BRITISH STANDARD

BS IEC 60092-502:1999

Electrical installations in ships —

Part 502: Tankers — Special features

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 502: Tankers – Special features

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60092-502 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This fifth edition cancels and replaces the fourth edition published in 1994.

The text of this standard is based on the following documents:

FDIS	Report on voting
18/853/FDIS	18/862/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annexes A, B, C, D and E are for information only.

A bilingual version of this standard may be issued at a later date.

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INTRODUCTION

This standard introduces the zonal concept for hazardous area classification and permits the use of earthed distribution systems.

It should be noted, however, that it is not in full concurrence with the requirements for electrical installations in hazardous areas given in Clause 10.2 of the IBC Code[1)] and Clause 10.2 of the IGC Code[2)] and the system earthing requirements of Regulations II-1/45.4.1 and 45.4.3 of SOLAS[3)].

Until the International Maritime Organization has decided upon corresponding amendments to the Codes and to SOLAS, users of this standard are advised to ask the appropriate authority to consider equivalence in accordance with the "Equivalents" provisions of Clause 1.4 of the IBC Code and Clause 1.4 of the IGC Code and Regulation I/5 of SOLAS.

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1) International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (1994 edition).

2) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (1993 edition).

3) SOLAS – the International Convention for the Safety of Life at Sea, 1974, and its Protocol of 1978 (Consolidated edition, 1997).

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ELECTRICAL INSTALLATIONS IN SHIPS –

Part 502: Tankers – Special features

1 Scope

This part of IEC 60092 deals with the electrical installations in tankers carrying liquids which are flammable, either inherently, or due to their reaction with other substances, or flammable liquefied gases.

The requirements in other parts of IEC 60092 also apply to tankers, unless otherwise mentioned in this standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60092. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60092 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(426):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 426: Electrical apparatus for explosive atmospheres*

IEC 60079-0:1983, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 60079-1:1990, *Electrical apparatus for explosive gas atmospheres – Part 1: Construction and verification test of flameproof enclosures of electrical apparatus*

IEC 60079-2:1983, *Electrical apparatus for explosive gas atmospheres – Part 2: Electrical apparatus, type of protection 'p'*

IEC 60079-4:1975, *Electrical apparatus for explosive gas atmospheres – Part 4: Method of test for ignition temperature*

IEC 60079-5:1997, *Electrical apparatus for explosive gas atmospheres – Part 5: Powder filling 'q'*

IEC 60079-6:1995, *Electrical apparatus for explosive gas atmospheres – Part 6: Oil-immersion 'o'*

IEC 60079-7:1990, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety 'e'*

IEC 60079-10:1968, *Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas*

IEC 60079-11:1991, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety 'i'*

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IEC 60079-12:1978, *Electrical apparatus for explosive gas atmospheres – Part 12: Classification of mixtures of gases or vapours with air according to their maximum experimental safe gaps and minimum igniting currents*

IEC 60079-14:1996, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installation in hazardous areas (other than mines)*

IEC 60079-15:1987, *Electrical apparatus for explosive gas atmospheres – Part 15: Electrical apparatus with type of protection 'n'*

IEC 60079-17:1990, *Electrical apparatus for explosive gas atmospheres – Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)*

IEC 60079-18:1992, *Electrical apparatus for explosive gas atmospheres – Part 18: Encapsulation 'm'*

IEC 60079-19:1993, *Electrical apparatus for explosive gas atmospheres – Part 19: Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)*

IEC 60092-101:1994, *Electrical installations in ships – Part 101: Definitions and general requirements*

IEC 60092-201:1994, *Electrical installations in ships – Part 201: System design – General*

IEC 60092-202:1994, *Electrical installations in ships – Part 202: System design – Protection*

IEC 60092-350:1988, *Electrical installations in ships – Part 350: Low-voltage shipboard power cables – General construction and test requirements*

IEC 60092-401:1980, *Electrical installations in ships – Part 401: Installation and test of completed installation*

3 Definitions

For the purpose of this part of IEC 60092, the following definitions apply.

3.1
certified safe-type equipment
electrical equipment of a type for which a national or other appropriate authority has carried out the type verifications and tests necessary to certify the safety of the equipment with regard to explosion hazard when used in an explosive gas atmosphere

3.2
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 [IEC 60078-18, 3.1]

3.3
enclosed space
any space within which, in the absence of artificial ventilation, the ventilation will be limited and any explosive atmosphere will not be dispersed naturally

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3.4
enclosure
all the walls which surround the live parts of electrical apparatus including doors, covers, cable entries, rods, spindles and shafts, ensuring the protection of the electrical apparatus [IEV 426-04-01, modified]

3.5
explosion protected enclosure
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

3.6
explosive limits

3.6.1
lower explosive limit (LEL)
concentration of flammable gas, vapour or mist in air, below which an explosive gas atmosphere will not be formed [IEV 426-02-09]

3.6.2
upper explosive limit (UEL)
concentration of flammable gas, vapour or mist in air, above which an explosive gas atmosphere will not be formed [IEV 426-02-10]

3.7
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 [IEV 426-02-03]

3.8
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 [IEV 426-06-01]

NOTE – IEC 60079-1 specifies the constructional features and test requirements for apparatus using this method of protection.

3.9
flammable gas or vapour
gas or vapour which, when mixed with air in certain proportions, will form an explosive gas atmosphere [IEC 60079-10, 2.14]

3.10
flammable liquid
liquid capable of producing a flammable vapour or mist under any foreseeable operating conditions [IEC 60079-10. 2.13 modified]

3.11
flammable material
material consisting of flammable gas, vapour, liquid and/or mist [IEC 60079-10, 2.12 modified]

3.12
flammable mist
droplets of flammable liquid, dispersed in air, so as to form an explosive atmosphere [IEC 60079-10, 2.15]

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3.13
flashpoint
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
[IEV 426-02-14]

NOTE – Differing values of flashpoint may be obtained under open-cup or closed-cup test conditions; for the purposes of this standard, only the flashpoint obtained under closed-cup conditions is considered.

3.14
gas-tight
attribute of a physical barrier which prevents any significant quantity of flammable gas or vapour from entering into an adjoining area

3.15
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 [IEV 426-03-01]

3.15.1
zone 0
area in which an explosive gas atmosphere is present continuously or is present for long periods [IEV 426-03-03]

3.15.2
zone 1
area in which an explosive gas atmosphere is likely to occur in normal operation
[IEV 426-03-04]

3.15.3
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
[IEV 426-03-05 modified]

3.16
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 [IEV 426-03-01 modified]

3.17
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 [IEC 60078-7, 3.1]

NOTE – IEC 60079-7 specifies the constructional features and test requirements for apparatus using this method of protection.

3.18
intrinsically-safe circuit "i"
circuit in which no spark or any thermal effect produced in the test conditions prescribed (which include normal operation and specified fault conditions) is capable of causing ignition of a given explosive gas atmosphere [IEV 426-11-01 modified]

NOTE – IEC 60079-11 specifies the constructional features and test requirements for apparatus using this method of protection.

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3.19
liquefied gas
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 °C

3.20
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 [IEV 426-03-02]

3.21
oil immersion "o"
type of protection in which the electrical apparatus or parts of the electrical apparatus are immersed in a protective liquid in such a way that an explosive atmosphere which may be above the liquid or outside the enclosure cannot be ignited

3.22
open space
space in an open air situation without stagnant areas where vapours are rapidly dispersed by wind and natural convection. Typical air velocities should rarely be less than 0,5 m/s and should frequently be above 2 m/s

3.23
opening
any aperture, or door, window or panel not designed to prevent the passage of gas or vapour

3.24
pressurisation "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 [IEC 60079-2, 2.2]

NOTE – IEC 60079-2 gives guidance on the design, construction and use of electrical apparatus protected by this technique.

3.25
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 [IEC 60079-15, 3.1]

NOTE – IEC 60079-15 specifies the constructional features and test requirements for apparatus using this method of protection.

3.26
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 limit [IEV 426-09-03]

3.27
sand-filled apparatus "q"
an apparatus is considered "sand-filled" when all its live parts are entirely embedded in a mass of powdery material [IEV 426-07-01 modified]

NOTE – IEC 60079-5 specifies the constructional features and test requirements for apparatus using this method of protection.

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3.28
semi-enclosed space
space limited by decks and/or bulkheads in such a manner that the natural conditions of ventilation in the spaces are notably different from those obtained on open deck

3.29
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 [IEV 426-03-06 modified]

3.30
tanker
sea-going cargo ship constructed or adapted for the carriage of liquid cargoes in bulk

3.31
ventilation

3.31.1
natural ventilation
movement of air and its replacement with fresh air due to the effects of wind and/or temperature gradients [IEV 426-03-07]

3.31.2
artificial ventilation
movement of air and its replacement with fresh air by artificial means (for example fans) and applied to a general area [IEV 426-03-08 modified]

4 Area classification

4.1 General

4.1.1 Basic principles

4.1.1.1 Area classification is a method of analyzing and classifying the areas where explosive gas atmospheres may occur. The object of the classification is to allow the selection of electrical apparatus able to be operated safely in these areas. 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 shall aim at reducing the likelihood of the occurrence of either or both of the above factors so that the likelihood of coincidence is so small as to be acceptable.

4.1.1.2 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 and the guidance given in this standard.

4.1.1.3 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.

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4.1.1.4 Area classification shall be carried out at an early stage of planning, before any construction work starts and the results documented in drawings showing the different zones.

NOTE 1 – Small pockets of non-hazardous areas within a general hazardous area or between hazardous areas should not be defined, unless such a pocket is a special feature of the design, for example an enclosure protected by pressurisation. Likewise small pockets of zone 2 should not be defined in or between zone 1 hazardous areas.

NOTE 2 – It is not necessary to determine the hazardous area that would arise from each individual source of release when this would not influence the overall zone boundary.

NOTE 3 – At completion of design and again at completion of construction, the area classification shown on the drawings should be reviewed against the actual sources of possible release and any structural changes. If necessary, modification to drawings and installation should be made.

NOTE 4 – Where any alteration is proposed to cargo containment system, cargo pumping or piping arrangements or ventilation arrangements, the impact on area classification should be reviewed. If necessary, modifications to drawings and installation should be made, and a further review, together with any necessary modification, carried out upon completion of the alteration.

4.1.1.5 Spaces and areas not mentioned in this standard, but considered by the appropriate authority, as a result of the application of the principles of IEC 60079-10, to present an equivalent risk of the presence of an explosive gas atmosphere as defined for zones 0, 1 and 2, shall be considered as these zones.

4.1.1.6 Examples of hazardous area classification are given in annexes A to E.

4.1.2 Substances capable of creating an explosive gas atmosphere

A hazardous area may arise from the presence of any of the following:

a) flammable liquid having a flashpoint (closed-cup test) not exceeding 60 °C;

b) flammable liquid having a flashpoint exceeding 60 °C, heated or raised by ambient conditions to a temperature within 15 °C of its flashpoint;

c) flammable gas, in gaseous or liquid state.

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

4.1.3 Sources of release

The following are examples of some sources of release:

a) venting and other openings to cargo tanks, slop tanks and cargo piping;

b) 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.

4.1.4 Separation by gastight boundaries

4.1.4.1 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 as indicated in 8.3, in accordance with table 1.

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, are acceptable to the appropriate authority.

4.1.4.2 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.

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Table 1 – Spaces separated by one gastight boundary from the zones mentioned in the column

	With source of release [1]		Without source of release	
	With ventilation [2]	Without ventilation	With ventilation [2]	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.

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

See table 2 and clause 8.

4.1.5.1 Access doors or other openings shall not 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. Where access doors or other openings are provided for operational reasons, 4.1.5.2, 4.1.5.3, 4.1.5.4 or 4.1.5.5 apply.

4.1.5.2 For spaces where the access doors or similar means of access are closable and capable of maintaining an over-pressure, the following provisions apply:

a) An enclosed space with access to any zone 1 location may be considered as zone 2 if:
   – the space is ventilated by over-pressure in accordance with 8.4, and
   – 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).

b) An enclosed space with access to any zone 2 location may be considered non-hazardous if:
   – the space is ventilated by over-pressure in accordance with 8.4, and
   – 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).

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