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Norwegian
Directorate for
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Regulations relating to maritime electrical installations

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Preface

These regulations have been laid down pursuant to the Act No. 4 of 24 May 1929 relating to Supervision of Electrical Installations and Electrical Equipment. The purpose of the Regulations is to achieve a satisfactory level of electrical safety in maritime electrical installations and electrical equipment connected to these installations. These regulations replace the Regulation for Electrical Installations – Maritime Installations of 1 March 1990.

These Regulations contain functional requirements for the safe operation of a maritime electrical installation. The text of the Regulations, which is legally binding, must be read in the context of the guide and the standards mentioned in section 5 of the Regulations. There may be ways of meeting the legal functional requirements of the Regulations other than those stated in the standards. However, if the guide and the standards are used, the legal requirements of the Regulations will be presumed met.

The document in annex II is to consider as a supplement to the IEC 60092-serie, and may be used to meet the requirements in the Regulations Relating to Maritime Electrical Installations. The text of this annex is a guide and thus not legally binding.

Enterprises, to which the provisions of these Regulations apply, are required to have a system of internal control that ensures compliance with the requirements in the Regulations, cf. Regulations relating to Systematic Health, Environmental and Safety Activities in Enterprises (Internal Control Regulations) laid down by Royal Decree of 6 December 1996.

These Regulations implement Council Directive 97/70/EC setting up a harmonised safety regime for fishing vessels of 24 metres in length and over, cf. Annex XIII of the Agreement on the European Economic Area, Council Directive 98/18/EC on safety rules and standards for passenger ships, cf. Annex XIII, subsection 56f, of the Agreement on the European Economic Area, and Directive 94/25/EC of the European Parliament and of the Council relating to recreational craft, cf. Annex II of the Agreement on the European Economic Area.

The supervision of maritime electrical installations is regulated through a separate agreement with the Norwegian Maritime Authority. The supervision of offshore installations is similarly regulated in an agreement with The Petroleum Safety Authority Norway.

The Norwegian Directorate for Civil Protection
4 December 2001

This translation is for information purposes only. Legal authenticity remains with the official Norwegian version as published in Norsk Lovtidend.

Laid down on 4 December 2001 by the Norwegian Directorate for Civil Protection pursuant to section 2 of Act No. 4 of 24 May 1929 relating to Supervisions of Electrical Installations and Electrical Equipment. These Regulations implement Council Directive 97/70/EC setting up a harmonised safety regime for fishing vessels of 24 metres in length and over, cf. Annex XIII of the Agreement on the European Economic Area, Council Directive 98/18/EC on safety rules and standards for passenger ships, cf. Annex XIII, subsection 56f, of the Agreement on the European Economic Area, and Directive 94/25/EC of the European Parliament and of the Council of 16 June 1994 relating to recreational craft, cf. Annex II of the Agreement on the European Economic Area.

Chapter I – Introductory provisions

§ 1 Purpose

The purpose of these regulations is to achieve a satisfactory level of electrical safety in maritime electrical installations and in the operation of electrical equipment connected to these installations.

Re § 1

These regulations apply to low voltage and high voltage installations.

Electrical safety comprises dangers posed by the electricity itself, such as danger arising from contact with electricity and fire and safety factors associated with the use of electricity and electrical equipment.

Electrical safety includes the following:

- protection against contact with energized parts,
- protection against arcing/overheating (personal injury, danger of fire, explosions),
- consequential injury,
- protection against electrostatic charges,
- protection against undesired chemical processes caused by electricity (fx in connections and when using a hull return system),
- protection against harmful effects from electromagnetic fields,
- electromagnetic compatibility,
- safe construction, installation and maintenance of electrical equipment,
- safe system design, construction, use and maintenance of maritime electrical installations,
- safe procedures and safety measures for work on or near maritime electrical installations,
- power supplied in a safe manner,
- high quality power supply,
- protection against lightning,
- protection to prevent power cuts causing danger to life or health.

§ 2 Scope

The Regulations apply to the design, construction, operation, alteration and maintenance of maritime electrical installations on Norwegian ships, mobile offshore units, floating or mobile installations, and recreational craft. The Regulations also apply to electrical equipment connected to maritime electrical installations.

The Regulations do not apply to:
– electronic radio, telecommunications and information equipment, and
– shipboard equipment or floating or mobile installations for military use.

These Regulations do not apply to those parts of the electrical installations on ships and mobile offshore units to which the provisions of the International Convention for the Safety of Life at Sea (SOLAS) apply.

Re § 2

Norwegian vessels, mobile offshore units and floating or mobile installations means those registered in for example the Norwegian Ordinary Register (NOR) or the Norwegian International Ship Register (NIS).

The supervisory responsibility of the Norwegian Directorate for Civil Protection on mobile offshore units is related to the issue of maritime certificates. Otherwise, under Act No. 72 of 29 November 1996 relating to petroleum activities, the Ministry of Petroleum and Energy is the authority responsible for safety on fixed and mobile offshore units engaged in petroleum activities on the Norwegian continental shelf. The Norwegian Directorate for Civil Protection assists The Petroleum Safety Authority Norway with regard to electrical installations on mobile offshore units used in petroleum activities.

Under the Seaworthiness Act, The Norwegian Maritime Authority is the supervisory authority for vessels and mobile offshore units. The responsibility of The Norwegian Directorate for Civil Protection with regard to vessels involves, among other duties, assisting the Norwegian Maritime Authority with the issue of maritime certificates.

Trade in electrical equipment is regulated by the Regulations of 14 January 2011 concerning electrical equipment. The use and maintenance of electro-medical equipment is regulated by the Regulations of 01 September 2005 concerning electromedical equipment.

Administered by the Norwegian Post and Telecommunications Authority (electronic radio, telecommunications and information equipment).

Administered by the Ministry of Defence (shipboard equipment or floating or mobile installations for military use).

The Convention of 1974 on the Safety of Life at Sea (SOLAS), with subsequent amendments, applies to vessels above 500 gross register tons in international traffic and passenger vessels registered for more than 12 passengers in international traffic. SOLAS was laid down by the IMO (International Maritime Organization) and is administered by the Norwegian Maritime Authority.

For recreational craft, see also Regulations of 20 December 2004 concerning recreational craft, laid down by the Ministry of Children and Family Affairs and administered by the Norwegian Maritime Authority.

With regard to fish farming equipment (net cages, feeding rafts, etc.), see regulations of 6 November 1998 concerning low voltage electrical installations. For installations on board ships and floating or mobile installations constructed abroad, these regulations are only applicable when the ship or floating or mobile installation has been registered in a Norwegian register. Inspection work carried out by the Norwegian Directorate for Civil Protection before registration in a Norwegian register is to be regarded as prior approval of electrical installations pursuant to these Regulations.

§ 3 Definitions

Hazardous area (explosive atmosphere)

Area where there is or may be an explosive atmosphere in such quantities that special precautions are required in connection with the design, installation and use of electrical equipment or other ignition sources.

Responsible for operation

To have the overall technical responsibility, and to ensure that electrical installations are planned, constructed and operated in compliance with provisions in regulations concerning notification and approval, technical construction, qualifications and safety routines.

Responsible for the construction of electrical installations

To have the overall technical responsibility and to ensure that electrical installations are constructed in accordance with the applicable regulations, including that the equipment used complies with current provisions concerning documentation and that personnel are qualified.

Responsible for maintenance

To have the overall technical responsibility and to ensure that maintenance is planned and carried out so that the condition of electrical installations and electrical equipment is as prescribed in the regulations.

Disconnection

A safety function which interrupts the power supply to all or some parts of the electrical installation by disconnecting these parts from the power source(s).

Recreational craft

Craft of any kind and with any form of propulsion, the hull of which is between 2.5 and 24 metres in length and to which the Regulations of 20 December 2004 concerning recreational craft apply.

Short circuit-proof installations

a. Single-core cable without metal sheath, armour, braiding/screen.

b. Single-core insulated cable mounted on supports of insulating material. Penetrations made of insulating material. Adequate distance between cores within cable and between core and base, although the cable's own fittings are excluded.

c. Uninsulated conductors mounted on insulators and with insulated penetrations. Adequate distance between cores within cable and between core and base, although the cable's own fittings are excluded.

d. Single-core uninsulated cables in insulated conduits, with one cable in each conduit.

Design

Design involves all aspects from preparing a detailed plan, project description and drawings for major maritime electrical installations to a simple plan for one individual circuit.

Shipowner

The shipowner is the person who equips and operates a ship at his or her own expense.

Floating or mobile installations

Floating and mobile installations are drilling platforms, lighters, dredgers, floating cranes, floating docks, etc.

Classes of passenger ship

Class A:

Passenger vessels engaged on domestic voyages other than those included in Classes B, C and D.

Class B:

Passenger vessels engaged on domestic voyages in the course of which the vessel is not at any time more than 20 nautical miles from land where ship-wrecked persons may be put ashore at medium tide.

Class C:

Passenger vessels engaged on domestic voyages in sea areas where the probability of significant wave heights of more than 2.5 m is less than 10 per cent over a period of one year when the vessel is in year-round operation, or in a specific period of the year when the vessel is exclusively in operation in that period (for example summer operation), where the vessel is at no time more than 15 nautical miles from land where ship-wrecked persons may be put ashore at medium tide.

Class D:

Passenger vessels engaged on domestic voyages in sea areas where the probability of significant wave heights of more than 1.5 m is less than 10 per cent over a period of one year when the vessel is in year-round operation, or in a specific period of the year when the vessel is exclusively in operation in that period (for example summer operation), where the vessel is at no time more than 6 nautical miles from land where ship-wrecked persons may be put ashore at medium tide.

Re § 3

Hull length is measured in accordance with the harmonized standards set out in the regulations laid down by the Ministry of Children and Family Affairs on 20 December 2004 concerning recreational craft, including the exceptions mentioned.

Chapter II – Persons subject to duties, and safety requirements

§ 4 Who these regulations are intended for

The shipowner shall ensure that installations to which these Regulations apply at all times satisfy the safety requirements laid down in the Regulations. Caution shall be shown when using or connecting electrical equipment to an installation so that there is no danger to life, health or property.

Anyone who designs, constructs, alters or carries out maintenance on electrical installations is responsible for ensuring that the work is carried out in accordance with the requirements of these Regulations.

Owners of recreational craft are subject to the same obligations as shipowners.

Re § 4

The regulations of 14 December 1993 relating to qualification of electrical professions and trades specify who is entitled to design, construct, make alterations to and carry out maintenance on maritime electrical installations.

Regulations of 1 July 2006 concerning safety when working on or operating electrical installations (fse) apply both with regard to the responsibility for constructing and repairing maritime electrical installations and to the responsibility for operating and carrying out maintenance on these installations.

With regard to qualifications required of crew members, see the Norwegian Maritime Authority's regulations of 1 Januar 2012 nr. 687 concerning requirements relating to qualifications and certificates.

§ 5 Compliance with safety requirements

The Regulations, supplemented by the accompanying guide, annexes and standards (including the more detailed technical guide) together indicate the safety level required. If a different solution is chosen, or parts of the standards are combined, documentary evidence shall be supplied to show that an equivalent level of safety has been achieved.

Re § 5

The detailed recommendations given in these guidelines and in the standards are not legally binding, i.e. other solutions may be chosen. The following standards describe how the safety requirements in Chapter IV may be met:

- **IEC 60092 series** Electrical Installations in Ships,
- **NEK EN 60079 series** Electrical installations in hazardous areas (for the construction of tankers, however, see IEC 60 092-502 Tankers, cf. however §2 regarding the interface between SOLAS and these regulations),
- **IEC 61892 series** Mobile and fixed offshore units – Electrical installations,
- **IMO Resolution MSC 36(63)** International Code of Safety for high-speed craft (HSC Code),
- **IMO Resolution A686(17)** Code on alarms and indicators,
- **ISO 8383** Lifts on ships – specific requirements,
- **AODC Code** Code of practice for the safe use of electricity under water,
- **MODU Code** Code for the construction and equipment of mobile offshore drilling units,
- **Nordic Boat Standard** for installations referred to in regulations from the Norwegian Maritime Directorate,
- **IEC 60439** Low-voltage switchgear and controlgear assemblies,
- **IEC 60533:** Electrical and electronic installations in vessels – Electromagnetic compatibility (EMC),
- **ISO/DIS 13297** Small craft – electrical systems – alternating current installations,
- **ISO/DIS 10133** Small craft – electrical systems – extra low voltage direct current installations,
- **NS ISO 8849** Small craft. Electric bilge pumps (=EN 28849:1993)(ISO 8849:1990),
- **ISO 10134** – Small craft – electrical devices – lightning protection,
- **NEK 400** – Electrical low voltage installations. Adapted translation of CENELEC HD 384 and IEC 60363 (relevant provisions).

With regard to NEK 400, relevant provisions for maritime installations might be a

description of distribution systems, installations in accommodation areas such as cabins, bathrooms etc., swimming pools, thermal systems, etc.

The IEC 60092 series was translated into Norwegian through NEK 410 Norwegian standards for maritime electrical installations – Installations and equipment on board ships. In the event of discrepancies between the IEC 60092 series and NEK 410, the IEC 60092 series will apply.

In Appendix II of these regulations, the Directorate for Fire and Electrical Safety has made necessary additions on which use of the IEC 60092 series may be based.

It is assumed that the latest issues of the standards referred to above are used at all times. References are therefore undated and there is no reference to any particular issue.

”Norms” and ”standards” are synonymous terms. In these regulations, the term ”standards” is used throughout.

Chapter III –Documentation, information and notification

§ 6 Inspection. Declaration of conformity. Documentation

Before using an installation and after each alteration, the shipowner shall see to it that the installation has been inspected and tested to ensure that it satisfies the safety requirements laid down in these Regulations.

Anyone responsible for designing, constructing or altering installations shall make out a declaration of conformity with the safety requirements in these Regulations for the shipowner.

Supporting documentation shall be prepared so that an assessment can be made of whether the installation conforms to the requirements of the Regulations.

The documentation shall be prepared in accordance with current IEC standards, or Norwegian standards.

A list shall be supplied of the standards used, or a detailed description of the solutions adopted to meet the requirements of these Regulations when standards have not been applied.

If special precautionary measures need to be taken when using the installation to satisfy the requirements relating to electromagnetic compatibility, the person responsible for designing or constructing the installation shall draw up instructions for the use and maintenance of these measures. These instructions shall be readily available on board.

The shipowner shall see to it that a declaration of conformity is carried on board.

The declaration of conformity shall at least contain the following:

- *the name and address of the person or persons responsible for designing,*

constructing or altering the installation,
- *the installation's identification code,*
- *names of standards applied in full or in part, or other technical specifications on which the installation has been based when standards have not been applied,*
- *a statement confirming that the installation satisfies the safety requirements in these Regulations,*
- *the signature(s) of the person or persons responsible for designing, constructing or altering the installation, and*
- *the date of the declaration.*

Special documentation requirements apply to electrical installations in hazardous areas, cf. § 20.

This section does not apply to recreational craft.

Re § 6

In the declaration of conformity, the person responsible for designing/constructing the installation declares to the owner that the electrical installation is in conformity with the safety requirements in the regulations. An example of the declaration of conformity is shown in Appendix I.

Documentation necessary for the issue of a declaration of conformity may include the following:

- results of electrotechnical system analysis and risk assessment, cf. section 10 and guidelines to section 10,
- statement showing basis of assessment for the determination of generator size (effect balance),
- rated values for generators with prime movers, transformers, convertors and accumulator batteries,
- one-line diagram for the entire installation, including operating philosophy, duplication, interlocking, cable types and cross section,
- arrangement drawings showing the location of generators, transformers, main and emergency switchboards, important services, cable layout for main circuits and circuits for emergency power supply,
- complete diagram and arrangement drawings for main switchboard and major junctions etc.,
- description of emergency power system,
- documentation of ship's lights system,

- overview diagram of steering engine system,
- special documentation for installations in hazardous areas (fire/explosion), including area classification and certificates for electrical equipment in hazardous areas,
- specifications showing arrangement and performance of the various protective devices and how they provide complete and coordinated automatic protection to ensure continuity of service through the discriminative action of the protective devices,
- results of checks and tests made of installation, and
- operational and maintenance procedures for the installation and any equipment connected to it.

For installations with a voltage below 50 V, see installation certificate 27, administered by the Norwegian Maritime Authority.

With regard to the definition of important equipment and important services, see regulations from the Norwegian Maritime Authority and regulations concerning safety and communications systems from The Petroleum Safety Authority Norway.

For alterations to existing installations, the need for new documentation must be assessed in each individual case. For minor alterations (cf. section 8), drawing in additions, corrections etc. on existing documentation will be sufficient.

Electrotechnical calculations are necessary if compliance with the safety requirements in the regulations cannot otherwise be verified.

With regard to the declaration of conformity etc for recreational craft see the regulations of 20 December 2004 relating to recreational craft, laid down by the Ministry of Children and Family Affairs.

An example of the form that may be used in connection with the declaration of conformity is available on the Directorate's website www.dsb.no.

§ 7 Responsibility for keeping documentation

The shipowner must at all times see to it that the declaration of conformity and the documentation necessary for the operation of the installation is available on board, cf. § 6. Other documentation related to the declaration of conformity must be kept by the shipowner.

Anyone who pursuant to section 6 makes out a declaration of conformity shall keep a copy of the declaration for a period of at least ten years from the day the declaration of conformity was made out.

This section does not apply to recreational craft.

Re § 7

This provision is intended to ensure that updated documentation is available and can provide the basis for inspection, maintenance, developments to the installation and other alterations.

Special documentation provisions apply to electrical installations in hazardous areas, cf. section 20.

§ 8 Notification

Before work commences to construct or alter maritime electrical installations, the shipowner shall ensure that the supervisory authority is notified of the work. Notification is not required for minor alterations.

The notification shall at least contain:

- information about the subject of the notification,
- the construction number of the ship/floating or mobile installation, or its name and distinctive numbers or letters,
- the shipowner's name and address,
- the name of the enterprise responsible for design and construction,
- the estimated date of completion.

Installations with a nominal voltage that does not exceed 50 V alternating voltage and 120 V direct voltage are exempt from notification providedthey are not placed in

hazardous locations.

This section does not apply to recreational craft.

Re § 8

Notification is to be sent to the Norwegian Directorate for Civil Protection, or whoever conducts supervision on behalf of the Norwegian Directorate for Civil Protection pursuant to section 49 of these regulations.

The Norwegian Directorate for Civil Protection has produced a notification form for maritime electrical installations. This form is available on the Directorate's website www.dsb.no.

"Minor alterations" means alterations that do not affect the generator system, main switchboards or major distribution boards or important services, and upgrading of the installation that cannot affect the choice of generator size.

When the Norwegian Directorate for Civil Protection has received notification, documentation may be required to be made available so as to assess whether the installation has been designed in accordance with the requirements in the regulations. See guidelines to section 6. Additional documentation may be required as necessary.

§ 9 Reporting accidents/incidents

Personal injury and material damage caused by electricity shall be reported as soon as possible to the Norwegian Directorate for Civil Protection.

Re § 9

The purpose of giving notification of accidents/incidents is to make it possible to find the cause of an accident and thereby prevent further damage and similar accidents. It is important that notification be given quickly, for example by telephone, telefax or electronic mail.

An electronic report system is available on the Directorate for Civil Protection's webpage, http://www.dsb.no/stromskader. This should be used for reporting accidents involving injuries.

Chapter IV – Basic safety for design, construction, alteration, operation and maintenance

§ 10 Planning and assessment of risk

Maritime electrical installations shall be such that life, health and property are protected from danger and injury or damage during normal use and such that the installation is appropriate to the use for which it was intended.

A risk analysis shall be carried out to uncover the risks in and relating to the electrical installation. The results of the analysis shall be taken account of in the electrical installation.

The installation and equipment must withstand the dynamic and static stresses that can be expected.

Re § 10

The concept of electrical safety (cf. guidelines to § 1) involves a total assessment of all aspects of the installation as it is used in order to ensure that the installation is appropriate to the use for which it was intended.

The system design, including the necessary protection measures, requires an assessment of the risks associated with the particular installation. This also means that output requirements, protection against interruption of the power supply and selectivity of protection must be taken into consideration so that the installation has adequate reliability with regard to power supply. The provision also means that for important services that are not duplicated, the power supply must not fail the first time an earth fault occurs.

Adequate reliability also means that any installation that according to Norwegian Maritime Authority regulations is required to have an emergency power supply, must be planned and constructed in accordance with the present Regulations.

How comprehensive a risk assessment should be is largely dependent on the complexity of the installation and the expected risks.

Examples of installations where special risk assessment is necessary are

- passenger vessels,
- tankers,
- mobile offshore units,
- explosive atmospheres,
- electrical propulsion systems,
- lift installations,
- electrical installations in spaces where electro-medical equipment will be located, and
- high voltage installations.

§ 11 Accessibility and maintenance

The installation shall be such:

- *that it is accessible for inspection, maintenance, repair, operation and testing,*
- *that there is sufficient room to replace and install individual components, and*
- *that such work can be conducted without danger for the person carrying out the work.*

Equipment that requires supervision or operation while running shall be placed so that it is accessible, in a suitable, well-lit location where such supervision and operation can take place without danger.

Parts of the installation no longer in use shall either be maintained in accordance with the Regulations, or be removed or made safe and clearly marked.

In the case of large systems where this is not practicable, however, it is considered sufficient to mark the system clearly and make it safe.

Re § 11

In planning and constructing an installation, an assessment must be made of the frequency and scope of maintenance that can reasonably be expected. In this assessment, the following factors must be taken into consideration:

- that it must be possible to carry out any periodical inspection, test, necessary repair etc. safely and easily, and
- that the effectiveness of safety measures is maintained.

§ 12 Distribution system

The installation shall be such that the distribution system used for all or parts of the installation together with the safety measures required for the various distribution systems do not result in

- *dangerous current flow,*
- *overheating that can lead to burns, fire, a risk of explosion or other harmful effects,*
- *power cuts that can endanger life, health and property,*
- *harmful effects on other parts of the installation or equipment in the installation or equipment connected to it.*

The distribution system shall be suited to its purpose.

In all voltage systems, the use of a hull or metal structure return system is not permitted.

Re § 12

For an installation to be safe, various distribution systems must be equipped with protection measures appropriate to the characteristics of the individual system. In distribution systems where the neutral point is earthed directly, an earth leakage circuit breaker in circuits for lighting and heating etc. may be one such measure.

See section 10 on planning and risk assessment.

This provision also means that TN-C systems are not permitted.

The use of high voltage should be considered if the presumed maximum short circuit current exceeds 50 kA (effective value) or the stipulated rated value on one of the generators exceeds 4 kA when low voltage is used.

With regard to the technical construction of permitted distribution systems, including the dimensioning of the neutral conductor, see relevant provisions in NEK 400.

§ 13 Earthing system

The earthing system shall be appropriate for the distribution system adopted for all or parts of the installation so as to prevent dangerous current flows or overheating that can result in burns or a fire.

Re § 13

Construction of earthing systems may be based on ”Guidelines on earthing in maritime installations”. The guidelines is available on the Directorate’s website www.dsb.no.

On board vessels where the hull is made of insulating material and the system voltage exceeds 50 V, the installation’s earthing system must be connected with copper plating at least 0.2 m^2 in area. The copper plating must be attached so that it will be submersed in the sea under all conditions.

This provision also means that earthed components of the installation must not themselves form a series connection functioning as a protective conductor.

A pipeline may not be used as earth connection.

§ 14 Protection against electric shock during normal use

To protect against electric shock during normal use, measures shall be put into effect to protect against danger that can arise from direct contact with energized parts of the installation or equipment.

Re § 14

Protection may be achieved

- by preventing people and animals in transport from being exposed to current flow by for example encapsulation or insulating energized parts, or
- by limiting contact voltage to a safe level, for example by using reduced voltage from a safety power source.

§ 15 Protection against electric shock as a result of a fault

To protect against electric shock as a result of a fault, measures shall be put into effect to protect against danger that can arise from contact with exposed parts of the installation that have become energized as a result of a fault (indirect contact).

Re § 15

Protection can be achieved

- by preventing people and animals in transport from being exposed to current flow by preventing them from coming into contact with exposed parts, or
- by limiting contact voltage to a safe level, for example by equipotential bonding, or
- by providing an automatic safety trip switch to disconnect the power supply when a fault arises that may result in a dangerous current flow for people or animals in transport if they come into contact with exposed parts.

§ 16 Protection against harmful thermal effects

Electrical installations and equipment shall be such that there is no danger of ignition of combustible materials because of excessive temperatures or electrical arcs. Nor shall there be any danger of people or animals receiving burns during normal operation.

Thermal devices shall be equipped with a trip switch designed to cause the device to disconnect before dangerous temperatures are reached, unless use of the device is permitted without such a switch. The trip switch shall have automatic release and manual reset. When there is a thermostat in addition to overheating protection, these shall work independently of each other. A fault in one of these or in the cables leading to one of them shall not affect the function of the other.

Re § 16

Particular attention must be given to the danger of high intermediate resistance at termination points for cables/wires.

The second paragraph entails a deviation from IEC 60092-307.

§ 17 Protection against overcurrents

Life, health and property shall be protected against injury and damage due to excessive temperatures or electromechanical stresses imposed by any kind of expected overcurrent in energized conductors.

Re § 17

Overcurrents for conductors means any current higher than the permitted currentcarrying capacity, for example due to overload, short circuit, etc.

This provision means that bus bars and uninsulated conductors and their fittings are required to have adequate mechanical strength to withstand the dynamic stresses that may arise in connection with a short circuit.

Protection may be achieved

- by ensuring that such an overcurrent is automatically disconnected before it reaches a harmful size, taking into consideration its duration,
- by limiting such overcurrents to a harmless size and duration, or
- by providing unprotected wires as to be proof against short circuit and earth faults. (Short circuit-proof installations)

The connection between starting battery and starting motor may be fitted with a switch instead of short circuit and overcurrent protection so that the connection can be quickly disconnected in the event of a fault.

§ 18 Protection against fault currents

Conductors other than energized conductors and any other part expected to conduct electricity as a result of insulation failure or other fault shall be able to conduct the fault current without damaging the installation or equipment.

§ 19 Protection against overvoltage

Life, health and property shall be protected

- *against the harmful effects of insulation failure or fault between circuits of differing voltages, and*
- *against damage due to other undesired high voltages.*

Re § 19

The second subparagraph of this provision refers to protection against circumstances due to

- overvoltages arising when connecting and disconnecting,
- other overvoltages, for example as a result of an earth fault in high voltage installations, or
- atmospheric overvoltages.

To reduce the probability of damage due to overvoltages so as

- to achieve an acceptable safety level for life, health and property, and
- to meet the requirements for the desired operational safety, an assessment must be made of
- the overvoltages that may arise in the installation, and
- the location and characteristics of equipment designed to protect against overvoltages.

In low voltage installations supplied from a high voltage installation, a voltage limiter or direct earthing of the neutral point would be relevant protection measures.

§ 20 Protection against ignition in hazardous areas

Installations in hazardous areas shall be such that they do not create a danger of ignition in these areas.

Updated documentation shall be available at all times showing categorization of the areas mentioned in the first paragraph, cf. section 7.

Re § 20

This provision means that the areas that can be categorized as hazardous must be pinpointed during the planning stage. The choice of equipment and its installation shall be carried out in such a way that the installation does not pose any danger.

The standards given in the guidelines to section 5 may provide the basis for area classification, choice of equipment, installation, maintenance and protection measures.

With regard to electrical installations on car decks, see the relevant sections of SOLAS and Chapter VI in these regulations.

§ 21 Protection against danger when reconnecting

Life, health and property shall be protected against dangerous situations that may arise or damage caused by reconnection after a total or partial voltage drop. If reconnection of a protection device may cause a dangerous situation, the reconnection shall not occur automatically.

Re § 21

Under this provision, engines that may endanger the operator or impair the safety of the installation if they start running unexpectedly are required to have a undervoltage protection or other measures that give the equivalent protection against dangerous situations that may arise, such as overcurrent relays with manual reset.

§ 22 Variations in voltage and frequency

Installations shall be such that variations in voltage and frequency do not exceed the levels the installation and equipment are designed for.

Re § 22

This provision means that the power supply must be dimensioned so that variations in voltage and frequency under normal conditions do not exceed the levels specified for each piece of equipment that forms a part of or is connected to an installation. If the equipment requires high starting current and/or high short-term loads giving an undesirable effect on other equipment as a result, this must be taken into account.

§ 23 Ventilation for accumulator batteries

There shall be adequate ventilation to prevent the accumulation of gas that may be given off by the batteries.

§ 24 Protection against external influences

The installation and its equipment shall be appropriate to the external influences that can be expected.

Re § 24

External influences may fx. be climatic conditions, the movements made by an appliance, shock and vibration.

If equipment has been constructed so that it will not withstand the stresses of its environment, it may nonetheless be used if it is given appropriate and adequate additional protection. When the location of a main switchboard implies that damp and oil vapour may be absorbed from below, such additional protection would be sealed bottom plates with sealed cable penetrations.

Temporarily installation/fastening/suspension of cables and wires during the installation period are to be done in a way not exposing the cables/wires to harmful stresses.

§ 25 Emergency disconnection

In installations where a rapid (manual) disconnection is necessary to prevent danger, equipment for emergency disconnection shall be installed. Such equipment shall be clearly visible and easily accessible, and it shall be possible to operate it safely.

The emergency stop system shall be such that it does not disconnect services other than as necessary, and measures shall be taken to guard against inadvertent disconnection.

Re § 25

In accordance with the regulations of 17 June 1986 No. 1296 relating to safety measures to prevent fire on board vessels to which the Safety at Sea Convention (SOLAS) does not apply, issued by the Norwegian Maritime Authority, switches for emergency disconnection of engine-room and boiler-room fans, switches for oil pumps and fans for oil-heating plants and ventilation fans for accommodation areas are required to be placed outside the relevant room.

§ 26 Equipment for disconnection

Equipment shall be installed to disconnect the installation, circuits or individual units of equipment so that maintenance, testing, fault detection and repairs can be safely carried out.

§ 27 Interruption in power supply

Installations where an interruption in the power supply can be dangerous to life, health or property shall be designed and constructed so that maintenance, replacements, etc. can be carried out without causing danger.

If an unexpected interruption in the power supply might involve a danger to life, health or property on a large scale, an emergency power supply shall supplement the ordinary power supply. Circuits supplied by emergency power shall have selective protection.

Re § 27

The purpose of this provision is to ensure that installations are planned and constructed to allow operation and maintenance to be carried out, including room and access for replacing parts.

Although the need for an emergency power supply must primarily be assessed in relation to the danger to life and health, it may also be relevant in relation to the protection of major material items.

When reclosing equipment that normally requires several generators to be run in parallell, measures shall be taken to prevent interruption of the power supply. Ex. interlocking to ensure that the equipment only might be reclosed when a sufficient number of generators are running.

§ 28 Marking of cables, protective devices and other equipment

Cables, equipment, protective devices etc. shall be clearly marked as far as is necessary in addition to the manufacturer's markings so that they can be identified. Marking shall also be used to the extent necessary to prevent danger.

The text of markings on board ships and floating or mobile installations in domestic traffic shall be in Norwegian, while the text in markings on board ships and floating or mobile installations in international traffic shall be in English.

Re § 28

If rewinding, repairs or alterations are made, re-marking must be carried out if there are changes in output, voltage, current etc. These requirements also apply to generators of which the rated values have been reduced.

Examples of areas where clear marking is important:

- on/off switches, emergency stop switches, circuit breakers, fuses and control devices if there is a danger of confusing these with other switches,
- battery installations, including charging devices and battery switches
- termination points for cables and conductors so that they can be identified for inspection, testing, fault localization, repairs and alterations to the installation, or
- earth conductors and neutral conductors so that they can be identified for all connections. PE conductors are considered adequately marked with the colour combination yellow/green.
- high voltage equipment and at the entrance to and at suitable points inside spaces for high voltage installations.

§ 29 Electrical and electromagnetic disturbances

Installations shall be such that they do not generate electrical or electromagnetic disturbances above the level at which equipment or an installation important to safety cease to function as intended.

An installation and its equipment shall have sufficient internal immunity from external electromagnetic influences so that the installation can function safely and as intended.

Re § 29

In order to meet the requirements for electromagnetic compatibility (EMC), the manufacturer's instructions with regard to EMC for each individual part must be taken into consideration during the planning and construction of an installation. Similarly, the equipment used and the method of installation must be appropriate to the particular conditions of the individual installation.

Specific EMC problems arising in an installation must often be resolved jointly by the involved parties, for example the equipment manufacturer and the parties responsible for design and construction.

Common causes of electrical disturbances are

- fluorescent lighting fittings are not fitted with noise filters,
- faulty earthing of equipment,
- lack of or incorrect earthing of cable screens or armouring,
- defective connections,
- lack of noise suppression for machines,
- interference generated by thyristor controls, convertors, etc.
- lack of or faulty earthing of aluminium superstructure on steel vessels,
- static electricity caused by synthetic materials in interior fittings,
- incorrect installation of cables,
- mutual interference between a radio receiver and radio transmitter, radar or television, or
- atmospheric disturbance.

§ 30 Mechanical and fire safety features

The electrical installation shall be constructed so that the mechanical and fire safety features of the ship or floating or mobile installation are not impaired.

Re § 30

This provision applies for example to cable penetrations in bulkheads and decks. See also regulations from the Norwegian Maritime Authority and other relevant provisions. The provision also means that when selecting cables, any necessary measures shall be taken to prevent secondary corrosion damage in the event of fire in the cables. Cables shall be installed so that any fires in cables or cable penetrations do not result in emergency escape routes being blocked.

§ 31 Connecting equipment

Electrical equipment that is part of or is intended to be connected to an installation shall be installed, maintained and used in accordance with the manufacturer's instructions.

Re § 31

This provision means for example that equipment must be connected and used according to the manufacturer's instructions. In particular, the location of equipment that emits heat, such as lighting equipment, radio or television, must not impede ventilation. When installing built-in light fittings, the fire safety characteristics must therefore be assessed.

The construction and sale of electrical equipment is regulated by the regulations of 14 January 2011 concerning electrical equipment.

The use and maintenance of electromedical equipment is regulated by the regulations of 15 December 2005 on the use and maintenance of electromedical equipment.

§ 32 Design of electrical equipment

All electrical equipment that is part of or is intended to be connected to an installation shall be designed to suit the purpose and function of the installation.

Re § 32

The provision means that selected equipment must withstand the existing operating conditions on board ships and floating mobile installations.

Examples of conditions that may be assessed are:

- vibrations
- climatic conditions

§ 33 Connection by flexible cable

Flexible cables with an earth conductor are required to have an earthing plug. Flexible cables without an earth conductor are required to have a plug without an earthing contact.

Flexible cables for Class II equipment (double-insulated) are not required to have an earth conductor, but may have an earthing plug.

Flexible cables are required to be connected in the room where the relevant equipment is used. This does not apply to equipment designed to be moved during use or for temporary use.

Re § 33

The use of flexible cables should be limited and these cables should be as short as possible.

Equipment designed to be moved during use means appliances such as vacuum cleaners and electrical hand tools.

The transition between fixed cable to flexible cords for mobile equipment is generally achieved by the use of socket-outlets and plugs. If a connection by plug and socket-outlet is not suitable, equipment with flexible cords with approved strain relief may be connected in a junction box.

Only one cord is to be attached to each plug. Plugs for extensions and branch-off plugs may only be plugged into fixed socket-outlets. Adaptor fittings to enable the use of plugs using rated current below that of the socket-outlet are prohibited.

For fixed motors and equipment that must be connected by a flexible cable in order to be used, for example certain cranes and other lift machinery, a system voltage of up to 1000 V may be used. The flexible cords must be connected by means of plugs and interlocked socket-outlets specially designed and marked for this purpose, or in special junction boxes with interlocked doors fitted with a switch. The latter requirement also applies when connecting refrigerated containers to a power source.

Chapter V – Supplement about safety of fishing vessels of 15 meters in length and over – Precautions against shock, fire and other hazards of electrical origin.

Re Chapter V

Chapter V implement Council Directive 97/70 setting up a harmonised safety regime for fishing vessels of 24 metres in length and over.

The Norwegian Maritime Authority has implemented the Directive for fishing vessels of 15 metres in length and over.

§ 34 Earthing

Exposed permanently fixed metal parts of electrical machines or equipment which are not intended to be "live", but which are liable under faults conditions to become "live" shall be earthed (grounded) unless:

- *they are supplied at a voltage not exceeding 55 V direct current or 55 V, root mean square, between conductors; autotransformers shall not be used for the purpose of achieving this alternative current voltage; or*
- *they are supplied at a voltage not exceeding 250 V by safety isolating transformers supplying one consuming device only; or*
- *they are constructed in accordance with the principle of double insulation.*

Portable electrical equipment shall operate at a safe voltage. Exposed metal parts of such equipment which are not intended to have a voltage but which may have such under fault conditions, shall be earthed. The Administation may require additional

precautions for portable electric lamps, tools or similar apparatus for use in confined or exceptionally damp spaces where particular risks due to conductivity may exist.

Electrical apparatus shall be so constructed and so installed that it shall not cause injury when handled or touched in the normal manner.

§ 35 Main– and emergency switchboards

Main and emergency switchboards shall be so arranged as to give easy access as may be needed to apparatus and equipment, without danger to attendants. The sides and backs and, where necessary, the fronts of switchboards, shall be suitably guarded. Exposed "live" parts having voltages to earth exceeding a voltage to be specified to the Administation shall not be installed on the front of such switchboards. There shall be nonconducting mats or gratings at the front and rear, where necessary.

§ 36 Distribution systems

The hull return system of distribution shall not be used for power, heating or lighting in vessels of 75 m in length and over.

This requirement does not preclude, under condition approved by the Administration, the use of:

- *impressed current cathodic protective systems;*
- *limited and locally earthed systems; or*
- *insulation level monitoring device provided the circulation current does not exceed 30 mA under the most unfavourable conditions.*

When the hull return system is used, all final sub-circuits (all circuits fitted after the last protective device) shall be two wire and special precautions shall be taken to the satisfaction of the Administration.

Re § 36

As regards accepted distribution systems, the Council Directive has no specific requirements for vessels with length less than 75 meters. The EU-commission has stated that the national authorities may establish own regulations for these vessels.
See § 12 in these regulations.

§ 37 Monitoring of insulation level to earth

Where a distribution system, whether primary or secondary, for power, heating or lighting, with no connection to earth is used, a device capable of monitoring the insulation level to earth shall be provided.

When the distribution system is in accordance with this, and a voltage exceeding 55 V direct current or 55 V, root mean square, between conductors, is used, a device capable of continuous monitoring the insulation level to earth and of giving an audible or visual indication of abnormally low insulation values shall be provided.

Distribution systems which are supplied at a voltage not exceeding 250 V direct current or 250 V, root mean square, between conductors and which are limited in extent, may comply with the first section of this paragraph, subject to the satisfaction of the Administation.

§ 38 Cables

Except as permitted by the Administration in exceptional circumstances, all metal sheaths and armour of cables shall be electrically continuous and shall be earthed.

All electrical cables shall be at least of a flame-retardant type and shall be so installed as not to impair their original flameretarding properties. The Administration may permit the use of special types of cables when necessary for particular applications, such as radio frequency cables, which do not comply with the foregoing.

Cables and wiring serving essential or emergency power, lighting, internal communications or signals shall as far as practicable be routed clear of galleys, machinery spaces of category A and other high fire risk areas and laundries, fish handling and fish processing spaces and other spaces where there is a high moisture content. Cables connecting fire pumps to the emergency switchboard shall be of a fire-resistant type where they pass through high fire risk areas. Where practicable all such cables should be run in such a manner as to preclude their being rendered unserviceable by heating of the bulkheads that may be caused by a fire in adjacent space.

Where cables which are installed in space where the risk of fire or explosion exists in the event of an electrical fault, special precautions against such risks shall be taken to the satisfaction of the Administration.

Wiring shall be supported in such a manner as to avoid chafing or other damage.

Terminations and joints in all conductors shall be made such that they retain the original electrical, mechanical, flameretarding and, where necessary, fire-resisting properties of the cable.

Cables installed in refrigerated compartments shall be suitable for low temperatures and high humidity.

Re § 38

Machinery spaces category A: Rooms containing combustion engines used for:

- either main propulsion, or
- other purposes when such engines has a total capacity not less than 375 kW, or containing oilburners or other oilburning equipment.

§ 39 Protection

Circuits shall be protected against short circuit. Circuits shall also be protected against overload, except in accordance with regulation 13 (about steering systems) or where the Administration may exceptionally otherwise permit.

The rating or appropriate setting of the overload protective device for each circuit shall be permanently indicated at the location of the protective device.

§ 40 Lighting fittings

Lighting fittings shall be arranged to prevent temperature rises which could damage the wiring and to prevent surrounding material from becoming excessively hot.

§ 41 Lighting circuits

Lighting or power circuits terminating in a space where the risk of fire or explosion exist shall be provided with isolating switches outside the space.

§ 42 Accumulator batteries

The housing of an accumulator battery shall be constructed and ventilated to the satisfaction of the Administration.
Electrical and other equipment which may constitute a source of ignition of flammable vapours shall not be permitted in these compartments exceptas permitted in § 43.

An accumulator battery shall not be located in accomodation spaces unless installed in a hermetically sealed container.

§ 43 Location of electrical equipment

In spaces where flammable mixtures are liable to collect and in any compartment assigned principally to the containment of an accumulator battery, no electrical equipment shall be installed unless the Administration is satisfied that it is:

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

§ 44 Lightning conductors

Lightning conductors shall be fitted to all wooden masts or topmasts. In vessels constructed of non-conductive materials the lightning conductors shall be connected by suitable conductors to a copper plate fixed to the vessel's hull well below the waterline.

Chapter VI – Supplement about safety rules and standards for passenger ships.

Re Chapter VI

Chapter VI implements those parts of Council Directive 98/18/EC on safety rules and standards for passenger ships concerning electrical installations.

(R.) refers to corresponding regulations in SOLAS 1974 and later amendments (chapter II-1 construction-subdivision and stability, machinery and electrical installations).

§ 45 Precautions against shock, fire and other hazards of electrical origin (R 45)

New class B, C and D and existing class B ships:

1. *Exposed metal parts of electrical machines or equipments which are not intended to be live but which are liable under faults conditions to become live shall be earthed unless the machine or equipment are:*

- supplied at a voltage not exceeding 50 V direct current or 50 V, root mean square, between conductors; auto-transformers shall not be used for the purpose of achieving the voltage; or
- supplied at a voltage not exceeding 250 V by safety isolating transformers supplying only one consuming device; or
- constructed in accordance with the principle of double insulation.

2. *All electrical apparatus shall be so constructed and so installed as not to cause injury when handled or touched in the normal manner.*

3. *The sides and the rear and, where necessary, the front of switchboards shall be suitably guarded. Exposed live parts having voltages to earth exceeding the voltage specified under 1.1 shall not be installed on the front of such switchboards. Where necessary, nonconducting mats or gratings shall be provided at the front and rear of the switchboard.*

In distribution systems with no connection to earth, a device capable of monitoring the insulation level to earth and giving an audible or visual indication of abnormally low insulation values shall be provided.

***5.1** All metal sheaths and armour of cables shall be electrically continuous and shall be earthed.*

***5.2** All electrical cables and wiring external to equipment shall be at least of a flame-retarding properties. Where necessary for particular applications the Administration of the flag State may permit the use of special type of cables such as radio frequency cables, which do not comply with the foregoing.*

New Class B, C and D ships:

***5.3** Cables and wiring serving essential or emergency power, lighting, internal communications or signals shall so far as practicable be routed clear of galleys, laundries, machinery spaces of category A and their casings and other high fire risk areas. In new and existing ro-ro passenger ships, cabling for emergency alarms and public address systems installed on or after the date referred in Article 14 (1) of the Directive (01.07.1998) shall be approved to the Administration of the flag State having regard to the recommendations developed by the IMO. Cables connecting fire pumps to the emergency switchboard shall be of a fire-resistant type where they pass through high fire risk areas. Where practicable all such cables should be run in such a manner as to preclude their being rendered unserviceable by heating of the bulkhead that may be caused by a fire in an adjacent space.*

***6.** Cables and wiring shall be installed and supported in such a manner as to avoid chafing or other damage. Terminations and joints in all conductors shall be so made as to retain the original electrical, mechanical flame-retarding and, where necessary, fire resisting.*

New Class B, C and D and existing Class B ships:

***7.1** Each separate circuit shall be protected against short circuit and against overload, except as permitted in regulation II-I/C/6 and II-1/C/ 7.(Electric and electro-hydraulic steering gear)*

New Class B, C and D ships:

***7.2** Lighting fittings shall be so arranged as to prevent temperature rises which could*

damage the cables and wiring, and to prevent surrounding material from becoming excessively hot.

***8.1** Accumulator batteries shall be suitably housed, and compartments used primarily for their accomondation shall be properly constructed and efficiently ventilated.*

***8.2** Electrical or other equipment which may constitute a source of ignition of flammable vapours shall not be permitted in these compartments.*

***9.** Distribution systems shall be so arranged that fire in any main vertical zone, as is defined in regulation II-2/A/2.9, will not interfere with services essential for safety in any other such zone.*

This requirement will be met if main and emergency feeders passing through any such zone are separated both vertically and horizontally as wide as is practicable.

Re § 45

Implements part II-1/D/5 of the Council Directive

Re § 45.5.3

Definition of "machinery space of category A", see § 38.

§ 46 Additional requirements for electric and electrohydraulic steering gear (R 30)

New Class B, C and D and existing Class B ships:

***1.** Means for indicating that the motors of electric and electro-hydraulic steering gear are running shall be installed on the navigating bridge and at a suitable main machinery control position.*

New Class B, C and D ships:

***2.** Each electric or electro-hydraulic steering system comprising one or more power units shall be served by at least two exclusive circuits fed directly from the main switchboard; however, one of the circuits may be supplied through the emergency switchboard. An auxiliary electric or electro-hydraulic steering system associated with a main electric or electro-hydraulic steering system may be connected to one of the circuits supplying this main steering system. The circuits supplying an electric or*

electro-hydraulic steering system shall have adequate rating for supplying all motors which can be simultaneously connected to them and may be required to operate simultaneously.

New Class B, C and D and existing Class B ships:

3. *Short circuit protection and an overload alarm shall be provided for steering gear electic and electro-hydraulic circuits and motors. Protection against excess current, including starting current, if provided, shall be for not less than twice the full load current of the motor or circuit so protected, and shall be arranged to permit the passage of the appropriate starting currents.*

New Class B, C and D ships:

The alarm required in this paragraph shall be both audiable and visual and shall be situated in a conspicuous position in the main machinery space or control room from which the main machinery is normally controlled and as may be required by regulation 6 of part E of this chapter.

When an auxiliary steering gear required by regulation 6.3.3(R 29) to be operated by power is not electrically powered or is powered by an electric motor primarily intended for other services, the main steering system may be fed by one circuit from the main switchboard. Where such an electric motor primarily intended for other services is arranged to power such an auxiliary steering system, the requirements of paragraph .3 may be waived by the Administation of the Flag State, if satisfied with the protection arrangement together with the requirements of regulation 6.4.1 and .4.2 (R 29) applicable to auxiliary steering system.

Re § 46

Implements part II-1/C/7 of the Council Directive

§ 47 Protection of special category spaces (R 37)

New Class B, C and D ships:

1. *Precautions against ignition of flammable vapours*

- On any deck or platform, if fitted, on which vehicles are carried and on which explosive vapours might be expected to accumulate, except platforms with openings of sufficient size permitting penetration of petrol gases downwards, equipment which may constitute a source of ignition of flammable vapours and, in particular, electrical equipment and wiring, shall be installed at least 450 mm above the deck or platform. Electrical equipment installed at more than 450 mm above the deck or platform shall be of a type so enclosed and protected as to prevent the escape of sparks. However, if the installation of electrical equipment and wiring at less than 450 mm above the deck and platform is necessary for the safe operation of the ship, such electrical equipment and wiring may be installed provided that it is of a certified safe type approved for use in an explosive petrol and air mixture.
- Electrical equipment and wiring, if installed in an exhaust ventilation duct, shall be of a type approved for use in explosive petrol and air mixture and the outlet from any exhaust duct shall be sited in a safe position, having regard to other possible sources of ignition

New Class B, C and D ships:

Additional provisions applicable only to special category spaces below the bulkhead deck

2. *Precautions against ignition of flammable vapours:*

- Electrical equipment and wiring, if fitted, shall be of a type suitable for use in explosive petrol and air mixtures. Other equipment which may constitute a source of ignition of flammable vapours shall not be permitted.
- Electrical equipment and wiring, if installed in an exhaust ventilation duct, shall be of a type approved for use in explosive petrol and air mixtures and the outlet from any exhaust duct shall be sited in a safe position, having regard to other possible sources of ignition.

Re § 47

Implements part II-2/B/14 of the Council Directive

Chapter VII – Supervision, appeal, penalties, etc.

§ 48 Supervision

The shipowner shall submit a request for inspection / supervision of new and existing installations in accordance with specific guidelines to the Norwegian Directorate for Civil Protection or whoever it so authorizes.

The Norwegian Directorate for Civil Protection or whoever is authorized to act on its behalf is responsible for supervision to ensure that these Regulations are complied with.

The Norwegian Directorate for Civil Protection shall at all times have free access to the installations under its supervision and may require any information necessary for the exercise of its duties to be supplied, cf. section 5 of Act No. 4 of 24 May 1929 relating to Supervision of Electrical Installations and Electrical Equipment.

A charge shall be paid for the supervision provided by the Norwegian Directorate for Civil Protection in accordance with a scale determined by the Crown.

Re § 48

Further provisions concerning when notification is to be submitted are laid down in an agreement between the Norwegian Maritime Authority and the Norwegian Directorate for Civil Protection and are included in an appendix to these regulations.

The supervision is carried out by the following measures:

- The issue of Regulations containing minimum requirement for the construction and operation of electrical installations
- System control to ensure that the owner provides for the construction and operation of the installation to be in accordance with the regulations in force.
- Spot checks on old and new installations including examination of documentation
- The issue of information and instructions for safety work
- Formal permission to put installations into operation

Authorization to monitor compliance with these regulations was granted to the following classification societies as of the date when these regulations were laid down:

- American Bureau of Shipping,
- Bureau Veritas,
- Det norske Veritas,
- Germanischer Lloyd, and
- Lloyds Register of Shipping.

These and other agents or persons may monitor compliance on behalf of the Norwegian Directorate for Civil Protection by special agreement.

With regard to how monitoring is to be carried out, see the agreement the Norwegian Directorate for Civil Protection and the Norwegian Maritime Authority.

For the collection of supervision fees, see section 4 of the Act of 24 May 1929 relating to Supervision of Electrical Installations and Electrical Equipment.

For vessels and floating or mobile installations constructed abroad, see guidelines to § 2.

§ 49 Decision

The Norwegian Directorate for Civil Protection, or whoever is authorized to act on its behalf, issues instructions and takes other individual decisions as necessary for the implementation of the provisions laid down in or pursuant to these regulations.

§ 50 Exemption

The Norwegian Directorate for Civil Protection may grant exemption from these Regulations if special circumstances so indicate. As a rule, exemption shall be given in writing.

Re § 50

The security requirements laid down in the regulations are in the opinion of the Norwegian Directorate for Civil Protection so basic that granting exemption from them will only be relevant in very special cases. Any application for exemption must be based on a risk assessment.

§ 51 Right of appeal

Decisions adopted pursuant to these Regulations may be appealed under the Act of 10 February 1967 relating to the procedure in administrative cases (Public Administration Act).

Re § 51

Appeals against decisions made by bodies subordinate to the Norwegian Directorate for Civil Protection are to be lodged with the Norwegian Directorate for Civil Protection. Appeals against decisions made by the Norwegian Directorate for Civil Protection are to be lodged with the Ministry of Labour and Government Administration.

The time limit for lodging appeals is three weeks from the date notification of the decision has reached the relevant party.

The appeal is to be submitted to the administrative agency responsible for making the decision.

§ 52 Penal provision

Contravention of these Regulations or a decision adopted pursuant to the Regulations is punishable under section 14 of the Act of 24 May 1929 relating to Supervision of Electrical Installations and Electrical Equipment.

§ 53 Entry into force. Repeal of other regulations. Transitional provisions.

These Regulations becomes operative on 1 January 2002.

As of the same date, the Regulation for Electrical Installations – Maritime Installations of 1 March 1990 is repealed. Maritime electrical installations may nonetheless be designed and constructed according to the provisions in the Regulation for Electrical Installations – Maritime Installations of 1 March 1990 until 1 January 2003.

Maritime electrical installations designed and constructed according to the provisions in the Regulations for Electrical Installations-Maritime Installations of 1 March, may be maintained in accordence with this regulations.

Annex I – Examples of conformity declarations

Example of declaration of conformity by electrical installation contractor

Declaration that construction is in accordance with the Regulations relating to Maritime Electrical Installations (see section 6)

*Electrical installation contractor:*_____

*Address:*_____

*Type of installation:*_____

*Address:*_____

Standards applied (see section 5 of the Regulations):

No.Name

Other technical specifications:

The undersigned declares that this installation has been inspected (see section 7) and meets the safety requirements in Chapter IV of the Regulations. Documentation in accordance with section 6 has been delivered to the shipowner.

Place/DateSignature/Stamp

Name of undersigned:Job title:
(In block capitals)

Example of declaration of conformity from designer

Declaration that design is in accordance with the Regulations relating to Maritime Electrical Installations (see section 6)

*Designed by:*_____

Address:

50 Regulations relating to maritime electrical installations

_____

*Type of installation:*_____

*Address:*_____

Standards applied (see section 5 of the Regulations):

No.Name

Other technical specifications:

_____

The undersigned declares that this installation has been designed to meet the safety requirements in Chapter IV of the Regulations. Documentation in accordance with section 6 has been delivered to the shipowner.

Place/DateSignature/Stamp

Name of undersigned:Job title:

(In block capitals)

_____

Annex II Supplements to the regulations

This document is to consider as a supplement to the IEC 60092-serie (NEK 410) in Norwegian), and may be used to meet the requirements in the Regulations Relating to Maritime Electrical Installations. The text of this annex is a guide and thus not legally binding. There may be ways of meeting the legal functional requirements of the Regulations other than those stated in standards and guides. However, if the guide and the standards are used, the legal requirements of the Regulations will be presumed met.

1. Definitions and general requirements

Combinations of materials. Corrosion

During both the construction and installation of electrical equipment special considerations is to be given when choosing materials to avoid corrosion due to different electrolytic potential. (NEK 410/IEC 60092.101.2.10)

2. System design – general

1. Starting arrangement for propulsion engines

Starting arrangements for propulsion engine(s) are to have at least two batteries installed in separate boxes or lockers, or in a battery room. If the batteries are installed in a common battery room they must not be installed above each other, or on common shelves. The batteries are to have separate circuits installed as far apart as practical.

The starting arrangements for a single propulsion engine must have a changeover switch for alternative connection of the starting motor to either of the two batteries.

The starting arrangement for two or more propulsion engines must be divided between the two batteries and connected by separate circuits. Alternative connection of one battery to both (or all) propulsion engines may be accepted.

Prime movers for emergency generators and emergency fire pumps may not have a charging unit for their starting batteries which is based on a charging generator run by the prime mover itself.

2. Starting arrangements for emergency generator, essential services etc.

Starting arrangements for each prime mover of an emergency generator, emergency fire pump or other prime movers of important services are to have a separate battery, which is not used for other purposes.

See amendment to SOLAS 1974, Chapter II-1 regulation 44 concerning requirements apply to the starting arrangements for emergency generating sets.

NEK/IEC 60092.201.6.2.4 makes the same demands on starting arrangements for prime movers of important services as for emergency generators.

3. Starting arrangements for a prime mover not intended for emergency use

Starting arrangements for a prime mover, not intended for emergency use, is to be by a separate battery or to be connected by a separate circuit to batteries for propulsion engines.

4. Starting arrangements for more than one prime mover

Starting arrangements for more than one prime mover are to be from at least two batteries as for propulsion engines. Batteries for propulsion engines may be used.

5. Capacity of batteries

Each battery is to be of sufficient capacity for at least the following number of start attempts of the prime mover which it normally supplies, each attempt of minimum 10 seconds duration:

- 12 starts for each reversible propulsion engine.
- 6 starts for each non-reversible propulsion engine connected to a variable pitch propeller or other device enabling the engine to be started with no load.
- 3 starts for each prime mover for generators, emergency fire pumps and similar.

If starter batteries are used also for supplying other services, the capacity is to be increased accordingly.

When determining the battery capacity, the following must also be taken into consideration:

- The battery is normally not fully charged.

- Reduction of capacity due to ageing.
- Reduction of capacity due to high or low temperatures.
- Reduction of capacity due to rapid discharge.

(NEK/IEC 60092.201.6.2.1)

6. Number and capacity of power units

The requirements in NEK 410/IEC 60092.201.6.2.2 means that there shall be equipment for automatic disconnection (tripping) of non-essential services to prevent disconnection of the generator in the event of overload. See also NEK 410/IEC 60092.202.8.3

7. Distribution systems with neutral earthed (TNsystems)

Concerning the description of the systems and the current rating of the neutral conductor (N-conductor), reference is made to relevant regulations in NEK 400. (NEK 410/IEC 60092.201.7.1).

8. Parallel operation in installations with earthed neutral

When generators are run in parallel in installations with the neutral earthed, it is to be ensured that the equalising current caused by harmonics does not exceed harmful values. Reference is made to guidance from the generator manufacturer. (NEK/IEC 60092.201.7.1.3)

9. Duplicated essential services

Two or more essential services for the same purpose are to be supplied from at least two distribution switchboards. Each of these is to be supplied by a separate supply circuit from the main switchboard or from the emergency switchboard.

The cables to such services are to be separated along their whole length as far as practicable. Wherever possible, however, the cables are not to be installed in a collision zone.

The collision zone is a zone distanced from the ship's side of width 1/5 that of the ship at any place. (NEK/IEC 60092.201.11)

10. Shore connection

A shore connection is to have an interlocked switch or a changeover arrangement to prevent connection of the generator circuit and the shore connection circuit.

Three-phase AC installations are to be provided with a phase-sequence indicator and a phase-sequence changeover switch on the shore connection cabinet or on the switchboard. A phase-sequence changeover switch may be omitted on ships having an electrician, when the flexible cable from shore is not permanently connected or cannot be connected by means of an appliance connector on board. (NEK 410/IEC 60092.201.14).

11. Degree of protection

Stoves, ovens and similar equipment in galleys, laundries etc may be accepted with IP 22 when additionally protected against water splashing off the floor and the bulkhead during hose washing.

(NEK 410/IEC 60092.201.26 and 307.3.1)

3. System design – protection

1. Protection of generators – reconnection

Short-circuit, overcurrent and reverse-power relays are to be such that it is possible to reconnect the circuit breaker within 30 seconds, provided that the voltage is within the range 85 – 110 % of the rate voltage. (NEK 410/IEC 60092.202.8.2.1)

2. Protection of generators – additional requirements for circuit-breakers

Miniature circuit breakers having release characteristics adjusted to the nominal current of the generator, may be used as generator protection when the generator capacity is less than 35 kVA. (NEK 410/IEC 60092.202.8.2.1)

3. Return power protection

Return power protection relays for generators arranged for parallel operation is normally to have a time delay of 3 -10 seconds. (NEK 410/IEC 60092.202.9.1)

4. Equipment – generators and motors

1. Voltage regulation

The requirements for voltage regulators must as far as possible apply to generators with capacity less than 50 kVA. (NEK 410/IEC 60092.301.4)

5. Low–voltage switchgear and controlgear assemblies

1. Instruments – location

Instruments and control gear, except disconnectors, are to be installed on the front of the switchboard. Other equipment which are to be operated or maintained, are to be installed easily accessible behind hinged doors.

When such items are installed behind front doors, bare live parts are to be protected against inadvertent touching by means of fixed covers of at least flameretardant material. These covers are to comply with the requirements for enclosure IP 20. (NEK 410/IEC 60092.302.7.6.101)

2. Instrumentation – secondary distribution system

Each secondary distribution system is to have one voltmeter. (NEK 410/IEC 60092.7.6.101)

3. Instruments – construction

Normal full load values shall be marked in red on the instrument scale for all indicating instruments. (NEK 410/IEC 60092.302.7.6.101.4)

4. Separation of generator cubicles and other cubicles

Generatorcircuits, other circuits for supply and circuits for important consumers are to have a separate control cubicle to prevent the spread of arcing from/to other parts of the installation. (Partitions between the cubicles are at least to be of flame-retardant material.)

Reference to IEC 60439.7.7 and IEC 60439 appendix D. (NEK 410/IEC 60092.302.7.7.101)

6. Equipment – transformers for effect and lighting

1. Transformers – type of connection

Y/Y-connected transformers have relatively high values of the zerosequence reactances and should therefore be avoided in installations having directly earthed neutral if the requirement concerning disconnection may be difficult to fulfil. (NEK 410/IEC 60092.303.3)

2. Equipment containing PCB

Electrical equipment such as transformers, converters, condensatores etc. with liquids containing polychlorinated biphenyl's (PCB) are not permitted.

Ministry of the Environment has established regulations for the use of PCB and products containing PCB. The Norwegian Directorate for Civil Protection is directed to survey that some of these requirements are complied with. (NEK/IEC 60092.303.3 and 401.15.2)

7. Equipment – accumulator batteries

1. Charging devices for accumulator batteries

Batteries are to have suitable automatic charging devices. For batteries whose capacity is taken into consideration when determining the output and number of power supply units, two mutually independent-charging devices with separate supply circuits from the main switchboard may be required.

By suitable charging device it is meant that the charging device is to be capable of keeping the battery fully charged as far as possible at all times. (NEK 410/IEC 60092.305.6)

8. Equipment – heating and cooking appliances

1. Space Heaters

Space heaters may be one of the following types

- convector heaters
- panel heaters
- heaters with ribs

Portable fan heaters are not permitted.

Other types may, however, be allowed after consideration in each case. Reference is made to relevant regulations in NEK 400. (NEK 410/IEC 60092.307)

2. Hot air equipment

Hot air equipment is, in addition to excess temperature protection, also to have thermostats. The excess-temperature protection is to be located at that place where the highest temperature occurs.

Reference to relevant regulations in NEK 400. (NEK 410/IEC 60092.307)

3. Heating cable installations

Heating cable installations are normally to have earth leakage circuit breakers or earth leakage relays with tripping not above 30 mA. Where this is necessary for operational reasons tripping currents up to 300 mA may be permitted if special measures are taken to avoid dangerous exposure to live parts. Reference is made to relevant regulations in NEK 400. (NEK 410/IEC 60092.307)

9. Installation and test of completed installation

1. Switchboards – passage way

In front of main switchboards there is to be a free height of at least 2 m.

Switchboard doors, when in the open position, must not obstruct passage way. (NEK 410/IEC 60092.401.11)

2. Charging stations

Batteries for trucks are to be charged in charging stations. Such a charging station is understood to be a separate room or a limited part of a larger room, e.g. a cargo hold.

This limited part of the room is to have a base of at least the area occupied by the trucks.

Installations in charging stations are normally to be of explosion proof design. However, this does not apply if the batteries are completely sealed.

Socket-outlets interlocked with switchgear, for connection of the charging cables can be installed. They are to have enclosures at least IP 56 or IP 44, depending on the location. (NEK 410/IEC 60092.401.17)

3. Accumulator batteries – location

Rooms, lockers and boxes for batteries are to be used for this purpose only. (NEK 410/IEC 60092.401.17)

4. Cable ladders

Cables, which have temperature classes above 85 °C, are not permitted to be installed on combustible supports. Cables and wires are not, under any circumstances, to cause the temperature of any support or adjacent combustible materials to rise above 80 °C.

Cable ladders, cable bridges, cable conduits and ducts are not to be used for other purposes, e.g. carrying water pipes, oil pipes or other pipes.

Such pipes, rails and similar are not normally permitted as supports for cables. (NEK 410/IEC 60092.401.31)

5. Cable ladders – protection against corrosion. Mechanical strength.

Cable ladders and bridges are to be made of steel, and are to be protected against corrosion. On open decks and in cargo holds the corrosion protection is normally to be hot-dip galvanizing.

In areas where equipment may be exposed to heavy corrosive ambient conditions, special requirements may be laid down.

Cable ladders and bridges must be able to withstand any mechanical and electro-dynamic stresses, which may occur. When deciding the dimensions of cable ladders and bridges intended for single-core cables, special attention should be paid to electrodynamic stresses in case of a short-circuit. (NEK 410/IEC 60092.401.31)

6. Cable ladders – expansion and contraction

Cable ladders and bridges are to be constructed and installed in such a way that they do not absorb forces or transfer stresses caused by the ship's movements, changing load conditions, temperature variations etc. (NEK 410/IEC 60092.401.31)

7. Cable ladders – division into sections

Cable ladders, pipes and ducts along the main deck are to be divided into sections. They are to be rigidly fixed to the deck at one point only. At other points they are to have sliding supports. (NEK 410/IEC 60092.401.31)

8. Protection against mechanical stresses. Insulating sleeving.

Cable cores are to have a special insulation of at least flame-retardant material if they

are likely to be subject to mechanical stresses once the core insulation has been stripped back. Cores, which have flammable conductor insulation, are also to have flame retardant insulating sleeving if the length of the tail exceeds 20 cm. This also applies to cables at conduit outlets and similar in connection boxes, terminal boards etc.

Insulating sleeving must have temperature resistance corresponding at least to the temperature class of the cable. (NEK 410/IEC 60092.401.35)

9. Mechanical protection of cables

The thickness of the protection covers is to be at least 4 mm. The wall thickness of the protection pipes is to be at least 2,5 mm.

Cables laid on aluminium supports may have a corresponding protection of aluminium. The thickness is to be at least 4 mm. (NEK 410/IEC 60092.401.35.2)

10. Fixing of cables

The requirement concerning fixing can normally be fulfilled when the cables are clamped as follows:

- For cables entering enclosures and conduits, the nearest clamp is to be placed at a maximum distance of 10 times the diameter of the cable concerned from the entry.
- At other points the distance between the clamps must not exceed the values in the following table:

External diameter of cable (mm)		**Maximum spacing of fixing points (mm)**		
Above	Up to	Cables without metal braid or armour (also cables with lead sheat only)	Cables with	
	8	200	250	300
8	13	250	300	370
13	20	300	350	450
20	30	350	400	450
30		400	450	450

(NEK 410/IEC 60092.401.38)

11. Cable conduits and ducts – Protection against corrosion. Mechanical strength

Cable conduits and ducts are to be made of steel, and are to be protected against corrosion. On open decks and in cargo holds, the corrosion protection is to be hot-dip galvanizing or equivalent.

When the conduits and ducts have aluminium supports, these may be made of aluminium.

Conduits are to have the following minimum average wall thickness:

External diameter of the pipe in mm	Minimum wall thickness in mm	External diameter of the pipe in inches	Minimum wall thickness in mm
16	1,5	5/8	1,5
20	1,5	3/4	1,5
25	1,6	1	1,8
32	1,6	1 1/4	1,8
40	1,6	1 1/2	2,0
50	1,8	2	2,0
63	1,9	2 1/2	3,0
		3	3,2
		3 ½	3,2
		4	3,4
		5	3,6

Conduits of larger diameter are to have a minimum average wall thickness of at least 4 mm.

Ducts are to have similar minimum average wall thickness corresponding to the external diameter of the duct.

Conduits with internal diameter exceeding 304,8 mm (12 inches) are not permitted. This also applies to ducts, which have a similar equivalent diameter.

12. Wall thickness on open decks and in water– and fuel oil tanks

Pipes and conduits on open decks and in water and fuel oil tanks are to have the following minimum average wall thickness:

Internal diameter of pipe, mm	Minimum wall thickness, mm
D ≤ 57	4,0
57,0 ≤ D ≤ 152,4	4,5
152,4 ≤ D ≤ 304,8	5,5

Ducts are to have similar wall thickness corresponding to the internal equivalent diameter of the duct.

Two concentric pipes should be used through tanks containing combustible liquids and in cargo holds containing combustible loads. (NEK 410/IEC 60092.401.40)

13. Cables behind panels or deck-platings

When cables are laid behind panels or deck-platings, these are to be easily removable. The cables are to be directly available when the panel or deck-platingis removed. However, single cables for lamps, socket-outlets and switches in dry areas may be installed behind wall panels, which are not easy to remove.

The requirements that panels or deck platings, are to be "easily removable" means that the panels or deck platings have to be hinged or fixed by screws in such a way that they can be dismantled without difficulty. Such panels or deck-platings should be able to be dismantled without damaging the interior. (NEK 410/IEC 60092.401.41)

14. Installation of cables in thermal insulation

Cables are not to be installed in or covered by thermal insulation, but they may be run the shortest way through such insulation. However cables in lighting final sub-circuits e.g. in cabins, may be installed in such insulation provided that documentation shows adequate heat dispersion. Cables laid along outer-decks, bulkheads or the hull, are to be located at the inside of the thermal insulation. (NEK 410/IEC 60092.401.41)

Reference is made to relevant regulations in NEK 400.

15. Plastic conduit installation

Plastic conduits are only permitted in dry areas in accommodation quarters. For this installation special precautions are to be taken concerning expansion, contraction, fastening and jointing. (NEK 410/IEC 60092.401.41) Reference also made to relevant regulations in NEK 400.

16. Terminations for conductors – Stripping and termination

Conductor insulation and sheaths are not to be stripped back more than is absolutely necessary.

Cables are to be terminated in a box or a board, etc. suitable for the purpose. (NEK 410/ IEC 60092.401.46)

17. Branching off and splicing of cables – connection boxes

In dry areas in accommodation quarter's boxes may be concealed behind wall and ceiling panels. Such boxes shall normally have a degree of protection IP44. The location is then to be plainly indicated outside the panel. The panels are to have adjustable openings giving easy access to the boxes. The covers of the openings are to be fixed in such a way that they can be easily removed without dismounting other equipment.

The inspection body may accept a lower degree of protection, if the risk of leakage from pipes etc. is low and the wall etc. are of incombustible material. (NEK 410/ IEC 60092.401.48)

18. Testing – insulation resistance

Machines, transformers, appliances and other apparatus are to have, at both ambient and operating temperatures, an insulation resistance of at least:

$$\frac{3 \times \text{rated voltage in V}}{\text{Output in kVA} + 1000} = M\Omega$$

Heating appliances may, however, at normal operating temperature, have a lower insulation resistance, but not below the following values:

- Appliances without earth connection:			50 000 ohms
- Appliances with earth connection:	up to	5 kW	50 000 ohms
		5 – 10 kW	40.000 ohms
		10 – 20 kW	30.000 ohms
		20 – 50 kW	20.000 ohms
	over	50 kW	10.000 ohms

In battery circuits the insulation resistance between each battery-pole and earth is to be at least 250 ohms per V of the nominal voltage.

19. Measurement of insulation resistance

Insulation resistance measurements are to be carried out by using direct current at a voltage of at least twice the nominal voltage of the installation, but not less than 250 V. However, a higher measuring voltage than 500 V is not required for installations with an operating voltage up to 1000 V.

During insulation measurement care must be taken to ensure that equipment which cannot withstand the measuring voltage is not damaged. It might be necessary to short circuit electronic equipment, such as thyristors and diodes while measuring. (NEK 410/ IEC 60092.401.55).

10. Special features – A.C. supply systems with voltage in range above 1 kV up to and including 11 kV

1. Scope

The requirements in this section apply to high voltage AC installations with a system voltage above 1 kV up to and including 11 kV in addition to the general requirements for installations on board ships, mobile drilling platforms, dredgers, floating cranes etc.

These additional requirements for high -voltage installations is based upon IEC-Publication 92-503(1975) «AC Supply system, with voltages above 1 kV up to and including ll kV- with the additional requirements laid down in this section. The inspection body may consider the use of higher voltage.

2. General requirements

2.1 Design

All equipment is normally to be designed and tested according to relevant IEC-standards or to equivalent and recognised national standards. The design must be for the special environmental conditions found onboard.

2.2 Protection against live parts

2.2.1

Parts of the installation, which are not made safe to touch, are to be located so that they

are not accessible to unauthorized persons.

A part of an installation, which is made safe to touch, is a part of an installation, which has an earthed screen, earthed enclosure or approved insulation.

2.2.2

Live parts, which are to be operated, or examined, are to be located and protected in such a way that they may be operated or examined easily and without danger.

2.2.3

An approved warning notice is to be fixed in a visible position at the high-voltage equipment and at places where the high voltage cables are accessible. Approved warning signboards are to be placed at suitable locations both inside high-voltage rooms and at the entrance.

2.3 Insulation resistance

2.3.1

On systems designed with an insulated neutral or with a highresistance-earthed neutral, control of the insulation level must be possible. In addition the following must be established:

- a fixed monitoring device giving an alarm in the event of an insulation fault or earth fault in the installation, or
- a device for automatic disconnection of the circuit when an earth fault occurs.

2.3.2

On systems designed with directly earthed neutral or low resistance earthed neutral, automatic disconnection of circuits in the event of an insulation fault is to be arranged. This earth fault protection is to operate at 1/3 of the maximum stipulated earth fault current. For lower earth fault current alarm must be given.

2.4 Clearance and creepage distances

2.4.1

Uninsulated conductors which are not earthed shall be installed with a clearance from one another and from other conductive objects and from walls, ceilings or their own protective covers of at least 5 cm + 0.5 cm for each 1 kV of operating voltage unless voltage tests carried out according to Norwegian or other similar standards shows that the insulation is adequate with less clearance. The Norwegian Directorate for Civil

Protection may after consideration of each case base the approval on other minimum clearances.

Other minimum clearances upon which approval may be based are as follows:

Nominal voltage (V)	Minimum clearance, distance (mm) for	
	Main switchboards	Other equipment and generators
< 1 100	14*)	14
< 3 300	32	26
< 6 600	60	50
≤ 11 000	100	80

*) 25 mm is required for busbars and other bare conductors in main switchboards

2.4.2

All equipment is to have satisfactory creepage distances.
Satisfactory creepage distances are given in the following tables:

Main switchboards and generators:

Nominal voltage (V)	Minimum creepage distance (mm) for proof tracking index			
	300 V	375 V	500 V >	600 V
< 1 100	26*)	24*)	22*)	20*)
< 3 300	63	59	53	48
< 6 600	113	108	99	
≤ 11 000	183	175	162	150

*) 35-mm minimum is required for bus bars and other bare conductors in main switchboards.

Other equipment:

Nominal voltage (V)	Minimum creepage distance (mm) for proof tracking index			
	300 V	375 V	500 V	> 600 V
< 1 100	18	17	15	14
< 3 300	42	41	38	26

< 6 600	83	80	75	70
≤ 11 000	146	140	130	120

2.5. Earthing

2.5.1

Earthing conductors are normally to be of copper and are to have a cross section area of at least 30 mm^2. The current density shall not exceed 150 A/mm^2 for copper earthing conductors at the maximum earth fault, which may occur.

2.5.2

Arrangements for earthing when working on an installation are to be established in accordance with the requirements laid down in the Safety regulations related to the maintenance and operation of electrical installations. At busbars and on all incoming and outgoing circuits on switchboards or similar, where reliable inter-locking is not arranged, earthing and short-circuiting devices are to be provided, using fixed earthing switches which have adequate making capacity for operation on system voltage.

In other locations earthing and short-circuiting may be executed by means of fixed earthing switches, portable earthing equipment or other suitable earthing equipment.

2.5.3

The secondary winding of current and voltage transformers is to be earthed. The earthing conductor is to be of copper and with a minimum cross-section area of 4 mm^2. The earthing conductor may be connected directly to the earthed enclosure of the transformer or to an earthed support.

Earthing switches will be approved according to IEC-Publication 129 (1984).

2.6 Enclosures.

2.6.1

Enclosures are to comply at least with the requirements in NEK 410/IEC 60092.201.26 unless a higher degree of protection is required in item 2.6.2 – 2.6.4

2.6.2

Rotating machines and neutral resistors are to have degree of protection of at least IP 43. However, in rooms, which are accessible for qualified persons only, a degree of IP23

may be accepted. Connection boxes are to have a degree of protection of at least IP 44.

Machinery spaces will generally be considered as being accessible only to qualified personnel. The same applies to other compartments which normally are kept locked, under the responsibility of the ship's officers.

2.6.3
Power transformers are to have a degree of protection of at least IP23 when located in rooms accessible to qualified personnel only and at least IP54 when located elsewhere. Alternatively power transformers with a lower degree of protection may be located in a separate room which is locked.

2.6.4
Switchgear and controlgear assemblies are to have a degree of protection of at least IP32.

2.7 Over-voltage protection
Over-voltage protection is to be arranged for lower voltage systems supplied through transformers from high voltage systems. The protection device e.g. a neutral voltage limiter or direct earthing of the lower voltage system, is to be fitted at the secondary winding of the transformer. Alternative protection may be considered in each case.

2.8 Anti-condensation heating
Equipment which can be expected to be periodically out of service and which is not located in heated and ventilated rooms is to be provided with a heating element. The heating is to be automatically switched on when the equipment is at standstill.

3. Distribution systems and voltages

3.1 Distribution systems
The following distribution systems are permitted:

3.1.1
three-phase three-wire with high-resistance earthed neutral,

3.1.2
three-phase three-wire with low-resistance earthed neutral,

3.1.3
three-phase three-wire with directly earthed neutral,

3.1.4
three-phase three-wire with the neutral earthed with equipment specially approved by The Norwegian Directorate for Civil Protection, and

3.1.5
three-phase three-wire with insulated neutral.

For systems having insulated neutral, test voltages higher than that for the other systems are required

For rotating machines, power transformers, current and voltage transformers, cables, switch-gear and fuse-gear for use in systems with insulated neutral point, the test voltage for the high voltage test, shall be not less than 7.5 times the normal voltage between phase and neutral of the system. The «inspection body» in each case may however, separately consider the test voltage.
A high resistance earthed neutral: is a system where the neutral is earthed through a resistance with numerical value equal to or somewhat less than 1/3 of the capacitive reactance between phase and earth.

A low-resistance earthed neutral: is a system where the neutral is earthed through a resistance which limits the earth fault current to a minimum value of 20 % and maximum 100 % of the rated current of the largest generator

Insulated neutral: the requirement in this clause of these regulations for higher testvoltages is because of the over-voltages, which may occur in the event of intermittent earth faults.

3.2 Maximum system voltages
The maximum nominal system voltage permitted is 11 kV. For control systems the maximum nominal system voltage permitted is 250 V.

The following nominal system voltages are standardized: 3, 3.3, 6, 6.6, 10 and 11 kV.

4. Power sources and power supply installations

4.1 Generators

4.1.1

If the cooling of generators is arranged by means of water/air heat exchangers these are to be of the double tube type. Leakage monitoring with alarm is to be provided.

4.1.2

When auxiliary power is used for the cooling system of a generator, e.g. water pump or separate fan, it is either to be interlocked so that the generator is disconnected if the auxiliary power fails, or the generator is to have winding temperature detectors which actuate an alarm at the maximum rated winding temperature, and disconnect the generator at 10 % over-temperature.

4.1.3

The windings of all rotating machines are to be provided with temperature detectors for monitoring and alarm.

Over-voltage protection may be required for temperature detector circuits.

4.2 Power transformers

Special measures may be required to avoid undesirable effects of possible inrushcurrents, if necessary.

4.3 Earthed neutral connections

Means for disconnection of each earthed neutral connection is to be provided. If a switch is used for this disconnection, an arrangement for locking must be provided.

5. Distribution systems, switchboards, controlgear

5.1 Distribution systems

5.1.1

The busbars of the main switchboard are to be divided into at least two independent sections, interconnected by circuit breakers or switches.

Connections from generators to important services are to be divided between the sections so that safe operation of the ship is ensured even with any one busbar section out of service.

5.1.2

When auxiliary power is needed for the operation of switches, an independent auxiliary power system is to be provided for each of the switchboard sections. The auxiliary power system is to have sufficient capacity for at least two operations of each circuit breaker on the system.

This requirement applies to switches being simultaneously disconnected, and without any abnormal voltage drop in the auxiliary power circuit or any abnormal drop of pressure in the hydraulic system used for the switch operation.

5.2 Generator circuits

Each generator output circuit is to be connected through a circuitbreaker.

In addition to the general requirements, a protection device is to be provided to include protection against short-circuit or earth fault in the generator or in the cable connection from the generator to the switchboard, by disconnection of the generator circuit breaker and de excitation of the generator.

In systems with isolated neutral or high-resistance earthed neutral an alarm may replace disconnection in case of earth fault in the generator or in the cable connection between generator and the switchboard.

5.3 Feeder circuits

Feeder circuits are normally to be provided with a circuit breaker.

A fused circuit breaker may be accepted provided that the fuses can be replaced without any hazard to personnel.

Fuses are not to be used for overload protection.

Switchgear for feeder circuits may be used as motor starters, only if the switchgear is designed for the starting current and the stipulated number of switching operations.

Certain types of fuses have an insufficient breaking capacity at currents between full-load and short-circuit.

It is assumed that the overcurrent protection device of the circuit breaker operates within the current range.

5.4 Power transformer circuits

5.4.1

Supply circuits to the primary side of transformers are to comply with the requirements in item 5.3 above. The protection system is to include alarm for over-current or overtemperature if a load diversity factor has been used when deciding the current rating of the transformer.

5.4.2

If the power transformers are arranged for parallel operation the secondary side circuits are to be provided with switchgear. The switchgear on the secondary side is to be interlocked with the switchgear on the primary side.

5.5 Voltage transformers

Voltage transformers are to be provided with fuses on the secondary side. For the circuit feeding voltage to a generators voltage regulator, fuses may however be omitted.

5.6 Shore connection circuits and circuits to other units

Shore connections and circuits to other units are permitted only with special approval by The Norwegian Directorate for Civil Protection.

5.7 Switchboards. Design and construction

5.7.1

Switchboards are to be of metal clad construction in accordance with IEC-Publication No. 60298 (1990) “AC metal enclosed switchgear and controlgear for rated voltage above 1 kV and up to and including 52 kV”, with the deviations and supplementary requirements given in the following subclauses.

Internal partitions of materials other than metal may be accepted by The Norwegian Directorate for Civil Protection after consideration of each case.

On feeder circuits if return power from the load side is not possible, enclosure between the cable terminals and the switchgear may be omitted.

Switchgear or controlgear is considered to be metal enclosed when it consists of an outer metal enclosure with components arranged in separate metal enclosed compartments. The metal enclosures are to be earthed.

5.7.2

Switch-gear and control gear shall be able to withstand all stresses due to short-circuiting. Documentation may be required.

5.7.3

The switchboard manufacturer shall issue a test report giving all the necessary information refered to in IEC 60298. For the impulse voltage test in this IEC publication "List 2" applies to systems without automatic disconnection in case of earth fault, "List 1" applies to other systems.

5.7.4

Means are to be provided for the disconnection of all circuit breakers and fused circuit breakers from the busbars. This can be effected by means of a disconnector having a visible isolating distance or gap or a reliable position indicating device for each movable contact system, or similar visible means e.g. a withdrawable multipole circuit-breaker in its isolating position.
The isolating distance shall be in accordance to tests in IEC-publication 60129 (1984) "Alternating current disconnectors (isolators) and earthing switches."

5.7.5

Doors of switchboards are preferably to be equipped with locking devices. Alternatively the switchboard may be located in a special room or fenced in area with lockable entrance doors.

Other alternatives may be accepted.

5.7.6

Except for short connections to instrument transformers, relays, auxiliary switches etc., control and instrumentation circuits are to be installed separated from the main circuits by means of earthed partitions of metal or partitions of insulating and flame retardant material.

The requirement concerning partitions may be effected e.g. by using cable conduits.

Alternative cable-connections may be accepted.

Fuses in control and instrumentation circuits requiring inspection while the equipment is in service shall be accessible without any hazard to personell.

5.8 Passageways

In front of each switchboard there is to be a passageway with a free width of at least 1 metre. Switchboards doors, when in the open position, or withdrawable switchgear in their isolating position, must not obstruct the passageways.

Access from both the front and rear of the switchboard may be required after consideration of each case.

6. Cables

6.1 Approval

6.1.1

Cables are to be of a manufacture and type of approved standards.

6.1.2

Cables for permanent installations will normally be approved if they comply with the specifications in IEC Publication No. 60502 "Extruded solid dielectric insulated power cables for rated voltages from 1 kV up to 30 kV", and with thespecial requirements laid down in the following:

- Cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) only is to be used as core insulation. Butyl rubber, PVC and thermoplastic polyethylene (PE) are not accepted.
- Conductor screening is required for all cables with XLPE insulation, and for EPR-insulated cables with rated voltage U0/U above 3.6/6 kV.
- Insulation screening is required for all cables.
- Only the types specified in IEC-Publication No. 60092-359 are to be used for sheath materials i.e. PVC, polychloropren or chlorosulfphonated polyethylene.
- Other constructions and materials may be considered for approval, depending upon the application.

6.1.3

Flexible cables for portable equipment can only be used after special consideration of each case.

6.1.4

The rated value (U) of cables shall be at least that of the nominal system voltage. In systems with high-resistance earthed neutral without means of disconnection in the event of earth fault, and in systems with isolated neutral the voltage class U between phase and earth shall be the same as the nominal system voltage.
This requirement means for instance that in a 6 kV installation with isolated neutral, cables with a voltage class U0/U = 3.6/6 kV will not be accepted. Cables with a voltage class 6/10 kV are to be used.

6.2 Installation

6.2.1

Cables for high-voltage are to be installed separately from cables for lower voltages, e.g. not grouped together or installed in the same conduit.

6.2.2

The Norwegian Directorate for Civil Protection depending on the application only permit installation of high-voltage cables in accommodation areas after special consideration.

6.2.3

Cables for high-voltage are to be specially marked, see item 2.2.3 above.

6.2.4

For uninsulated conductors the clearance distances laid down in item 2.4.1 apply.

6.2.5

For terminations and joints not protected by earthed metal screens the clearance distances in item 2.4.1 apply.

If the terminations are made in accordance with the installation instructions given by the manufacturer, these installation instructions may be considered to be sufficient documentation. A relevant test report has, however, to be available. Cable terminations are not to be made in the same enclosures as equipment at lower voltages, see item 5.7.6 above.

6.3 Current rating

The requirements for cables with temperature class 85 °C given in NEK 410/ IEC 60092.201, table 6 and NEK 410/IEC 60092.352.6, table 1, are to be used with a derating factor of 10 %.

6.4 Testing

Cables with terminations and joints are to be subjected to a voltage test after installation according to "clause 18» of IEC Publication No.60502. This means a D.C. voltage test at least 4 x U0 for 15 minutes. U0 is the rated phase to earth voltage of the cable.

Alternatively an AC voltage test may be accepted. This must, however, be agreed upon by the cable manufacturer.

7. Switch-gear, controlgear, fuses and socket-outlets

7.1 Switch-gear, controlgear and fuses

Switchgear, controlgear and fuses are to be designed so as to comply with relevant IEC-standards

With relevant IEC standards means:

- IEC -Publication No. 60056." High-voltage alternating current circuitbreakers"
- IEC -Publication No. 60129. " Alternating current disconnectors and earthing switches"
- IEC -Publication No. 60282. "High-voltage fuses"

7.2 Socket-outlets

Socket-outlets may be used only with the special approval of The Norwegian Directorate for Civil Protection.

8. Motors

The requirements laid down for generators applies to motors as far as these requirements are relevant for the purpose.

Annex III Periodical surveys

Type of vessels	Intervals	Guidance:
Passenger ships	once every 5th year	Employed in domestic trade
	once every year	Employed in foreign trade
Fishing vessels	once every 4th year	
Barges	once every 5th year	
Cargo ships	once every 5th year	
”Oil defence vessels” which do not operate in areas containing released oil	once every 5th year	
“Oil defence vessels” which may operate in areas containing released oil”	once every 2nd year	Alternatively during the 3rd year of the sertificate cycle
Fishing vessels (less than 15 meters)	once every 5th year	Survey by authorized company

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