
I = to be submitted for information in duplicate

(2) Diagrams are also to include, where applicable, the (local and remote) control and monitoring systems and automation systems

Table 2 : Information to be submitted

No.	I/A **(1)**	Document
1	A	Nature and service temperature and pressure of the fluids in particular at the inlet and outlet of main components
2	A	Material, external diameter and wall thickness of the pipes
3	A	Type of the connections between pipe lengths, including details of the weldings, where provided
4	A	Material, type and size of the accessories
5	A	Capacity, prime mover and, when requested, location of the pumps and compressors
6	A	For plastic pipes: • the chemical composition • the physical and mechanical characteristics in function of temperature • the characteristics of inflammability and fire resistance • the resistance to the products intended to be conveyed
(1) A = to be submitted for approval, in four copies; I = to be submitted for information, in duplicate.		

1.4 Operation in inclined position

1.4.1 Hydrocarbon import and export systems are to be designed to operate when the unit is upright and when inclined at any angle of list either way and trim by bow or stern as stated in Tab 1 of Pt C, Ch 1, Sec 1 of the Rules for the Classification of Ships.

The Society may permit deviations from angles given in Tab 1, taking into consideration the type, size and service conditions of the unit.

1.5 Ambient conditions

1.5.1 Hydrocarbon import and export systems are to be designed to operate properly under the ambient conditions specified in Tab 2 of Pt C, Ch 1, Sec 1 of the Rules for the Classification of Ships.

The Society may permit deviations from temperatures given in Tab 2, taking into consideration the type, size and service conditions of the unit.

SECTION 2 OIL IMPORT AND EXPORT SYSTEM

1 General

1.1 Application

1.1.1 The requirements in this section apply to **FSOs** and **FPSOs** and **MODUs**.

1.2 Handling system

1.2.1 A complete system of pumps and piping is to be fitted for handling the oils. Except where expressly permitted, and namely for the bow and stern loading and unloading stations, this system is not to extend outside the cargo area and is to be independent of any other piping system on board.

2 Oil handling pumping system

2.1 Number and location of oil handling pumps

2.1.1 Each oil handling system is to be served by at least two separate fixed means of handling and stripping. However, for tanks fitted with an individual submerged pump, the second means may be portable.

2.1.2 Oil handling pumps are to be located:

- in a dedicated pump room, or
- on deck, or
- when designed for this purpose, within the oil cargo tanks.

2.2 Use of oil pumps

2.2.1 Except where expressly permitted otherwise, oil handling pumps are to be used exclusively for handling the oils and are not to have any connections to compartments other than cargo tanks.

Subject to their performance oil handling pumps may be used for tank stripping.

Oil handling pumps may be used, where necessary, for the washing of cargo tanks.

2.3 Oil handling pumps drive

2.3.1 Prime movers of oil handling pumps are not to be located in the cargo area, except in the following cases:

- steam driven machine supplied with steam having a temperature not exceeding 220 °C
- hydraulic motors
- electric motors of certified type.

Pumps with a submerged electric motor are not permitted in oil cargo tanks.

Where oil handling pumps are driven by a machine which is located in a non hazardous area outside the oil pump room, the following arrangements are to be made:

a) drive shafts are to be fitted with flexible couplings or other means suitable to compensate for any misalignment

b) the shaft bulkhead or deck penetration is to be fitted with a gas-tight gland of a type approved by the Society. The gland is to be efficiently lubricated from outside the pump room and so designed as to prevent overheating. The seal parts of the gland are to be of material that cannot initiate sparks.

c) Temperature sensing devices are to be fitted for bulkhead shaft gland bearings; see [2.5].

Note 1: The provisions of this requirement also apply to stripping pumps and ballast pumps.

2.4 Design of oil handling pumps

2.4.1 Materials of oil handling pumps are to be suitable for the products handled.

2.4.2 The delivery side of oil handling pumps is to be fitted with relief valves discharging back to the suction side of the pumps (bypass) in closed circuit. Such relief valves may be omitted in the case of centrifugal pumps with a maximum delivery pressure not exceeding the design pressure of the piping, with the delivery valve closed.

2.4.3 Pump casings are to be fitted with temperature sensing devices; see [2.5].

2.5 Monitoring of oil pumps

2.5.1 Oil handling pumps are to be monitored as required in Tab 1.

2.6 Control of oil handling pumps

2.6.1 Oil handling pumps are to be capable of being stopped from:

- a position outside the pump room, and
- a position next to the pumps.

Table 1 : Monitoring of cargo pumps

Equipment, parameter	Alarm **(1)**	Indication **(2)**	Comments
pump, discharge pressure		L	• on the pump **(3)**, or • next to the unloading control station
pump casing, temperature	H		visual and audible, in cargo control room or pump control station
bulkhead shaft gland bearing, temperature	H		visual and audible, in cargo control room or pump control station

(1) H = high
(2) L = low
(3) and next to the driving machine if located in a separate compartment

3 Oil handling piping system

3.1 General

3.1.1 Unless otherwise specified, oil handling piping is to be designed and constructed according to the requirements of Pt C, Ch 1, Sec 10 of the Rules for the Classification of Ships applicable to piping systems of class III.

3.1.2 Corrosion allowance c for steel pipes is to be 2,0 mm.

3.1.3 For tests, refer to [7].

3.2 Materials

3.2.1 Oil handling piping is, in general, to be made of steel or cast iron.

Valves, couplings and other end fittings of cargo pipe lines for connection to hoses are to be of steel or other suitable ductile material.

Spheroidal graphite cast iron may be used for cargo piping.

Grey cast iron may be accepted for cargo lines:

- within cargo tanks, and
- on the weather deck for pressure up to 1,6 Mpa.

It is not to be used for manifolds and their valves or fittings connected to cargo handling hoses.

Aluminized pipes may be permitted in ballast tanks, in inerted cargo tanks and, provided the pipes are protected from accidental impact, in hazardous areas on open deck.

Plastic pipes may be used in the conditions specified in Pt C, Ch 1, App 3 of the Rules for the Classification of Ships. Arrangements are to be made ton avoid the generation of static electricity.

3.3 Connection of pipe length

3.3.1 Oil handling pipe lengths may be connected either by means of welded joints or, unless otherwise specified, by means of flange connections.

For mechanical joints, see Pt C, Ch 1, Sec 10, Tab 16 of the Rules for the Classification of Ships.

3.4 Expansion joints

3.4.1 Where necessary, oil handling piping is to be fitted with expansion joints or bends.

Expansion joints including bellows are to be of a type approved by the Society.

Expansion joints made of non-metallic material may be accepted only inside tanks and provided they are:

- of an approved type
- designed to withstand the maximum internal and external pressure
- electrically conductive.

Sliding type couplings are not to be used for expansion purposes where lines for oil pass through tanks for ballast.

Expansion joints have to comply with the requirements in Pt C, Ch 1 Sec 10 [2.6] of the Rules for the Classification of Ships.

3.5 Valves with remote control

3.5.1 Valves with remote control are to comply with Pt C, Ch 1, Sec 10, [2.7.3] of the Rules for the Classification of Ships.

Submerged valves are to be remote controlled. In the case of a hydraulic remote control system, control boxes are to be provided outside the tank, in order to permit the emergency control of valves.

Valve actuators located inside oil cargo tanks are not to be operated by means of compressed air.

4 Arrangement and installation

4.1 Oil handling pipes passing through tanks or compartments

4.1.1 Oil handling piping is not to pass through tanks or compartments located outside the cargo area.

Oil handling piping and similar piping to cargo tanks is not to pass through ballast tanks except in the case of short lengths of piping complying with the following:

- they are to have welded or heavy flanged joints the number of which is kept to a minimum
- they are to be of extra-reinforced wall thickness as per Pt C, Ch 1, Sec 10, Tab 5 of the Rules for the Classification of Ships
- they are to be adequately supported and protected against mechanical damage.

Oil handling piping may pass through vertical fuel oil tanks adjacent to oil cargo tanks on condition that the above provisions are complied with.

4.2 Oil handling piping passing through bulkheads

4.2.1 Oil handling piping passing through bulkheads is to be so arranged as to preclude excessive stresses at the bulkhead. Bolted flanges are not to be used in the bulkhead.

4.3 Valves

4.3.1 Stop valves are to be provided to isolate each cargo tank.

A stop valve is to be fitted at each end of the oil handling manifold.

When an oil pump in the oil pump room serves more than one cargo tank, a stop valve is to be fitted in the oil pump room on the line leading to each tank.

Main oil valves located in the oil pump room below the floor gratings are to be remote controlled from a position above the floor.

4.4 Prevention of the generation of static electricity

4.4.1 To avoid the hazard of an incentive discharge due to the build-up of static electricity resulting from the flow of the liquid/gases/vapours, the following requirements are to be complied with:.

- the loading pipes are to be led as low as practicable in the tank.
- the resistance between any point on the surface of the cargo and slop tanks, piping systems and equipment, and the hull of the unit is not to be greater than 10^6 Ω.

Bonding straps are required for cargo and slop tanks, piping systems and equipment which are not permanently connected to the hull of the unit, for example:.

a) independent cargo tanks

b) cargo tank piping systems which are electrically separated from the hull of the unit

c) pipe connections arranged for the removal of the spool pieces.

Where bonding straps are required, they are to be:

a) clearly visible so that any shortcoming can be clearly detected

b) designed and sited so that they are protected against mechanical damage and are not affected by high resistivity contamination, e.g. corrosive products or paint

c) easy to install and replace.

4.5 Bow or stern oil loading and unloading arrangements

4.5.1 Where the unit is arranged for loading and unloading outside the cargo area, the following provisions are to be complied with:

a) the piping outside the cargo area is to be fitted with a shut-off valve at its connection with the piping system within the cargo area and separating means such as blank flanges or removable spool pieces or equivalent (see Note 1) are to be provided when the piping within the cargo area is not in use

b) the import/export connections are is to be fitted with a shut-off valve and a blank flange

c) pipe connections outside the cargo area are to be of welded type only

d) arrangements are made to allow the piping outside the cargo area to be efficiently drained and purged.

Note 1: Those indicated in the IMO MSC/Circ. 474 are acceptable as equivalent

4.6 Cleaning and gas-freeing

4.6.1 The oil handling piping system is to be so designed and arranged as to permit its efficient cleaning and gas-freeing.

5 Integrated oil and ballast systems design

5.1 Functional requirements

5.1.1 The operation of oil and/or ballast systems may be necessary, under certain emergency circumstances or during the course of the unit operation, to enhance the safety of units.

As such, measures are to be taken to prevent oil and ballast pumps becoming inoperative simultaneously due to a single failure in the integrated oil and ballast system, including its control and safety systems. The same criteria apply to control systems of cargo and ballast valves.

5.2 Design features

5.2.1 The following design features are, inter alia, to be fitted:

a) the emergency stop circuits of the oil and ballast systems are to be independent from the circuits for the control systems. A single failure in the control system

circuits or the emergency stop circuits is not to render the integrated oil and ballast system inoperative;

b) manual emergency stops of the oil pumps are to be arranged such that they do not cause the shutdown of the power pack making ballast pumps inoperable;

c) the control systems are to be provided with backup power supply, which may be satisfied by a duplicate power supply from the main switchboard. The failure of any power supply is to provide audible and visible alarm activation at each location where the control panel is fitted.

d) in the event of failure of the automatic or remote control systems, a secondary means of control is to be made available for the operation of the integrated oil and ballast system. This is to be achieved by manual overriding and/or redundant arrangements within the control systems.

6 Oil transfer hoses

6.1 General

6.1.1 Oil transfer hoses are to be type approved by the Society for the intended conditions of use.

Oil transfer hoses are to comply with Pt C, Ch 1 Sec 10 [2.6] of the Rules for the Classification of Ships and with the following requirements:

a) Hoses subject to tank pressure or pump discharge pressure are to be designed for a bursting pressure not less than 5 times the maximum pressure under cargo transfer conditions.

b) The ohmic electrical resistance of cargo hoses is not to exceed 10^6 Ω.

7 Certification, inspection and testing

7.1 Application

7.1.1 The provisions of this Article are related to oil piping and other equipment intended oil transfer.

They supplement those given in Pt C, Ch 1, Sec 10 [21] of the Rules for the Classification of Ships for piping systems.

7.2 Workshop tests

7.2.1 Tests for materials

Where required in Tab 2, materials are to be subjected to the tests specified in Pt C, Ch 1, Sec 10, [21.3.2] of the Rules for the Classification of Ships.

7.2.2 Hydrostatic testing

a) Where required in Tab 2, oil pipes, valves, fittings and pump casings are to be submitted to hydrostatic tests in accordance with the relevant provisions of Pt C, Ch 1 Sec 10, [21.4] of the Rules for the Classification of Ships.

b) Expansion joints and oil hoses are to be submitted to hydrostatic tests in accordance with the relevant provisions of Pt C, Ch 1, Sec 10, [21.4] of the Rules for the Classification of Ships.

c) Where fitted, bellow pieces of gas-tight penetration glands are to be pressure tested.

7.2.3 Tightness tests

Tightness of the following devices is to be checked:

- gas-tight penetration glands

Note 1: These tests may be carried out in the workshops or on board.

7.2.4 Summarising table

Inspections and tests required for oil piping and other equipment fitted intended for oil handling are summarised in Tab 2.

7.3 Shipboard tests

7.3.1 Pressure test

After installation on board, the oil handling piping system is to be checked for leakage under operational conditions.

7.3.2 Functional tests

The overall performance of the oil handling system is be verified for compliance with the design parameters during the initial initial import and export operations. Records of the performance of the components and equipment essential to verify the design parameters are be maintained and be available to the Society.

Table 2 : Inspection and testing at works

N°	Item	Test for materials		Inspections and tests for the products			References
		Y/N **(1)**	Type of material Certificate **(2)**	during manufacturing **(1)**	after completion **(1) (3)**	Type of product certificate **(2)**	
1	expansion joints and hoses	Y **(4)**	W	N	Y	C	[7.2.1] [7.2.2]
2	oil pumps	Y	W	Y **(5)**	Y	C	[7.2.1] see note **(5)** [7.2.3]
3	gas-tight penetration glands	N		N	Y	C	[7.2.3] [7.2.4]

(1) Y = required, N = not required.
(2) C = class certificate, W = works' certificate.
(3) includes the checking of the rule characteristics according to the approved drawings.
(4) if metallic.
(5) inspection during manufacturing is to be carried out according to a program approved by the Society.

SECTION 3 GAS IMPORT AND EXPORT SYSTEM

1 General

1.1 Application

1.1.1 The requirements in this section apply to **FSRUs**.

1.2 Handling system

1.2.1 A complete system of pumps and piping is to be fitted for handling the liquefied petroleum gases and natural gases. Except where expressly permitted, and namely for the bow and stern loading and unloading stations, this system is not to extend outside the cargo area and is to be independent of any other piping system on board.

1.3 Gas import system

1.3.1 The liquid import systems include the liquid and vapour loading arms, the high duty gas compressors and the cryogenic hoses or the cargo manifold, depending on the ship to ship transfer configuration employed, plus all on deck valves and piping up to the liquid and vapour inlet flanges on the cargo tank domes.

1.4 Export systems

1.4.1 The gas export systems include the gas flow lines from the regasification facility up to and including the entire gas swivel on turret moored units or the last onboard flange on units maintained on station through a spread mooring system.

1.5 Design considerations

1.5.1 Offshore transfer systems are subject to continuous loads due to the floating unit to tanker interface and the environment. For the adoption of a transfer system the following general issues required to be considered:

- Compliance with the requirements of EN 1474 (2009)
- Application of proven offshore systems and components
- Ability to monitor and manage relative movements between the two vessels and the velocity of drift of the shuttle tanker
- Reliability of control equipment (logic control systems and hydraulic drive systems);
- Enhanced emergency release system
- Optimum access to all system parts for inspection and maintenance.

Transfer systems is to be designed, constructed and maintained with sufficient integrity to withstand operational and environmental loading throughout the system lifecycle.

Systems and structures is to be designed with suitable functionality and survivability for prevention, detection, control and mitigation of foreseeable accident events affecting the installation.

1.5.2 Novel technologies

Novel gas projects may involve systems for which there is no relevant service history. These may typically include technology such as LNG transfer systems, some cryogenic components of the transfer systems and regasification processes, with consideration also being given to liquefaction processes in the marine environment. Existing codes and standards may not fully cover or describe these processes adequately and consequently a systematic approach to qualification of these processes is to be taken ensuring that the technology functions reliably and to specified limits.

2 Liquid gas pumping system

2.1 General

2.1.1 Liquid gas handling pumping system has to comply with Chapter 5 of IGC Code, Pt E, ch 3, Sec 5 and to the requirements in this section.

2.2 Liquid gas pumps

2.2.1 Unless liquid gas pumps are of the fully immersible type and are located in their relevant cargo tanks, they are to be contained within a pump room.

The number of pumps to be installed will be dictated by the design capacity of the pumps and the designed discharge rate of the unit.

For those pumps that are fully immersed in the fluid within the cargo tanks and inaccessible for maintenance whilst the tank is in service then failure of one pump in a tank will not negate the ability to pump liquid gas from that tank.

In the event of total failure of the inaccessible pumps in a tank, then an alternative means of displacing the liquid gas from that tank must be provided for example an emergency pump or displacement of liquid gas by pressurization of the tank.

Pumps to be used for liquid gas service are to be designed for the most demanding liquid gas density which may be encountered.

Pumps used for transfer of liquid gas below -55 °C are to be provided with suitable means for pre-cooling to reduce the effect of thermal shock.

2.3 Liquid gas pumps drive

2.3.1 Where liquid gas pumps are driven by a machine which is located in a non hazardous area outside the pump room, the following arrangements are to be made:

a) drive shafts are to be fitted with flexible couplings or other means suitable to compensate for any misalignment

b) the shaft bulkhead or deck penetration is to be fitted with a gas-tight gland of a type approved by the Society. The gland is to be efficiently lubricated from outside the pump room and so designed as to prevent overheating. The seal parts of the gland are to be of material that cannot initiate sparks.

c) Temperature sensing devices are to be fitted for bulkhead shaft gland bearings.

Where drives are integral with or located in the same space as the pumps they have to comply with the requirements for equipment located in that space.

2.4 Discharge into common header

2.4.1 When two or more pumps located in different cargo tanks are operating at the same time discharging into a common header, the stopping of the pumps is to activate an alarm at the cargo control room.

3 Gas handling piping

3.1 General

3.1.1 Gas handling piping system has to comply with Chapter 5 of IGC Code, Pt E, Ch 3, Sec 5 and to the requirements in this section.

4 Bow and stern Loading/Unloading

4.1 General

4.1.1 Gas transfer piping system outside the cargo area has to comply with IGC Code [3.8.3].

5 Loading Arms

5.1 General

5.1.1 Loading arms are to be designed and constructed in accordance with a recognized national or international standards acceptable to the Society. Loading arms for LNG transfer are to to meet the standards EN1474-1 (2009).

5.2 Disconnecting devices

5.2.1 A Quick Connect Disconnect (QCDC) connection is to be provided for the coupling of loading arms to the LNG/LPG carrier manifold.

In addition to the Quick Connect Disconnect (QCDC) connection an emergency release system is to be fitted. This forms a second stage Emergency Shut Down (ESD) system in addition to the cargo transfer system's ESD. Its purpose is to provide the means to quickly uncouple the transfer hose with minimum product release to the environment. The system disconnection is to be achieved by means of a Powered Emergency Release Coupler (PERC) which provides the interlocks to prevent the coupling from releasing before the safe closure of the valves.

6 Gas transfer hoses

6.1 General

6.1.1 Gas transfer hoses are to be type approved by the Society and designed according to an approved standard for the intended fluid(s) to be handled and to be fully tested to handle all the conditions of that fluid(s) in operation. Flexible hoses intended for the handling of LNG are to meet the standards EN1474-2(2009) or equivalent standards.

Additionally flexible hoses are to comply with IGC Code [5.7].

A Quick Connect Disconnect (QCDC) connection is to be provided for the coupling of transfer hoses to the LNG/LPG carrier manifold.

In addition to the Quick Connect Disconnect (QCDC) connection an emergency release system is to be fitted. This forms a second stage Emergency Shut Down (ESD) system in addition to the cargo transfer system's ESD. Its purpose is to provide the means to quickly uncouple the transfer hose with minimum product release to the environment. The system disconnection is to be achieved by means of a Powered Emergency Release Coupler (PERC) which provides the interlocks to prevent the coupling from releasing before the safe closure of the valves.

7 Certification, inspection and testing

7.1 Application

7.1.1 The provisions of this Article are related to piping and other equipment intended gas transfer.

7.2 Workshop tests

7.2.1 Tests for materials

Where required in Tab 1, materials used for pipes, valves and fittings are to be subjected to the tests specified in IGC Code [6.2].

7.2.2 Inspection of welded joints

Where required in Tab 1 welded joints are to be subjected to the examinations specified in IGC Code [5.4.6].

7.2.3 Hydrostatic testing

a) Where required in Tab 1, gas pipes, valves, fittings and pump casings are to be submitted to hydrostatic tests in

accordance with the relevant provisions of Pt C, Ch 1, Sec 10 [21.4] of the Rules for the Classification of Ships.

b) Expansion joints are to be submitted to hydrostatic tests in accordance with the relevant provisions of Pt C, Ch 1, Sec 10 [21.4] of the Rules for the Classification of Ships.

c) Flexible hoses are to be submitted to hydrostatic tests in accordance with the relevant provisions of Pt C, Ch 1, Sec 10 [21.4] of the Rules for the Classification of Ships.

d) Where fitted, bellow pieces of gas-tight penetration glands are to be pressure tested.

7.2.4 Tightness tests

Tightness of the following devices is to be checked:

- gas-tight penetration glands

Note 1: These tests may be carried out in the workshops or on board.

7.2.5 Summarising table

Inspections and tests required for gas piping and other equipment fitted intended for gas handling are summarised in Tab 1.

7.3 Shipboard tests

7.3.1 Pressure test

After installation on board, the gas handling piping system is to be checked for leakage according to IGC Code [5.5.3].

7.3.2 Functional tests

The overall performance of the gas handling system is be verified for compliance with the design parameters during the initial import and export operations. Records of the performance of the components and equipment essential to verify the design parameters are be maintained and be available to the Society.

Table 1 : Inspection and testing at works

N°	Item	Test for materials		Inspections and tests for the products			References
		Y/N **(1)**	Type of material Certificate **(2)**	during manufacturing **(1)**	after completion **(1) (3)**	Type of product certificate **(2)**	
1	pipes, valves and fittings	Y	• C where ND≥32mm • W where ND<32 mm	Y **(4)**	Y	C	[7.2.1] [7.2.1] [7.2.2] [7.2.3]
2	expansion joints and hoses	Y **(5)**	C	N	Y	C	[7.2.1] [7.2.3]
3	liquefied gas pumps and gas compressors	Y	C	Y **(6)**	Y	C	[7.2.1] see note **(6)** [7.2.3]
4	gas-tight penetration glands	N		N	Y	C	[7.2.3]; [7.2.4]

(1) Y = required, N = not required.
(2) C = class certificate, W = works' certificate.
(3) includes the checking of the rule characteristics according to the approved drawings.
(4) only in the case of welded construction.
(5) if metallic.
(6) inspection during manufacturing is to be carried out according to a program approved by the Society.

Part C
Machinery, Systems and Fire Protection

Chapter 6
HYDROCARBON PRODUCTION AND PROCESS SYSTEMS

SECTION 1 GENERAL REQUIREMENTS

1 General

1.1 Application

1.1.1 The requirements of this Chapter apply to the systems intended to process liquid or gaseous hydrocarbons from the completed wells or from loading arrangements (loading arms or hoses). These systems include separation, treating and processing systems as well as systems intended for supporting the hydrocarbon production and process such as power supply, hydraulic system, utility/instrument air system, produced gas as fuel system, fuel oil system etc).

1.2 Production and process boundaries

1.2.1 The main boundaries of the production and process systems are:

- any part of the production and process system located on the unit
- control systems
- the shutdown valve at the export outlet from the production or process plant to the storage or offloading facility.
- the outlet from hydrocarbon flare and vent system
- shut down valve between liquefaction plant and gas storage tanks
- shut down valve between gas storage and regasification plant and export line.

1.3 Documentation to be submitted

1.3.1 Tab 1 lists the plans, information, analysis, etc. which are to be submitted in addition to the information required in the other Parts of the Rules.

1.3.2 Additional information

The information listed in Tab 2 is also to be submitted.

Table 1 : Documents to be submitted

No.	A/I **(1)**	Documents **(2)**
1	I	Characteristics of hydrocarbons to be processed.
2	I	Specification of the hydrocarbon process system including the complete description of all the equipment, machinery and plants used to carry out the design activity.
3	A	Diagram of the process piping system, including P&IDs and PFDs and line list.
4	A	Diagram of production support systems.
5	A	Risk Analysis Documentation.
6	A	Emergency shutdown system (ESD) including cause and effects charts.
7	A	Constructional drawings of boilers (fired and unfired), pressure vessels and heat exchangers **(3)**
8	A	Diagram of pressure relief and depressurization vent systems showing arrangements sizing of the lines, capacities of the relief valve, materials, design capacity, calculations for the relief valves, knock out drums, anticipated noise levels and gas dispersion analyses.
9	A	Diagram of systems which will dilute gaseous hydrocarbons into the atmosphere.
10	A	Constructional drawings of flares, including pilots, igniters and water seal and design calculations, including stability and radiant heat analyses.
11	A	Constructional drawings of burners for hydrocarbons.
12	I	Compressors and pumps data sheets.
13	I	Operating Manual of the process system.

(1) A = to be submitted for approval in four copies I = to be submitted for information in duplicate

(2) Diagrams are also to include, where applicable, the local and remote control and monitoring systems and automation systems

(3) The drawings and information requested in Tab 3, Tab 4 and Tab 5 of Pt C, Ch 1, Sec 3 of the Rules for the Classification of Ships are to be submitted.

Table 2 : Information to be submitted

No.	A/I **(1)**	Document
1	I	Nature and service temperature and pressure of the fluids in particular at the inlet and outlet of main components
2	I	Standards according to which the production, process and support piping systems have been designed.
2	A	Material, external diameter, corrosion allowance and wall thickness of the pipes, branch schedules etc.
3	A	Type of the connections between pipe lengths, including details of the welding, where provided
4	A	Material, type, rating and size of the valves and accessories.
5	A	Capacity, prime mover and, when requested, location of the pumps and compressors.
6	A	For plastic pipes: • the chemical composition • the physical and mechanical characteristics in function of temperature • the characteristics of inflammability and fire resistance • the resistance to the products intended to be conveyed
(1) A = to be submitted for approval in four copies I = to be submitted for information in duplicate, in four copies; I = to be submitted for information, in duplicate.		

1.4 Operation in inclined position

1.4.1 Production and process systems and relevant support systems are to be designed to operate when the unit is upright and when inclined at any angle of list either way and trim by bow or stern as stated in Tab 1of Pt C, Ch 1, Sec 1 of the Rules for the Classification of Ships.

The Society may permit deviations from angles given in Tab 1, taking into consideration the type, size and service conditions of the unit.

1.5 Ambient conditions

1.5.1 Production and process systems and relevant support systems are to be designed to operate properly under the ambient conditions specified in Tab 2 of Pt C, Ch 1, Sec 1 of the Rules for the Classification of Ships.

The Society may permit deviations from temperatures given in Tab 2, taking into consideration the type, size and service conditions of the unit.

SECTION 2 PRODUCTION, PROCESS AND SUPPORT PIPING SYSTEMS

1 General

1.1

1.1.1 The design and manufacturing of production, process and support piping systems are to be in accordance with a recognized Standard and with the requirement of this section. The standards are to be adhered to in their entirety.

Use of other standards is subject to the approval by the Society.

The plant piping systems are to be divided into segments. Each segment is to be segregated by shutdown valves that are operated from the shutdown system. The valves are to segregate production systems based on consideration of plant layout, fire zones, depressurizing system and pressure ratings.

A single failure of support systems which are essential to the operation of the production and process system has not to cause an unacceptable operating condition.

The design of piping systems is to take into consideration the effects of hull girder bending.

Support piping systems are to be in general independent from piping systems essential to the safety of the unit.

Piping systems for substances which present a hazard due to a reaction when mixed are to be independent each other.

Suitable protection against fire, mechanical damage, erosion and corrosion is to be provided for the production and process piping system.

The production piping systems are to be fitted with sufficient drain and vent pots to enable draining and depressurizing of all segments in a controlled manner. They are to be permanently or temporarily connected to the flare, venting and drain disposal systems.

2 Arrangement

2.1

2.1.1 In general all equipment associated with the processing and production of hydrocarbons is to be located within the cargo area whether it is fixed to the main deck or, as in most cases, located on supports above the main deck.

The risk to personnel from potential hazards is to minimize. In this respect the most hazardous areas of the process plant are to be located as far as possible from the accommodation area.

The most hazardous process areas are considered those where the hydrocarbons being handled are at their highest pressure and possibly in their most volatile condition. For an FSRU the most hazardous process area is to be considered as the regasification plant and the export facility.

The piping used within the process areas is tol be kept to a minimum and all piping are to be adequately protected from hazards such as fire, environmental exposure, dropped objects and dynamic flexing of the unit.

The closer a process area, by virtue of space, has to be located to the accommodation then the lesser risk that process should impose.

Where space permits, the final process areas is to be separated from the accommodation by the process support area where more benign fluids and systems exist.

All elements of the production plant are to be suitable for the overall design loads and are to be designed for the most onerous load combination.

They are to be designed and constructed with sufficient integrity to enable safe operation during all foreseeable conditions.

One single maloperation or malfunction within a process system has not to lead to critical situation for personnel or the unit or installation.

Facilities for safe isolation are to be provided for all elements of the production and support systems that contain high pressure and flammable substances and that require to be opened for maintenance or other operations whilst the remainder of the process remains active.

2.2 Materials

2.2.1 Material for piping systems conveying hydrocarbon or other hazardous fluids is to be steel or other approved metallic material.

Material for piping systems conveying H2S-contaminated products (sour service) is to comply with the National Association of Corrosion Engineers (NACE) Standard MR 01 75

Material for piping systems essential to the production and process operations is to be steel or other approved metallic material.

2.3 Corrosion

2.3.1 Corrosion allowance is to be provided for carbon steel hydrocarbon production and process piping as per NACE RP0176. The minimum corrosion allowance for different material will be established on a case by case basis.

For continuous and in service monitoring of corrosion within the piping systems a regime of corrosion coupons or removable test spool pieces is to be included in the design of the relevant piping systems.

If test spool pieces are to be used as the means of monitoring they must be easily isolated, removed and replaced.

If it is considered necessary for the hydrocarbons being handled, sand probes, sand catchers and filters are to be provided to monitor and knock-out entrained sand and possible reservoir fracture elements.

2.4 Valving requirements

2.4.1 Quarter turn soft-seated valves and fittings which incorporate elastomeric sealing materials installed in systems containing hydrocarbons or other flammable fluids are to be of a fire-resistant type as per API Std 607.

Suitable isolating valves, operable from the control stations as well as locally, are to be provided to isolate the unit from the supply and discharge of produced oil and gas.

Where locking of valves in open/closed position is foreseen, suitable keyed locking devices operated under a sequence which does not cause an unacceptable operating condition are to be provided.

If there is a necessity for personnel to periodically enter a vessel for inspection, maintenance or survey then means are to be fitted to fully isolate that vessel from the pressure and/or hazardous fluid systems. This is to be achieved by the installation of approved isolation valves and spectacle blinds. Double block and bleed isolating valves and if necessary a means to blank off open ended piping may be required following risk assessment of the potential hazards.

2.5 Pipe connections

2.5.1 The number of detachable pipe connections in hydrocarbon production and process piping is to be limited to those which are necessary for connection to valves, expansion joints, spool pieces and similar fittings or where required for coating, lining, fabrication, inspection or maintenance.

2.6 Flexible hoses and expansion joints

2.6.1 All flexible hoses and expansion joints intended for conveying produced and processed hydrocarbons and their support fluids are to be manufactured to a recognized Code or Standard. The flexible element has to maintain its integrity and functionality as the same period required for the total piping system and components.

Means shall be provided to isolate flexible hoses and expansion elements, if when they are used in systems such as their failure would result in a critical uncontrolled outflow of medium.

Additionally flexible hoses and expansion joints and their arrangement have to comply with Pt C, Ch 1, Sec 10 [2.6] of the Rules for the Classification of Ships.

3 Process equipment and vessels

3.1 General

3.1.1 Process pressure vessels and associated heat exchangers are to comply with the requirements in Pt C, Ch 1, Sec 3 of the Rules for the Classification of Ships.

Equipment used in production plants such as pumps, compressors, gas turbines etc or otherwise related to safety in conjunction with production, are to be in accordance with a recognized Standard and with the with the applicable requirements in Chap 1. The standards are to be adhered to in their entirety.

Use of other standards is subject to the approval by the Society

4 Pressure relief

4.1 General

4.1.1 All pressure systems are to be fitted with pressure relief devices that are set no higher than the design pressure for the system. The devices are to have suitable capacity and characteristics to limit pressure build up to within the limits of the design for the system or component.

4.1.2 Pressure vessels and pressure-rated equipments

Process vessels and pressure-rated equipment are to be protected against overpressure by pressure relief valves.

The number, discharge capacity and installation of the said relief valves are to comply with a recognised standard.

The back pressure of the venting system is to be taken into account.

Block valves for maintenance purposes may be fitted upstream and downstream of the pressure relief valves provided that the following requirements are complied with:

a) suitable arrangements are provided to prevent more than one pressure relief valve being out of service at the same time;

b) a device is fitted which automatically and clearly indicates which one of the pressure relief valves is out of service; and

c) pressure relief valve capacities are such that if one valve is out of service the remaining relief devices have the required combined relieving capacity.

For process vessels not subject to the requirements of the IGC Code, as an alternative to the requirements in a), b) and c), an isolation valve arrangement complying with a recognised standard, such as API 520 Pt II, may be accepted by the Society.

All pressure-rated equipment, such as compressors and pumps, is to have protective relief devices fitted that will protect the equipment from the effects of overpressure. These devices will relieve safely to either the flare, the

atmospheric vent or the closed drain systems as applicable for their service and location.

The devices may take the form of pressure relief valves, a bursting disc or water seal designed, chosen and approved for that specific function.

4.1.3 Liquid hydrocarbon piping systems

Pressure relief valves that are installed in liquid hydrocarbon pipe section are to discharge to a storage tank or to a closed drain system the sizing of which has to take into account the number of relief valves discharging into it.

Pressure relief valves that are installed in liquid hydrocarbon pump delivery are to discharge back to the pump suction, to a drains system or to a storage tank. The option will depend on the dynamics of the system involved and the effects on other relief systems.

4.1.4 Gas hydrocarbon piping systems

Pressure relief valves in gas hydrocarbon piping are to discharge to one or more closed vessels that may be connected to the flare or gas vent system complying with requirements in [6] and [7].

The back pressure in the closed vessel is to be taken into account for the design of the pressure relief valves.

In the case of closed-in, liquid filled, liquefied gas piping, pressure relief valves are to be installed in case of pressure build-up in the piping, and they are to discharge into a relief valve header with the header being routed back to a storage tank. In general an interlocking key system is to be arranged for the return valves to the storage tanks so that at no time is the relief header fully closed off.

4.1.5 Rupture discs

Rupture discs may be considered for use in systems where the substance contained within the system may render a relief valve ineffective.

The use of rupture discs upstream of pressure relief valves or in parallel to pressure relief valves will be considered on a case by case basis.

Where rupture discs are used in series with relief valves, or with another rupture disc, the volume between the two devices is to be monitored for leakage or pressure increase and an alarm initiated to indicate a change in this space.

5 Depressurizing (Blowdown) Systems

5.1 General

5.1.1 An emergency vapor depressurizing system is to be provided for all equipment processing light hydrocarbons with operating pressures of 1.7 MPa and above, to ensure safe disposal of hydrocarbons under normal operations and during emergency conditions.

The depressurization system is to be designed to be as simple as possible and according to the fail-safe philosophy. This implies that the blow-down valves are spring-return, and fail to the open position (open on loss of power).

The aim of the system is to gain rapid control of a situation in which for example a closed in process vessel is being overheated by a fire with subsequent pressure increase. The blowdown system will depressurize the vessel to 0.7 MPa in as short a space of time as possible without damage to the vessel.

In cases where the equipment is handling high pressure and large inventories of hydrocarbon, and depressurizing to 0.7MPa is impractical, it is acceptable to depressurize to 50% of the equipment design pressure if such depressurization is achieved within 15 minutes.

In these cases the equipments to be designed with ample margin of safety to prevent the vessel from failing due to overheating. Calculations, showing the maximum allowable temperature of the equipment would not exceed the equipment rated temperature, are to be submitted for verification. See Appendix A of API RP 521 for information on the effect of heat input to non-insulated steel vessels.

As these depressurizing systems can involve the expansion of a high pressure gas to a lower pressure then consideration is to be given to the cooling effect of expanding gases in this manner. Different gases exhibit different cooling effects and consideration must be given to materials and equipment used for the gases involved.

6 Flares

6.1 General

6.1.1 Flares for hydrocarbons are to be designed according to API RP 521 or equivalent and installed so as not to cause hazards on board.

Flares are not to be installed in hazardous areas. As regards the choice of their location on board, the area affected by the radiating heat during the maximum foreseen combustion activity is to be taken into consideration. As a rule, the position in which combustion takes place is to be not less than 50 m away from the accommodation area, control room, etc. In particular cases, suitable barriers, for example sprayed water, may be used to reduce the area affected by the combustion activity of flares.

Means are to be provided to allow the combustion to be activated by remote control, to intercept the delivery of hydrocarbons in time and to send inert gas into the gaseous hydrocarbon piping inlet to the flare.

There may be a necessity, by virtue of a flares position, to reduce noise emissions. This can also be accomplished by water screens or other screening devices. Noise measurements of flares at their maximum intensity are to be taken to establish whether or not noise reduction measures are to be taken. Acceptable maximum allowable level of continuous noise is 90 dB(A) within work areas using ear protection, 75 dB(A) in control areas and 60 dB(A) for accommodation areas.

7 Cold Vents

7.1 General

7.1.1 For hydrocarbon vapor where disposal is by atmospheric dispersion from a vent stack, the vent outlet is to be of sufficient height or distance from the facilities to accomplish the following:

a) In the case of accidental ignition the calculated radiant heat intensity from the resulting flame (including solar radiation) is not to exceed 4.73 kW/m^2, at the maximum possible venting rate.

This is to be considered the maximum at any deck level or location where normal maintenance or operating activities could take place, by personnel wearing adequate protective clothing.

In the event of accidental ignition a snuffing system or equivalent is to be provided to immediately extinguish the flame. A flame arrestor is to be fitted on a vent system wherever a permanent or lon g standing relief is to be made from the vent system.

b) The following concentration of hazardous vapors, calculated as per API RP 521 or other equivalent standard, is not to be exceeded at any deck level where normal maintenance or operating activity could take place, based on the reasonable worst-case conditions (e.g., still air and low vent velocity):
   - 10 ppm for H2S
   - 20% LEL for flammable vapours.

c) The vent outlet is to be at least 8 m above any immediately adjacent process vessel or hydrocarbon processing equipment, and at least 3 m above the top of any vessel or equipment within an 8 m radius of the vent.

d) Where a short vent stack is used in lieu of a vent boom, the vent outlet is to be provided with devices to prevent the passage of flame into the system, such as a flame arrestor. The pressure drop of the flame arrestor is to be considered in the vent diameter sizing calculations.

When a dispersion model based on a modeling method other than API RP 521 is used, a validation study of the model is to be made available for verification to confirm that at any point on the installation the concentration of hydrocarbons remains below 50% LEL.

Similar noise considerations for cold vents as for flares are to be taken into consideration.

8 Control and Safety system

8.1 General

8.1.1 A control and safety system is to be provided for the production and process systems.

There are to be two independent levels of protection to prevent or minimise the effects of a single malfunction or fault in process equipment and piping systems, including their controls.

The two levels of protection are be provided by functionally different types of safety devices to reduce the probability for common cause failures.

Activation of depressurisation valves may be incorporated in either the process or emergency shutdown.

Systems, actuated devices and controls are to be designed fail safe. This means that failure of the controls or associated systems will result in the system going to the operational mode that has been pre-determined as safest. This normally implies that shutdown valves will 'fail-to-closed' position, and depressurization valves, 'fail- to-open' position. Sensors are to be normally energised closed circuits and contacts.

Where required, stored energy devices for actuators are to be designed, located and protected to ensure that the fail safe function is not impaired by defined design accidental events.

Pneumatic and hydraulic systems are to be monitored. Process shutdown of such systems are to be initiated if pressure falls below a level where functionality is lost.

Components which, for safety reasons, are required to maintain functionality for a specific period of time during an emergency (e.g. fire resistance of valves) are to be verified as having the appropriate qualifying properties, e.g. by tests, calculations etc.

9 Quick disconnection system

9.1 General

9.1.1 Where the unit is fitted with a quick disconnect system, the control of this system is to be totally independent of the process safety shutdown system required for the hydrocarbon process system. However, the source of power for the process safety shutdown system and controls for the disconnect system need not be totally independent, provided that the failure in one system does not render the other system ineffective, e.g., failure through leakage in the hydraulic or pneumatic control lines.

Means are to be provided for the activation of the disconnect system from the control station and locally in the vicinity where the disconnect arrangements are located.

The disconnect arrangement is to be designed such that upon its activation, all process flow to the unit is automatically stopped immediately with minimal leakage of process fluids.

10 Support systems

10.1 General

10.1.1 Support systems are to comply with the requirements of Pt C, Ch 1, Sec 10 of the Rules for the Classification of Ships and to the following requirements.

Support systems (e.g. steam, heating medium, cooling medium, compressed air etc) that are connected to systems containing flammable or toxic liquids or gases are in general not to be connected to non-hazardous systems or similar systems located in non-hazardous areas.

Where the above is unavoidable or impracticable such interconnections is to be designed to eliminate or control the risk of cross-contamination to an absolute minimum. This may be mitigated by the use of protective measures such as:

a) Identification of possible failure modes and an identification of realistically acceptable leak size.

b) Evaluation of the consequences of a cross contamination.

c) Monitoring of the fluids involved and the use of proven equipment to maintain separability of the fluids (e.g. non-return valves, primary and secondary circuits, liquid seals, detectors etc)

If it is found that the risk of cross contamination is high and the consequences of such are found to be significant and any protective measures that have been instigated are difficult to verify or maintain, then separate systems must be provided.

11 Certification, inspection and testing

11.1 Workshop and shipboard testing

11.1.1 Certification, inspection and testing of process pressure vessels and associated heat exchangers of production and process systems has to comply with the requirements of Pt C, Ch 1, Sec 3, [7] of the Rules for the Classification of Ships.

Certification, inspection and testing of production and process piping systems has to comply with the requirements of Chapter 5 as applicable.

Certification, inspection and testing of support piping systems has to comply with the requirements of Pt C, Ch 1, Sec 10, [21] of the Rules for the Classification of Ships.

12 Shipboard functional tests

12.1 General

12.1.1 The overall performance of the process and production system is be verified for compliance with the design parameters during the initial introduction of first oil, first gas and during initial import and export operations. Records of the performance of the components and equipment essential to verify the design parameters are to be maintained and be available to the Society.

Part C
Machinery, Systems and Fire Protection

Chapter 7
RISK ANALYSIS

SECTION 1 GENERAL REQUIREMENTS

1 Objective

1.1

1.1.1 This section provides the general requirements for the risk assessment techniques, which can be used to support the classification of an installation or of any of its systems, subsystems or components alternatively to the application of the prescriptive Rules.

2 Definitions

2.1 Accident, accident scenario, accident sequence

2.1.1 In general terms, it is an unplanned event or sequence of events that results in undesirable consequences.

2.2 Basic event

2.2.1 Basic event in a fault tree is an event that represents the lowest level of resolution in a model considered necessary (e.g., equipment item failure, human error etc.)

2.3 Consequence

2.3.1 Consequence of an accident scenario is the outcome that can negatively affect subjects of interest. It can be expressed by qualitative or quantitative estimates of the effects of the accident scenario in terms of factors such as health impact, economic loss and environmental damage.

2.4 Event

2.4.1 In general terms, an event is an occurrence, internal or external to a system, which has an associated outcome. There are typically a number of potential outcomes from any initial event that may range in severity from trivial to catastrophic, depending upon other conditions and subsequent occurrences.

2.5 Event tree

2.5.1 An event tree is a logic model that graphically represents schematic combinations of events and circumstances in accident sequences, starting from an initiating event through intermediate events down to the consequences of each accident sequence.

2.6 Failure mode

2.6.1 Failure mode is a symptom, condition, or way in which an item ceases to perform its intended function. According to the situation, it may be a loss of function (total or partial), an unintended intervention, a loss of containment or any cause for which the item exceeds its acceptable operation.

2.7 Fault event

2.7.1 In a fault tree, a fault event is an event that requires further development.

2.8 Frequency

2.8.1 Frequency is the expected number of occurrences of an undesirable event expressed as events per unit time.

2.9 Hazards

2.9.1 Hazards are conditions that exist that may potentially lead to an undesirable event.

2.10 Human error

2.10.1 A human error is a human action (or lack thereof) that exceeds some limit of acceptability.

2.11 Initiating event

2.11.1 An initiating event is the first event in an event sequence, which can result in an accident unless safety systems or human actions intervene to prevent or mitigate the escalation.

2.12 Intermediate event or node

2.12.1 In an event tree, a node is an event that propagates or mitigates the initiating event during an accident sequence.

2.13 Likelihood

2.13.1 Likelihood is a measure of the expected probability or frequency of an event's occurrence.

2.14 Major Hazard

2.14.1 A major hazard is characterized by potentially unacceptable risk if not eliminated, controlled, and/or managed.

2.15 Minimal cut set

2.15.1 A minimal cut set (MCS) is a combination of failures necessary and sufficient to cause the occurrence of a top event in a fault tree.

2.16 Qualitative Risk Assessment

2.16.1 Qualitative risk assessment expresses the risk in terms of quality or kind (e.g., low, medium, high).

2.17 Quantitative Risk Assessment

2.17.1 Quantitative Risk Assessment (QRA) is an analysis that expresses the risk in terms of risk impact per unit time (e.g., amount of losses per year).

2.18 Risk Analysis

2.18.1 Risk analysis is the process of understanding (1) what undesirable things can happen, (2) how likely they are to happen, and (3) how severe the effects may be.

2.19 Risk

2.19.1 Risk is the combination of the frequency of an undesirable event and the consequence of the event's outcome.

2.20 Sensitivity Analysis

2.20.1 Sensitivity analysis is aimed at the determination of how rapidly (sensitive) the output of a risk analysis changes with respect to variations in the input (it can include variations in input data or assumptions).

2.21 Top event

2.21.1 In a fault tree, the top event is an undesired event at the top of the tree that is traced downward to more basic events using Boolean logic gates (most frequently AND, OR, NOT) to determine its possible causes.

2.22 Undeveloped event

2.22.1 In a fault tree, an event in undeveloped when it does not require further development, either because is not significant or because more detailed information is unavailable.

2.23 Worst case

2.23.1 The worst case estimate is a conservative evaluation of the consequences of the most severe accidents identified.

SECTION 2 APPLICATION

1 Application

1.1

1.1.1 The requirements apply to offshore installations.

1.1.2 When the proposed design of an arrangement is alternative to the existing prescriptive Class rules, or is characterized by novel features for which the provision of the existing Class rules are not directly applicable, it is to be demonstrated that such design provides an equivalent level of safety (see following paragraph). The demonstration may be based on risk assessment techniques.

1.1.3 The classification based on risk assessment may be applied only to a part of the installation, and in this case the other parts are to comply with Class rules. Care is to be taken to ensure the proper management of the two approaches within the same project, to avoid conflicts between the risk-based and the prescriptive issues.

1.1.4 The Owner/Operator is responsible for the compliance of the alternative or novel arrangements with any further requirements of the National Administration. If the Administration requests the owner to produce a Safety Case, if the risks related to classification are covered therein, it can be credited for the purpose of classification upon review and approval by the Society.

2 Principle of Equivalency

2.1

2.1.1 Design solutions that deviate from the applicable Rules are required to be equivalent to the prescriptions included in the Rules, in terms of safety for personnel, safety for the ship and pollution prevention. This approach is to be consistent with SOLAS II-2/17 (dedicated to fire safety), II-1/55 (dedicated to life-saving appliances) and III/38 (dedicated to machinery and electrical installations). The equivalency is to be demonstrated and submitted to the Society for approval, risk assessment being one of the possible tools to be employed. In any case, the identification of the safety objectives, which are often implicit in the Rules, is most critical aspect of the activity and constitutes its cornerstone.

SECTION 3 RISK ASSESSMENT

1 Analysis

1.1 Scope

1.1.1 A risk assessment, in general terms, is a systematic process used to identify potential events, or combination thereof, which may affect safety, environment and property, and highlight possible risk control options to reduce the risk to an acceptable level.

A non-exhaustive list of typical risks applicable to offshore installations is given in the following.

- Extreme weather
- Collision
- Dropped objects
- Extreme temperatures
- Fire/explosion
- Release of hazardous gas
- Release of hazardous non-cryogenic liquid
- Cryogenic release
- Rollover (thermodynamic instability due to LNG stratification)
- Loss of stability
- Failures in station keeping systems
- Loss of electrical power supply
- Failures in process systems
- Failures in cargo systems.

Risk control options can be preventive, mitigative or a combination of the two. Once identified, they are to be approved and surveyed as the other Class items. A typical hierarchical approach to risk reduction is:

- Minimization of hazards inherent in the design
- Prevention
- Detection
- Control
- Mitigation of consequences
- Escape, Evacuation and Rescue.

1.2 Process

1.2.1 The scope and objectives of the risk assessment, the performance standards, the proposed methodology and the tools to be used (described in more detail in the Tasneef Guide for Risk Analysis) are to be approved by the Society at the beginning of the project. It is recommended that the Society be involved early in the risk assessment process, and its participation be ensured in its main tasks with the purpose of monitoring and validating the various steps.

2 Acceptance Criteria

2.1

2.1.1 Acceptance criteria are the criteria to be applied to the risk assessment results, to demonstrate that the unit achieves an acceptable level of safety. Acceptance criteria are based on the safety objectives required for the unit, which are to be set forth up front by the Owner/Operator and approved by the Society.

For design issues that deviate from the Rules, such objectives should be based on the spirit and criteria of the Rules. Therefore, the purpose of the risk assessment is the demonstration of the equivalency with a standard design resulting from the direct application of the Rules. A guidance on the philosophy of this approach may be found in the "Guidelines for alternative design and arrangements for fire safety", IMO MSC/Circ. 1002 and "Guidelines on Alternative Design and Arrangements for SOLAS Ch II-1 and III", IMO MSC.1/Circ.1212.

Novel designs for which the principle of equivalency cannot be applied (e.g. because the Rules are not directly applicable), ad-hoc safety objectives will have to established and the risk assessment will be used to demonstrate the compliance with such objectives.

3 Follow-up of the Risk Assessment Results

3.1 Verification - new installation

3.1.1 After review and approval of the risk assessment, the Society will verify that the identified critical items have been included in the design and/or operational procedures of the installation, and that they are fit for their intended purpose. Where applicable, manufacture, construction, installation and commissioning will be examined by the Society to confirm that the critical items meet the approved performance standards.

The owner/operator is to provide all the elements required by the Society to perform the verification.

3.2 Verification - existing installation

3.2.1 The Society will verify that the critical items for the operating phase have been identified and that they are fit for their intended purpose. Where applicable, manufacture, construction, installation and commissioning will be examined by the Society, to confirm that the critical items meet the approved performance standards, and that they remain

in such conditions as to continue to meet their required performance standards.

In particular, the Society will review the Owner/Operator's Inspection and Maintenance Plan and operational procedures. Verification activities may include review of records, audit of procedures and activities of surveyor acting on behalf of the Owner/Operator, sample checks and physical examination of the installation, as appropriate. The verifications will be performed on a regular basis on a periodicity that will depend on the characteristics of the critical items. The verification reports will be added to the documentation that includes statutory certificates and maintenance of Class.

3.2.2 The owner/operator is to provide all the elements required by the Society to perform the verification.