GUIDANCE NOTES
GD 01-2010

CHINA CLASSIFICATION SOCIETY

GUIDELINES FOR HAZARDOUS AREA CLASSIFICATION AND ELECTRICAL INSTALLATIONS OF TANKERS

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2010

BEIJING

Contents

Chapter 1 General

1.1 General

1.1.1 The Guidelines applies to tankers carrying flammable liquid cargoes in bulk.

1.1.2 The Guidelines is used by the designers, ship builders and surveyors of tankers for reference, and it does not change the relevant requirements of CCS rules and IEC publications in force.

1.1.3 The term "flammable" referred to in the Guidelines includes:

(1) hazard results determined by the flashpoint, boiling point, flammability and spontaneous ignition temperature of the cargo carried;

(2) hazard results from the reaction of the cargo with other materials.

1.2 Definitions

1.2.1 In addition to the following definitions, the relevant definitions in PART FOUR of CCS Rules for Classification of Sea-going Steel Ships apply to the Guidelines.

(1) Tanker

A tanker is a cargo ship constructed or adapted for the carriage in bulk of liquid cargoes of an inflammable nature.

(2) Enclosed space

Enclosed space is a space sheltered by bulkhead and deck with doors, windows or other openings which may be opened or closed.

(3) Semi-enclosed space

Semi-enclosed space is a space limited by top plate, wind break and bulkhead, etc. in such a manner that the natural conditions of ventilation in the space are notably different from those obtained on weather deck and the gas is uneasily diffuse.

(4) Open space

Space in an open air situation without stagnant areas where vapours are rapidly dispersed by wind and natural convection.

(5) Flashpoint (closed-up)

Lowest liquid temperature at which, under certain standardised conditions, a liquid gives off vapours in quantity such as to be capable of forming an ignitable vapour/air mixture.

(6) Boiling point

Temperature of a liquid boiling at an ambient pressure of 101.3 kPa (1013 mbar) (determined in a standard laboratory distillation without fractionation).

(7) Ignition temperature (of an explosive gas atmosphere)

Lowest temperature of a heated surface at which, under specific conditions according to IEC 60079-4, the ignition of a flammable material in the form of a gas or vapour in mixture with air will occur.

(8) Maximum surface temperature

Highest temperature which is attained in service under the most adverse operating conditions① (but within recognized tolerances) by any part or surface of the electrical apparatus, which would be able to produce an ignition of the surrounding explosive atmosphere.

(9) Liquefied gas

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① The most adverse conditions include recognized overloads and fault conditions recognized in the specific standard for the type of protection concerned.

A liquid formed by pressurisation and/or cooling of a gas having a vapour pressure exceeding 2.8 bar absolute at a temperature of 37.8℃

(10) Flammable gas or vapour

Gas or vapour which, when mixed with air in certain proportions, will form an explosive gas atmosphere.

(11) Flammable liquid

Liquid capable of producing a flammable vapour under any foreseeable operating conditions.

(12) Explosive gas atmosphere

Mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour or mist, in which, after ignition, combustion spreads throughout the unconsumed mixture.

(13) Lower explosive limit (LEL)

Concentration of flammable gas, vapour or mist in air, below which an explosive gas atmosphere will not be formed.

(14) Upper explosive limit (UEL)

Concentration of flammable gas, vapour or mist in air, above which an explosive gas atmosphere will not be formed.

(15) Source of release

Point or location from which a gas, vapour, mist or liquid may be released into the atmosphere so that an explosive atmosphere may be formed under normal operating conditions, for example valves and flanges in cargo piping systems.

(16) Natural ventilation

Movement of air and its replacement with fresh air due to the effects of wind and/or temperature gradients.

(17) Artificial ventilation

Movement of air and its replacement with fresh air by artificial means (for example fans) and applied to a general area.

(18) Hazardous area

Area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

(19) Zone 0

Area in which an explosive gas atmosphere is present continuously or is present for long periods.

(20) Zone 1

Area in which an explosive gas atmosphere is likely to occur in normal operation.

(21) Zone 2

Area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only.

(22) Non-hazardous area

Area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

(23) Certified safe-type equipment

Electrical equipment of a type for which CCS or other appropriate authority has certified the safety of the equipment with regard to explosion hazard when used in an explosive gas atmosphere. Such equipment is to be manufactured and tested in accordance with the requirements of IEC 60079.

(24) Type of protection

Specific measures applied to electrical apparatus to avoid ignition of a surrounding explosive atmosphere.

(25) Intrinsically safe circuit

Circuit in which any spark or any thermal effect produced in the specified conditions, which include normal operation and specified fault conditions, is not capable of causing ignition of a given explosive gas atmosphere.

(26) Encapsulation “m”

A type of protection in which the parts which could ignite an explosive atmosphere by either sparking or heating are enclosed in a compound in such a way that this explosive atmosphere cannot be ignited.

(27) Increased safety “e”

Type of protection applied to electrical apparatus that does not produce arcs or sparks in normal service, in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and the occurrence of arcs and sparks.

(28) Pressurization “p”

Technique of guarding against the ingress of the external atmosphere, which may be explosive, into an enclosure by maintaining a protective gas therein at a pressure above that of the external atmosphere.

(29) Flameproof enclosure “d”

Type of protection of electrical apparatus in which the enclosure will withstand an internal explosion of a flammable mixture which has penetrated into the interior, without suffering damage and without causing ignition, through any joints or structural openings in the enclosure, of an external explosive atmosphere consisting of one or more of the gases or vapours for which it is designed.

(30) Protection “n”

Type of protection applied to electrical apparatus such that, in normal operation, it is not capable of igniting a surrounding explosive gas atmosphere and a fault capable of causing ignition is not likely to occur.

(31) Sand-filled apparatus “q”

An apparatus is considered "sand-filled" when all its live parts are entirely embedded in a mass of powdery material.

(32) Purging

Passing of sufficient volume of protective gas through a pressurized enclosure and its ducts before the application of voltage to the apparatus to reduce any explosive gas atmosphere to a concentration well below the lower explosive.

(33) Associated apparatus①

Electrical apparatus in which the circuits or parts of circuits are not all necessarily intrinsically safe but which contains circuits that can affect the safety of the intrinsically safe circuits associated with it.

(34) Simple apparatus

Electrical component or combination of components of simple construction with well-defined electrical parameters which is compatible with the intrinsic safety of the circuit in which it is used.

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① The associated apparatus may be, for example, shunt diode safety barriers located in the non-hazardous area.

The following apparatus is considered to be simple apparatus:

① passive components, e.g. switches, junction boxes, resistors and simple semi-conductor devices;

② sources of stored energy with well-defined parameters, e.g. capacitors or inductors, whose values are considered when determining the overall safety of the system;

③ sources of generated energy, e.g. thermocouples and photocells, which do not generate more than 1.5 V, 100 mA and 25 mW. Any inductance or capacitance present in these sources of energy are considered as in b) above.

(35) Visual inspection

Inspection which identifies, without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye.

(36) Close inspection[①]

Inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only by the use of access equipment, for example steps, (where necessary), and tools.

(37) Detailed inspection

Inspection which encompasses those aspects covered by a close inspection and, in addition, identifies those defects, such as loose determinations, which will only be apparent by opening the enclosure, and/or using, where necessary, tools and test equipment.

(38) Secondary barrier

Secondary barrier is the liquid-resisting outer element of a cargo containment system designed to afford temporary containment of any envisaged leakage of liquid cargo through the primary barrier[②] and to prevent the lowering of the temperature of the ship's structure to an unsafe level.

1.3 Documentation

1.3.1 The plans and documents submitted for approval is to include the following details:

(1) Spaces held at over-pressure, airlocks, ventilation openings, bulkheads, structures, etc. are to be indicated in general arrangement of the ship which shows hazardous area classification.

(2) All electrical apparatus located in hazardous areas and the following details are to be indicated in arrangement of electrical apparatus in gas-hazardous zones:

① manufacturer and type[③];

② certificate number or reference and date of manufacturer's declaration;

③ type of protection, apparatus group and temperature class;

④ degree of protection;

⑤ hazardous area classification of space where electrical apparatus is installed (if no hazardous area classification is indicated).

(3) Diagram of intrinsically safe circuit and the related data (if applicable).

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① Close inspections do not normally require the enclosure to be opened, or the equipment to be de-energized.

② Primary barrier is the inner element designed to contain the cargo when the cargo containment system includes two boundaries.

③ Plans submitted for approval may not provide such information, however it is to be completed prior to the construction survey and confirmed by attending surveyor.

Chapter 2 Area classification

2.1 General

2.1.1 Basic principles

(1) Where it is necessary to use electrical apparatus in an area in which there may be an explosive gas atmosphere and it is not possible to eliminate:

a) any possibility of an explosive gas atmosphere occurring around any source of ignition, or,

b) any source of ignition,

then measures are to aim at reducing the likelihood of the occurrence of both of the above factors so that the likelihood of coincidence is so small as to be acceptable.

(2) In order to facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2 according to IEC 60079-10-1 and the guidance given in the Guidelines.

(3) The likelihood of the presence of an explosive gas atmosphere and hence the type of zone depends mainly on the source of release and rate at which the released substance is dispersed by natural or artificial ventilation. Pressurisation and other factors such as the provision of an inert atmosphere may also affect the type of zone.

(4) Area classification is to be carried out at an early stage of planning. At completion of design and again at completion of construction, the area classification shown on the drawings is to be reviewed against the actual sources of possible release and any structural changes. If necessary, modification to drawings and installation is to be made.

(5) Spaces and areas not mentioned in the Guidelines, as a result of the application of the principles of IEC 60079-10-1, to present an equivalent risk of the presence of an explosive gas atmosphere as defined for zones 0, 1 and 2, are to be considered as these zones.

2.1.2 Substances capable of creating an explosive gas atmosphere

(1) flammable liquid having a flashpoint (closed-cup test) not exceeding 60℃;

(2) flammable liquid having a flashpoint exceeding 60℃, heated or raised by ambient conditions to a temperature within 15℃ of its flashpoint;

(3) flammable gas, in gaseous or liquid state;

(4) substances (for example acids) reacting with other products/materials to evolve flammable gases.

2.1.3 Sources of release

(1) The following are examples of some sources of release:

① venting and other openings to cargo tanks, slop tanks and cargo piping;

② piping systems and equipment, containing liquid or gas, having flanged joints or glands or other openings through which leakage may occur under normal operating conditions.

2.1.4 Separation by gastight boundaries

(1) A space separated by gastight boundaries from a hazardous area may be classified as zones 0, 1, 2, or considered as non-hazardous, taking into account the sources of release inside that space and its conditions of ventilation, in accordance with Table 2.1.4(1) (see clauses A.1 to A.12 of annex A for reference). A bulkhead or other such boundary having penetrations, for example a bolted, gasketted plate or cargo pump drive shaft seal, may be considered to remain gastight, provided that the sealing and securing arrangements and provisions to prevent opening other than under gas-free conditions.

(2) Tanks, continuous fully welded pipes without flanges, joints, glands, etc., containing liquid or gas are not considered as sources of release, although account may need to be taken of the possibility of an escape of gas, vapour, mist or liquid under abnormal conditions, for example seepage through a cargo tank bulkhead.

Spaces separated by one gastight boundary from the zones mentioned in the column

Table 2.1.4(1)

Adjacent space / Classification of the space	With source of release①		Without source of release	
	With ventilation②	Without ventilation	With ventilation②	Without ventilation
Zone 0	Zone 1 for example cargo pump room (see annex A, clause A.1)	Zone 0 for example cofferdams with cargo pipe flanges (see annex A, clause A.4)	Zone 2 for example ballast pump rooms adjacent to cargo tanks (see annex A, clause A.7)	Zone 1 for example cofferdam, void space (see annex A, clause A.10)
Zone 1	zone 2 for example rooms with cargo pipe flanges, (see annex A, clause A.2)	zone 1 for example rooms with cargo pipe flanges (see annex A, clause A.5)	Non-hazardous areas (see annex A clause A.8)	Non-hazardous areas (see annex A, clause A.11)
Zone 2	Zone 2 for example rooms with cargo pipe flanges (see annex A, clause A.3)	Zone 1 for example rooms with cargo pipe flanges (see annex A, clause A.6)	Non-hazardous areas (see annex A, clause A.9)	Non-hazardous areas (see annex A, clause A.12)

① The following are examples of some sources of release:
– venting and other openings to cargo tanks, slop tanks and cargo piping;
– seals of cargo pumps, cargo compressors and process equipment;
– seals of valves and flanges and other connections and pipe fittings.

② Where the area classification of a space is dependent upon its ventilation, the arrangements shall be such that discontinuities in ventilation are not expected to occur for long periods and there is no accumulation of gas or vapour in the vicinity of any source of release, or where electrical equipment is installed.

2.1.5 Openings, access and ventilation conditions affecting the extent of hazardous area

(1) Access doors or other openings are not to be provided between an area intended to be considered as non-hazardous and a hazardous area, or between a space intended to be considered as zone 2 and a zone 1 space except where required for operational reasons, see Table 2.1.5(1).

(2) For spaces where the access doors or similar means of access are closable, the following provisions apply:

① An enclosed space with access to any zone 1 location may be considered as zone 2 if (see annex A, clause A.13):

a) the space is ventilated by over-pressure in accordance with 2.2.2, and

b) the access is fitted with a self-closing door without holding back arrangements, capable of maintaining the over-pressure, opening into the zone 2 space (if the door is hinged).

② An enclosed space with access to any zone 2 location may be considered non-hazardous if (see annex A, clause A.14):

a) the space is ventilated by over-pressure in accordance with 2.2.2, and

b) the access is fitted with a self-closing door without holding back arrangements, capable of maintaining the over-pressure, opening into the non-hazardous space (if the door is hinged).

③ An enclosed space with access to any zone 1 location may be considered non-hazardous if (see annex A, clause A.15):

a) the access is fitted with two doors forming an air-lock, both self-closing and without holding back arrangements, capable of maintaining the over-pressure in each of the spaces, and

b) the space and the air-lock are ventilated by over-pressure in accordance with 2.2.2.

④ An enclosed space with access to any zone 1 location may be considered as zone 2 if (see annex A, clause A.18):

a) the access is fitted with two doors forming an air-lock, both gas-tight, self-closing and without holding back arrangements, and

b) the space and the air-lock have artificial ventilation in accordance with 2.2.1.

⑤ An enclosed space with access to any zone 2 location may be considered non-hazardous if (see annex A, clause A.19):

a) the access is fitted with two doors forming an air-lock, both gas-tight, self-closing and without holding back arrangements, and

b) the space and the air-lock have artificial ventilation in accordance with 2.2.1.

⑥ Notices, warning that the doors are to be kept closed, are to be fitted whenever any of the above arrangements is adopted.

(3) Enclosed spaces with ventilation or semi-enclosed spaces with openings or doors not forming an air-lock to a hazardous area are to be designated as the same hazardous zone as the area in which the openings or doors are located (see annex A, clauses A.16 and A.17).

(4) Enclosed spaces without ventilation with openings or doors to a hazardous area are to be designated as the same hazardous zone as the area in which the openings or doors are located, or as a more hazardous zone (see annex A, clauses A.20, A.21 and A.22).

(5) In the event of loss of the protection by over-pressure or loss of ventilation the requirements of 2.2.1 or 2.2.2, respectively, are to be complied with.

Spaces without source of release and separated by door(s) from the zones mentioned in the column **Table 2.1.5(1)**

Space separated / Classification of the space	Protected by over-pressure relative to the surrounding hazardous area		Not protected by over-pressure relative to the surrounding hazardous area but artificially ventilated		Not protected by overpressure relative to the surrounding hazardous area and not artificially ventilated	
	Separated by one door ①	Separated by two doors②	Separated by one gastight door③	Separated by two gastight doors④	Separated by one door⑤	Separated by two doors⑤
Zone 1	Zone 2 (see annex A, clause A.13)	Non-hazardous area (see annex A, clause A.15)	Zone 1 (see annex A, clause A.16)	Zone 2 (see annex A, clause A.18)	Zone 1 (see annex A, clause A.20)	Zone 1 (see annex A, clause A.20)
Zone 2	Non-hazardous area (see annex A, clause A.14)	Non-hazardous area (one door is sufficient, see annex A, clause A.14)	Zone 2 (see annex A, clause A.17)	Non-hazardous area (see annex A, clause A.19)	Zone 2 (see annex A, clause A.21)	Zone 2 (see annex A, clause A.21)

① Door capable of maintaining the over-pressure.
② Two doors forming an air-lock capable of maintaining the over-pressure.
③ Watertight doors or fire doors class A are considered as gastight.
④ Two gastight doors forming a ventilated air-lock.
⑤ Any type of doors.

2.2 Ventilation related to area classification

2.2.1 Where the area classification of a space is dependent upon its ventilation the arrangements is to be such that discontinuities in ventilation are not expected to occur for long periods. The arrangements are to ensure that there is no accumulation of gas or vapour in the vicinity of any source of release, or where electrical equipment is installed. Failure[①] of artificial ventilation is to be alarmed (audible and visual) at a manned station.

2.2.2 Where a space has an opening into an adjacent, more hazardous space or area, it may be made into a less hazardous space or non-hazardous space in accordance with the following requirements (see also Table 2.1.5(1)).

(1) A minimum over-pressure[②] of 25 Pa (0.25 mbar) with respect to the adjacent, more hazardous, space or area is to be maintained at all points inside the space and its associated ducts at which leaks are liable to occur, all doors and windows being closed.

(2) During initial start-up, or after shutdown, and whatever the classification of the hazardous area, it is necessary, before energising any electrical apparatus within the space which is not suitably protected for the classification of the space in the absence of pressurisation, to:

① either ensure that the internal atmosphere is non-hazardous, or proceed with prior purging of sufficient duration that the internal atmosphere may be considered as non-hazardous, and

② pressurize the space.

(3) A differential pressure monitoring device or a flow monitoring device, or both, is to be provided for monitoring the satisfactory functioning of pressurisation of spaces having an opening into a more hazardous zone.

(4) Where a flow monitoring device is used to indicate failure of pressurisation, it is either to be verified that the pressurisation level required by 2.2.2(1) is maintained with any door or other opening open, or an alarm is to be given if any door or opening is not closed.

(5) In the event of the loss of over-pressure, the protective measures indicated in Table 2.2.2(5) are to apply.

① Initiation of an alarm by a fan motor running or fan rotation monitoring device will not satisfy this requirement.
② This over-pressure will prevent the ingress of the external atmosphere for wind speed up to approximately 3.5 m/s.

Protective measures to be taken in the event of failure of pressurization Table 2.2.2(5)

Classification of the space①	Electrical equipment installed		
	Equipment suitable for use in zone 1	Equipment suitable for use in zone 2	Equipment not protected for any hazardous area
Zone 1	No action necessary	– Suitable alarm (visible and audible) – Immediate action to restore pressurisation – Programmed disconnection of power supplies if the pressurisation cannot be restored for an extended period or if the concentration of flammable gas rises to a dangerous level	– Suitable alarm (visible and audible) – Immediate action to restore pressurisation – Automatic interruption of the power supplies as rapidly as practicable within a prescribed delay time with regard to the needs of a programmed shut-down
Zone 2	No action necessary	No action necessary	– Suitable alarm (visible and audible) –Immediate action to restore pressurisation – Programmed disconnection of power supply if the pressurisation cannot be restored for an extended period or if the concentration of flammable gas rises to a dangerous level
① Classification of the space or area into which the opening leads.			

2.3 Tankers carrying flammable liquids other than liquefied gases having a flashpoint (closed-cup) not exceeding 60℃

2.3.1 Hazardous areas zone 0

The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo or developing flammable gases or vapours (see annex B, clause B.1).

2.3.2 Hazardous areas zone 1

(1) void spaces adjacent to, above or below integral cargo tanks (see annex B, clause B.2);

(2) hold spaces containing independent cargo tanks (see annex B, clause B.3);

(3) cofferdams and permanent (for example, segregated) ballast tanks adjacent to cargo tanks (see annex B, clause B.4);

(4) cargo pump rooms (see annex B, clause B.4) and pump rooms in cargo area;

(5) enclosed or semi-enclosed spaces, immediately above cargo tanks (for example, between decks) or having bulkheads above and in line with cargo tank bulkheads, unless protected by a diagonal plate acceptable to the appropriate authority (see annex B, clause B.4);

(6) spaces, other than cofferdam, adjacent to and below the top of a cargo tank (see annex B, clause B.4) (for example, trunks, passageways and hold);

(7) areas on open deck, or semi-enclosed spaces on open deck, within 3 m of any cargo tank outlet, gas or vapour outlet①, cargo manifold valve, cargo valve, cargo pipe flange, cargo pump-room ventilation outlets and cargo tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation (see annex B, clause B.5);

(8) areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of any

① Such areas are, for example, all areas within 3 m of cargo tank hatches, sight ports, tank cleaning openings, ullage openings, sounding pipes, cargo vapour outlets.

cargo gas outlet intended for the passage of large volumes of gas or vapour mixture during cargo loading and ballasting or during discharging, within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet (see annex B, clause B.6);

(9) areas on open deck, or semi-enclosed spaces on open deck, within 1.5 m of cargo pump room entrances, cargo pump room ventilation inlet, openings into cofferdams or other zone 1 spaces (see annex B, clause B.6);

(10) areas on open deck over all cargo tanks (including all ballast tanks within the cargo tank area) where structures are restricting the natural ventilation and to the full breadth of the ship plus 3 m fore and aft of the forward-most and aft-most cargo tank bulkhead, up to a height of 2.4 m above the deck (see annex B, clause B.7);

(11) areas on open deck within spillage coamings surrounding cargo manifold valves and 3 m beyond these, up to a height of 2.4 m above the deck (see annex B, clause B.6);

(12) compartments for cargo hoses (see annex B, clause B.7);

(13) enclosed or semi-enclosed spaces in which pipes containing cargoes are located (see annex B, clause B.7).

2.3.3 Hazardous areas zone 2

(1) areas of 1.5 m surrounding open or semi-enclosed spaces of zone 1 as specified in 2.3.2, if not otherwise specified in the Guidelines (see annex B, clause B.8);

(2) spaces 4 m beyond the cylinder and 4 m beyond the sphere defined in 2.3.2(8) (see annex B, clause B.9);

(3) the spaces forming an air-lock as defined in 2.1.5(2)③;

(4) areas on open deck extending to the coamings fitted to keep any spills on deck and away from the accommodation and service areas and 3 m beyond these up to a height of 2.4 m above the deck (see annex B, clause B.9);

(5) areas on open deck over all cargo tanks (including all ballast tanks within the cargo tank area) where unrestricted natural ventilation is guaranteed and to the full breadth of the ship plus 3 m fore and aft of the forward-most and aft-most cargo tank bulkhead, up to a height of 2.4 m above the deck surrounding open or semi-enclosed spaces of zone 1;

(6) Spaces forward of the open deck areas (see annex B, clause B.10) to which reference is made in 2.3.2(10), below the level of the main deck, and having an opening on to the main deck or at a level less than 0,5 m above the main deck, unless:

① the entrances to such spaces do not face the cargo tank area and, together with all other openings to the spaces, including ventilating system inlets and exhausts, are situated at least 5 m from the foremost cargo tank and at least 10 m measured horizontally from any cargo tank outlet or gas or vapour outlet; and

② the spaces are mechanically ventilated.

2.4 Tankers carrying flammable liquids other than liquefied gases having a flashpoint (closed-cup) exceeding 60℃

2.4.1 Unheated cargoes and cargoes heated to temperature (T_H) below, and not within 15℃, of their flashpoint (FP)

(1) The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo may be considered as

hazardous areas zone 2 (see annex C).

2.4.2 For cargoes heated to temperature (T_H) above their flashpoint (FP) and cargoes heated to temperature within 15℃ of their flashpoint[①], the requirements of 2.3 are applicable.

2.5 Tankers carrying flammable liquefied gases

2.5.1 Hazardous areas zone 0

(1) areas as specified in 2.3.1 (see annex D, clause D.1);

(2) interbarrier spaces and, only where the cargo tank requires a secondary barrier (see annex D, clause D.1).

2.5.2 Hazardous areas zone 1

(1) areas as specified in 2.3.2 (see annex D, clause D.2);

(2) cargo compressor rooms (see annex D, clause D.2);

(3) areas on open deck, or semi-enclosed spaces on open deck, within 3 m of cargo compress room ventilation outlets (see annex D, clause D.2);

(4) areas on open deck, or semi-enclosed spaces on open deck, within 1.5 m of cargo compressor room entrances or cargo compressor room ventilation inlets (see annex D, clause D.2);

(5) a space separated from a hold space, where cargo is carried in a cargo tank requiring a secondary barrier, by a single gastight boundary (see annex D, clause D.3);

(6) enclosed or semi-enclosed spaces in which pipes containing cargo products for boiloff gas fuel burning systems are located, unless special precautions approved by the appropriate authority are provided to prevent product gas escaping into such spaces (see annex D, clause D.4).

2.5.3 Hazardous areas zone 2

(1) areas as specified in 2.3.3 (see annex D, clause D.5);

(2) an area within 2.4 m of the outer surface of a cargo tank where such surface is exposed to the weather (see annex D, clause D.6).

2.6 Tankers carrying cargoes (for example acids) reacting with other products/materials to evolve flammable gases

2.6.1 Hazardous areas zone 1

(1) areas as specified in 2.3.1, 2.3.2(4) and 2.3.2(12) (see annex E, clause E.1).

2.6.2 Hazardous areas zone 2

(1) areas of 1.5 m surrounding openings of zone 1 spaces as specified in 2.6.1;

(2) areas as specified in 2.3.2(1), 2.3.2(2), 2.3.2(3), 2.3.2(5), 2.3.2(6) and 2.3.2(13) (see annex E, clauses E.3, E.4 and E.5);

(3) areas as specified in 2.3.2(7) and 2.3.2(11) but with the distances of 2.4 m and 3 m reduced to 1.5 m (see annex E, clauses E.6 and E.7);

(4) areas as specified in 2.3.2(8) but with the distance of 6 m reduced to 3 m (see annex E, clause E.7).

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① $T_H \geq FP - 15℃$.

Chapter 3 Electrical systems

3.1 Sources of electrical power

3.1.1 The main and emergency sources of electrical power and associated transforming equipment, if any, the main and emergency switchboards, the transitional source of emergency power, if any, and the emergency lighting switchboard, are to be installed only in locations which are non hazardous.

3.2 Distribution systems

3.2.1 Distribution systems are to comply with the provisions of paragraph 2.4.1 of Section 4 in PART FOUR of CCS Rules for Classification of Sea-going Steel Ships.

3.3 Electrical protection

3.3.1 Protection arrangements are to comply with the provisions of paragraph 2.4.2 of Section 4 in Chapter 2 of PART FOUR of CCS Rules for Classification of Sea-going Steel Ships, subject to the additional requirements of 3.3.2 and 3.3.3 set out below.

3.3.2 Where any circuit, other than an intrinsically-safe circuit, passes into any zone 0 area, the circuit is to be disconnected automatically and/or is to be prevented from being energized in the event of an abnormally low level of insulation resistance and/or high level of leakage current.

3.3.3 Where a circuit passes into any zone 0 area, the protective systems are to be arranged so that manual intervention is necessary for the reconnection of the circuit after disconnection as the result of a short-circuit, overload or earth-fault condition.

3.4 Earthing

3.4.1 Earthing is to comply with the provisions of paragraph 1.3.4 of Section 1 in Chapter 1 of PART FOUR of CCS Rules for Classification of Sea-going Steel Ships, subject to the additional requirements of 3.4.2 and 3.4.3 set out below.

3.4.2 Where tanks or piping systems for poorly conductive fluids, other than cargo, are located in a hazardous area, 1.3.4.12 of PART FOUR of CCS Rules for Classification of Sea-going Steel Ships is also to apply to these tanks and systems.

3.4.3 For fans installed in a hazardous area or serving a space that would be classified hazardous in the absence of ventilation, electrostatic charges both in the rotating body and the casing are to be prevented by the use of antistatic materials and satisfactory earthing, ensuring that the resistance between any point on the surface of the unit and the hull of the ship is not greater than $10^6\ \Omega$.

3.5 Cathodically protected metallic parts

3.5.1 Cathodically protected metallic parts are some external live parts (especially with impressed current), though they are relatively low negative potential. No impressed current cathodic protection is to be provided for metallic parts in hazardous areas, unless it is specially designed for this application and acceptable to the appropriate authority.

Chapter 4 Electrical equipment

4.1 General

4.1.1 In order to select the appropriate electrical apparatus for hazardous areas, the following information is required:

(1) classification of the hazardous area —— electrical apparatus is to be selected according to the category of hazardous zone in which it is to operate, see 4.3;

(2) the ignition temperature of the gas or vapour involved, see 4.4;

(3) the gas or vapour classification, see 4.5;

(4) external influences and ambient temperature, see 4.6.

4.1.2 For some types of protection, for example pressurisation, oil-immersion, sand-filling and increased safety, gas or vapour classification may not be required.

4.1.3 Consideration is to be given to limiting the use of sand-filled and oil-immersed apparatus. These types of protection may not remain effective if the motion of the vessel reduces the depth of cover of electrical parts due to movement of the filling material.

4.1.4 Movable equipment, if accepted by the appropriate authority to be used in a hazardous area, is to be of a certified safe type, suitable for portable or transportable use and selected in accordance with 4.1.1.

4.1.5 Electrical apparatus is to, additionally, in certain locations, be limited to specific types of protection and/or functions recognised by the appropriate authority as essential in, and suitable for, these locations.

4.2 Certified safe-type equipment

4.2.1 Electrical equipment located in hazardous areas is to be of certified safe type.

4.2.2 Electrical apparatus having type “n” protection is to be constructed in accordance with IEC 60079-15.

4.2.3 The nameplate of certified safe-type equipment is at least to include:

(1) “Ex” is to be clearly marked on the upper right of the nameplate;

(2) the type, group, level and temperature class are to be marked in sequence, for example flameproof enclosure Group IIB, Class T3 is marked as “Exd IIB T3”;

(3) certificate number and product ID;

(4) special condition need to be marked;

(5) date of dispatch.

4.3 Selection of electrical equipment in hazardous areas

4.3.1 Electrical equipment or cables is not normally to be installed in hazardous areas. Where essential for operational purposes, the types of equipment and the cables may be considered according to 4.1.

4.3.2 The following equipment may be considered for zone 0:

(1) certified intrinsically-safe apparatus of category “ia”;

(2) simple electrical apparatus and components (for example 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 energy① in excess of the limits given in IEC 60079-14;

(3) other electrical apparatus specifically designed and certified by the appropriate authority for use in zone 0; for precautions against operation under conditions of earth fault or failure of electrical insulation, see 3.3.3;

(4) submersible electrically-driven pumps, having at least two independent methods of shutting down automatically in the event of low liquid level. The construction and installation of the pump and associated cabling, and the means by which it is prevented from being energized when not submerged or in an atmosphere incapable of supporting combustion.

4.3.3 The following equipment may be considered for zone 1, unless required by 4.3.6:

(1) electrical apparatus mentioned in 4.3.2;

(2) certified intrinsically-safe apparatus of category "ib";

(3) simple electrical apparatus and components (for example 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 the limits given in IEC 60079-14;

(4) certified flameproof (type "d");

(5) certified pressurized (type "p");

(6) certified increased safety (type "e");

(7) certified encapsulated (type "m");

(8) certified sand filled (type "q");

(9) certified specially② (type "s");

(10) hull fittings containing the terminals or shell-plating penetrations for anodes or electrodes of an impressed current cathodic protection system, or transducers such as those for depthsounding or log systems, provided that such fittings are of gastight construction or are housed within a gastight enclosure, and are not located adjacent to a cargo tank bulkhead;

(11) through runs of cable.

4.3.4 The following equipment may be considered for zone 2:

(1) electrical equipment mentioned in 4.3.2;

(2) electrical apparatus having type "n" protection;

(3) the type which ensures the absence of sparks and arcs and of "hot spots" during its normal operation.

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

4.3.6 For oil tankers carrying cargo oils having a flash point not exceeding 60℃, electrical equipment installed in cargo pump rooms are to comply with the requirements of 2.16.6.2(3) of Chapter 2 in PART FOUR of CCS Rules for Classification of Sea-going Steel Ships.

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① Consideration may need to be given to matters such as the integrity of the insulation from earth of the circuit, the suitability of any plastics or light metals incorporated in the construction of the apparatus or component, and (except in the cases of switches, plugs and sockets, and terminals) the maximum surface temperature of any part of the apparatus. Apparatus reliant upon voltage or current limiting or suppression devices for remaining within the limits set by IEC 60079-14, is excluded from the category of "simple apparatus".

② Where the electrical equipment is of the type of protection not included in the standard (flameproof, increased safety, intrinsically safe, pressurized, oil immersion，sand filled, encapsulated and protection "n"), it may be used as special equipment (type "s") with the approval of survey unit.

4.4 Selection with respect to ignition temperature of the gas or vapour

4.4.1 The electrical apparatus is to be so selected that its maximum surface temperature will not reach the ignition temperature of any gas or vapour, or mixture of gases or vapours, which can be present. Generally, the ignition temperature of a mixture is determined by test. However, it is recognized that the properties of certain categories of cargo are sufficiently well established to allow selection of equipment without individual analysis or test①; for example equipment of temperature class T3 may be accepted for use in hazardous areas on crude oil or oil products tankers without analysis or test of particular cargoes.

4.4.2 Symbols for the temperature classes which may be marked on the electrical apparatus have the meaning indicated in Table 4.4.2.

Relationship between the temperature classes and ignition temperature Table 4.4.2

Temperature class of electrical apparatus	Maximum surface temperature of electrical apparatus	Ignition temperature of gas or vapour
T1	450℃	>450℃
T2	300℃	>300℃
T3	200℃	>200℃
T4	135℃	>135℃
T5	100℃	>100℃
T6	85℃	>85℃

4.5 Selection with respect to the classification of gas or vapour

4.5.1 According to IEC 60079-12, gas and vapour are to be categorized as groups IIA, IIB and IIC. Since flameproof enclosures and intrinsically-safe electrical apparatus are closely related with the properties of the gas in flammable atmosphere, they are to be categorized corresponding to the classification of gas and vapour.

4.5.2 Apparatus marked for particular gases is to be selected only where no other flammable gas can be present.

4.5.3 Mixtures of gases are generally to be allocated to a group only after a special determination of their relevant properties. However, in the absence of such a special determination, a mixture may be allocated to the group of the component having the most onerous requirements.

4.5.4 It is also recognised, as in the case of ignition temperature, that the properties of certain cargoes allow the selection of equipment without individual analysis; for example equipment of group IIA may be accepted for use in hazardous areas on crude oil or products tankers without analysis or test of particular cargoes.

4.6 Verification of intrinsically safe circuits

4.6.1 When installing intrinsically safe circuits, including cables, the maximum permissible inductance and capacitance are not to be exceeded. The permissible values are to be taken from qualification certificate, the marking plate or the associated apparatus installation instructions.

4.6.2 For intrinsically safe circuits with only one associated apparatus, the sum of the maximum effective internal capacitance C_i of each item of intrinsically safe apparatus and the cable capacitance C_c is not to exceed the maximum value C_o marked on the associated apparatus.

① Temperature class of part of the gas and vapour are given in Table B in Annex B of IEC60079-0 for reference.

4.6.3 For intrinsically safe circuits with only one associated apparatus, the sum of the maximum effective internal inductance L_i of each item of intrinsically safe apparatus and the cable inductance L_c is not to exceed the maximum value L_o marked on the associated apparatus.

4.6.4 Where the intrinsically safe apparatus contains no effective inductance and the associated apparatus is marked with an inductance/resistance *L/R* value, if the *L/R* value of the cable, measured between the two cores in the cable having maximum separation, is less than this figure, it is not necessary to satisfy the L_o requirement.

4.6.5 The values of permissible input voltage U_i, input current I_i of each intrinsically safe apparatus is to be greater than or equal to the values U_o, I_o respectively of the associated apparatus.

4.6.6 The values of maximum permissible inductance, capacitance of intrinsically safe circuits are to be taken from the marking plate and associated apparatus instructions. The values of maximum permissible inductance, capacitance of cables are to be provided by manufacturer.

4.7 Environmental conditions

4.7.1 Electrical apparatus is to be protected against the external influences (for example chemical, mechanical and thermal stresses) to which it may be subjected.

4.7.2 The electrical apparatus is to, in general, be suitable for an ambient air temperature range from –25℃ to +45℃. If the marking of the electrical apparatus does not include an ambient air temperature range, this is understood to be from –20℃ to +40℃.

4.7.3 If it is established, to the satisfaction of an appropriate authority, that the safe operation of equipment will not be impaired, it may be used at ambient air temperatures outside the range specified in 4.7.2, or that for which the equipment is marked.

Chapter 5 Installation

5.1 General

5.1.1 Electrical installations in hazardous areas are to comply, as far as applicable, with IEC 60079-14.

5.1.2 The installation is to comply with any special conditions that may apply to the safe use of the electrical apparatus, particularly, any stated in the installation instructions of the apparatus.

5.1.3 For the construction and testing of cables see IEC 60092.

5.1.4 The wiring system and its components are to be suitable for the hazardous area environment, including mechanical, chemical and corrosion factors.

5.2 Selection and installation of cables

5.2.1 All cables, other than those of intrinsically-safe circuits, installed in zone 0, zone 1 areas are to be sheathed with at least one of the following:

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

(2) copper or stainless steel sheath (for mineral insulated cables only). Aluminium sheathed cables may be considered for special applications.

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

5.2.3 Where intrinsically-safe circuits may be subjected to disturbances by magnetic or electric fields, special attention is to be given to transposition or other means so that these fields do not adversely affect the intrinsic safety of the circuit.

5.2.4 Where cables are subject to lengthy immersion in the cargo, the construction of the cables is to be such as to withstand the substances to which they can be exposed, or the cables are to be enclosed in casings (such as metallic pipes) capable of withstanding such substances.

5.2.5 The use of flexible cables for movable electrical equipment is to be restricted. Where they are necessary, transportable and portable electrical equipment are to have cables with a heavy polychloroprene or other equivalent synthetic elastomeric sheath, cables with a heavy tough rubber sheath, or cables having an equally robust construction. The conductors are to be stranded and are to have a minimum cross-sectional area of 1.0 mm^2. If a protective earthing (PE) conductor is necessary, it is to be separately insulated in a manner similar to the other conductors and is to be incorporated within the supply cable sheath.

5.2.6 All metallic protective coverings of power and lighting cables, other than single-core cables for circuits rated in excess of 20A, passing through a hazardous zone, or connected to equipment in such a zone, are to be earthed at their both ends. The metallic covering of all other cables are to be earthed at least at one end (e.g. control or instrument cables).

5.3 Connection of cables

5.3.1 Cables are to enter an explosion protected enclosure only by means of a gland (in accordance with regulation 16 of IEC60079-0) or equivalent device capable of maintaining the integrity of the enclosure①.

5.3.2 The connection of cables to all other apparatus are to be made in accordance with the

① Enclosure, the mechanical integrity of which is considered essential for, and is examined in detail for, its certification or acceptance for use in a hazardous area.

relevant type of protection.

5.4 Cable joints

5.4.1 Cable runs in hazardous areas are to, where practicable, be uninterrupted. Where discontinuities cannot be avoided, the joint is to be made in an enclosure with a type of protection appropriate to the requirements for the location such as flameproof enclosure. Cable joints are permitted to be in zones 1 and 2. Except for intrinsically-safe circuits, cable joints are not permitted to be in zone 0.

Chapter 6 Inspection and maintenance

6.1 General

6.1.1 Electrical apparatus in hazardous areas is specially designed to adapt to such environment. Therefore, the electrical apparatus in such hazardous areas is to maintain the properties specially designed during its whole life period for safety's sake.

6.1.2 Shipowners, shipyards and surveyors may refer to this Chapter during the inspection and maintenance of the electrical apparatus in hazardous areas, subject to the relevant requirements of the flag State Government and CCS.

6.1.3 For those not covered by this Chapter, reference may be made for IEC 60079-17.

6.2 Inspections

6.2.1 Before plant or apparatus is brought into service, it is to be given an initial inspection. Initial inspections are used to check that the selected type of protection and its installation are appropriate.

6.2.2 To ensure that the installations are maintained in a satisfactory condition for continued use within a hazardous area, regular periodic inspections are to be carried out by skilled personnel. Periodic inspections may be visual or close as appropriate. A visual or close periodic inspection may be used, and a further detailed inspection may be carried out once any defects are found.

6.2.3 Inspection schedule for Ex "d", Ex "e", Ex "n", Ex "p" and Ex "i" installations are listed in Tables 6.2.3(1) to (3).

Inspection schedule for Ex "d", Ex "e" and Ex "n" installations

(D = Detailed, C = Close, V = Visual) **Table 6.2.3(1)**

Check that:		Ex"d"			Ex"e"			Ex"n"		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
A	**Apparatus**									
1	Apparatus is appropriate to area classification	×	×	×	×	×	×	×	×	×
2	Apparatus group is correct	×	×		×	×		×	×	
3	Apparatus temperature class is correct	×	×		×	×		×	×	
4	Apparatus circuit identification is correct	×			×			×		
5	Apparatus circuit identification is available	×	×	×	×	×	×	×	×	×
6	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	×	×	×	×	×	×	×	×	×
7	There are no unauthorized modifications	×			×			×		
8	There are no visible unauthorized modifications		×	×		×	×		×	×
9	Bolts, cable entry devices (direct and indirect) and blanking elements are of the correct type and are complete and tight									
	physical check	×	×		×	×		×	×	×
	visual check			×			×			
10	Flange faces are clean and undamaged and gaskets, if any, are satisfactory	×								×
11	Flange gap dimensions are within maximal values permitted	×			×			×		

Check that:		Ex"d"			Ex"e"			Ex"n"		
		Grade of inspection								
		D	C	V	D	C	V	D	C	V
12	Lamp rating, type and position are correct	×			×			×		
13	Electrical connections are tight				×			×		
14	Condition of enclosure gaskets is satisfactory				×			×		
15	Enclosed-break and hermetically sealed devices are undamaged							×		
16	Restricted breathing enclosure is satisfactory							×		
17	Motor fans have sufficient clearance to enclosure and/or covers	×			×			×		
18	Breathing and draining devices are satisfactory	×			×			×		
B	**Installation**									
1	Type of cable is appropriate	×			×			×		
2	There is no obvious damage to cables	×	×	×	×	×	×	×	×	×
3	Sealing of trunking, ducts, pipes and/or conduits is satisfactory	×	×	×	×	×	×	×	×	×
4	Stopping boxes and cable boxes are correctly filled	×								
5	Integrity of conduit system and interface with mixed system is maintained	×			×			×		
6	Earthing connections, including any supplementary earthing bonding connections are satisfactory (for example connections are tight and conductors are of sufficient cross-section)									
	physical check	×			×			×		
	visual check		×	×		×	×		×	×
7	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	×			×			×		
8	Insulation resistance is satisfactory	×			×			×		
9	Automatic electrical protective devices operate within permitted limits	×			×			×		
10	Automatic electrical protective devices are set correctly (auto-reset not possible)	×			×			×		
11	Special conditions of use (if applicable) are complied with	×			×			×		
12	Cables not in use are correctly terminated	×			×			×		
13	Obstructions adjacent to flameproof flanged joints are in accordance with IEC 60079-14	×	×	×						
14	Variable voltage/frequency installation in accordance with documentation	×	×		×	×		×	×	
C	**Environment**									
1	Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors	×	×	×	×	×	×	×	×	×
2	No undue accumulation of dust and dirt	×	×	×	×	×	×	×	×	×
3	Electrical insulation is clean and dry				×			×		

Note 1: D = Detailed, C = Close, V = Visual.

Note 2: General: the checks used for apparatus using both types of protection “e” and “d” will be a combination of both columns.

Note 3: Items B7 and B8: account should be taken of the possibility of an explosive atmosphere in the vicinity of the apparatus when using electrical test equipment.

Note 4: “×”— relevant inspection is to be carried out.

Inspection schedule for Ex "p" installations **Table 6.2.3(2)**

Check that:		Grade of inspection		
		Detailed	**Close**	**Visual**
A	**Apparatus**			
1	Apparatus is appropriate to area classification	×	×	×
2	Apparatus group is correct	×	×	
3	Apparatus temperature class is correct	×	×	
4	Apparatus circuit identification is correct	×		
5	Apparatus circuit identification is available	×	×	×
6	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	×	×	×
7	There are no unauthorized modifications	×		
8	There are no visible unauthorized modifications	×	×	×
9	Lamp rating, type and position are correct	×		
B	**Installation**			
1	Type of cable is appropriate	×		
2	There is no obvious damage to cables	×	×	×
3	Earthing connections, including any supplementary earthing bonding connections are satisfactory, for example connections are tight and conductors are of sufficient cross-section			
	physical check	×		
	visual check		×	×
4	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	×		
5	Automatic electrical protective devices operate within permitted limits	×		
6	Automatic electrical protective devices are set correctly	×		
7	Protective gas inlet temperature is below maximum specified	×		
8	Ducts, pipes and enclosures are in good condition	×	×	×
9	Protective gas is substantially free from contaminants	×	×	×
10	Protective gas pressure and/or flow is adequate	×	×	×
11	Pressure and/or flow indicators, alarms and interlocks function correctly	×		
12	Pre-energizing purge period is adequate	×		
13	Conditions of spark and particle barriers of ducts for exhausting the gas in hazardous area are satisfactory	×		
14	Special conditions of use (if applicable) are complied with	×		
C	**Environment**			
1	Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors	×	×	×
2	No undue accumulation of dust and dirt	×	×	×
Note: "×"— relevant inspection is to be carried out.				

Inspection schedule for Ex "i" installations **Table 6.2.3(3)**

Check that:		Grade of inspection		
		Detailed	**Close**	**Visual**
A	**Apparatus**			
1	Circuit and/or apparatus documentation is appropriate to area classification	×	×	×
2	Apparatus installed is that specified in the documentation — fixed apparatus only	×	×	
3	Circuit and/or apparatus category and group correct	×	×	
4	Apparatus temperature class is correct	×	×	
5	Installation is clearly labelled	×	×	
6	There are no unauthorized modifications	×		
7	There are no visible unauthorized modifications		×	×
8	Safety barrier units, relays and other energy limiting devices are of the approved type, installed in accordance with the certification requirements and securely earthed where required	×	×	×
9	Electrical connections are tight	×		
10	Printed circuit boards are clean and undamaged	×		
B	**Installation**			
1	Cables are installed in accordance with the documentation	×		
2	Cable screens are earthed in accordance with the documentation	×		
3	There is no obvious damage to cables	×	×	×
4	Sealing of trunking, ducts, pipes and/or conduits is satisfactory	×	×	×
5	Point-to-point connections are all correct	×		
6	Earth continuity is satisfactory (for example connections are tight and conductors are of sufficient cross-section)	×		
7	Earth connections maintain the integrity of the type of protection	×	×	×
8	The intrinsically safe circuit is isolated from earth or earthed at one point only (refer to documentation)	×		
9	Separation is maintained between intrinsically safe and non-intrinsically safe circuits in common distribution boxes or relay cubicles	×		
10	As applicable, short-circuit protection of the power supply is in accordance with the documentation	×		
11	Special conditions of use (if applicable) are complied with	×		
12	Cables not in use are correctly terminated	×	×	×
C	**Environment**			
1	Apparatus is adequately protected against corrosion, weather, vibration and other adverse factors	×	×	×
2	No undue accumulation of dust and dirt	×	×	×
Note: "×"— relevant inspection is to be carried out.				

6.2.4 For spaces protected by pressurisation, it is to be verified that:

(1) the construction of the space and the protective measures have been examined, and the purge time required at the minimum flow rate of the ventilation system has been recorded;

(2) the minimum over-pressure required by 2.2.2(1) can be maintained with the minimum flow

rate of the pressurisation system with all the openings closed (or open, if ventilation flow rate only is monitored), in normal working conditions;

(3) any required shutdown and/or alarm signal(s) is (are) initiated upon ventilation overpressure or flow rate falling below the prescribed values.

6.2.5 For spaces other than those protected by pressurisation, where area classification depends on mechanical ventilation (for example the spaces specified in 2.1.5⑤ of the Guidelines), it is to be verified that:

(1) any testing considered necessary by the appropriate authority has been carried out to confirm that the ventilation flow rate is adequate and that the arrangements leave no stagnant air, leading to an accumulation of gas or vapour;

(2) any required ventilation failure alarm operates correctly.

6.2.6 For apparatus for which safety in hazardous areas depends upon the correct operation of protective devices, (such as the overload protection relay for an Exe motor, or the thermal cutout of a heater), and/or the operation of an alarm (such as the loss of pressurisation alarm for an Exp control panel), it is to be verified that:

(1) the devices have the correct settings or rating;

(2) any testing considered necessary by the appropriate authority to confirm the correct operation of the arrangements has been carried out.

6.2.7 For apparatus for which safety in hazardous areas depends upon the correct fusing of its electrical supply or limitation of the prospective fault level of the supply (such as Ex s or Ex m apparatus), it is to be verified that fuse-links of the correct characteristics are installed, or that the prospective fault level does not exceed that permitted.

6.2.8 For equipment permitted only by virtue of the provision of appropriate interlocking and shutdown arrangements, such as submerged cargo pumps, it is to be verified that any testing considered necessary to confirm the correct operation of those arrangements has been carried out.

6.2.9 For installation of electrical equipment and electrical systems with the type of protection “i”, it is to be verified that the installation has been examined and that the necessary tests have been carried out to ensure that the equipment and associated wiring are installed correctly in accordance with the manufacturer’s documentation.

6.2.10 Alarms, monitoring and interlocks associated with pressurized equipment and spaces are to be periodically tested to ensure correct operation.

6.3 Maintenance

6.3.1 Certified safe type explosion-proof equipment is to be maintained in a satisfactory condition in any circumstance.

6.3.2 Following any replacement, repair, modification or adjustment, the items concerned are to be inspected in accordance with the relevant items of the detailed column of Tables 6.2.3(1) to (3). If, at any time, there is a change in the area classification or if any apparatus is moved from one location to another, the relevant changed plans are to be submitted for approval and a check is to be made to ensure that the type of protection, apparatus group and temperature class, where appropriate, are suitable for the revised conditions. If plant or apparatus is dismantled during the course of an inspection, precautions are to be taken during reassembly to ensure that the integrity of the type of protection is not impaired.

6.3.3 Maintenance procedures and records for electrical equipment located in and associated with

hazardous areas are to be verified.

6.3.4 Documentation is to include the date of inspection, details of any maintenance procedure found necessary, and the date when such maintenance was completed. The company(ies) and name(s) of the person(s) who carried out the inspection and maintenance work are also to be recorded.

Annex A
(informative)

Examples of hazardous area classification – Basic principles

Symbols:

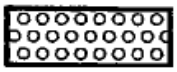
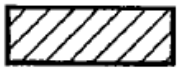
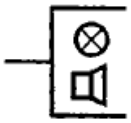
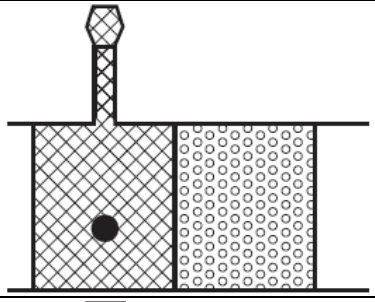
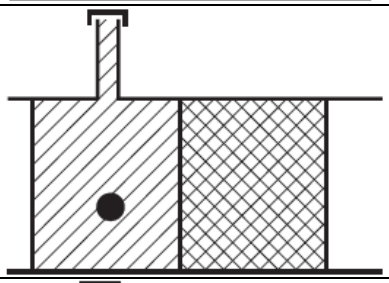
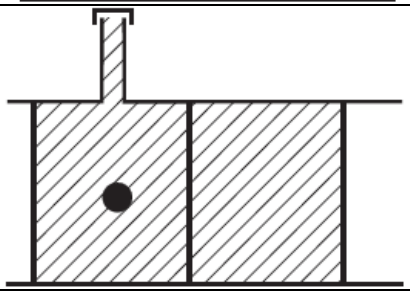
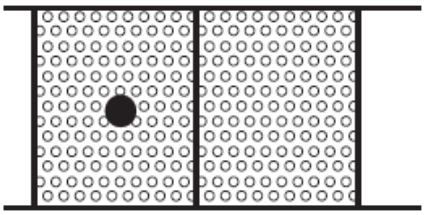
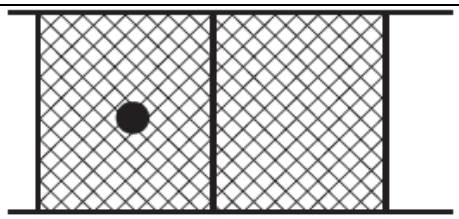
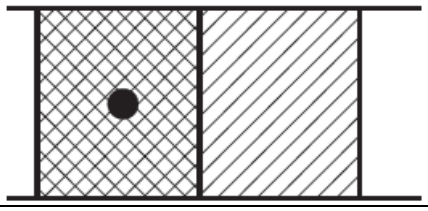
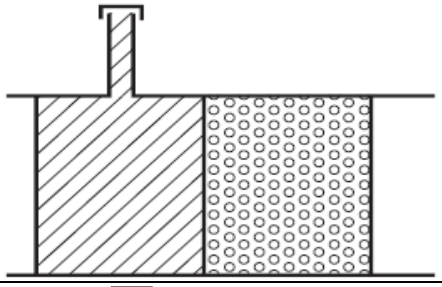
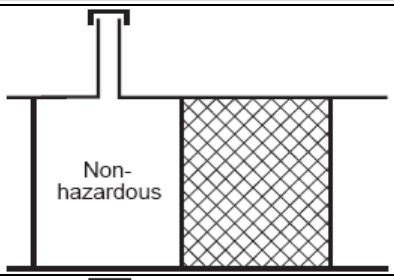
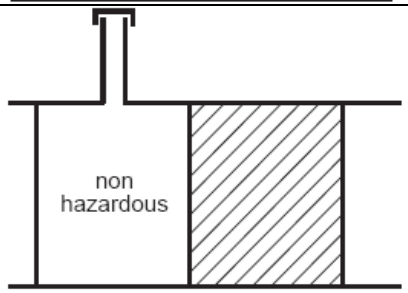
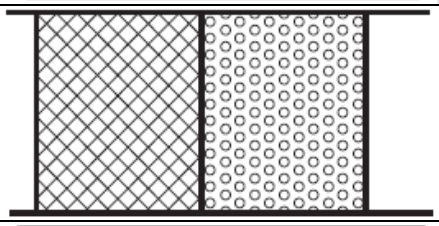
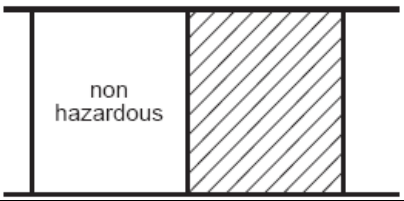
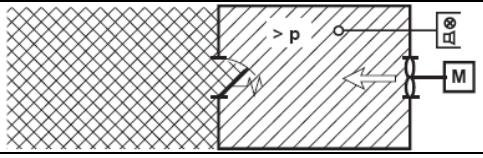
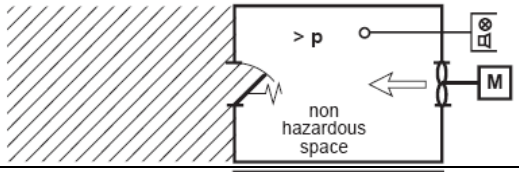
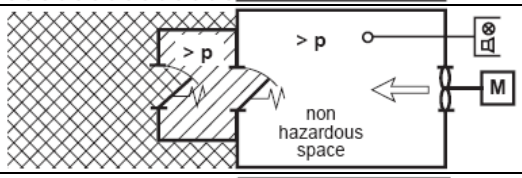
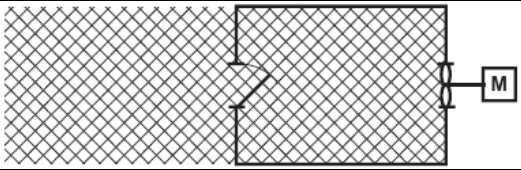
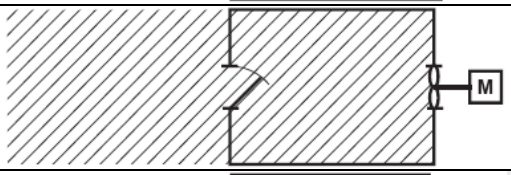
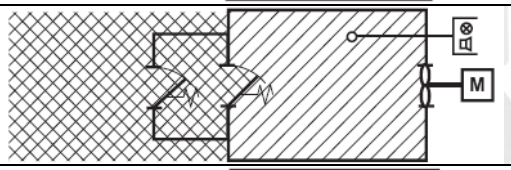
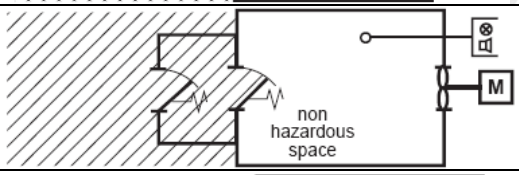
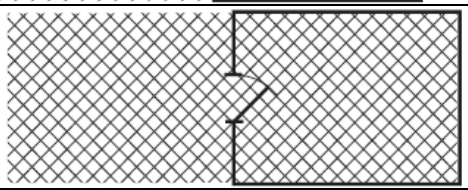
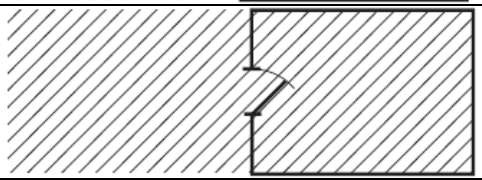
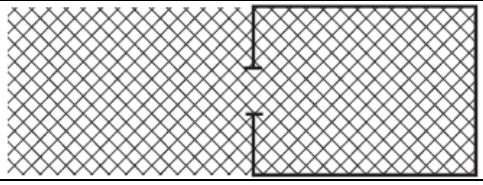
	Area classification as zone 0
	Area classification as zone 1
	Area classification as zone 2
	Self-closing door without holding back arrangements
	Audible and visual alarm in case of loss of pressure or failure of ventilation
	Source of release
>p	Pressure above atmospheric pressure

Table A

Item	Subclause	Typical examples	Remarks
A.1	2.1.4(1) Table 2.1.4(1)		
A.2	2.1.4(1) Table 2.1.4(1)		
A.3	2.1.4(1) Table 2.1.4(1)		
A.4	2.1.4(1) Table 2.1.4(1)		
A.5	2.1.4(1) Table 2.1.4(1)		
A.6	2.1.4(1) Table 2.1.4(1)		

Item	Subclause	Typical examples	Remarks
A.7	2.1.4(1) Table 2.1.4(1)		
A.8	2.1.4(1) Table 2.1.4(1)		
A.9	2.1.4(1) Table 2.1.4(1)		
A.10	2.1.4(1) Table 2.1.4(1)		
A.11	2.1.4(1) Table 2.1.4(1)		
A.12	2.1.4(1) Table 2.1.4(1)		
A.13	2.1.5(2)① Table 2.1.5(1)		Pressurized space

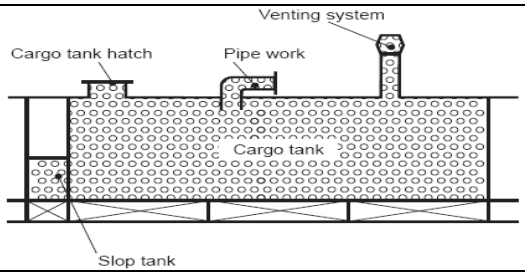
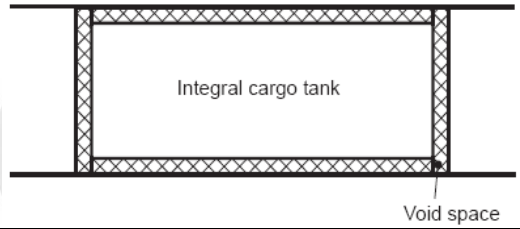
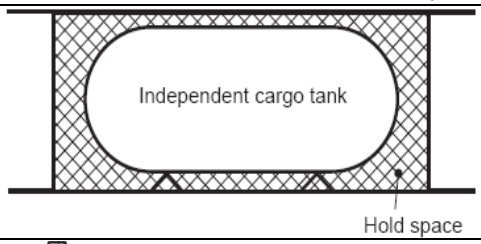
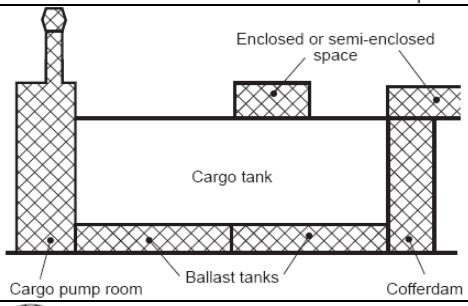
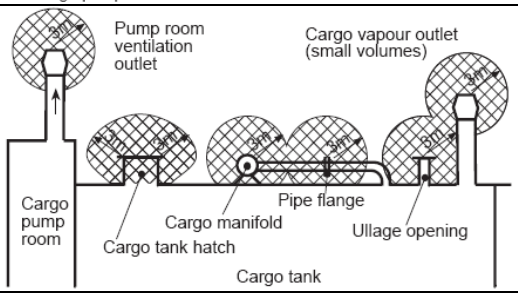
Item	Subclause	Typical examples	Remarks
A.14	2.1.5(2)② Table 2.1.5(1)		Pressurized space
A.15	2.1.5(2)③ Table 2.1.5(1)		Pressurized space
A.16	2.1.5(3) Table 2.1.5(1)		With or without door With natural or artificial ventilation
A.17	2.1.5(3) Table 2.1.5(1)		With or without door With natural or artificial ventilation
A.18	2.1.5(2)④ Table 2.1.5(1)		Airlock to be ventilated
A.19	2.1.5(2)⑤ Table 2.1.5(1)		Airlock to be ventilated
A.20	2.1.5(4) Table 2.1.5(1)		With one or two doors
A.21	2.1.5(4) Table 2.1.5(1)		With one or two doors
A.22	2.1.5(4) Table 2.1.5(1)		Or more hazardous zone

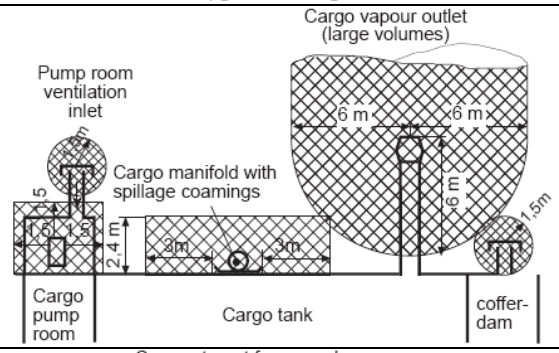
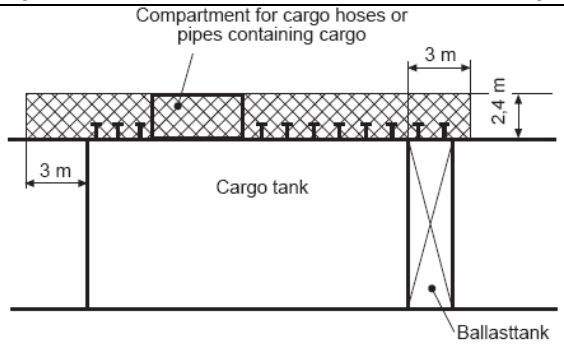
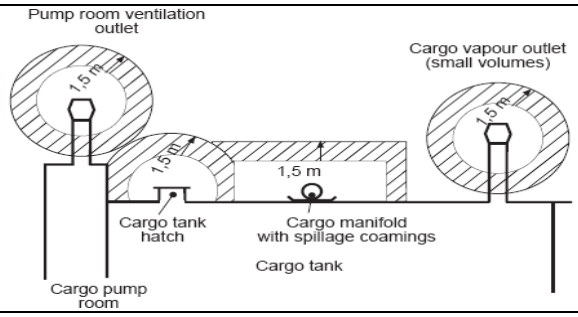
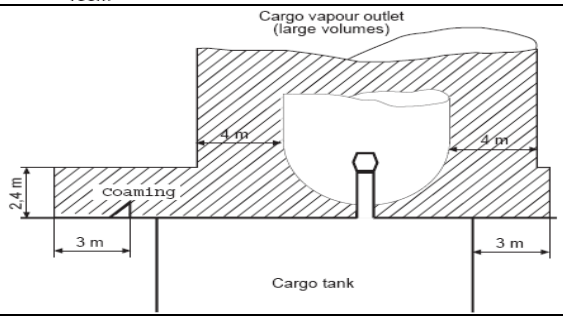
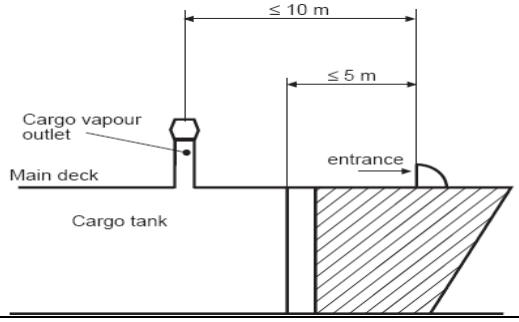
Annex B
(informative)

Examples of hazardous area classification –
Tankers carrying flammable liquids other than liquefied gases having a flashpoint not exceeding 60℃, for example, crude oil, oil products, chemical products

Symbols: see annex A

Table B

Item	Subclause	Typical examples	Remarks
B.1	2.3.1(1)		
B.2	2.3.2(1)		
B.3	2.3.2(2)		
B.4	2.3.2(3) 2.3.2(4) 2.3.2(5) 2.3.2(6)		
B.5	2.3.2(7)		Cargo vapour outlet caused by thermal variation

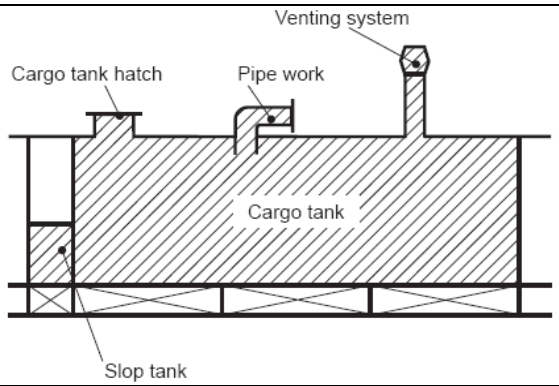
Item	Subclause	Typical examples	Remarks
B.6	2.3.2(8) 2.3.2(9) 2.3.2(11)		Cargo vapour outlet caused by loading, ballasting or discharging
B.7	2.3.2(10) 2.3.2(12) 2.3.2(13)		
B.8	2.3.3(1)		Cargo vapour outlet caused by thermal variation
B.9	2.3.3(2) 2.3.3(4) 2.3.3(5)		Cargo vapour outlet caused by loading, ballasting or discharging
B.10	2.3.3(6)		Space not mechanically ventilated and opening less than 0.5 m above main deck

Annex C
(informative)

Examples of hazardous area classification – Tankers carrying flammable liquids having a flashpoint exceeding 60℃ –Unheated cargoes and cargoes heated to temperature (T_H) below, and not within 15℃, of their flashpoint (FP): T_H < FP –15℃

Symbols: see annex A

Table C

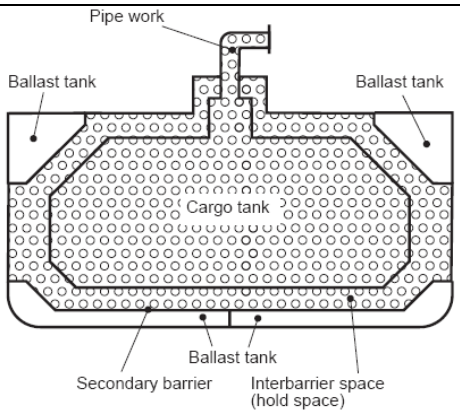
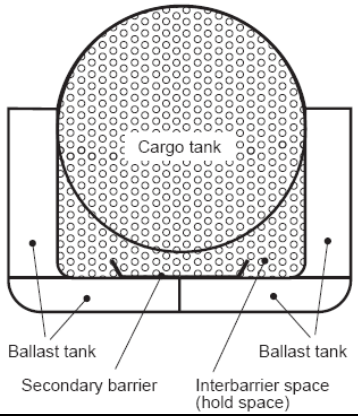
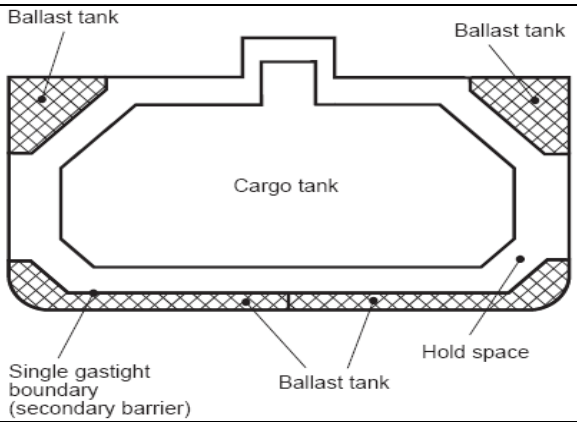
Item	Subclause	Typical examples	Remarks
C.1	2.4.1(1)		

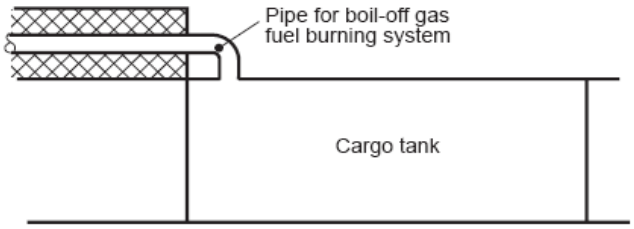
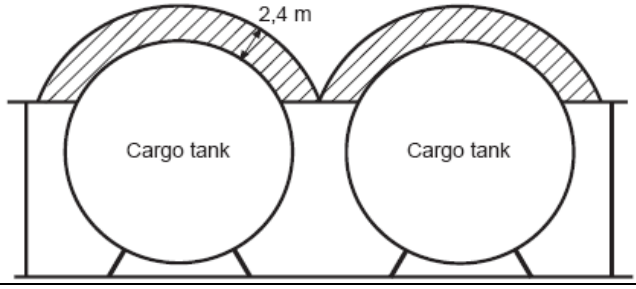
Annex D
(informative)

Examples of hazardous area classification –
Tankers carrying flammable liquefied gases

Symbols: see annex A

Table D

Item	Subclause	Typical examples	Remarks
D.1	2.5.1(1) 2.5.1(2)	 	Where secondary barrier is required
D.2	2.5.2(1)	see annex B	
D.3	2.5.2 (5)		Where secondary barrier is required

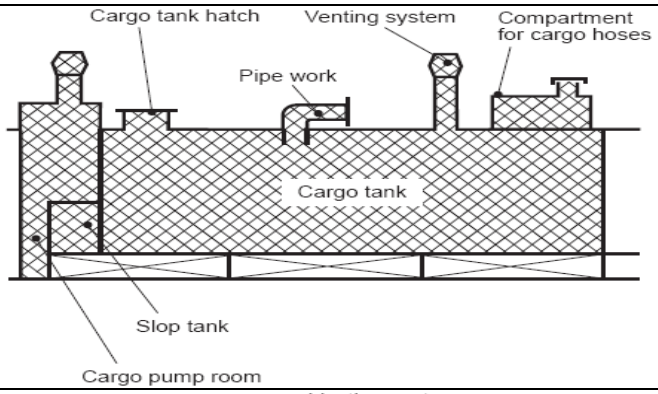
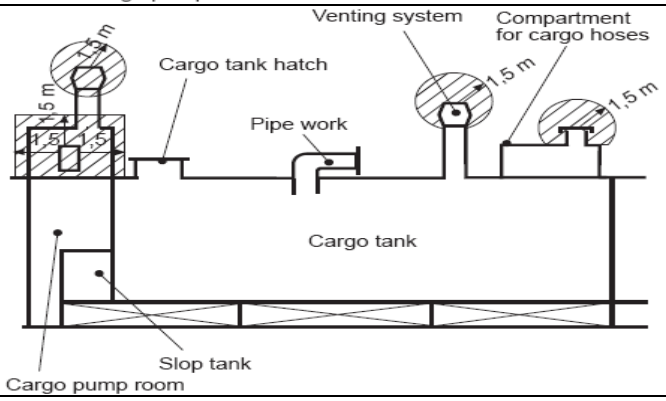
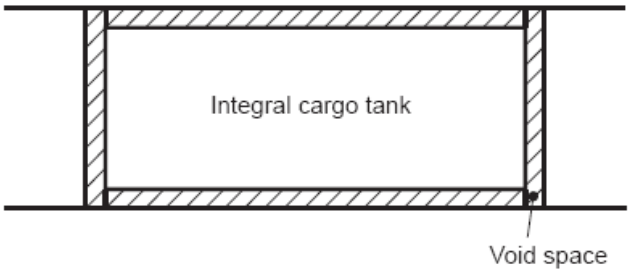
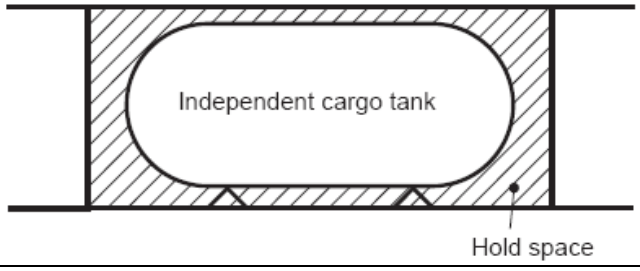
Item	Subclause	Typical examples	Remarks
D.4	2.5.2(6)		Unless special precautions are provided
D.5	2.5.3(1)	see annex B	
D.6	2.5.3(2)		Outer surface of the cargo tank is taken to be the outer surface of insulation

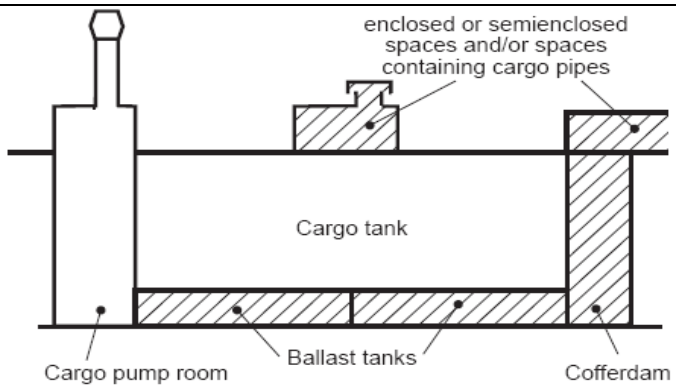
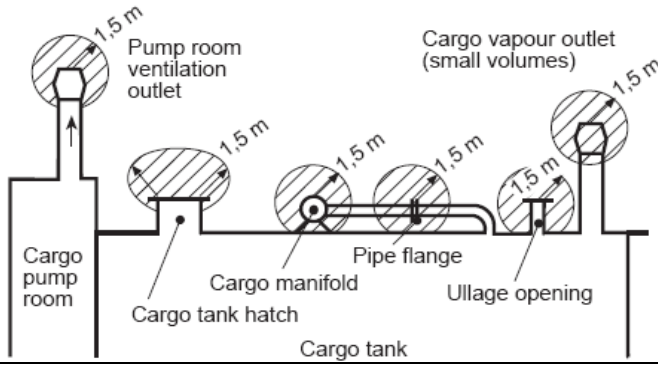
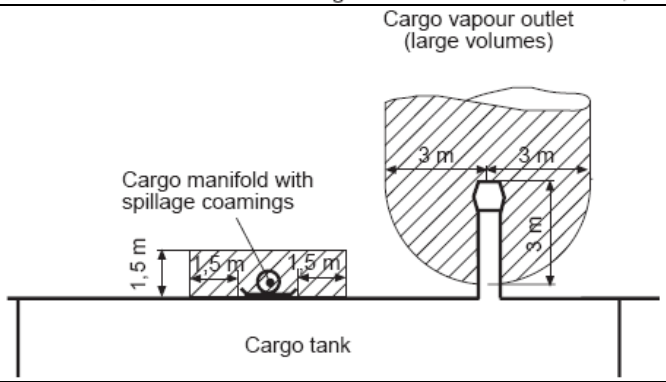
Annex E
(informative)

Examples of hazardous area classification –
Tankers carrying cargoes (for example acids) reacting with other products/materials to evolve flammable gases

Symbols: see annex A

Table E

Item	Subclause	Typical examples	Remarks
E.1	2.6.1(1)		
E.2	2.6.2(1)		
E.3	2.6.2(2)		
E.4	2.6.2(2)		

Item	Subclause	Typical examples	Remarks
E.5	2.6.2(2)		
E.6	2.6.2(3)		Cargo vapour outlet caused by thermal variation
E.7	2.6.2(3) 2.6.2(4)		Cargo vapour outlet caused by loading, ballasting or discharging