REGULATIONS
FOR
ELECTRICAL INSTALLATIONS
ON BOARD
SHIPS, MOBILE DRILLING PLATFORMS, DREDGERS, FLOATING CRANES ETC.

of 11 November 1975

Prepared by

THE NORWEGIAN WATER RESOURCES
AND ELECTRICITY BOARD
pursuant to
ACT RELATING TO SUPERVISION OF
ELECTRICAL INSTALLATIONS

of 24 May 1929 with later amendments
cfr. delegation from the Ministry of
Industry and Handicraft of 6 October
1971.

Published in
Norsk Lovtidend sec. 1
No. 10/1976

Should doubt arise about the interpretation of the regulations in this translation, the original regulations in the Norwegian language will be decisive.

CONTENTS

CHAPTER A
GENERAL PROVISIONS

CHAPTER B. DEFINITIONS

CHAPTER C. HEAVY-CURRENT INSTALLATIONS

Section 12. *General requirements.*

CHAPTER A. GENERAL PROVISIONS

SECTION 10. SCOPE, SUPERVISION, NOTIFICATION, EXEMPTIONS, PENALTIES, ENTRY INTO FORCE.

§ *1001.* *Scope.*

These Regulations apply to electrical installations on board ships, dredgers, floating cranes and similar, including mobile drilling platforms, but not including installations for radio telephony and radio telegraphy.

For installations on board ships without passenger certificate, with class notation in Classification Societies which have been authorized for Special Supervision, the Rules of the Society concerned do however apply as regulations to the extent these have been enforced by the Norwegian Water Resources and Electricity Board (Norges vassdrags- og elektrisitetsvesen, abbr. NVE).

G u i d a n c e:

The exemptions for installations for radio telephony and radio telegraphy are stated in the Act of 24 May 1929 relating to Supervision of Electrical installations.

These Regulations also apply to installations on board Norwegian registered mobile oil drilling platforms, see § 3101.

The Rules of the Classification Societies (listed in § 1003) may, under certain conditions, be enforced as Regulations for installations on board ships, without passenger certificate, with a class notation by the Society concerned.

These Regulations apply to installations on board all passenger ships, even if these have class notation in a Classification Society authorized for Special Supervision.

These Regulations also apply to heavy current installations which are not required to be notified as far as they are applicable.

These Regulations also apply to installations for propulsion. For such installations the NVE may establish supplementary provisions, see § 1041.

§ *1003. Supervision.*

The construction, maintenance and operation of electrical installations are subject to supervision.

Supervision is undertaken by the NVE, the Electricity Supervision (Elektrisitetstilsynet).

This supervision does not cover light-current installations, except those parts which cross or come into dangerous proximity to heavy-current installations and parts in hazardous areas.

The NVE may, in special cases, give authorization for Special Supervision.

G u i d a n c e:

a. For the time being the following Classification Societies are authorized as Special Supervision for electrical installations on board ships, of 50 registered tons gross and above, without passenger certificate, which have a class notation from these Societies:

   Det norske Veritas, Lloyd's Register of Shipping, Bureau Veritas, Germanischer Lloyd and American Bureau of Shipping.

b. Persuant to the Act of 9 June 1903 relating to Public Control of the Seaworthiness of ships, the Norwegian Maritime Directorate has in Regulations of 15 February 1967 with later additions and amendments relating to Control of Electrical Installations on Board Ships, given further administrative provisions for the supervision and survey of electrical installations. In circular no. 27/1973 of 3 April 1973 from the Norwegian Maritime Directorate to the Norwegian Ship Control, information is given concerning i.o. the cooperation between the Norwegian Ship Control and the Electricity Supervision.

§ *1006. Duties of the Electricity Supervision.*

The duties of the Electricity Supervision are to ensure that the provisions stated for electrical installations are observed and by survey of all installations which are subject to their supervision, to be satisfied that the requirements in the Regulations are met.

Survey of an installation and instructions given after survey implies no economic responsibility on the part of the Electricity Supervision, nor does it give the owner of the installation any right which may be invoked during a subsequent survey or during the construction of other installations.

G u i d a n c e:

The provision in the 2nd paragraph implies that if the Electricity Supervision, during the survey of an installation, has failed to notice defects of the installation, this does not exempt the owner of the installation from the duty to carry out instructions given at a later survey. The corresponding will also apply to the construction of other installations.

§ *1007. Electricity Supervision's access to the installations and the owner's duty to give information.*

The Electricity Supervision shall at any time have unrestricted access to the installations subject to its supervision.

If the Electricity Supervision requires, the owner of the installation or his representative must be present during the survey and is to point out any changes which have been made to the installation. The owner must also furnish the Electricity Supervision with all information which it may consider necessary in order to carry out adequate supervision and to check that its instructions are complied with, or to calculate the charges mentioned in § 1018.

§ *1009. Survey.*

The Electricity Supervision is required to carry out surveys of the installations in accordance with the decisions of the NVE.

G u i d a n c e:

For the time being the following applies:

a. Survey of electrical installations on board ships must take place at the request of the Norwegian Ship Control or the Norwegian Maritime Directorate.

b. Installations on board passenger ships employed in foreign trade are generally to be surveyed at least once a year, as stated in the International Convention for the Safety of Life at Sea - SOLAS 1960.

c. Installations on board passenger ships employed in domestic trade, and installations on board other ships of 50 registered tons gross and above without a class notation by one of the Classification Societies authorized for Special Supervision, are generally to be surveyed at least once every 4th year.

d. Installations on board ships below 50 registered tons gross without passenger certificate and without a class notation by one of the Classification Societies authorized for Special Supervision, are generally to be surveyed only once, i.e. before the installation is put into operation.

e. Installations on board dredgers, floating cranes etc. which are not requested to be surveyed by the Ship Control, are generally to be surveyed at least once every 4th year by the Electricity Supervision.

The Maritime Directorate has in Circular no. 27/1973 laid down directions for the cooperation between the Ship Control/the Maritime Directorate and the Electricity Supervision.

§ *1013.* *Defective construction.*

Should the Electricity Supervision find that an installation or any part of that installation is not constructed in a proper manner, or not in accordance with the regulations in force, the Electricity Supervision is empowered to forbid further work and to require the installation to be modified, renewed and repaired. The same applies if the installation is not constructed in accordance with the conditions which the NVE may have given for the installation or parts of the installation.

§ *1014.* *Defective maintenance, inconvenient electrical interference.*

When an installation contains any part which is poorly or defective maintained, or is in such a condition that, in the opinion of the Electricity Supervision, it constitutes a danger to life or property, the Electricity Supervision may require that such installation is at once to be disconnected, to be put into a condition which satisfies these Regulations or to be removed.

When an installation mentioned in the foregoing paragraph gives rise to inconvenient electrical interference, the Electricity Supervision may order that the installation must at once be put into such a condition that the interference is reduced as far as possible.

§ *1016. Complaint.*

Orders or prohibitions given by the Electricity Supervision must, in order to be valid, be made in writing or by telegram.

Complaints against the NVE or the Electricity Supervision, according to the provisions in these Regulations, may be made to the Ministry of Industry and Handicrafts. The complaint shall not have a delaying effect unless the authority which made the decision declares that the carrying through of the decision, totally or partly, is to be delayed until the complaint is settled. For the delay, special conditions may be given.

§ *1018. Charges.*

A charge for the survey carried out by the Electricity Supervision is to be paid to the Treasury in accordance with regulations issued by the Crown. These regulations include provisions as to when and by whom charges are to be paid. For light-current installations no charge is to be paid.

If the charge is not paid in due time, interest at 6% per annum will be added. This charge carries the same rights of distraint in respect of the installations as do taxes in respect of real estate and can be enforced in the same manner.

§ *1021. Notification. Operating permission.*

.1 Installations designed for voltage above 42 V, but not above 500 V, are before the construction commences, to be notified by the owner and the electrical contractor to the Electricity Supervision on a special form - Initial notification (Forhåndsmelding). The same applies to subsequent extensions and alterations.

For installations which include light-current installations in hazardous areas, notification is to be submitted regardless of the voltage they are intended to be connected to.

.2 For installations designed for voltage above 500 V the construction is not to be commenced without permission in writing from the NVE. Application for permission, in duplicate, is to be forwarded through the Electricity Supervision.

.3 Installations are, when completed, again to be notified by the owner and the electrical contractor on a special form - Notification when completed (Ferdigmelding). Installations are not to be put into operation before permission is obtained from the Electricity Supervision. Before such permission is granted, the Electricity Supervision may wish to test the installations or parts of the installations. For testing of installations, see §§ 3301 - 3311.

.4 Correspondingly, lift installations are to be notified by the lift contractor.

G u i d a n c e:

a. Forms for notification mentioned in .1 and .3 are obtainable from the Electricity Supervision.

b. Owner in .1 is understood to be the shipyard, who also must sign the initial notification.

Owner in .3 is understood to be the shipowner, who also must sign the Notification when completed.

c. The requirement that the installations are not to be put into operation before permission is obtained from the Electricity Supervision implies that such permission also is to be obtained before the ship is allowed to make a trial voyage. Such permission is not required for testing of the installation.

d. The extensions and alterations in .1 are among other things, understood to be the replacement or installation of generators, alterations of switchboards, alterations to steering gear installations, navigation light installations or other installations serving essential services, see § 1401, as well as extensions involving such an increase in the load that this could be of importance in determining the capacity of the power sources. Additions to the installation in the galley and the accommodation spaces etc. are also to be notified.

e. The Norwegian Maritime Directorate, in Regulation of 15 February 1967, with later additions and amendments, relating to control of Electrical Installations on Board Ships, has stated that notifications for installations on board ships surveyed by the Norwegian Ship Control are to be forwarded to the Electricity Supervision through the Ship Control.

For installations on board ships not surveyed by the Norwegian Ship Control nor by a Classification Society authorized for Special Supervision, and for installations on board dredgers, floating cranes, lodging ships, hotel ships etc., notifications are to be sent directly to the Electricity Supervision.

f. For installations on board ships built abroad, Norwegian laws do not come into force until the ship is delivered to the Norwegian shipowners. Therefore the requirements regarding initial notification requesting permission to put the installation into operation for trial voyage etc. do not come into force for such installations.

§ *1022.* *Exemption from duty to notify.*

The following installations are exempted from the requirements regarding notification to the Electricity Supervision:

- Light-current installations, see § 1101, however, not those installed in hazardous areas.

- Heavy-current installations, see § 1102, having an operating voltage not above 42 V, however, not those installed in hazardous areas.

- Electrical installations on board ships, without passenger certificate, having a class notation by a Classification Society authorized for Special Supervision.

§ *1023.* *Change of owner, change of name, cessation of operation.*

When the ownership of an installation - ship, dredgers, floating cranes etc. - is changed, the new and the former owner are immediately to notify the Electricity Supervision.

Likewise, when the name of an installation is changed, the owner is immediately to notify the Electricity Supervision.

When an installation is to cease to operate for any considerable length of time or is closed down, the owner is immediately to notify the Electricity Supervision. Operation is not to be recommenced until permission is acquired from the Electricity Supervision.

G u i d a n c e:

All Norwegian ships are listed in the Norwegian register of ships. A list of new ships, ships changing name, ships changing ownership etc. is published twice a month by the Maritime Directorate.

By "considerable length of time" in the third paragraph is generally understood 1 year or more.

§ *1031. Design, operation and maintenance.*

Every installation is to be constructed in a professional manner. The construction, modification and repair of heavy-current installations are to be carried out only by tradesmen whose qualifications satisfy the public requirements stated pursuant to law.

The owner and the user of electrical installations have the duty to ensure proper use, maintenance and examination of the installation, in such a way that it at any time is in a condition which satisfies these regulations.

The owner and the user have the duty, when errors or defects are pointed out, to provide at once for the installation to be corrected so that it satisfies the Regulations.

When installations and appliances are in use care shall be taken to ensure that no danger is created to life or property.

Parts of installations which are no longer in use are to be removed or maintained in accordance with the Regulations.

G u i d a n c e:

Requirements in respect of technical training for those who are to work on heavy-current installations with voltage above 42 V are laid down in regulations concerning the technical training for electrical tradesmen stated in the Royal Decree of 19 September 1975 with later amendments.

For work in installations with voltage 42 V and below the Maritime Directorate has stated provisions in Regulation of 15 February 1967 regarding Control of electrical installations on board ships.

Requirements regarding the technical training of ships' electricians are stated in the Act of 21 June 1968 and in Regulations concerning certification etc. for ships' electricians, stated by Royal Decree of 21 June 1968.

The requirement that the owner and the user have the duty to ensure proper use, maintenance and examination of the installation etc., implies that necessary spare parts for the installation as well as tools and special equipment necessary for maintenance and repairs are to be on board. The kind of spare parts which are considered necessary in this connection depend on the trade of the ship, the size of the ship, whether the ship has an electrician etc.

§ *1041.* *Dispensation, special provisions etc.*

The NVE may permit exemptions from the Regulations. Application for exemption is to be forwarded, in duplicate, through the Electricity Supervision.

The NVE may, due to special conditions, order measures beyond the Regulations to be taken.

The NVE may establish supplementary provisions concerning operation, use and maintenance of installations and equipment.

The NVE may order that other provisions or recommendations shall apply, totally or partly.

The NVE may establish arrangement for type approval, see § 1260.4.

G u i d a n c e:

The Recommendations which may apply are the recommendations published by the International Electrotechnical Commission (IEC) particularly IEC Publication no. 92, Electrical Installations in ships.

Other provisions which may apply are the rules of the Classification Societies which are authorized to carry out Special Supervision.

§ *1042.* *Penalties.*

Failure to obey these Regulations or an order and prohibition made in pursuance of them or failure to provide the information required by § 5 of the Act of 24 May 1929 relating to the Supervision of Electrical Installations, shall be punished by fines according to § 14 of the Act mentioned above, unless a more severe punishment is appropriate in accordance with the general civil Penal Code, cfr. § 352 of the Penal Code.

G u i d a n c e:

Extract from the general Penal Code, § 352:

"A fine or imprisonment of up to three months shall be imposed on whomsoever is concerned in the manufacture, use, keeping or handling of explosives, firearms, machines, boilers, electrical powerlines or other things should they be guilty of careless conduct likely to cause danger to the life or health of others or contributing thereto.

The same penalty shall be incurred by whomsoever shall cause danger of an outbreak of fire by the careless handling of fire or combustible materials or shall transgress Regulations governing precautions against outbreaks of fire or explosions or similar Regulations made under the law or in pursuance thereof."

§ *1051.* *Entry into force.*

These Regulations enter into force on 1 July 1976.

New installations are to be constructed, maintained and operated in accordance with these Regulations. This also applies to extensions, modifications and repair of older installations.

In addition, the NVE may order that certain provisions in these Regulations which are of particular importance for the safety of ships and those on board are to be applied to older installations.

G u i d a n c e:

New installations are installations on board ships whose construction is commenced on or after the day these Regulations enter into force. A ship purchased from abroad on or after the said date is considered as equivalent to a new ship.

CHAPTER B. DEFINITIONS

SECTION 11. LIGHT-CURRENT INSTALLATIONS, HEAVY-CURRENT INSTALLATIONS, DISTRIBUTION, VOLTAGE, EARTHING, INSULATION, CONDUCTOR, CABLE, EQUIPMENT, CLASS OF EQUIPMENT, SWITCHGEAR, FUSEGEAR, ENCLOSURES, DEGREES OF PROTECTION, PROPERTIES OF MATERIALS, APPROVED CONSTRUCTION.

§ *1101. Light-current installations.*

Light-current installations are installations in which the electricity is used exclusively for the transmission of sound, images, signs, writings, figures, signals and the like, or installations which operate on so low a current or voltage that the installations cannot entail danger to life or property. In doubtful cases decision is to be made by the Electricity Supervision.

G u i d a n c e:

The expression "operate on" is understood to apply to installations which produce, transform, transmit or use electricity of such voltage, or current that it cannot cause danger to persons or property.

This definition is important for the correct choice of equipment and apparatus in accordance with the provisions in these Regulations. When deciding which part of the Regulations applies to an installation it is therefore not solely the value of the voltage or current which is decisive but the degree of danger entailed by the installation.

For example, an installation whose normal voltage is high may be considered as a light-current installation if its power is so small that it does not constitute an effective danger to its surroundings.

§ *1102.* *Heavy-current installations.*

Heavy-current installations are all electrical installations which cannot, according to § 1101, be considered to be light-current installations.

G u i d a n c e:

Parts of electrical installations connected via transformers or convertors are considered as heavy-current installations in so far as the installation cannot be regarded as light-current installations in accordance with the definition in § 1101.

An installation must be treated as a heavy-current installation, even though the voltage is very low, if the power carried by that voltage is so great that the current, for example, in the event of a short-circuit in the installation, could result in a dangerous rise in temperature or powerful arcing. As examples of such installations may be mentioned servomotor installations, hand-lamps and hand-tools connected to the mains via transformers or convertors as well as lighting installations and starting arrangements connected to accumulator batteries. All installations of this kind are to comply with the regulations for heavy-current installations, as far as they are applicable, but need not to be notified if the voltage does not exceed 42 V, however, see § 1021 regarding installations in hazardous areas.

§ *1104.* *Primary distribution.*

Primary distribution is a system having galvanical connection to the generator.

§ *1105.* *Secondary distribution.*

Secondary distribution is a system which is not galvanically connected to the generator but separated from it by a transformer with separate windings, or a motor-generator, for example.

§ *1106.* *Main circuits.*

Main circuit is a circuit supplying a consumer or a group of consumers.

§ *1107.* *Rated values/nominal values.*

.1 Rated values are those values of voltage, current, frequency, output etc. with which electrical machines, appliances, apparatus, lighting equipment and installation materials are marked by the manufacturer.

.2 Nominal values are the actual values of voltage, current and frequency of an electrical installation.

§ *1108.* *System voltage.*

System voltage is the r.m.s. value of the voltage between 2 phase conductors.

§ *1109.* *Safety extra-low voltage (Reduced voltage).*

Safety extra-low voltage is a voltage of not more than 42 V, obtained from the supply mains by means of an isolating transformer or a convertor with separate windings where the secondary winding is not earthed.

§ *1114.* *Earthing.*

.1 Protective earthing is a good, permanent conductive connection from a conductive part of the construction to earth (i.e. the hull of the vessel).

.2 Operational earthing is a good, conductive connection between the operational circuit of an installation and earth (i.e. the hull of the vessel).

§ *1116.* *Insulation.*

.1 Functional insulation is the insulation necessary for the proper functioning of the installation and for basic protection against electric shock.

.2 Supplementary insulation (protective insulation) is an independent insulation provided in addition to the functional insulation, in order to ensure protection against electric shock in the event of a failure of the functional insulation.

G u i d a n c e:

An insulating enclosure may be made as, and form a part of, supplementary insulation.

.3 Double insulation is insulation comprising both functional insulation and supplementary insulation.

.4 Reinforced insulation is an improved functional insulation with such mechanical and electrical qualities that it provides the same degree of protection against electric shock as double insulation.

G u i d a n c e:

An insulating enclosure may be made as, and form part of, reinforced insulation.

.5 Extra insulation is either double insulation or reinforced insulation, or a combination of these.

§ *1118.* *Conductor, wire, insulated conductor, cable.*

.1 Conductor is a material having a low specific resistance, or an object made of such material and designed for transmission of electric current.

.2 Wire is a solid conductor formed as a wire or such part of a conductor.

.3 Insulated conductor is an insulated solid or stranded conductor, or a combination of several insulated conductors.

.4 Cable is one or more insulated conductors surrounded by a common protective sheath.

§ *1119.* *Neutral conductor.*

Neutral conductor is a conductor connected to the neutral point of the system.

§ *1121.* *Equipment.*

Equipment is electrical machines, switchboards, appliances, apparatus, lighting equipment and installation equipment with accessories, of any kind.

G u i d a n c e:

Cables and insulated conductors are generally not considered as equipment.

§ *1122. Class of equipment.*

.1 Class 0 equipment is equipment having functional insulation, but without provision for earthing.

.2 Class I equipment is equipment having at least functional insulation and provided with an earthing terminal.

.3 Class II equipment is equipment with double insulation and/or reinforced insulation and without provision for earthing.

.4 Class III equipment is equipment designed for operation at safety extra-low voltage, and which has no circuits, either internal or external, which operate at a voltage other than safety extra-low voltage.

§ *1123. Fixed equipment - portable equipment.*

.1 Fixed equipment is equipment fixed to the support.

.2 Portable equipment is either equipment which is moved while in operation or equipment which can easily be moved from one place to another while connected to the supply.

G u i d a n c e:

Vacuum cleaners, domestic irons, soldering irons, hand-drills etc. are portable equipment.

§ *1126. Switchgear.*

.1 Switchgear: a common term for equipment used for making and breaking circuits, including auxiliary components such as e.g. short-circuit and over-current relays, soils etc.

.2 Multipole: switchgear having, unless otherwise is specified, separate contacts for simultaneously making and breaking all insulated phases (poles) of the circuit in which it is used.

.3 Circuit breaker: a mechanical device for making and breaking a circuit under both normal conditions and under short-circuit and over-current; the breaking by short-circuit and over-current being automatic, unless otherwise specified.

.4 Fused circuit-breaker: a circuit-breaker with fuses for breaking short-circuit currents exceeding the circuit-breakers breaking capacity.

.5 Switch: a mechanical device for non-automatically making and breaking a circuit under full-load.

.6 Fuse-switch: a switch with moving parts carrying one or more fuses.

.7 Isolating switch: a mechanical device for non-automatically making and breaking a circuit under no-load only.

.8 Contactor: a mechanical device for making and breaking a circuit under full-load, being electromagnetically operated.

.9 Motor-starter: a device for making and breaking a circuit in order to start and stop an electric motor.

.10 Motor controller: equipment for controlling a motor's speed and/or current, e.g. during the starting or acceleration period.

.11 Control gear: a common term for equipment used for controlling consumer equipment, e.g. by switching on/off, starting and stopping a motor, controlling a motor's speed.

§ *1128.* *Fuse-gear.*

.1 Fuse-gear: a common term for all parts of fuse equipment.

.2 Fuse: the combination of a fuse link, a fuse link holder and a fuse-base.

.3 Fuse-link: a replaceable device for breaking a circuit by means of a conductor designed to melt when an excess current flows, contained in a cartridge of insulating material (which may be filled with a powdered substance for extinction of the arc), and having contacts for connection to the fuse-base or fuse link holder.

.4 Fuse-base: a fixed device for carrying, and for making contact with a fuse link, and with terminals for connection to the circuit conductors (may be in combination with a removable cover of insulating material).

.5 Gauge-piece: the part of a D-type fuse designed to prevent the use of a fuse-link having a higher rated current than that corresponding to the gauge-piece.

§ *1131.* *Enclosures and degrees of protection. General.*

.1 The definitions of enclosures in §§ 1133 - 1149 are in accordance with IEC Publication No. 144 "Degrees of protection of enclosures for low-voltage switchgear and controlgear." For rotating machines, however, IEC Publication No. 34 - 5 applies.

When testing of enclosures is required, the test is to be carried out in accordance with the requirements in one of the IEC Publications mentioned above, depending on the equipment to be tested.

G u i d a n c e:

An enclosure in accordance with IEC Publication No. 144 is designated by a code, comprising the letters IP and two characteristic numerals, for instance IP 22. The first characteristic numeral designates the degree of protection against contact with live or moving parts inside the enclosure and against ingress of solid foreign bodies. The second characteristic numeral designates the degree of protection against ingress of liquid.

Within the IEC, Technical Committee, TC 70, is being prepared a common publication concerning enclosures. A draft is available, IEC Document 70 (Secretariat) 7 "Draft classification of degrees of protection provided by enclosures."

.2 The definitions of degrees of protection in §§ 1153 - 1160 are based on IEC Publication No. 79, Part 0 to 10. Testing is to be carried out in accordance with the requirements in the publications mentioned or equivalent approved national requirements.

§ *1133.* *Enclosure IP 00.*

Enclosure IP 00 has:
- No protection against contact with live or moving parts inside the enclosure.

- No protection against ingress of solid foreign bodies.

- No protection against ingress of liquid.

G u i d a n c e:

The nearest Norwegian, Swedish and German (DIN-standard) designations are: "Åpen utførelse", "oskyddad utförande" S 00 and P 00 respectively.

§ *1134.* *Enclosure IP 10.*

Enclosure IP 10 has:

-Protection against accidental or inadvertent contact

with live or moving parts inside the enclosure by a large surface of the human body, for example a hand, but not protection against deliberate access to such parts.

-Protection against ingress of large solid foreign bodies.

-No protection against ingress of liquid.

G u i d a n c e:

The nearest Swedish and German (DIN-standard) designations are: S 10, P 10 respectively.

§ *1135.* *Enclosure IP 20.*

Enclosure IP 20 has:

-Protection against contaction with live or moving parts inside the enclosure by fingers.

-Protection against ingress of medium size solid foreign bodies.

-No protection against ingress of liquid.

G u i d a n c e:

The nearest Norwegian, Swedish and German (DIN-standard) designations are: "Dekket utførelse", "beröringsskyddad utförande" S 20, P 20 respectively.

§ *1137.* *Enclosure IP 22.*

Enclosure IP 22 has:

-Protection against contact with live or moving parts inside the enclosure by fingers.

-Protection against ingress of medium size solid foreign bodies.

-Protection against drops of liquid: drops of falling liquid shall have no harmful effect when the enclosure is tilted at any angle up to 15° from the vertical.

G u i d a n c e:

The nearest Norwegian, Swedish and German (DIN-standard) designations are: "dryppsikker utførelse", "droppskyddad utförande" S 21, P 21. NEMKO's symbol for this degree of protection is:

§ 1141. *Enclosure IP 44.*

Enclosure IP 44 has:

-Protection against contact with live or moving parts inside the enclosure by tools, wires or such objects of thickness greater than 1 mm.

-Protection against ingress of small solid foreign bodies.

-Protection against splashing: liquid splashed from any direction shall have no harmful effect.

Such design is, if necessary, to have outlets for condensed water.

G u i d a n c e:

The nearest Norwegian, Swedish and German (DIN-standard) designations are: "Sprutsikker utførelse" og "lukket utførelse", "striltätt utförande" S 33, P 33 respectively. NEMKO's symbol for the "Sprutsikker utførelse" degree of protection is: ⚠

§ 1142. *Enclosure IP 54.*

Enclosure IP 54 has:

-Complete protection against contact with live or moving parts inside the enclosure.

-Protection against harmful deposits of dust. The ingress of dust is not totally prevented, but dust cannot enter in an amount sufficient to interfere with satisfactory operation of the equipment enclosed.

-Protection against splashing: liquid splashed from any direction shall have no harmful effect.

Such design is, if necessary, to have outlets for condensed water.

G u i d a n c e:

The nearest Swedish and German (DIN-standard) designations are: S 43, P 43 respectively.

§ 1145. *Enclosure IP 56.*

Enclosure IP 56 has:

-Complete protection against contact with live or moving parts inside the enclosure.

-Protection against harmful deposits of dust. The ingress of dust is not totally prevented, but dust cannot enter in an amount sufficient to interfere with satisfactory

operation of the equipment enclosed.

-Protection against conditions on ships decks: water from heavy seas shall not enter the enclosures under prescribed conditions.

Such design is, if necessary, to have outlets for condensed water.

G u i d a n c e:

The nearest Norwegian designation is: "Dekk-vanntett".

§ *1147.* *Enclosure IP 67.*

Enclosure IP 67 has:

-Complete protection against contact with live or moving parts inside the enclosure.

-Protection against ingress of dust.

-Protection against immersion in water: it must not be possible for water to enter the enclosure under stated conditions of pressure and time.

Such design is, if necessary, to have outlets for condensed water.

G u i d a n c e:

The nearest Norwegian, Swedish and German (DIN-standard) designations are: "Tett utførelse", S 55, P 55 respectively. NEMKO's symbol for "tett utførelse" is: ▪▪

§ *1149.* *Enclosure IP 68.*

Enclosure IP 68 has:

-Complete protection against contact with live or moving parts inside the enclosure.

-Protection against ingress of dust.

-Protection against indefinite immersion in water under specified pressure: it must not be possible for water to enter the enclosure.

G u i d a n c e:

The nearest Norwegian, Swedish and German (DIN-standard) designations are: "Trykkvanntett utførelse", "trykkvattentät" S 56, P 55 h respectively.

§ *1153.* *Increased safety.*

Increased safety is a method of protection by which

additional measures are applied, so as to give increased security against the possibility of excessive temperatures and of the occurence of arcs and sparks in normal service.

G u i d a n c e:

The definition of increased safety corresponds to the definition of protection "e" (increased safety) in the IEC-Publication No. 79-7 (1969) in which construction and testing requirements are stated. In this IEC Publication the designation for such protection is "Ex e". Increased safety corresponds to the German designation "erhörte sicherheit" (Ex e). Swedish designation: "höyd säkerhet" (Xh).

§ *1155.* *Pressurized equipment.*

Pressurized enclosure is an enclosure which is pressurized with air or an inert gas from a safe area in such a way that inflammable gases and vapours are prevented from penetrating into the enclosure.

G u i d a n c e:

The IEC-Publication 79-2 deals with pressurized enclosures. This publication is, however, subject to revision.

In this IEC-Publication the term for pressurized equipment is "Ex p".

Pressurized enclosure corresponds to the German designation "fremdbelüftung" (Ex f). Swedish designation: "Utförande med ventilasjon" (Xv).

§ *1157.* *Flameproof enclosure.*

Flameproof enclosure is an enclosure for electrical apparatus that will withstand an internal explosion of the inflammable gas or vapour which may enter it, without suffering damage and without communicating the internal flammation to the external inflammable gas or vapour for which it is designed, through any joints or structural openings in the enclosure.

G u i d a n c e:

This definition of flameproof enclosure corresponds to the definition of flameproof enclosure in the International Electrotechnical Commission (IEC) Publication 79-1 (1971) in which construction and testing requirements are stated. In this IEC-Publication the term for flameproof enclosure is "Ex d".

Flameproof enclosure corresponds to the English designation "flameproof", the American "explosionproof", the German "Druckfest" (Ex d) and the Swedish "Eksplosionstätt utförande" (Xt).

§ *1160.* *Intrinsic safety.*

.1 Intrinsically safe circuit: a circuit in which any spark or thermal effect produced normally (that is, by breaking or closing the circuit) or accidentally (for example, by short circuit or earth fault) is incapable, under prescribed test conditions, of causing ignition of a prescribed gas or vapour.

.2 Intrinsically safe apparatus: apparatus in which all the circuits are intrinsically safe.

.3 Appurtenant equipment: equipment which may be connected to intrinsically safe apparatus without all circuits being intrinsically safe, but containing circuits which may have influence on the safety of the connected intrinsically safe apparatus.

G u i d a n c e:

The definition of intrinsically safe circuit corresponds to the definition of an intrinsically safe circuit in IEC-Publication 79-3.

For the definition of intrinsically safe apparatus reference is made to IEC-document 31 G (Central office) dated 12 March 1973.

In the IEC-Publication the term for intrinsic safety is "Ex i".

Intrinsically safe apparatus corresponds to the English designation "intrinsically safe" and the German "Eigensicher".

§ *1171.* *Interlocking.*

Interlocking is an electrical and/or mechanical arrangement such that connection or disconnection can only be made dependent on a preceding operation.

G u i d a n c e:

An interlocked socket-outlet is a socket-outlet with a built-in switch which cannot make contact if the plug is disengaged, and so that the plug cannot be pulled out while the built-in switch is closed.

§ *1176.* *Strain-relief.*

Strain-relief is a device that prevents strain or torsional effects being transmitted to the contact connection of a flexible cable or cord. Such a device is to be of insulating material or be coated with insulating material and so designed that the outer sheath of the flexible cable or cord will not be damaged.

§ *1181.* *Insulating materials.*

Insulating material is a material that is not electrically conductive at the humidity, temperature and other operational stresses for which the material is intended.

§ *1182.* *Moisture-resistant material.*

Moisture-resistant material is an insulating material that is not hygroscopic or porous and that retains its shape, insulation resistance and safety against breakdown or flash-over, at the humidity, temperature and other operational stresses for which the material is intended.

G u i d a n c e:

In IEC Publication No. 92-1 test requirements are given for "moisture-resistant materials".

§ *1183.* *Material resistant to tracking.*

Material resistant to tracking is an insulation material on whose surface tracking does not occur when used under the conditions for which it is designed.

G u i d a n c e:

A material is considered as resistant to tracking when it sustains a tracking test in accordance with IEC Publication No. 112 (1959) "Recommended method for determining the comparative tracking index of solid insulating materials under moist conditions," or equivalent tests. When testing in accordance with the IEC Publication a tracking index of at least 175 V is required.

For clearances and creepage distances, see § 2310.

§ *1184.* *Heat-resistant material.*

Heat-resistant material is a material which, at the humidity, temperature and other operational stresses for which it is designed, retains its shape and mechanical properties. For electrical insulating materials this includes the retention of insulation resistance to prevent flashover and breakdown.

§ *1185.* *Flame-retardant materials.*

Flame-retardant material is a material which sustains a specific flame-retardant test in accordance with IEC-Recommendations.

G u i d a n c e:

Regulations for the flame-retardant test (flame-retardant material tests) are given in IEC Publication 92 - 1 (1964) clause 2.38 and IEC Publication 92 - 3 (1965) clause 10.50. IEC, TC 18 A has agreed on amendments to this publication. Document 18 A (Central office) 26 will be issued as addition.

§ *1187.* *Corrosion-resistant material.*

Corrosion-resistant material is a material which retains its structure and shape and does not change its properties during use when exposed to such climatic conditions, aggresive atmosphere, corrosive gases or liquids and similar, for which it is intended.

§ *1195.* *Approved design.*

Approved design is a design for which the use is permitted by the Electricity Supervision.

CHAPTER C. HEAVY-CURRENT INSTALLATIONS.

SECTION 12. GENERAL REQUIREMENTS.

§ 1201. *Construction, location and use with regard to safety.*

.1 The rated type of current, rated frequency and rated voltage of the equipment must correspond to the type of current, nominal frequency and nominal voltage of the installation concerned.

.2 Equipment must be so constructed and installed and be used in such a way that all parts of the installation can withstand with sufficient safety the electrical, thermal, chemical and mechanical stresses which must be expected.

Guidance:

If necessary cooling, ventilation, outlet for condensed water, screening, cleaning, instruction for operation etc. beyond what is required for the equipment under normal operating conditions, must be provided.

Equipment located in cool and moist places and not continuously in use ought to have heating elements which are automatically switched on when the equipment is disconnected.

.3 Equipment is to be used for the purpose and under the conditions for which it is constructed. It is to be located so that it can be inspected easily. Equipment requiring inspection or control when in use is to be located in accessible and suitable places which are well illuminated and where inspection and control during operation can be carried out without danger. It is to be placed in the position for which it is designed, and is to be so mounted and used that unnecessary stresses do not occur, neither on the equipment itself nor on the support. Marking and location is to be so arranged that incorrect use which can result in damage is avoided as far as possible. Switch and control gear is to be fitted in such a manner that circuits cannot be connected or disconnected unintentionally.

Components intended for fastening are to be securely attached to their supports, see § 1214.

G u i d a n c e:

An example of unnecessary stresses is the corrosion caused by equipment with a brass enclosure mounted on aluminium supports. In such cases a suitable intermediate layer is to be used.

.4 Equipment is to be suitably designed, and is to be so dimensioned, constructed and located that when full-load current is applied continuously under normal conditions at the location concerned, this shall not result in detrimental heating of the installation components themselves, their connection leads or the surroundings.

.5 Equipment is to be constructed, installed and used in such a way that it can cause neither detrimental heating or ignition of the surroundings, nor of oil, oil vapour or other liquid substances or gases with which it may come into contact either in normal use or by accident.

Whenever possible flame-retardant or non-combustible materials are to be used.

.6 It must be possible to effect connection and inspection after the component has been fixed to the support. Equipment is to have suitable connection space and connection terminals. The connection space and cover must be properly designed and sufficiently spacious to permit conductors and cables to be connected and installed without damage.

Connection terminals are to be marked, distinct and durable, to avoid confusion, if the method of connection is not self-evident.

Connection terminals are to be so constructed that the supply leads can be connected without loosening of internal conductors. Connection terminals are to be so constructed that the cable can be connected without special preparation of the conductors. Cable lugs or similar approved methods of connection may however be used.

Cable entrances are generally to be from below or from the side. A drip loop is to be arranged on cables entering from the side. This however does not apply when enclosure IP 20 is allowed.

G u i d a n c e:

By special preparation is meant soldering of the strands, forming of eyelets etc., but not a twisting of the strands to get a joint end before the conductor is put into the terminal.

.7 Equipment is to be so constructed and installed that components requiring inspection and maintenance are accessible, easily and without danger.

G u i d a n c e:

This requirement implies that cleaning is to be possible, easily and without danger.

.8 Portable equipment, see § 1123.2, is to be of class II (with double or reinforced insulation) to the extent that such equipment is available and suitable for the purpose.

G u i d a n c e:

The requirement applies among others to hand-tools, portable lighting equipment for cargo holds, anchor lanterns etc.

§ *1210* *Inclination and trim.*

Equipment is to operate satisfactorily under all conditions when the ship has up to 15° permanent inclination, by rolling up to 22½° and/or when the trim of the ship is up to 5° off normal, for ships of length exceeding 150 m, and 10° for smaller ships.

Emergency power installation, and equipment supplied from this, is to operate satisfactorily with a permanent inclination of 22½° and/or trim up to 10° off normal, regardless of the size of the ship.

§ *1214.* *Vibrations, shock.*

Equipment is to function satisfactorily under the vibrations and shock which can occur on board.

Screws and other fastenings for live components and earth connections are to be secured in such a manner that they cannot shake loose. Screws and other fastenings for components which carry no current are also to be secured in such a manner that they cannot shake loose, to the extent that it is necessary.

G u i d a n c e:

In IEC Publication no. 95-504 (1974) "Electrical installations in ships. Part 504: Special features control and instrumentation" requirements regarding vibration tests are laid down. The requirements are (see section 3, clause 26 of the publication):

"Vibration

All control equipment should operate satisfactorily under the following vibration conditions:

2,0 Hz to 13,2 Hz, displacement amplitude ± 1,0 mm,
13,2 Hz to 80,0 Hz, acceleration amplitude ± 0,7 g.

Maximum acceleration 0,7 g.

The natural frequencies of equipment, suspension and supports, including individual parts, should not lie within the 0 Hz to 80 Hz range.

If the natural frequencies cannot be kept outside the specified range by constructional design methods, the vibration should be damped so that undue amplification can be avoided.

At special localities, e.g. direct on engines, diesel exhaust pipes, etc. where more severe vibration may be expected, special care should be taken to ensure the ability of the control devices to withstand the conditions satisfactorily at each individual place.

The following values should be considered:

I. On all diesel engines, diesel generator sets, compressors and in the steering gear compartment:

2,0 Hz to 25,0 Hz, displacement amplitude ± 1.6 mm
25,0 Hz to 100,0 Hz, acceleration amplitude ± 4,0 g.

Maximum acceleration 4,0 g.

II. Vibration and acceleration levels on diesel engine exhaust pipes are very severe and vary considerably depending on equipment size and piping arrangement. Measurements on installations indicate that acceleration up to 150 g and frequencies up to 5000 Hz can be expected."

For the tests it is recommended that the general testing methods stated in IEC Publication No. 68-2-6 (1970) "Basic enviromental testing procedures. Part 2: Tests - Test Fc: Vibrations (Sinusoidal)" are to be followed.

IEC Publication no. 92-504 deals with control and instrumentation equipment especially.

Tests carried out in accordance with the provisions in this publication will however normally be accepted for heavy-current equipment. Equipment passing such tests will normally be considered satisfactory.

Tests carried out in accordance with other provisions will only be accepted after a decision has been made in each individual case.

IEC has for the time being not laid down recommendations regarding shock tests. In cases where tests are considered necessary, test regulations will be established in each individual case.

§ 1217. *Ambient temperatures - cooling.*

Equipment is to be so constructed that it functions satisfactorily at the ambient temperatures which may occur.

Generally the following ambient temperatures can be assumed:

Location	Average ambient temperature (°C)	
	Max.	Min.
.1 Engine room, boiler room, galley and similar spaces and in accommodation spaces...	+ 45	0
.2 Dry cargo holds, steering gear compartment, deckhouses, forcastle spaces and similar spaces which are not provided with space heating, and on open deck.....	+ 45	-20
.3a Refrigerated chambers and holds, generally.....	+ 45	-20 or below, if this lower temperature is specified for the installation.
.3b Refrigerated chambers and holds, for equipment which is only used for refrigeration service.....	+ 35	

.4 In certain cases, when it is obvious that the maximum temperature will be higher or the minimum temperature will be lower than the values specified in .1 - .3b, these higher or lower temperatures are to be taken into account.

G u i d a n c e:

Such high temperatures must be expected on top of the engines and near to the boilers. A temperature of 55°C will not be unusual at these locations.

.5 For ships in non-tropical waters, the maximum ambient temperature limits specified in .1 - .3b may be reduced by 10°C.

.6 Water-cooled equipment is generally to be designed for a cooling-water temperature of 25°C for ships in non-tropical waters, and 30°C for ships in tropical waters.

.7 Spaces where electrical equipment is installed are to be sufficiently ventilated, to keep the ambient temperatures within the limits specified in .1 - .3b, see however .4.

.8 The cooling air for ventilated equipment is to be as clean and dry as practicable.

Cooling air is not to be drawn from below the floorplates.

G u i d a n c e:

The temperatures specified in .1 - .3b are in some cases considerably higher than those for which normal equipment for use on shore is designed, and this must be considered. On board ships the size of the room in which the equipment is fitted is often small in relation to the heat developed by that equipment and it may be necessary to provide special ventilation for the equipment. Particular attention should also be paid to equipment in boiler rooms, in funnels and specially for motors of forced draft fans for boilers.

For equipment which has a critical maximum ambient temperature at which it may suddenly fail, this critical temperature should not be less than 15°C above the limits specified in .1 - .6.

§ *1225. Interference to radio, compasses etc.*

Equipment is to be so constructed that it does not cause unacceptable interference to the ship's radio installation, compasses or other navigational instruments.

The following is of special importance:

All permanently fitted cables within 9 m of radio aerial system, radio cabin, etc. are to have either metal sheaths, copper screens, steel wire braid or be installed in steel or metal pipes or otherwise sufficiently screened, unless the cables are screened from the mentioned places by a bulkhead or deck of steel or metal. 1-core cables are not to be used less than 5.m from compasses.

Machines, appliances, etc. in the vicinity of compasses are to be sufficiently screened, so that the compasses are not subject to interference by magnetic fields.

G u i d a n c e:

Interference is commonly caused by:

1. Fluorescent lighting fittings without noise suppressors.
2. Imperfect earthing of equipment.
3. Missing or faulty earthing of screen or armour of cables.
4. Bad contact connections.
5. Missing noise suppression of machines.
6. Noise generated from thyristor controllers, convertors etc.
7. Missing or faulty earthing of aluminium superstructures on steel ships.
8. Static electricity due to plastic materials etc. in the accommodation spaces.
9. Faulty choice of cable runs.
10. Mutual interference between radio receiver, transmitter, radar and TV.
11. Atmospheric noise.

Items 2. 3. 4. 5. 7 and 9 are interferences dealt with in these Regulations.

Interference due to thyristor controllers is a frequent problem, as such controllers are getting more common for controlling electrical machines etc. It is important that such equipment is fitted with the necessary noise supressors.

Due to the relation between the number of radio receivers and the number of noise generating equipment it is often good economy to screen the receivers as far as possible, so that the interference to the receivers from the heavy-current installation is reduced.

Regarding magnetic compasses, attention is drawn to regulations regarding installation of magnetic compasses, issued by the Maritime Directorate.

§ *1230. Protection against electrical shock. Qualified personel.*

Equipment with rated voltage above 30 V AC or 50 V DC is to be so constructed and arranged that live parts cannot be touched when in normal operating conditions.

Regarding welding equipment, see however §§ 2701-2709.

The Electricity Supervision may permit exemptions for main switchboards, emergency switchboards, other larger switchboards and motor starters operated by qualified personel only.

G u i d a n c e:

Qualified personel is in this connection generally considered to be the ship's electrician, the ship's engineers and also named, specially instructed personel, according to decisions by the Electricity Supervision in each separate case.

§ *1231. Working on live parts.*

Working on live parts with system voltage above 250 V is not allowed. However, necessary adjustment, fault finding and similar on such installations is allowed.

§ *1235. Earthing.*

.1 All metal parts of conductive materials with the exception of live parts, are to be earthed. For earthing of live parts, see however § 1301. Likewise the conductive sheaths, armour, or screens of cables are to be earthed. Earthing is to be carried out at both ends of the cable except for final branch cables, where earthing on the supply end is sufficient.

For earthing of cables for light-current installations, see § 4015.

Equipment of class II (double or reinforced insulation) is not to be earthed.

Earthing may be omitted for the following parts, provided this does not cause inconvenient electromagnetic interference:

a. Lamp shields, reflectors and grills which are attached to lamp-holders or lighting fittings of non-conductive material.

b. Parts which are fixed to non-conductive materials, and are separated from current carrying parts in such a way that they cannot become live or come into contact with earthed parts.

c. Bearing housings which are insulated in order to prevent circulating currents.

d. Clips for fluorescent lighting tubes.

e. Equipment supplied from DC systems with system voltage not above 50 V.

f. Equipment supplied from AC systems with system voltage not above 30 V.

This however does not apply to installations in bathrooms and showers.

g. Cable clips and short lengths of pipe for protection of cables.

§ *1238. Performance of earthing.*

.1 Earthing is to be carried out by means of copper conductors.

Equipment being welded or riveted to the steel hull so that satisfactory conductive connection is obtained does not, however, require separate earthing.

Metal parts being welded, riveted or screwed together so that satisfactory conductive connection is obtained between the metal parts, may have a common earthing terminal.

G u i d a n c e:

The requirement in the third paragraph implies that equipment such as contactors, transformers for control circuits etc. screwed onto a base of cadmium plated, galvanized or stainless steel may be considered earthed by earthing connections to a common earthing terminal when the contact connection between the equipment and the base is satisfactory. There must be at least 2 screws and the contact area is to be clean and free from paint etc.

.2 The cross section of the earthing conductors is to be dimensioned according to the earth fault currents which must be anticipated. In distribution systems with earthed neutral or earthed phase (pole), the likely short-circuit current caused by short-circuits between phase-conductor (pole) and neutral conductor or between phase-conductor (pole) and earthing conductor must be taken into consideration.

.3 In distribution systems with insulated neutral, the cross section of the earthing conductor is to be at least 1/3 of the cross section of the phase-conductors. In distribution systems with earthed neutral the earthing conductor must have at least the same cross section as the phase-conductors when these have a cross section of 16 mm^2 or less. With phase conductors above 16 mm^2 the earthing conductor must have a cross section of at least 50% of the cross section of the phase conductors but not less than 16 mm^2. The cross-section of the earthing conductor is, in no case, to be less than 1,5 mm^2, and need not normally be greater than 50 mm^2 (see however .2).

.4 Separately installed earthing conductors are to be stranded. Copper busbars with cross section of at least 30 mm^2 may however be used.

Such earthing conductors are to have a cross section of at least 1/3 of that of the phase conductor. The cross section is however not to be less than 16 mm^2 where the conductor is exposed and is not provided with special protection against mechanical stresses; and not less than 4 mm^2 where it is protected. In switchboards, panels, etc. separately installed earthing conductors may have a cross section not less than 1,5 mm^2.

Separately installed earthing conductors with cross section of 6 mm^2 and less are to be insulated.

In switchboards, cupboards, boxes, etc. earthing conductors are to be insulated or covered by insulating sleeves. Earthing busbars and similar may, in general, be uninsulated. Short earthing conductors which cannot come into contact with live parts may also be uninsulated.

.5 Earthing conductors installed in the same conduit as the supply conductors are to be stranded and insulated in the same manner as the phase conductors.

.6 An earthing conductor in a cable may either be a copper screen or a stranded conductor insulated and laid under the same sheath as the other conductors. Such earthing conductors are to be of cross section as stated in .3.

In a cable with conductive protective sheath the earthing conductor may be uninsulated if laid under, and in contact with, the conductive protective sheath of the cable. The earthing conductor is to be stranded and have a cross-section of at least:

1,0	mm^2	for	cables	with	cross	section	1,5	mm^2
1,0	"	"	"	"	"	"	2,5	"
1,5	"	"	"	"	"	"	4	"
1.5	"	"	"	"	"	"	6	"
2,5	"	"	"	"	"	"	10	"

For distribution systems with earthed neutral, see however .3.

.7 Earthing conductors in a flexible cable must have the same cross section as the phase conductors.

The earthing conductor is to be insulated in the same manner and be laid under the same sheath as the phase conductors and have approved green/yellow colour coding. Conductors marked with the colours green/yellow are to be used for no other purpose than earthing.

§ *1241. Installation and connection of earthing conductors.*

.1 Earthing conductors are to be as short as possible. They are to be installed in such a manner that the conductors and their connections can be readily inspected. They are to be protected against corrosion and mechanical damage.

G u i d a n c e:

The requirement that earthing conductors are to be installed in such a manner that they can readily be inspected generally implies that the conductors must be colour coded. The code colours are green/yellow. Earth conductors with insulation of other colours are to be colour coded by covering the conductors with insulation sleeves, colour coded with green/yellow. This also applies to earthing conductors in dismantled cables, cfr. the requirement in § 1238.4 regarding insulation.

The requirement that the earthing connections may be readily inspected generally implies that a separate copper busbar is to be used for connection of the earthing conductors.

.2 Switches and fuses are not allowed in earthing connections.

.3 Earthing conductors are to be connected and arranged in such a way that the earthed components themselves do not form a series connection as earthing conductor. Earthing conductors are to be connected and arranged in such a manner that the earthing connection is not broken by removing a component.

Connection to the earthed component is to be effected by means of a specially robust earthing terminal. This terminal is not to be used for other purposes.

The earthing terminal is to be clearly and permanently marked with the earth symbol ⏚ or in an equivalent manner if it could be mistaken for other terminals or screws for mechanical construction.

Earthing terminals are, except when separately installed earthing conductor is used, to be located in the same connection space as the terminals for the supply cable.

Connections are to be effected with special care.

Connections to the steel hull are to be made by screws of corrosion resistant materials of at least 6 mm in diameter.

Earthing conductors for protective earthing and earthing conductors for operational earthing, are not to have common earthing terminals.

Heavy-current installations and light-current installations are each to have separate earthing conductors and separate connections to the hull.

G u i d a n c e:

The requirement in the 6th paragraph regarding corrosion resistant materials generally implies the use of stainless or acid resistant steel.

.4 Pipings are not to be used for earthing.

.5 If components such as instruments, signal lamps, switches, etc. are mounted on hinged doors of switchboards or other enclosures, the doors are to be connected to the switchboard or enclosure by a flexible copper conductor.

.6 Aluminium superstructures, insulated from the steel hull in order to prevent corrosion, are to have earthing connections to the steel hull.

These connections are to be of flexible copper wires or bands with a cross section of at least 16 mm^2 or Cupal metal with equivalent conductivity. The total conductivity for these connections is not to be less than equivalent to 50 mm^2 copper. The distance between these conductors is to be maximum 10 m. At least one of these conductors must be accessible.

Provisions are to be made to prevent galvanic action at the connections of copper and aluminium, for instance by using "Cupal" metal or special cable terminals.

G u i d a n c e:

The requirement that such connections are to be accessible implies that the connections are to be immediately accessible or behind easily removable covers.

.7 On ships with hull of insulating material, the earthing system of the installation is to be connected to a copper plate with an area of at least 0,2 m^2. The copper plate is to be fixed to the hull on a place where it will be submerged under all conditions at sea.

§ *1250. Insulation resistance.*

.1 The insulation resistance for generator circuits, switchboard installations, outgoing circuits from switchboards, etc. as well as between the individual conductors and between each conductor and earth, is to be at least 1 MΩ

During measurement, machines, transformers, thermal appliances and other apparatus are to be disconnected.

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

$$\frac{3 \cdot \text{rated voltage in V}}{\text{output in kVA} + 1000} \quad \text{MΩ}$$

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 Ω
Appliances with earth connection:	up to 5 kW	50 000 "
	5 - 10 "	40 000 "
	10 - 20 "	30 000 "
	20 - 50 "	20 000 "
	above 50 "	10 000 "

.3 The insulation resistance of accumulator batteries is to be such that the current measured between each pole and earth does not exceed 0,5 o/oo of the maximum discharge-current for which the battery is designed. During measurement, the battery is to be disconnected from the remainder of the installation, but not from the selector switch.

.4 Insulation resistance measurement is to be carried out by using direct current at a voltage of at least twice the rated 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 500 V.

G u i d a n c e

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.

.5 The insulation resistance is to be measured on new installations and also after extentions and repairs have been effected.

.6 The Electricity Supervision may require that portable insulation-measuring equipment is to be carried on board any ship.

§ *1255.* *Marking*

.1 Equipment is to be marked, durably, clearly and distinctly, with the maker's name or trade mark and type of designation, and where necessary for the operation, also with the voltage, type of current, amperage, output, frequency, r.p.m., type of connection, type of enclosure, etc.

In the case of rewinding or modification, a new marking plate is to be applied if the output, voltage, amperage, etc. is changed. The original plate is not, however, to be removed. On the new plate the year in which the modification was done is to be indicated.

.2 When switchboards are divided into sections, each section is to have marking indicating which parts of the installation it belongs to. When the sections contain equipment with different voltage, the voltages are to be indicated.

Panels, motor starters, etc. are to have similar marking to the extent this is necessary for the operation.

.3 At fuses, switchgear, etc. there are to be signs unambiguously indicating the designation or the equipment being served.

For switchgear for lighting installations such marking may be omitted when there is no risk of confusion.

For fuses, fused circuit-breakers and circuit-breakers in a main circuit, the rated current, the set value for the tripping current and the cross section of the main circuit conductors are to be indicated.

For motor starters with over-current relays the "set value" for the over-current release is to be indicated.

For switchgear each position is to be marked to the to the extent that it is necessary for the operation.

.4 Terminal blocks, conductors of outgoing cables, fuses, relays in switchboards, control panels, motor starter panels, etc. are to have unambiguous marking to the extent that it is necessary for the operation. The marking is to correspond to the marking on circuit diagrams.

.5 All marking is to be permanent and unambiguous and so located that it is easily readable.

Marking plates and signs are to be of at least flame-retardent material. However, marking according to .4 and for similar purposes in switchboards, control panels, motor starter panels, etc. and in smaller distribution panels, a simpler type of marking may be used.

Marking plates and signs are to be fastened by means of screws or by riveting.

Marking on board ships used in Norwegian waters only are to be in Norwegian. Marking on board ships used in international trade are to be in Norwegian and/or English.

G u i d a n c e:

The requirement that all marking is to be permanent and unambiguous implies that marking plates cannot be placed on removable covers which can be mixed up, for instance, covers on fuse-bases. The requirement that the marking is to be easily readable and permanent implies that marking must be engraved or similar. Engraved marking plates and signs should have dark writing on a light background.

§ *1259. Requirements regarding enclosures and degree of protection.*

.1 Equipment is to be enclosed and have a degree of protection corresponding to the use and the conditions in the location where it is used.

.2 The enclosure and degree of protection is to be at least in accordance with the following table:

	N: Not allowed to be installed in this location	A Switchboards	B Control gear and motor starters	C Rotating machines	D Transformers and rectifiers	E Lighting fittings	F Heating appliances	G Socket-outlets	H Switches, connection boxes etc.
	Engine and boiler rooms,								
a	above the floor	IP 22[15]	IP 22	IP 22	IP 22	IP 22	IP 22	IP 44	IP 44
b	control rooms	IP 22[15]	IP 22	IP 22	IP 22	IP 22	IP 22	IP 22	IP 22
c	below the floor	N	N	IP 44	N	IP 44	IP 44	N	IP 44
d	Compartments for fuel oil and lub. oil separators	IP 44	IP 44	IP 44	IP 44	IP 44	IP 44	N	IP 44
e	Fuel oil tanks[1]	N	N	N	N	N	N	N	N
f	Ballast and other water tanks, bilge wells[1]	N	N	IP 68	N	N	IP 68	N	N
g	Ventilation ducts	N	N	IP[13] 44[14]	N	N	N	N	N
h	Deckhouses, forecastle spaces, steering gear compartments and similar spaces	IP 22[2]	IP 22[2]	IP 22[2]	IP 22[2]	IP 22	IP 22	IP 44	IP 44
i	Ballast pump rooms and similar rooms below the load line 9)	IP 44	IP 44	IP 44	IP 44	IP 44	IP 44	IP 56	IP 56
j	Cargo holds 4) 9)	N	N	IP 44	N	IP 44[3]	N	IP 56	IP 56
k	Open deck, keel ducts 9)	IP 56	IP 56	IP 56[5]	IP 56	IP[10] 56[17]	IP 56[17]	IP 56	IP 56
l	Battery rooms, charging stations, lamp rooms, paint stores, stores for welding gas bottles	N	N	Ex[18]	N	Ex[18]	N	N[16]	Ex[18]
m	Dry accommodation spaces	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20[6]
n	Bath rooms and showers	N	N	N	N	IP 44[19]	IP 44	N[7]	IP 56
o	Galleys, laundries and similar rooms 8)	IP 44	IP 44	IP 44	IP 44	IP 44	IP 44	IP 44	IP 44
p	Car decks (special cargo holds) 11) 12) 14) 20)								

1) Regarding cable pipes and ducts through fuel oil and water tanks, see § 1865.

2) Equipment not in continuous operation is to have heating elements which are to be switched on automatically when the equipment is switched off.

3) Regarding enclosures in cargo holds, so located that they are liable to come into contact with the cargo or cargo handling gear, see § 2217.

4) Regarding truck battery charging arrangements, see § 1463.

5) Rotating machines on deck are to be naturally cooled, i.e. without external cooling fans. Exemptions are allowed for machines which are used in port only. A marking plate shall then be placed on the machines, requiring that the machines are provided with additional covers (e.g. tarpaulins) at sea.

6) Regarding connection boxes behind panels, see § 1869.

7) Regarding special socket-outlets for razors, see § 1925.

8) Stoves, ovens and similar equipment may be accepted with IP 22 when additionally protected against water splashing off the floor during hose washing.

9) Enclosures of aluminium alloy are not allowed, unless it is proved that they are sufficiently resistant against corrosion.

10) Painting or similar of steel enclosures is not allowed as the only protection against corrosion.

11) Regarding motors for ventilation of car deck, see section 20.

12) Regarding socket-outlets for connection of welding apparatus and socket-outlets for connection of refrigeration equipment on cars, see § 1925.

13) Regarding motors in ventilation ducts from battery rooms, see § 1453.

14) Regarding motors in ventilation ducts from car deck, see § 2021.
Motors in ventilation ducts where heavy contamination of e.g. grease and oil can be expected, are to have enclosure at least IP 56.

15) Regarding main switchboards, see § 1641.

16) Regarding socket-outlets for connection of charger cables in charging stations, see § 1463.2.

17) Lighting equipment for illumination may have a lower degree of protection subject to approval from the Electricity Supervision in each individual case. Similarly, equipment, such as heating counters and refrigerated counters may have a lower degree of protection when the equipment is located on a sheltered deck.

18) The Electricity Supervision will in each individual case state the degree of protection which is required, see §§ 1153 - 1170.

19) Lighting equipment with a degree of protection lower than IP 44 may be accepted when the lighting equipment is so located that it will not be exposed to splashing etc., subject to approval by the Electricity Supervision in each individual case.

20) Regarding installations in special Category spaces, reference is made to SOLAS 1960 with additions, part H, Rules 94 and 108 in particular.

§ *1260. Construction, inspection and approval of materials and equipment.*

.1 Whoever manufactures, offers for sale or sells electric equipment and materials assembled or as single components, has the duty to ensure that the construction and the information given by marking, installation instructions and similar comply with Regulations for Electrical Installations on Board Ships, and provisions given pursuant to these regulations.

G u i d a n c e:

The requirement regarding pursuance to Regulations for Electrical Installations on Board Ships will normally be considered fulfilled by compliance with Norwegian testing regulations or standards. When such are not laid down, or Regulations for Electrical Installations on Board Ships are not adequate, other equivalent regulations or standards may be used as a guide, possibly with modifications.

.2 Materials and equipment which are subject to inspection in accordance with the Act of 24 May 1929 relating to Supervision of Electrical Installations are not to be offered for sale, sold, installed or used before samples of the type in question have been approved by the Norwegian Board for Testing and Approval of Electrical Equipment (NEMKO).

G u i d a n c e:

By the Sovereign Crown Prince's Decree of 31 May 1956 with later amendments rules are laid down concerning the types of electrical equipment which are subject to compulsory control by NEMKO pursuant to the Act of 24 May 1924 relating to Supervision of Electrical Installations.

The Decree also contains provisions regarding the types of equipment which are exempt from compulsory control.

NEMKO has in "Survey of Electrical Equipment Subject to Compulsory Control by NEMKO" and other documents given information regarding the types of equipment which are liable to compulsory control for the time being.

The extent of compulsory control is contained in NEMKO's test specifications.

By the term "approved" in this context is also understood materials and equipment which, in accordance with agreements in force, is tested and approved by equivalent testing stations referred to in the Nordic agreement concerning approval, or based on a CB-certificate. (CB is an abbreviation for CEE Certification Body which uses the approval mark Ê.)

NEMKO publishes lists of approved electrical materials, lighting equipment and apparatus.

.3 For materials and equipment which are not covered by .2 tests carried out by an equivalent testing institution may be accepted by the Electricity Supervision when deciding on the question of approval.

Testing carried out by the manufacturer may also be accepted by arrangement with the Electricity Supervision.

G u i d a n c e:

By an equivalent testing institution is meant an institution, public or private, which is working according to similar directions and which carries out control and testing according to equivalent testing specifications as does NEMKO, e.g. to CEE or IEC Recommendations.

Acceptance of whether the testing carried out by such an institution or by the manufacturer will be decided by the Electricity Supervision in each individual case. The specifications on which the testing is based will be of importance for such decisions.

.4 The Electricity Supervision may require that individual items of equipment, and equipment for special purposes which are not covered by .2, are to be submitted for special inspection by NEMKO.

NVE may for such equipment establish arrangements for type approval by the Directorate of Electricity.

.5 Explosion protected equipment is to be constructed and tested in accordance with the Norwegian or international regulations or in accordance with equivalent national regulations.

Test certificates from a recognized testing station are to be submitted.

G u i d a n c e:

The following European testing stations are considered as recognized in this connection:

Norges Elektriske Materiellkontroll (NEMKO), Norway.

Physikalisch Technische Bundesanstalt (PTB), West Germany.

Berggewerkschaftliche Versuchsstrecke (BVS), West Germany.

British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA), Great Britain.

Bundesversuchs - und Forschungsanstalt Arsenal Elektrotechnische Versuchsanstalt (ETVA), Austria.

Institut National des Industries Extractives (INIEX), Belgium.

Versuchstrecke Freiburg (V:Fr.), East Germany.

Statens Provningsanstalt, Sweden.

Laboratoire Central des Industries Electriques (LCIE), France.

Centro Elettrotecnico Sperimentale Italiano (CESI), Italy.

Materialprüfanstalt des schweizerischen Elektrotechnischen Vereins (SEV), Switzerland.

SECTION 13. DISTRIBUTION SYSTEMS AND VOLTAGES

§ 1301. *Distribution systems.*

The following distribution systems are permitted:

.1 D.C. installations:

.1.1 Two-wire insulated system

.1.2 Two-wire system with one pole earthed at the power source, but not with hull return.

.2 A.C. installations:

.2.1 Single-phase insulated system.

.2.2 Single-phase, two-wire system with one phase (pole) earthed at the power source, but not with hull return.

.2.3 Three-phase, three-wire insulated system.

.2.4 Three-phase, three-wire system with the neutral earthed.

.2.5 Three-phase, four-wire system with the neutral earthed, but not with hull return.

.3 Exceptions:

.3.1 For tankers special requirements apply, see § 3011

.3.2 NVE may accept other systems than those specified above.

Application for permission is to be submitted in duplicate through the Electricity Supervision.

3.3 The requirements in 1. and .2 do not apply to welding circuits.

Guidance:

Distribution systems include systems for control and signal circuits.

§ 1302. *Maximum system voltages.*

The following maximum system voltages are permitted:

.1 For fixed motors and for fixed equipment directly connected to fixed wiring ..... 500 V

.2 For lighting equipment (including signal lamps), space heaters in accommodation spaces, smaller fixed equipment, portable equipment, socket-outlets, light-current installations and instrumentation installations in general ..... 250 V

G u i d a n c e:

4 kW may be used as the limit between "larger" and "smaller" equipment. The practical limit depends on the construction of the equipment and is subject to consideration in each case until special construction and test regulations are stated.

For hand-tools and hand-lamps etc., which are used in particularly exposed positions such as engine rooms, in tanks, on deck etc., it is recommended, in a.c. installations, that if the system voltage is above 42 V an isolating transformer (see § 1109) be used for each separate apparatus.

.3 For permanently installed motors and equipment, where connection by flexible cable is necessary because of the application, e.g. for certain cranes and other hoisting gear, a system voltage of 500 V maximum may be accepted, after consideration by the Electricity Supervision in each individual case.

The flexible cables are to be connected by means of plugs and interlocked socket-outlets specially approved and marked for the purpose, or in special connection-boxes having a door which is interlocked with a switch.

The special marking is to indicate the voltage and the equipment which may be connected.

.4 For larger portable equipment, e.g. welding transformers, portable vegetable-oil pumps and refrigerated containers, system voltages of 500 V maximum may be accepted on the same conditions as stated in .3.

.5 For control current installations which are a part of a motor installation or a heating installation, a system voltage of 500 V maximum may be accepted. However, this system voltage is not to exceed the system voltage for the motor installation or the heating installation. All the components of the control current installation are to be approved for this voltage.

.6 The maximum voltages stated above do not apply to internal circuits in light-current equipment, e.g. in radio, television and radar equipment, to external transmission circuits for radio and radar equipment nor to the internal and external circuits of specially approved equipment, e.g. ignition circuits of oil burners.

§ *1303.* *Normal voltages and frequencies.*

.1 Standardized voltages and frequencies are generally to be used.

G u i d a n c e:

The following system voltages are standardized: (Those marked x are commonly used, see however § 1302 regarding maximum voltages).

a. D.C. Installations, V:	6	12	24	48	60	110	220
			x			x	x
b. A.C. Installations, V:	12	24	48	55	110	115	127
		x			x		
	220	250	380	440			
	x		x	x			

For A.C. installations the following frequencies are standardized: 50 Hz and 60 Hz.

50 Hz, commonly used for 380 V installations.
60 Hz, commonly used for 440 V installations.

IEC has, in the IEC Publication No. 92-1, Amendment No. 1, listed recommended voltages and frequencies.

§ *1306.* *Voltage variations.*

Concerning requirements for voltage regulation of generators, see §§ 1423 and 1427.

All equipment is to operate satisfactorily at the voltage variations which can occur during ordinary operation conditions.

For these voltage variations the following apply:

.1 For installations supplied by generators, the voltage on the bus-bars in the main switchboard is to be kept within 97.5 and 102.5% of the nominal voltage of the installation during all steady load conditions.

.2 For D.C. installations supplied by batteries, the voltage variation between the battery's full-charged and minimum-charged voltages is to be maintained.

For batteries with continuous charging, the maximum charging voltage is to be maintained.

.3 The transient voltage variations on the bus-bars of the main switchboard at the maximum power and current variations which can occur during ordinary operating conditions, are not to exceed -15% and +20% of the nominal voltage.

In special cases, larger variations may be accepted by the Electricity Supervision, provided that the equipment is constructed to withstand such variations.

.4 The voltage drop in any circuit at full load is not to exceed 6% of the nominal voltage, measured between the bus-bars of the main switchboard and the equipment.

§ *1307.* *Frequency variations.*

Concerning requirements for the speed regulation of prime movers for generators, see § 1410.

All equipment is to operate satisfactorily at the frequency variations which can occur during ordinary operating conditions.

For these frequency variations the following apply:

.1 During steady load conditions the variations are not to exceed ±5% of the nominal frequency.

.2 During transient load conditions the variations are not to exceed ±10% of the nominal frequency.

In special cases larger variations may be accepted by the Electricity Supervision, provided that the equipment is constructed to withstand such variations.

SECTION 14. POWER SOURCES AND POWER SUPPLY INSTALLATIONS.

§ 1401. *Important consumers (purposes) - non-important consumers (purposes).*

.1 The following are considered as important consumers (purposes):

.1.1 All machines and equipment which are necessary and/or prescribed for the propulsion, steering or navigation of the ship.

Guidance:

Such consumers are:

- Fuel oil supply pumps, including transfer pumps.
- Lubricating oil pumps.
- Cooling water pumps.
- Starting air compressors.
- Feed water pumps, condensate pumps, oil burning installations etc. for steam plants.
- Ventilating fans for engine and boiler room.
- Steering gear including auxiliary and alarm equipment.
- Rudder indicator.
- Pumps for variable pitch propellers.
- Remote control systems.
- Engine telegraph.
- Control systems for propulsion and auxiliary engines.
- Navigation lights which are required by the Norwegian Ship Control.

.1.2 All machines and all equipment belonging to the prescribed fire extinguishing and bilge systems for the ship, and the ventilation system.

Guidance:

Such consumers are:

- Fire pumps.
- Fire alarm systems.
- Alarm and interlocking systems for CO_2 installations.
- Sprinkler systems with auxiliary- and alarm systems.
- Ventilation systems for enclosed car decks, for battery rooms and for other spaces where gas and/or temperature conditions require forced ventilation.
- Bilge and ballast pumps.
- Compressors for pneumatic and hydraulic remote operated valves for the bilge system.

- Installations for operation of watertight doors with alarm and control system.
- Control system for fire-doors.
- General alarm installations.

.1.3 Equipment for the lighting which is necessary for safe traffic and the safety of passengers and crew in the accommodation and other places on board where passengers and crew are staying or have to pass through to reach the life boat and life raft stations (muster stations).

Also lighting in spaces for propulsion and auxiliary engines, steering, navigation, radio equipment and in control rooms.

G u i d a n c e:

The requirement implies that there must be necessary lighting in:

- Saloons and lounges.
- Alleyways and stairways.
- Cabins.
- Signs for exits etc.
- Boat and life raft stations (muster stations) and deck spaces leading to these.
- Spaces for main engines, auxiliary engines and emergency generator.
- Steering gear room.
- Wheel-house and chart room.
- Radio room.
- Control stations, including rooms for CO_2 installations, rooms for pumps for operation of watertight doors and similar.

In the Norwegian Ship Control Rules, regulations are given for the location of lighting equipment in certain rooms, also requirements for the minimum lighting intensity for certain rooms if artificial lighting is used.

.1.4 Equipment which is part of the power supply for important consumers, e.g. rotating convertors, static convertors and transformers.

.1.5 Passenger lifts.

.2 Less important consumers (purposes) are considered to be those consumers which, according to .1, are not regarded as important.

§ 1404. *Number and capacity of power supply units.*

.1 The number of generators, transformers and convertors supplying important consumers is to be at least 2.

The number and capacity are to be such that with any one unit not in operation, the remaining unit(s) are to have sufficient capacity for supplying all important consumers which are expected to be in operation simultaneously, at full power on the propulsion plant and at the maximum load which is expected to occur on the lighting installation.

.2 If an important consumer being supplied electrically is duplicated with one being supplied non-electrically, this may be taken into consideration when the capacity of the power supply units is calculated.

The same applies if an important consumer can be supplied from an accumulator battery with sufficient capacity for the ship's service.

§ 1410. *Prime movers for generators.*

.1 Each generator required according to § 1404, is normally to be driven by a separate prime mover (internal combustion engine, reciprocating steam engine, steam turbine, gas turbine).

Such prime movers may, after consideration in each case, be permitted to be used for driving other auxiliary machinery. They are then to have sufficient capacity for the total load, or the machinery arrangement is to be such that the generator and the other auxiliary machinery are not expected to be used simultaneously.

G u i d a n c e:

The requirement that the generator and the other auxiliary machinery are not expected to be used simultaneously implies that the other auxiliary machinery cannot be an important consumer.

.2 When generators are driven by reciprocating steam engines or steam turbines and the steam production depends on the electric power supply, there is to be at least one generator driven by an auxiliary internal combustion engine or gas turbine, so that the steam production can be started.

.3 Prime movers for all main generators, except main-engine-driven D.C. generators, are to have speed governors which automatically govern their speed so that the permanent change of speed from no-load to full-load and vice-versa does not exceed 5%. When full load is suddenly thrown off or on, a 10% transient variation is acceptable.

In special cases, larger variations may be accepted by the Electricity Supervision provided that the equipment is constructed to withstand such variations.

G u i d a n c e:

When making such decisions the following must be taken into consideration:

a) The maximum load which will suddenly be connected.

b) Large and sudden variations of the load, e.g. by operation of cranes, winches, bow thrusters etc.

c) The kinetic energy of the generator and the prime mover.

d) Influence of speed variations, frequency and/or voltage variations.

It will usually be required that the 10% limit is not exceeded when 70% of full load is suddenly connected.

In installations where large and sudden load variations frequently occur, the kinetic energy of each generator with its prime mover ought not to be less than 1000 Nm/BHP at nominal speed.

.4 The governing characteristic for prime movers for generators running in parallel is to be such that the sharing power is stable during all load conditions. However, oscillations of power may be neglected, provided that they do not exceed $\pm$20% of each generator's rated power.

In the range of 20 - 100% of the rated power of each generator, its actual power (mean values, if oscillations occur) is not to differ from its proportionate share of the total power by more than 10% of the rated power of the largest generator in parallel; or not more than 25% of the smallest generator's rated power, if this is less than the former. Each governor is to be such that the generator's power can be adjusted with an accuracy of $\pm$5% of the rated value.

G u i d a n c e:

Because of the influence of power oscillations it is recommended for A.C. generators running in parallel that the static be adjusted to between 4 and 5%.

.5 For generators driven by single-cylinder or two-cylinder reciprocating engines, the cyclic irregularity

$$\frac{\omega_{max} - \omega_{min}}{\omega_{average}}$$

with constant load momentum is not to exceed 1/75.

For generators driven by reciprocating engines with more than 2 cylinders, the cyclic irregularity is not to exceed the following values:

No. of impulses per sec.	Maximum irregularity
4 and less	1/150
6	1/220
8 - 20	$\frac{1}{\frac{2000}{f} - f}$
Above 20	1/75

G u i d a n c e:

The table is in accordance with a corresponding table in IEC document 18 (Central Office) 440.

.6 The NVE may permit one or more of the generators required in accordance with § 1404 to be driven by a propulsion engine.

Application for permission is to be submitted in duplicate through the Electricity Supervision.

G u i d a n c e:

The conditions for such permission will generally be:

a) The ship must have variable pitch propeller(s).

b) Each generator is to be driven by one propulsion engine, and each propulsion engine is allowed to drive one generator only.

c) Each propulsion engine with its generator is to be able to be disconnected from the propeller drive by means of a clutch.

d) The propulsion engine with its governor is to comply with the requirements in .3, .4 and .5.

e) In addition to the propulsion engine-driven generator(s) there is to be at least one generator driven by an internal combustion engine or a gas turbine. The capacity of this generator is to be at least sufficient for supplying lighting equipment according to § 1404.1.3, navigation and signal lights and consumers necessary for starting of the propulsion engines.

§ *1420.* *Generators.*

.1 Generators are to be constructed in accordance with the Norwegian Standards for rotating machines or with equivalent international standards, but adapted to the special operating conditions on board ships as specified in §§ 1210 - 1217.

G u i d a n c e:

Equivalent international standards are here understood to be IEC standards. Design and construction according to national standards or equivalent will be considered in each individual case.

.2 The manufacturer is to issue test reports, giving all necessary information in accordance with the standard to which the generator is constructed.

.3 Generators of rating 125 kVA and above are, if required by the Electricity Supervision, to be inspected during manufacture and testing.

.4 For generators serving special purposes, other requirements than those stated in §§ 1423 and 1427 may be laid down.

G u i d a n c e:

This applies especially to generators for operation of trawl winches, convertors for winches, for gyro compasses etc.

.5 Generators are preferably to be installed with their shaft in the fore and aft direction. Generators are

to be installed in well ventilated spaces in which inflammable gases cannot accumulate, see also § 1217.7 and .8.

§ *1423.* *A.C. Generators.*

.1 A.C. Generators are to have automatic voltage regulation to maintain the voltage within 97.5% - 102.5% of the rated voltage during all steady load conditions. Alternatively, the generators are to be of the self-regulating type having a voltage characteristic so adjusted in relation to the speed characteristic of the prime mover, see § 1410.3, that the voltage is kept within these limits.

.2 The voltage variations during transient conditions are to comply with the following:

When the generator is running at no-load or full load, and the largest load on board which normally can be switched on/off is suddenly connected or disconnected, the instantaneous voltage drop or rise is not to be more than 15% or 20% respectively of the rated voltage.

In special cases, larger variations may be accepted by the Electricity Supervision, provided that the equipment is constructed to withstand such variations.

When two or more generators are normally driven in parallel, the maximum load which can be switched on/off may be divided between the generators in relation to their ratings.

G u i d a n c e:

If the largest load on board which can be switched on/off is not known by the generator manufacturer, the generator design should be based on the following values:

Switching on full-load current at $\cos \varphi = 0.4$
Switching off full-load current at $\cos \varphi = 0.8$

.3 Generators for parallel running are to be such that the sharing of active and reactive load is stable during all load conditions. However, oscillations of active and reactive load up to 20% of each generator's rated values are acceptable.

.4 When generators are run in parallel in installations with the neutral earthed, it is to be ensured that the equalizing current caused by harmonics does not exceed 20% of the rated current of each generator.

G u i d a n c e:

This can be obtained by an arrangment where the neutral of one generator only is connected to earth at any one time, e.g. by interlocked contactors connected between the neutrals of the generators and the earth.

If not arranged in such a way the generators are to be so constructed that too large equalizing currents will not occur.

It should also be noted that equalizing currents caused by harmonics may affect the voltage regulation and the sharing of reactive load of some generator types.

.5 A.C. generators are to withstand terminal short circuits of at least 1 second without damage to the generator itself or to its excitation equipment.

.6 A.C. generators are to have sufficient transient and stationary short circuit current in relation to the release characteristics of switches and fuse gear in the installation, to ensure a selective release by short-circuits anywhere in the installation.

G u i d a n c e:

The stationary short-circuit current should normally not be less than 3 times the rated current.

§ *1427*. *D.C. Generators.*

.1 D.C. generators are normally to be compound wound, or shunt or stabilized shunt wound with automatic voltage regulator.

.2 Series field coils are normally to be connected in the negative pole.

.3 The voltage characteristics of compound-wound generators are to be as follows, taking into consideration the effect of the speed characteristics of the prime mover.

After having adjusted the rated voltage to ±1% at 20% load, the voltage at full-load is not to differ from the previous adjusted voltage by more than 1.5%. The average of the voltage for ascending and descending load between 20% load and full-load is not to vary more than 3% from the rated voltage.

.4 The automatic voltage regulation of shunt-wound generators, and for all generators driven by propulsion-engines according to § 1410.6, is to be such that the voltage is kept within 97.5% - 102.5% of the rated voltage during all steady load conditions between no-load and full-load.

.5 Means are to be provided on the switchboard to enable the voltage of each generator to be adjusted separately.

The equipment is to be capable of adjusting the voltage to any value between 97.5% and 102.5% of the rated voltage. The accuracy of the adjustment is to be 0.5% of the rated voltage for generators above 100 kW, and 1% of the rated voltage for smaller generators. This applies to all steady load conditions between no-load and full-load.

.6 Generators for parallel operation are to be such that the sharing of load is stable during all load conditions between no-load and full-load. When the voltage has been adjusted to the correct value, the load sharing is to be within limits specified in § 1410.4.

.7 Compound-would generators for parallel operation are to comply with the following:

- The voltage drop of the series field coil and its connection to the switchboard is to be approximately equal for all generators.

- The series field coils are to be parallel connected by equalizing connections. The equalizing connections are to be in the negative pole. The cross section of the equalizing connections is to be at least 50% of that of the negative pole.

§ *1430.* *Transformers.*

.1 Transformers are to be constructed in accordance with Norwegian Standards for transformers or with equivalent international standards, but adapted to the special operating conditions on board ships, as specified in §§ 1210-1217.

G u i d a n c e:

Concerning standards the same apply as for generators, see § 1420.4, Guidance.

.2 The manufacturer is to issue test reports, giving

all necessary information in accordance with the standards to which the transformer is constructed.

.3 3-Phase transformers of rating 100 kVA and above, and 1-phase transformers of rating 60 kVA and above are, if required by the Electricity Supervision, to be inspected during manufacturing and testing.

.4 Transformers are to have separate windings. Starting transformers for motors can, however, be of the autotransformer type.

.5 Transformers are usually to be of the dry, air-cooled type.

However, in the engine room and similar spaces, liquid-cooled transformers with non-inflammable liquid may be used. Liquids containing poly-chlorinated bi-phenyls (PCB) are, however, not acceptable.

.6 Liquid-cooled transformers are to be of the conservator type with level indicator which indicates the accepted maximum and minimum liquid level.

Suitable provisions for collecting any liquid leakages are to be arranged.

.7 Transformers for the general power distribution may have maximum 2.5% voltage drop from no-load to full-load at $\cos\varphi = 1$.

The voltage ratio of such transformers is to be within 0.5% of the rated ratio.

.8 Transformers are to withstand secondary terminal short-circuits of at least 1 second, with rated primary voltage and frequency, without suffering damage.

.9 Transformers for parallel operation are to have compatible phase relationship and voltage ratio.

The current of each of the transformers is not to differ from its proportionate share of the total load current by more than 10% of the rated current of the transformer.

.10 Transformers are to be installed in well ventilated spaces in which inflammable gases cannot accummulate, see § 1217.7 and .8.

§ *1440.* *Convertors.*

.1 Convertors are to be constructed in accordance with Norwegian Standards for convertors or with equivalent international standards, but adapted to the special operating conditions on board ships, as specified in §§ 1210-1217.

G u i d a n c e:

Norwegian Standards for convertors do not exist for the time being. Concerning standards the same apply as for generators, see § 1420.1, Guidance.

.2 Convertors are generally to be of the dry, air-cooled type.

However, in engine rooms and similar spaces liquid-cooled convertors with non-inflammable liquid may be used. Liquids containing polychlorinated biphenyls (PCB) are, however, not acceptable.

.3 Convertors are to be installed in well ventilated spaces in which inflammable gases cannot accumulate, see § 1217.7 and .8.

§ *1450.* *Accumulator Batteries.*

.1 Batteries are to be so constructed that they can withstand the special operating conditions on board ships as specified in §§ 1210-1217. Electrolyte is not to be spilled consequent on the ship's movement within the limits specified in § 1210.

.2 For hermetically sealed batteries exceptions from the requirements in § 1451.7, and .8, .10 and § 1453 may be accepted.

§ *1451.* *Location of Accumulator Batteries.*

.1 Batteries are to be so located and installed that all cells are easily accessible for inspection, maintenance and replacement.

.2 Batteries with capacity of above 20 kWh are to be installed in special rooms. Batteries with capacity of above 5 kWh, but not above 20 kWh, are to be installed in special rooms or lockers.

Batteries with capacity 5 kWh and less are to be installed in special rooms, lockers, or boxes with covers.

Rooms, lockers and boxes for batteries are to be used for this purpose only.

Boxes and lockers for batteries may be located in engine rooms and similar spaces, but not in living quarters. Boxes and lockers for batteries with capacity not above 5 kWh may be located on open deck when satisfactorily protected.

G u i d a n c e:

Calculation of the battery capacity is to be based upon the estimated discharge time for the battery.

.3 In rooms and lockers for batteries the cells are to be located on shelves, with sufficient space for air circulation.

When the cells are located at one height only there is to be minimum 300 mm free space above each cell and at least 20 mm free space on all sides and below each cell.

When the cells are located at more than one height there is to be at least 300 mm free space above each cell, at least 20 mm free space below and at least 50 mm free space on all sides of each cell.

.4 In battery boxes the cells are to be located at one height only, with sufficient space for air circulation, at least 20 mm free space above, below and at all sides of the battery.

.5 Batteries with different electrolytes are not to be installed in the same room, locker or box.

.6 All batteries are to be fixed so they cannot be displaced by the ship's movement.

.7 All materials used in the rooms, lockers or boxes, including ventilation ducts and fans, are to be corrosion resistant, or are to be protected against corrosion by suitable painting.

The materials are to be at least flame retardant, however, impregnated wood may be used as supports of battery cells, and for battery boxes on open deck.

.8 The shelves in rooms and lockers and the bottoms of battery boxes are to be constructed of or covered with corrosion-resistant materials.

The shelf lining is to have a minimum thickness of 1.5 mm and be carried up not less than 75 mm on all sides in order to collect efficiently spilled electrolyte.

When the shelves are constructed of corrosion-resistant materials without lining for collecting of electrolyte, the floor is instead to be covered with such lining, carried up at least 150 mm on all sides.

G u i d a n c e:

For acid batteries the lining can be of lead and for alkaline batteries, of steel.

.9 All batteries are to have easily readable nameplates of at least flame retardant materials, giving information on the application for which the battery is intended, maker, type, voltage and capacity in kWh.

A notice giving information concerning maintenance is to be fitted near the battery.

G u i d a n c e:

The Norwegian Ships Control requires notices to be placed giving warning against smoking and the use of naked lights.

.10 Installations for lighting equipment and equipment for space heating are to have explosion protected enclosures.

Installations for other purposes are not permitted.

§ *1453.* *Ventilation for accumulator batteries.*

.1 All rooms, lockers and boxes are to have sufficient ventilation. The air inlet is to be in the lower part and the air outlet is to be in the upper part, and so arranged that gases cannot accumulate.

For batteries with capacity of above 5 kWh the air outlet is to lead directly to free air, or through a separate ventilation duct to free air. Smaller batteries may have air outlets to the room in which they are located, provided that this room itself has sufficient ventilation.

.2 Rooms for batteries with capacity of above 20 kWh are to be provided with separate mechanical ventilation with suction fan for minimum 30 air changes per hour. The ventilation fan is to be

started automatically when full or quick charging is commenced and is not to stop until 30 minutes after the charging is completed.

The fan motor is to have explosion protected enclosure when it is located in the battery room or in the ventilation duct.

G u i d a n c e:

In addition to the requirement that the motor is to have explosion protected enclosure, the fan is to be of the non-sparking type.

The Norwegian Maritime Directorate has stated that the following constructions will be accepted as non-sparking:

a) Impeller and fan housing of non-metallic construction.

b) Impeller and fan housing of non-iron construction (e.g. impeller and fan housing of the same alloy).

c) Impeller and fan housing of stainless steel.

d) Impeller and fan housing of iron, provided there is at least 13 mm clearance between the impeller and the fan housing.

.3 Rooms and lockers for batteries with capacity of above 5 kWh but not above 20 kWh are to have ventilation as stated in .2, or may be provided with natural ventilation. The air outlet for such natural ventilation is to be either direct or through a duct not inclined more than 45° from the vertical.

§ *1455.* *Charging devices for accumulator batteries.*

.1 Batteries are to have suitable automatic charging device. For batteries whose capacity is taken into consideration when stipulating the capacity and number of the power supply units, see § 1404, two mutually independent charging devices with separate supply circuits from the main switchboard may be required.

G u i d a n c e:

By suitable charging device it is meant that the charging device is to be capable of keeping the battery as far as possible fully charged at all times.

.2 The charging device is to be protected against a battery fault by means of circuit-breakers or fuses in each pole. These are also to protect the connections to the battery, unless the connections are installed so as to be short-circuit-proof and proof against an earth fault.

The arrangement is to be such that the charging device can be disconnected without breaking the supply to consumers fed by the battery.

G u i d a n c e:

Concerning short-circuit and earth fault protection of installations, see § 1457.2. Guidance.

.3 A charging dynamo, driven by the prime movers of emergency generators, emergency fire pumps or the like, is not permitted to be used as a charging device for starter batteries on prime movers of emergency generators, emergency fire pumps or the like.

§ *1457.* *Protection of circuits for accumulator batteries.*

.1 Battery circuits are to be protected against short-circuit and overload. The protection device is to be installed as near as possible to the batteries, however see .3.

G u i d a n c e:

The requirement implies that fuses, switchgear etc. for the batteries are to be installed in the nearest adjacent room when separate battery rooms are used.

.2 When conductors from the batteries do not have protection against short-circuit and overload, the conductors are to be installed so as to be short-circuit-proof and proof against earth fault.

G u i d a n c e:

The requirement can be met by:

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

b. Insulated conductors installed on supports of insulating materials. Insertion of additional insulating materials providing adequate distance between the conductors themselves and between the conductors and the base. The supports for the conductors themselves are not included.

c. Uninsulated conductors, installed on insulators and with insulated insertions providing adequate distance between the conductors and the base. The supports for the conductors themselves are not included.

This also applies to connections from the charging device(s).

.3 For starter batteries, the connection from the battery to the starting motor may, instead of being protected against short-circuit and overcurrent, be provided with a switch so that the circuit can be quickly disconnected in event of faults.

The switch is to have a breaking capacity corresponding to the starting currents which may occur.

Circuits from the starter battery to equipment other than starting motors are to have separate protection against short-circuits and overload.

§ *1459.* *Accumulator batteries for starting arrangements.*

.1 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 are not to be installed above each other, or on common shelves. The batteries are to have separate circuits installed as far apart as practical.

.2 The starting arrangement for one single propulsion engine is to have a change-over switch for alternative connection of the starting motor to either of the two batteries.

.3 The starting arrangement for two or more propulsion engines is to 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.

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

.5 Starting arrangements for a prime mover which is not for emergency use, is to be by a separate battery or be connected by a separate circuit to one of the batteries for the propulsion engine, in accordance with .1-.3.

.6 Starting arrangements for more than one prime mover are to be from at least two batteries as stated in .1-.3. Batteries for propulsion engines may be used.

.7 Each battery is to be of sufficient capacity for at least the following number of start attempts of the engines 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 pitch propeller or other device enabling the engine to be started with no load.

3 starts for each prime mover for generators, except emergency generators.

12 starts for each prime mover for emergency generator, emergency fire pump and similar.

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

G u i d a n c e:

When stipulating the battery capacity it must also be taken into consideration that:

- The battery is normally not fully charged
- Reduction of capacity due to aging.
- Reduction of capacity due to high temperatures.
- Reduction of capacity due to rapid discharge.

1463. Charging of accumulator batteries for trucks.

.1 Batteries for trucks are to be charged in charging stations. Such a charging station is understood to be a separate room or a special part of a larger room, e.g. a cargo hold. This special part of the room is to have a base of at least the area occupied by the trucks plus 1 meter in all directions.

.2 Installations in charging stations are normally to have explosion protected enclosures. Howevever, this does not apply if the batteries are hermetically 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.

.3 Charging stations are generally to be mechanically ventilated with at least 30 air changes per hour. The ventilation arrangement is further to be as specified for batteries with capacity of above 20 kWh, see § 1453.2.

However, for charging stations in cargo holds having mechanical overpressure ventilation, a natural ventilation outlet from the upper part of the charging station to free air is acceptable.

These requirements do not apply if the batteries are hermetically sealed.

SECTION 15. EMERGENCY POWER SOURCES AND EMERGENCY POWER DISTRIBUTION SYSTEMS.

Regulations for emergency power sources and emergency power distribution systems will be stated later. Further reference is made to the Rules of the Norwegian Ship Control and SOLAS 1960.

The electrotechnical construction of such installations is to comply with these Regulations.

SECTION 16. DISTRIBUTION SYSTEMS AND SWITCHBOARDS.

§ *1601.* *General provisions.*

The installation is to be such that failure of any single circuit will not put important consumers in accordance with § 1401.1, out of operation for long periods.

G u i d a n c e:

The requirement implies that:

a) if the bus bars in the main switchboard are divided into two or more sections e.g. in order to avoid parallel running of generators, or in order to decrease the short-circuit currents, or

b) if two main switchboards are used, or

c) if the emergency switchboard is used for primary distribution in accordance with § 1604.1, there are to be arrangements for connection between the different bus-bars, so that the requirement is complied with in the event of failure of any one generator.

§ *1604.* *Circuits from power sources and transformers and convertors.*

.1 Generators required according to § 1404 are to be connected to the main switchboard by a separate circuit.

.2 Accumulator batteries according to § 1404 are to be connected to the main switchboard by a separate circuit. However, the Electricity Supervision may, after consideration in each individual case, accept that such accumulator batteries be connected to separate distribution switchboards, provided that the requirements in § 1404 are complied with.

.3 Transformers and convertors required according to § 1404 are to be connected to the secondary main distribution switchboard by separate circuits.

.4 Power supply units serving special purposes may be connected to separate switchboards. For such switchboards the same requirements apply as for main switchboards.

§ *1606.* *Primary distribution.*

.1 The following consumers are to be supplied by separate circuits from the main switchboard or from the emergency switchboard:

- Important consumers larger than 10 kW.

- Transformers and convertors supplying the secondary main distribution switchboard for important consumers.

Concerning steering gear, see § 1625.

.2 The following consumers are to be supplied by separate circuits from the main switchboard, the emergency switchboard or from a distribution switchboard:

- Important consumers which are not covered by .1. Concerning navigation lights, see § 1665.

- Non-important consumers, when these are motors larger than 1 kW.

- Other non-important consumers with rated current above 16 A.

.3 Two or more important consumers for the same purpose are to be supplied from at least two distribution switchboards when such are used according to .2. Each of these is to be by a separate supply circuit from the main switchboard or from the emergency switchboard.

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

G u i d a n c e:

Concerning the collision zone, see § 1625.2 Guidance.

.4 Lighting equipment in the following places is to be supplied by circuits from at least two distribution switchboards, each having a separate supply from the main switchboard or from the emergency switchboard:

- Main and auxiliary engine rooms.

- Control rooms.

- Saloons and lounges.

- Alleyways and stairways.

- Boat and life raft stations and deck spaces leading to these.

§ 1608. *Secondary distribution.*

.1 Secondary distribution may supply important consumers on the following conditions:

- There is to be a secondary main distribution switchboard. For this the same requirements apply as for the main switchboard for the primary distribution, see § 1606.

  The secondary main distribution switchboard is to be installed in the same place as, and may be a part of, the main switchboard for the primary distribution or the emergency switchboard.

- The secondary main distribution switchboard is to be supplied through at least two transformers or convertors, each with a separate supply circuit. These circuits are to be provided with switchgear and fusegear as stated in § 1617.

.2 The requirements in § 1606 also apply.

§ 1610. *Control and signal circuits.*

.1 Control and signal circuits are to be branched off from the main circuit, see however .4 - .6.

Concerning steering gear, see § 1711.4

.2 Control and signal circuits are to be provided with separate short-circuit protection. However, the secondary side of current transformers is not to be provided with such protection. Short-circuit protection may further be omitted for:

- Circuits for automatic voltage regulators for generators.

- Circuits branched off from main circuits which have fuses rated not above 16 A or which have a corresponding short-circuit protection.

- Circuits branched off from main circuits which have fuses rated not above 25 A or which have a corresponding short-circuit protection, and where the control and signal circuits wiring is within one enclosure only.

Signal lamps are to be protected by separate fuses, if a lamp when short-circuited can put the control circuit out of operation.

.3 Transformers for control and signal circuits are to be provided with short-circuit protection on the secondary side. However, such protection may be omitted if:

a. The transformer is short-circuit proof, or

b. The protection on the primary side efficiently provides protection for the transformer against a short-circuit on the secondary side.

.4 The Electricity Supervision may, after consideration in each case, accept that control and signal circuits for two or more important consumers not serving the same purpose, are supplied from control and signal circuits which are common for several important consumers. This is only permitted if at least the following conditions are observed:

- Such common circuits are to be supplied from the same switchboard and bus-bar as the respective main circuits, or from a common accumulator battery being charged from the same switchboard and bus-bar as the respective main circuit.

- Control and signal circuits for each consumer are to be provided with separate short-circuit protection.

.5 For control and signal circuits for two or more important consumers serving the same purpose, the requirements in § 1606.3 apply correspondingly. Control circuits for important consumers serving other purposes may be similarly connected.

.6 Control and signal circuits for non-important consumers may be supplied from control and signal circuits which are common for several non-important consumers, provided that such common circuits are supplied from the same switchboard and bus-bars as the respective main circuit.

.7 If the control and signal circuits remain live when the main circuit is switched off, the switchgear is to have marking which orders that the control and signal circuit is also to be switched off when the main circuit is switched off for maintenance purposes.

.8 Control circuits for under-voltage release of generator circuit-breakers are not to supply purposes other than possible closing coil and reverse-power relay.

Voltage coils of generator instruments are to be connected to separate circuits. However, signal lamps for the generator circuit may be connected.

.9 Signal circuits are generally to be such that the most frequently occuring faults, e.g. a break in the connection or a contact failure, give a signal, (i.e. a normally closed circuit).

§ *1615*. *Short-circuit and overcurrent protection.*

.1 Each circuit is to be provided with short-circuit and overcurrent protection so constructed that selective disconnection is obtained by faults anywhere in the installation. The Electricity Supervision may, after consideration in each case, permit exemptions for:

- Circuits for consumers which are used only when the ship is in port.

  Such circuits are to be switched off at sea, and the switchgear on the switchboard is to be fitted with a signboard requiring such disconnection.

- Circuits from distribution switchboards supplying non-important consumers only.

- Circuits supplying lighting equipment if the supplies are so arranged that a failure in a lighting distribution switchboard and its supply will not darken any area.

Concerning steering gear, see § 1711.

G u i d a n c e:

When deciding whether the requirements have been fulfilled, the number of generators and convertors normally running at sea should be taken into consideration.

.2 Fuses with rated current above 320 A are not to be used as overcurrent protection.

G u i d a n c e:

Concerning short-circuit and overcurrent protection for:

- Generators, see § 1617.

- Motors, see §§ 1705 and 1885.

- Cables, see § 1883

Concerning short-circuit protection for control and signal circuits, see § 1610.

.3 Fuses are not to be installed in the neutral conductor. Fuses may be installed in two-wire branch circuits fused not above 16 A, provided that the neutral does not serve as an earth conductor behind the fuses.

§ *1617.* *Generator circuits.*

.1 Generators are to be provided with short-circuit and overcurrent protection.

.2 Generators rated above 50 kW and generators operating in parallel are to be provided with multipole circuit-breakers in the main switchboard. For D.C. compound-wound generators operating in parallel, the circuit-breakers are to have a contact for the equalizer connection. This contact is to make before and break after the main contacts.

G u i d a n c e:

Usual setting of the overcurrent relays for generators is: tripping at 110-125% of rated current, with time delay of 20 seconds - 2 minutes.

.3 Generators which are not included in .2 are to be provided on the main switchboard with multipole circuit-breaker, multipole fused circuit-breaker or multipole switch and fuses in each insulated phase (pole). However, multipole switch and fuses are not allowed for generators with rated current above 320 A.

When switch and fuses are used, the fuses are to be installed on the generator side, and they are to be so selected that the generator is efficiently protected against overcurrent and short-circuit.

G u i d a n c e:

The requirement implies that when selecting fuses the melting characteristics of the fuses are to be taken into account. Generally, it will be necessary to instal a fuse with rated current not above the rated current of the generator.

.4 Other arrangements of generator protection may be permitted after consideration by the Electricity Supervision in each case.

G u i d a n c e:

Such generator protection may be, e.g. over-temperature alarm for the winding combined with time delay release operated by power relays or by equipment on the prime-mover.

In order to obtain efficient protection of the generator and the cables from the generator to the main switchboard, equipment for automatic de-energizing of the generator or equivalent equipment, must be provided.

For ships with two generators, a practical limit for installing such equipment will be a total generator rating above 500-600 kVA. For installations with three generators the limit will be 1000 - 1200 kVA.

.6 Each A.C. generator operating in parallel in installations with total generator rating 150 kVA and above is to be provided with reverse-power protection.

Each D.C. generator operating in parallel, including parallel operation with accumulator batteries, is to be provided with a reverse-power relay.

Such protection/relay is to release the circuit-breaker at:

- Maximum 15% of the rated power for generators driven by internal combustion engines or reciprocating steam engines.

- Maximum 6% of the rated power for generators driven by steam or gas turbines, at rated voltage and rated power factor.

The time delay is to be 3 - 10 seconds. The tripping power is not to depart from the set value by more than 50% at voltage drop down to 60% of the rated voltage and at any power factor. Reverse-current relays for D.C. compound-wound generators are to be connected in the pole opposite to that in which the series winding is connected.

.7 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 rated voltage.

.8 In installations where parallel operation of generators is necessary, each such generator is to be provided with time-delayed overcurrent relay for automatic tripping of non-important consumers.

Such automatic tripping may be allowed for important

consumers after consideration by the Electricity Supervision. The arrangement is then to be such that these consumers can be reconnected when the generator current is reduced to 60% of the rated current.

G u i d a n c e:

Tripping relays are usually to be set for tripping at 100 - 110% of rated current, with time delay 5 - 20 seconds.

§ *1619.* *Shore connections.*

.1 When the installation is arranged for supply from shore, there is to be a connection box or cabinet suitably located for connection of the flexible cable from shore.

Shore connection cabinet or box is to have switchgear as required for outgoing circuits from distribution switchboards.

The flexible cable is to be connected to copper bus-bars by means of bolts with accessories giving permanent contact connection. Other equivalent means of connection may be accepted. The flexible cable is to be provided by approved strain-relief.

Shore connection circuits fused not above 63 A may be connected by means of an appliance inlet and appliance connector, and a fuse in each insulated phase (pole), instead of by the method mentioned above.

In installations with earthed neutral a satisfactory connection between the neutral on shore and the neutral points on board the ships must be provided.

When the ship is in dry dock or on a slipway, the earthing system on the ship is to be connected to the earthing system on shore. The shore connection box or cabinet is to be equipped for such earthing of the ship.

.2 The shore connection circuit is to be connected to the main switchboard or to the emergency switchboard. In the switchboard the circuit is to have at least an interlocked switch or a change-over arrangement excluding connection between the generator and the shore connection circuit. The switchboard is to be provided with an indicator (signal lamp or voltmeter) indicating whether the shore connection circuit is live before connection is made.

.3 Three-phase A.C. installations are to be provided with a phase-sequence indicator and a phase-sequence change-over switch on the shore connection cabinet or on the switchboard. Phase-sequence change-over 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.

.4 When D.C. installations on board are supplied from A.C. installations on shore, the installation is to be divided into sections by means of change-over switches in order to prevent motors and other equipment designed for D.C. only, being supplied by A.C.

.5 For power supply from the ship's installation to shore or to other ships, there is to be a separate permanent installation directly from the main switchboard or the emergency switchboard. There is to be a connection box or a connection cabinet suitably located on deck for connection of the flexible cable.

Circuits fused not above 63 A may be connected by means of socket-outlet and plug, instead of by the method mentioned above.

The flexible cable from the ship is to be provided with an appliance connector for connection on shore or on board other ships when the circuit is fused 63 A or less.

Power supply from the ship's installation to shore or to other ships is not permitted if the ship's power sources thereby can be operated in parallel with power sources on shore or on board other ships.

G u i d a n c e:

Such installations will usually be of use only on board salvage vessels, for power supply to other ships, and for car ferries, for power supply of installations for operation of car ramps on shore.

It will usually be necessary to have a phase-sequence indicator and a phase-sequence change-over switch on shore in order to avoid incorrect direction of rotation for the motors.

§ *1621* . *Outgoing main circuits.*

.1 In the main switchboard each outgoing circuit is to be provided with:

a) A multipole circuit-breaker, or

b) A multipole fused circuit-breaker, or

c) A multipole switch and fuse in each insulated phase (pole).

The fuses are to be installed between the bus-bars and the switch. However, the switch may be installed between the bus-barsand the fuses on the following conditions:

- The switch is to have a breaking capacity of at at least six times its rated current.

- The making capacity of the switch is to be so adapted in relation to the back-up short circuit protection that no damage of the switch occurs when it is closed on a short-circuit, or

- The connection between the switch and the fuses is to be installed in a short-circuit and earth-circuit-proof way, see § 1457.2.

.2 In distribution switchboards, each outgoing circuit is to be provided with:

a) A multipole circuit-breaker, or

b) A multipole fused circuit-breaker, or

c) A multipole switch and fuse in each insulated phase (pole). The switch may be omitted when the fuses are rated 63 A or less.

.3 In emergency switchboards, the outgoing circuits are to be designed according to the requirements for outgoing circuits from the main switchboard. Outgoing circuits on that part of the emergency switchboard which serves as a distribution switchboard may be designed according to the requirements for outgoing circuits from distribution switchboards.

.4 Overcurrent protection may be omitted for circuits supplying motors or other consumers having overcurrent protection in their control gear.

.5 Equipment with rated current above 10 A is generally to be protected according to its rated current, unless otherwise specified.

.6 For circuits supplying non-important consumers , circuit-breakers with insufficient breaking capacity, e.g. miniature circuit-breakers, can be used, provided that they are supplemented ("backed up") by a common circuit-breaker or fuses with

sufficient breaking capacity. The generator protection is not permitted to be used as such back-up protection.

.7 When the starting of a motor usually requires that two or more generators are run in parallel, interlocking is to be proveded, ensuring that the motor concerned can be switched on only when a sufficient number of generators are connected.

.8 Switchgear for outgoing circuits is not permitted to be used as control gear for the consumers concerned. The Electricity Supervision may permit exemptions when at least the following conditions are fulfilled:

- The switchgear is to be installed in a separate cubicle in the switchboard and separated from other cubicles and from the bus-bars by arc-proof partitions of at least flame-retardant material.

- It must be possible to isolate the switchgear from the bus-bars by a separate multipole isolating switch, or by fuses in each insulated phase (pole).

§ *1623.* *Lighting circuits.*

.1 Lighting circuits are not to be fused above 16 A. However, separate circuits to searchlights or similar may have fuses above 16 A.

Lighting circuits fused 16 A may supply the following maximum number of lighting points including socket-outlets:

System voltage V	Number of outlets
0 - 48	10
49 - 127	14
128 - 250	18

.2 Lighting installations with more than one lamp in each lighting point will be considered by the Electricity Supervision in each case.

§ *1625.* *Steering gear circuits.*

.1 Installations with one motor are to be supplied by a separate circuit from the main switchboard.

a) A multipole circuit-breaker, or

b) A multipole fused circuit-breaker, or

c) A multipole switch and fuse in each insulated phase (pole).

The fuses are to be installed between the bus-bars and the switch. However, the switch may be installed between the bus-barsand the fuses on the following conditions:

- The switch is to have a breaking capacity of at at least six times its rated current.

- The making capacity of the switch is to be so adapted in relation to the back-up short circuit protection that no damage of the switch occurs when it is closed on a short-circuit, or

- The connection between the switch and the fuses is to be installed in a short-circuit and earth-circuit-proof way, see § 1457.2.

.2 In distribution switchboards, each outgoing circuit is to be provided with:

a) A multipole circuit-breaker, or

b) A multipole fused circuit-breaker, or

c) A multipole switch and fuse in each insulated phase (pole). The switch may be omitted when the fuses are rated 63 A or less.

.3 In emergency switchboards, the outgoing circuits are to be designed according to the requirements for outgoing circuits from the main switchboard. Outgoing circuits on that part of the emergency switchboard which serves as a distribution switchboard may be designed according to the requirements for outgoing circuits from distribution switchboards.

.4 Overcurrent protection may be omitted for circuits supplying motors or other consumers having overcurrent protection in their control gear.

.5 Equipment with rated current above 10 A is generally to be protected according to its rated current, unless otherwise specified.

.6 For circuits supplying non-important consumers , circuit-breakers with insufficient breaking capacity, e.g. miniature circuit-breakers, can be used, provided that they are supplemented ("backed up") by a common circuit-breaker or fuses with

sufficient breaking capacity. The generator protection is not permitted to be used as such back-up protection.

.7 When the starting of a motor usually requires that two or more generators are run in parallel, interlocking is to be proveded, ensuring that the motor concerned can be switched on only when a sufficient number of generators are connected.

.8 Switchgear for outgoing circuits is not permitted to be used as control gear for the consumers concerned. The Electricity Supervision may permit exemptions when at least the following conditions are fulfilled:

- The switchgear is to be installed in a separate cubicle in the switchboard and separated from other cubicles and from the bus-bars by arc-proof partitions of at least flame-retardant material.

- It must be possible to isolate the switchgear from the bus-bars by a separate multipole isolating switch, or by fuses in each insulated phase (pole).

§ *1623. Lighting circuits.*

.1 Lighting circuits are not to be fused above 16 A. However, separate circuits to searchlights or similar may have fuses above 16 A.

Lighting circuits fused 16 A may supply the following maximum number of lighting points including socket-outlets:

System voltage V	Number of outlets
0 - 48	10
49 - 127	14
128 - 250	18

.2 Lighting installations with more than one lamp in each lighting point will be considered by the Electricity Supervision in each case.

§ *1625. Steering gear circuits.*

.1 Installations with one motor are to be supplied by a separate circuit from the main switchboard.

.2 In installations with two motors, each of these is to have a separate circuit direct from the main switchboard. However, one of the circuits may be connected to the emergency switchboard.

A change-over system may be arranged in the steering-gear compartment so that each circuit can supply either of the motors or both at the same time.

The circuits to the motors are to be separated throughout their length as far as possible. The cables are however not to be installed in the collision zone.

G u i d a n c e:

The collosion zone denotes a zone from the ship's side with a width of 1/5 of that of the ship at any place.

.3 Fuse-gear and switchgear in circuits to steering-gear motors are to be located in the switchboard in such a way that a fault which puts one circuit out of operation will not, as far as possible, influence the other circuit.

§ *1628*. Secondary distribution, circuits.

.1 For circuits supplied from rotary convertors the requirements in § 1617 apply.

.2 When a secondary distribution switchboard is supplied from two or more transformers or convertors the circuit from each transformer or convertor must be proveded with:

a. A separate multipole circuit-breaker, or

b. A separate multipole fused circuit-breaker, or

c. A separate multipole switch and fuses in each insulated phase (pole). Fuses may be omitted when two power supply units of the same rating are used.

.3 When interlocking arrangements are used to prevent more than one power supply unit from being connected at the same time, the interlocking is to be such that a fault in it cannot put more than one circuit out of operation.

§ *1631*. *Switchgear between bus-bar sections.*

.1 Such switchgear is to have sufficient breaking and making capacity for the purpose.

In order to prevent incorrect operation, signboards with necessary operation instructions for correct use are to be placed near the operating gear.

.2 Short-circuit, overcurrent and under-voltage protection are not permitted, with the following exemptions:

a. Circuit-breakers and fused circuit-breakers, when used as back-up protection according to § 1621.6.

b. Circuit-breakers, fused current-breakers and contactors, when used for automatic tripping according to § 1617.8. Such contactors are to have sufficient breaking capacity, or separate fuses for back-up protection.

§ *1641*. *Main switchboards - location, accessibility, protection.*

.1 Main switchboards are to be installed in easily accessible and well ventilated locations where combustible gases, acid vapours or similar do not occur. The switchboards are to be located well clear of heat sources such as boilers, heated oil tanks, steam-exhaust pipes or other heated pipes.

.2 Main switchboards are normally to be located so that pipes do not lead above, immediately below, in front of or behind the switchboards. If sufficient distance from the pipes cannot be obtained, the switchboards are not to be located where the pipes have joints, valves and similar. The pipes are further to be screened to protect the main switchboard against splashing or leakages.

.3 When switchboards are so located that humidity and oil vapours can penetrate from below, the switchboards are to have tight bottom plates with tight cable penetrations.

.4 In front of main switchboards there is to be a passageway with a free width of at least 0.8 m throughout its length and a free height of at least 2 m.

At the rear of main switchboards which have parts requiring operation from the rear, there is to be

passageway with a free width of at least 0.6 m throughout its length and a free height of at least 2 m. At frames and stiffeners the width may be reduced to 0.5 m.

Doors on the front and rear of main switchboards are, in the open position, not to obstruct the passage ways.

.5 Each panel of the main switchboard is to be provided with handrails along the passageway. Handrails are to be rigid. They are to be of insulating material or are to be covered with insulating material of a thickness at least 2.5 mm along the whole length. On open-rear switchboards the handrails are to be horizontal and so arranged to prevent anyone from falling onto live parts.

The floor in the passageway is to be covered by mats or grating of oil-resistant, insulating materials.

.6 The roof of main switchboards is at least to comply with the requirements for enclosures of IP 22. The roofplate is to reach at least 5 cm outside the switchboard on all sides. Moreover, the construction must comply with the requirements for enclosure of IP 20, however, openrear switchboards may be permitted in special cases.

.7 Cable entries are to be as stated in § 1201.6.

.8 Instruments and control gear except for isolating switches, are to be installed on the front of the switchboard.

Other components which need to be operated or inspected are to be installed easily accessible behind hinged doors, see, however, .6. The location is to be such that live parts cannot readily be touched and the danger of causing short-circuits and earth faults is reduced as far as is practical.

Fuse-bases are to have partitions of insulating and at least flame-retardant material between the phases (poles) unless the construction is such that short-circuits cannot be caused during insertion and removal of the fuses.

.9 All components, including cables and conductors are to be installed so that they are easily accessible for inspection, maintenance and repair.

.10 Equipment for different distribution systems is to be located in separate cubicles, or is to be separated by arc-proof partitions of at least flame-retardant material.

.11 Each generator is to have a separate control cubicle. Partitions between the generator cubicles themselves and between the generator cubicles and other cubicles are to be arc-proof and of at least flame-retardant material.

The switchgear for circuits to important consumers is also to have such separation mutually and against the rest of the switchboard when it is possible for the arcs, due to short-circuits, to be transmitted to other parts of the switchboard.

.12 Main switchboards are to have a pressure relief arrangement when the pressure caused by short-circuits makes it necessary. The pressure relief arrangements is not to be mounted on the front of the switchboard.

§ *1643.* *Main switchboards - mechanical parts.*

.1 Frameworks, cubicles and doors are to be of steel or seawater resistant aluminium alloy. The construction is to be rigid.

By construction and installation the necessary measures are to be taken in order to prevent damage caused by vibration.

.2 Doors are to have an easily operated locking device. Furthermore, there is to be an arrangement for keeping the doors in an open position. For smaller, light doors this arrangement can be omitted. Doors are to be hinged to the framework of the switchboard.

§ *1645.* *Main switchboards - bus-bars and bare conductors.*

.1 Bus-bars and bare conductors are to be of copper. The minimum permitted cross-section for bus-bars and bare conductors is 6 mm^2.

The maximum permanent load for bus-bars and bare conductors with cross-section 10 mm^2 and less is not to exceed the values given in § 1881, table IV.

For cross-sections above 10 mm^2 the dimensions are to be such that the conductor temperature does not exceed 90°C.

The neutral conductor in 3-phase 4-conductor systems is to have a cross-section at least 50% of that of the phase conductors, however, not less than 30 mm^2.

G u i d a n c e:

Recommondations for the dimensioning of bus-bars and bare conductors are given in DIN 43671 and in similar standards.

.2 Bus-bars and bare conductors are to be installed on insulating materials in accordance with § 2306.

The distance between live parts of different polarity or belonging to different circuits is to be at least 19 mm (3/4"). The distance between live parts and other parts and supports, own supports not included, is to be at least 16 mm (5/8"). However, these requirements do not apply to equipment which is approved with shorter distances.

.3 Bus-bars and bare conductors with their supports are to have sufficient mechanical strength to withstand the dynamic stresses during short-circuit.

Short-circuit calculations are to be based upon IEC recommendations, or other equivalent calculating methods.

.4 Bus-bars and bare conductors are to be protected when they are so located that e.g. tools falling down on them,may cause short-circuits.

§ *1648.* *Main switchboards - internal wiring, connection of cables.*

.1 For the installation of cables and insulated conductors the requirements in section 18 apply as far as applicable, with those additions and exemptions which are stated in the following .2 - .6.

.2 Connections from the bus-bars and from the generator circuit terminals to circuit-breakers and fuses are to be installed in a short-circuit-proof and earch-fault proof manner, as far as is practical.

The same applies to connections from the terminals of secondary circuits of convertors when the back-up fuses do not give short-circuit protection.

The same also applies to other connections which do not have sufficient short-circuit protection.

Such connections are to be as short as possible.

G u i d a n c e:

Concerning short-circuit-proof and earth-fault-proof installations, see § 1457.2, Guidance.

.3 The cables of each generator's control and tripping circuits, e.g. undervoltage circuit, are generally to be installed within the generator's cubicle. However, control circuits for the making and breaking of the circuit-breaker and circuits for synchronizing may be connected to a common control panel provided that the construction is such that the control command is given by closing the circuit (normally open circuit). Furthermore, it must be possible to operate the circuit-breaker from the generator panel and to disconnect the circuits by means of switches or fuses.

.4 When cables and insulated conductors are installed in bunches or ducts, due consideration must be given to the reduced heat dissipation when calculating the load, see § 1881.

.5 Incoming and outgoing cables are to be connected to suitable fixed terminals located in accessible positions and with sufficient space for the connection. The terminals of the circuits' switch- and fuse-gear may be used for this purpose when the requirements concerning accessibility and sufficient space are complied with.

.6 Earth-bars are to be so arranged and located that earth conductors and their terminals are easily accessible, when the installation is completed.

§ *1651.* *Main switchboards - location of switchgear.*

Switchgear is to be so located that arcs which may occur by making and breaking cannot cause short-circuits.

§ *1653.* *Main switchboards - instruments.*

.1 Instruments are to have a nominal accuracy of at least 2.5%. The scale graduation is to be adapted for the use in each case.

Ammeters and wattmeters are to have an upper scale limit of at least 130% of the rated full-load of the circuit. For generators which are run in parallel, the instruments are to have scales for reading of reverse current or reverse power corresponding to at least 15% of the rated full load of the circuit.

Voltmeters are to have an upper scale limit of at least 120% of the rated voltage.

Frequency meters are to have a scale range of at least ±8% of the nominal frequency.

The scales on ammeters, wattmeters and voltmeters which are required, according to these regulations, are to have a red mark at the rated value.

Instruments are to have efficient screening which reduces the faults caused by induction.

.2 On the switchboard each D.C. generator is to have:

- One ammeter. For compound wound generators the ammeter is to be connected in the pole opposite to that in which the series winding is connected.

- One voltmeter. For generators run in parallel, 2 voltmeters may be used instead of one voltmeter for each generator. One of these is to be permanently connected to the bus-bar and the other one is to be provided with a change-over switch for connection to the different generators.

.3 On the switchboard each A.C. generator is to have:

- One ammeter in each phase, or one ammeter with change-over switch for connection to all phases.

- One wattmeter indicating the actual three phase load. On a three-phase, three-wire system with insulated neutral, single-phase connection may be used, provided that the load distribution during normal use is such that more than 5% unbalance, referred to full-load, will not occur. For generators which cannot be run in parallel, the wattmeter may be omitted.

- One frequency meter.

- One voltmeter.

For generators which are run in parallel, 2 frequency meters may be used instead of one frequency meter for each generator. One of these is to be permanently connected to the bus-bars and the other one is to be provided with a change-over switch for connection to the different generators.

.4 For A.C. generators which can be run in parallel there are to be two independent sets of synchronizing devices, of which at least one set is to be synchronizing lamps.

.5 Each secondary distribution system is to have:

- One ammeter.

- One voltmeter.

.6 Each primary and secondary distribution system is to have a device for insulation control.

.7 Concerning shore connection, see § 1619.

.8 Concerning emergency power installations, see section 15.

§ *1657.* *Main switchboards - adjustment devices.*

.1 Control gear for voltage regulation of D.C. generators and control gear for adjusting the speed of the prime motors for generators, except for propulsion engines, are to be installed on the front of the main switchboard. The requirements in § 1648.3 apply correspondingly.

§ *1659.* *Emergency switchboards.*

For emergency switchboards the requirements for main switchboards apply. However, see § 1621.3

§ *1661.* *Distribution switchboards.*

.1 For construction and location of large distribution switchboards the requirements for main switchboards apply.

.2 Other switchboards are to be located in easily accessible places. They are to have enclosures suitable for the conditions of the location.

.3 All parts which require operation during normal use are to be installed on the front of the switchboard or easily accessible behind hinged front doors.

When such parts are installed behind front doors, bare live parts are to be protected against inadvertent touching by means of fixed covers of at least flame-retardant material. These covers are to comply with the requirements for enclosure IP 20.

.4 Distribution switchboards are to have lockable doors, and the doors are to be kept locked when the switchboards are normally accessible to persons not concerned with their use.

.5 Each distribution switchboard is not to have more than one supply circuit unless there is an arcproof partition of at least flame retardant material between the systems.

.6 If one circuit supplies several distribution switchboards, it must be possible to disconnect each of these by a switch in the switchboard. Components in the switchboard remaining live after the disconnection are to be protected against inadvertent touching by means of a fixed cover or similar of at least flame retardant material, complying with the requirements for enclosure IP 10.

.7 The requirements for main switchboards, see §§ 1641-1657, apply as far as applicable.

§ *1665. Navigation light switchboard.*

.1 Electrical masthead lanterns, port and starboard lanterns, stern lanterns, anchor lanterns and lanterns for ships not under command (N.U.C.) as required in the Rules of the Norwegian Ship Control, are to be connected to a special switchboard - navigation light switchboard - using separate circuits for each lantern. The switchboard is not to be used for other purposes. However, other lanterns which are required in the Rules of the Norwegian Ship Control may be connected.[1)]

.2 Electrical emergency masthead lanterns, port and starboard lanterns, stern lanterns, anchor lanterns and lanterns for ships not under command (N.U.C.) as required in the Rules of the Norwegian Ship Control, are to be connected to a special switchboard - navigation light switchboard - using separate circuits for each lantern. The switchboard is not to be used for other purposes.

The navigation light switchboards according to .1 and .2 are to have marking "hovedlanterner" and "reservelanterner" or other equivalent marking (e.g. "main lanterns" and "emergency lanterns").[1)]

.3 The navigation light switchboard in .1 is to have two supply circuits from the main switchboard. When the ship has an emergency power source one of the supply circuits is to be connected to the emergency switchboard. The supply circuits may be run via distribution switchboards. On the navigation light switchboard these circuits are to be connected through a change-over switch.

.4 The navigation light switchboard in .2 is to have a separate supply circuit from the emergency switchboard or from a separate battery having sufficient capacity for the ship's trade. In addition, the navigation light switchboard may be supplied from another power source. On the navigation light switchboard these circuits are to be connected through a change-over switch.

.5 The navigation light switchboards in .1 and .2 are to be located in the wheel-house and in such a way that they can be easily observed by the officer on duty.

.6 The navigation light switchboards in .1 and .2 are to be electrically separated from each other and from switchboards used for other purposes. They are each to have separate arc-proof enclosures of at least flame-retardant material. For the construction, the requirements for distribution switchboards apply, see § 1661.

1) The text in .1 and .2 has been changed according to Communication no. 4/76 from the NVE, Directorate of Electricity.

G u i d a n c e:

The requirement concerning electrical separation implies that cables supplying the navigation light switchboard itself, e.g. from a control panel situated where the switchboard is installed, are to be in separate conduits or as separate cables for each circuit. The requirement also implies that terminals in such circuits are to have separate arc-proof enclosures of at least flame-retardant material.

.7 On the switchboard each navigation light circuit is to have:

a. A multipole circuit-breaker, or

b. A multipole fused circuit-breaker, or

c. A multipole switch and fuses in each insulated phase (pole).

For these circuits complete protection of the supply circuits is required against short-circuits and over-currents.

.8 On the switchboard each navigation light circuit is to have an automatic warning device giving optical and acoustic warning when a navigation light burns out or if the protective device operates when the circuit is switched on. It must be possible to switch off the acoustic warning device when a fault is warned, but it is to have an automatic reset to give warning of a succeeding fault.

The warning device is to be constructed in such a way that faults in it cannot cause the navigation lights to go out.

The optical warning device is to be such that it will not cause dazzling in the dark. A device for reducing the light intensity may be fitted. It must not be possible to disconnect the optical warning.

.9 On ships built to travel in both directions and with one set of navigation lights for each direction, there is to be optical warning which automatically indicates which set of navigation lights is connected.

G u i d a n c e

To prevent reduction of vision, the signal lamp indicating which set of navigation lights is switched on must be placed behind the helmsman - in the rear of the wheel-house according to the direction of the ship. For ships built for travel in both directions a lamp indicating when the wrong set of navigation lights is switched on must be placed in front of the helmsman so that he cannot avoid seeing it.

.9 Navigation light switchboards are to be type approved, see § 1260.4.

G u i d a n c e:

The requirement for central approval also applies for navigation light switchboards for voltages below 42 V if a navigation light switchboard is required for the ship according to the Rules of the Norwegian Ship Control.

SECTION 17. CONTROL GEAR FOR MOTORS AND OTHER EQUIPMENT.

§ *1701. Control gear for motors.*

.1 Each motor is to be provided with a separate:

a. Multipole circuit-breaker, or

b. Multipole fused circuit-breaker, or

c. Multipole contactor.

For motors rated less than 1.0 kW only multipole switches are required.

.2 Each motor with its control gear is to be arranged for individual isolation from the supply circuit by means of:

a. Multipole isolating switch at the control gear, or

b. The circuit switchgear on the switchboard, or

c. The circuit fuses.

The switchgear in a. and b. is to be lockable or is to be protected in another way, and when necessary kept locked or protected in "off" position if so located that it cannot be watched while work is in progress on the motor and its control gear. However, non-important motors supplied from a distribution switchboard may have a common isolating device. The switchgear or the fuses in the supply circuit to the switchboard may be used for such isolating. Switchgear used for this purpose is to be lockable, and when necessary be kept locked in "off" position.

.3 The control gear for each motor is to be provided with a separate enclosure.

The control gear for duplicate motor serving the same important purpose may, instead of having a separate enclosure, be installed in main switchboard cubicles or distribution switchboards, but not in the same cubicle or the same distribution switchboard as one another.

The control gear for motors serving other purposes may be located in a common enclosure or switchboard when the following conditions are fulfilled:

a. The equipment for each of the motors is separated, also from other current-carrying equipment, including current-carrying bus-bars, by means of arc-proof partitions of at least flame-retardant material. The arrangement is to be such that maintenance and repairs of the motor equipment can be carried out without danger when this equipment is isolated while the rest

is live. However, these requirements do not apply to the equipment for non-important motors when this equipment is placed in a common enclosure or distribution switchboard and provided with a common isolating device as specified in .2.

b. On the main switchboard the equipment is to be located in separate cubicles or parts of cubicles, separated from other parts by partitions of at least flame-retardant material. The arrangement is to be such that arcs occuring by short circuit in a starter cannot spread to the bus-bars.

c. When the equipment is located in different main switchboard cubicles according to the foregoing, these cubicles are to be separated from each other by arc-proof partitions of at least flame-retardant material.

G u i d a n c e:

The provision does not prevent control-current switches and signal lamps being installed in a common enclosure, e.g. control desk.

.4 The method of starting motors is to be such that voltage and frequency variations are limited to the permissable values, see §§ 1306-1307.

.5 For the connection and disconnection of automatically controlled motors, the control device is not to be directly connected in the main current circuit. However, this does not apply to motors rated less than 1.0 kW.

.6 Control circuits for motors duplicated for the same important purpose, are to be kept separate from each other, and are not to be located in the same enclosure. However, a common control device for such motors is permitted when only one can be run at a time. Common devices for such motors are to have a separate enclosure, and the construction is to be such that only the control device for the running motor is energised from the common control current circuit. However, the starter of the motor which is not running may be energised from the common control circuit, provided that this supply can be disconnected by a switch located in the common device enclosure.

The starters are to be arranged for individual operation.

.7 The requirements for distribution switchboards also concern control gear for motors as far as they apply, see § 1661.

§ 1705. *Protection of motors.*

.1 Motors are to have protection against overcurrent, short circuit and undervoltage.

The protection is to be such that the motor cannot be overheated in a non-permissable way.

However:

- The overcurrent protection can be omitted for motors serving important purposes, when these are duplicated and have overcurrent alarm. For steering gear motors, see § 1711.
- Undervoltage protection can be omitted for motors rated less than 1.0 kW.

.2 The protection against overcurrent is to be by:

a. Overcurrent relays in each insulated phase (pole), or

b. Temperature detectors in the motor windings, which have appurtenant devices giving equivalent protection of the motor, or

c. Other equivalent approved devices.

For D.C. motors, overcurrent relay in one pole only is accepted. The overcurrent protection in the switchboard is then not to be omitted see § 1621.4.

.3 Overcurrent relays are generally to be adjustable within the range 90% - 110% of the motor's rated current, with sufficient time delay adapted to the starting current of the motor.

Overcurrent relays are to have manual reset.

For adjustment of the motor protection, see § 1885.

G u i d a n c e:

In certain cases it may be preferable to adjust the protection according to the actual load current to prevent the equipment driven by the motor from being damaged.

.4 Protection against short circuit is to consist of:

a. Fuses in each insulated phase (pole), or

b. Multipole circuit-breaker, or

c. Multipole fused circuit-breaker.

.5 Undervoltage protection is not to preclude the intended automatic reconnection upon restoration of the voltage after a voltage "black-out". The arrangement is to be such that the total starting current of motors which have automatic restart, will not cause excessive voltage or overcurrent.

G u i d a n c e:

Undervoltage protection should be adjustable within the range 60-85% of the rated voltage.

§ *1708.* *Emergency stop control.*

.1 Motors for the following purposes are to have emergency stop control readily accessible, located outside the engine and boiler rooms:

- Fuel oil pumps, including transfer pumps.
- Fuel oil separators.
- Cooling oil pumps for fuel oil valves.
- Fans for boilers.
- Ventilation fans for engine and boiler rooms.
- Ventilation fans in .2.

.2 Motors for the following purposes are, in addition to the emergency stop control in .1, to have emergency stop control located on the bridge:

- Ventilation fans for accommodation spaces.
- Ventilation fans for galleys.
- Ventilation fans for holds.
- Ventilation fans for car decks.

However, when the normal control switches are located on the bridge the emergency stop control there can be omitted.

.3 Motors for oil pumps and fans for oil heating plants sited elsewhere than in engine and boiler rooms are to have emergency stop control located readily accessible outside the room concerned.

G u i d a n c e:

The requirement in .1 and .3 concerning the location of the emergency stop control involves consideration being given to the ship's size and type, manning etc.

The requirement may, in certain cases, involve emergency stop controls for the same motor being located in different places.

.4 Emergency stop control is to have particularly conspicuous marking. It must be protected against accidental operation.

§ *1711.* *Steering-gear - control gear and monitoring equipment, protection.*

.1 Steering-gear motors are to be provided with control gear and protection in accordance with §§ 1701 and 1705, with the following exemptions:

- Overcurrent protection is not to be fitted.
- For motors where direct-on-line starting may be permitted according to § 1701.5, the starter may be a multipole switch.

G u i d a n c e:

The requirement that overcurrent protection is not to be fitted, entails that fuses used as short circuit protection must have a rated current of at least 2 times the rated current of the motors. Correspondingly, with circuit-breakers used as short circuit protection, the adjusted tripping current of the overcurrent relay is to be at least twice the rated current of the motor.

.2 Steering-gear motors are to be controlled from the engine room and from the bridge.

The arrangement is to be such that the motors can be started and stopped independently from either of these operating positions.

.3 The control gear is to be such that the motors will restart automatically upon restoration of the supply after a voltage "black-out", provided that disconnection has not been effected.

.4 Each steering-gear motor is generally to be provided with the following monitoring device in the engine room, on the bridge easily observable by the officer on duty, and at other operating stations:

- Signal lamp, green, lighting when the motor is running.
- Signal lamp, red, and acoustic device indicating overcurrent occuring when the motor is running or voltage failure.

It must be possible to switch off the acoustic warning device when a fault is warned, but it must have automatic reset for warning of a succeeding fault. The

supply to the warning lamp and the acoustic warning device is to be independent of the supply to the steering-gear motor.

The warning device is to be constructed in such a way that a failure in it cannot cause the motor to stop running.

The signal lamps may be provided with dimmers.

.5 For electro-handhydraulic steering-gear which has automatic change-over to handhydraulic operation when the electric-driven pump stops, the signal lamp and the acoustic warning device may be omitted.

§ *1714.* *Steering-gear - control-circuits.*

.1 If the rudder is electrically operated from the bridge, there must be:

a. 2 independent electrical control systems, or

b. 1 electrical control system and 1 independent, manually-driven system, or

c. 1 electrical control system and an arrangement for manual steering in the steering-gear room with telephone communication to the bridge.

.2 When 2 independent electrical control systems are used, the supply to these must be:

a. 2 separate circuits as for important consumers according to the requirements in § 1606.3 or in § 1608.2, or

b. 2 separate circuits branched off from the 2 separate steering-gear motor circuits.

If one electrical system is used, the supply to this is to be a circuit as for important consumers according to the requirements in § 1606.3 or in § 1608.2. However, on single-motor installations the circuit may be branched off from the steering-gear motor circuit.

.3 If 2 independent systems are used, these are usually to be separated from each other by using separate cables. The equipment in these 2 systems is to be separated from each other by using separate enclosures.

However, change-over-switches between the systems and/or between "hand"- and "gyro" - steering systems may be accepted. The systems must then be arranged for disconnection from the common parts, and it must be possible to use "hand"-steering regardless of faults occuring in the other system or in the common parts. The 2 electrical systems may be operated by the same wheel or lever shaft.

.4 Each electrical system is, at each of the operating stations, to have a green signal lamp indicating when the system is ready for operation. The lamp on the bridge is to be easily observable by the officer on duty. The lamp may be provided with a dimmer.

.5 When there are more steering controllers which have control circuits branching off from the main steering controller, it must be possible to disconnect each such circuit by a multipole switch on the main steering station.

§ *1719.* *Control gear for consumers other than motors.*

.1 Equipment, other than motors, is to have at least a multipole switch. However, in dry areas which have insulating floor-covering any lighting equipment using filament lamps (which are not required to be earthed), may have single-pole switches.

.2 Control gear supplied from different circuits is usually not to be installed in the same enclosure. However, exemptions as specified for motor control gear are accepted, see § 1701.

.3 Control circuits for important consumers are to be constructed according to the same requirements as specified for motor starters, see § 1701.

SECTION 18. CABLES.

§ *1801.* *Approval.*

.1 Cables are to be of a manufacture and type approved by the NVE for installation on board ships.

.2 Cables for permanent installations are usually approved on the basis of the specifications in International Electrotechnical Commission Publication 92-3 (1965) with later amendments and additions, however, see §§ 1805 and 1811.

Flexible cables are usually approved if in conformity with CEE-specifications.

G u i d a n c e:

Temperature classes, type designations for insulating materials etc. referred to in section 18 are in accordance with IEC Publications 92-3 (1965) with later amendments and additions.

§ *1805.* *Conductors.*

Conductors are to be of copper and are to be stranded. However, solid conductors are accepted for mineral-insulated cables.

§ *1807.* *Classification of insulating materials.*

Within the following temperature classes the following materials can be used:

60°C: Polyvinylchloride (PVC), type V 60.

75°C: Polyvinylchloride (PVC), type V 75.

80°C: Butyl Rubber, type B 80.

85°C: Ethylene Propylene Rubber (EPM, EPDM), type E 85.
Cross-linked Polyethylene (PEX), type R 85.

95°C: Silicone Rubber, type S 95.
Mineral insulation, type M 95 (see § 1816)

§ *1811.* *Protective sheaths, screen, braid or armour.*

.1 Within the following temperature classes the following materials can be used:

60°C: Polyvinylchloride (PVC), type SV 1.

85°C: Polyvinylchloride (PVC), type SV 2.
Polychloroprene (PCP), type SP 1.
Chlorosulphonated Polyethylene (CSP), type SH 1.

95°C: Silicone Rubber, type S 95.

All temperature classes:

Lead
Copper
Metal-screen, -braid, -sheath and -armour.

.2 The sheath of multi-core cables is to have an external protective sheath of non-metallic material. The screen, braid, sheath or armour of metal is also to be protected by this external protective sheath. For mineral-insulated cables, an outer corrosion-proof sheath is required when they are to be mounted on supports where corrosion between the cable and the support might otherwise occur.

.3 Sheath materials are to be such that the cable is at least flame-retardant, see § 1185.

§ *1812.* *Marking.*

The manufacture type designation, size and rated voltage is to be indicated on the protective sheath of the cable.

§ *1813.* *Single-core conductors.*

The insulating material is to be at least flame-retardant, see § 1185.

§ *1816. Mineral-insulated cables.*

.1 For circumstances not covered by the specifications in this paragraph or in IEC-Publication 92-3 (1965) with later amendments and additions, the IEC-recommendations or corresponding national standards for mineral-insultated cables apply.

.2 The maximum conductor cross section permitted is 130 mm^2 (0.2 sq. in.)

.3 The minimum permitted average thickness of the insulation is:

For cables having rated voltage 250 V: 1.0 mm.
For cables having rated voltage 750 V: 1.5 mm.

§ *1831. Range of use for cables.*

.1 Cables are to be installed and used in such a way that they are not subject to stresses higher than calculated.

.2 General ranges of use for cables permanently installed are as follows, but with the further limitations stated in §§ 1835, 1837, 1843:

a. Single-core cables: switchboard installation. Installation in conduits in dry areas in accommodation quarters when the system voltage is not above 250 V.

b. Cables having insulation type V 60: dry areas in accommodation quarters and in equivalent areas.

c. Cables having insulation type V 75, B 80, E 85, R 85, S 95, M 95: anywhere on board ships.

.3 General ranges of use for flexible cables are as follows, but with the further limitations stated in §§ 1835, 1837, 1840:

a. Tough oil-proof rubber-sheathed cable or better: anywhere on board ships where flexible cables are permitted.

G u i d a n c e:

Tough oil-proof rubber-sheathed cable is a cable constructed according to CEE (2) 65. Norwegian type designation: NMHVO.

b. Ordinary tough rubber-sheathed cable or better: in accommodation and equivalent areas.

G u i d a n c e:

Ordinary tough rubber-sheathed cable is a cable constructed according to CEE (2) 53. Norwegian type designation: NMH.

c. Light plastic-insulated flexible cable or better, round-shaped: in accommodation and equivalent areas.

G u i d a n c e:

Light plastic-insulated flexible cable, round-shaped, is a cable constructed according to CEE (13) 52. Norwegian type designation: PLH.

.4 Cables are to have rated voltage not less than the system voltage of the circuit.

.5 The minimum cross section permitted is 1.5 mm^2, with the following exceptions:

- Internal wiring in control boards and similar may have cross section 1.0 mm^2.

- For ships being built outside Norway the minimum conductor cross section usual in the country concerned is permitted, but not less than 1.0 mm^2. This also applies to ships being repaired abroad, provided that this fits in with the remaining installations on board.

- Flexible cables for portable equipment and internal wiring of lighting fittings and equipment may have cross section 0.75 mm^2. The rated current of the equipment is then not to be above 6 A, and the circuit is not to have fuses above 16 A, or equivalent protection.

.6 Separate cables or separate conduits are to be used for all circuits having separate short circuit protection or overcurrent protection according to § 1621. However, a control circuit branched off from its main circuit may be carried in the same cable, flexible cable or conduit as the main circuit. The conductors are then to be marked to prevent mistakes being made.

.7 Circuits for heavy-current, light-current, different voltages or types of current are not to be carried in a common cable, a common flexible cable or a common conduit.

However, in particular cases, after a decision has been taken by the Electricity Supervision, heavy-current and light-current circuits for control measuring and signal circuits which have different voltages, or types of current,

are permitted to be carried in a common cable, a common flexible cable or in a common conduit. This is on the condition that the light-current conductors fulfil the requirements for insulation of heavy-current conductors. The conductors are to be marked to prevent mistakes being made.

G u i d a n c e:

Lift installations can be mentioned as an example of such a special case.

§ *1835.* *Limitations in use related to temperature classes.*

.1 The temperature class of cables is to be at least 10°C above the ambient temperature.

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

G u i d a n c e:

For such cables the terminals, etc. are to be constructed for the corresponding temperatures

§ *1837.* *Limitations in use related to insulating materials.*

.1 With regard to the thermal stresses by short-circuits, the cross section of PVC-insulated cables is to be at least:

$$A = 0.0517 \cdot I_k'' \cdot \left(\frac{U}{100}\right)^2$$

A = Cross section in mm^2

I_k'' = Subtransient short-circuit current (r.m.s. value) at the supply end of the circuit, kA.

U = System voltage, V.

Internal PVC-insulated cables in switch-boards, when "short-circuit-proof" installed, are exempt from this requirement.

.2 Cables with PVC insulation and/or common sheath of PVC are not permitted to be used in places where the ambient temperature is likely to be -20°C or below. Such cables are not permitted to be installed across expansion joints on weather decks.

.3 Because of their poor mechanical strength, special precautions are to be taken when using silicon-rubber-insulated cables.

§ *1840.* *Flexible cables.*

.1 The use of flexible cables is to be limited to applications where flexibility is necessary, and they are to be as short as possible.

The cables are to be connected in the area where the equipment is used.

G u i d a n c e:

The requirements are that socket-outlets have to be installed in each area, and at places where portable equipment is likely to be used. The requirements do also mean that the use of extension cables must be limited.

.2 Flexible cables are to be fixed to the equipment and the plug in such a way that the terminations are not subject to tension or torsion. Cables are to have insulating strengthening at the entry on connectors and equipment which may be moved during use.

.3 Equipment which is connected through a flexible cable and which is required to be earthed, is to have earthing through an earth conductor in the cable.

.4 Cable joints without approved connectors or cable couplers are not permitted.

.5 Transition from permanent installation to flexible cable is to be effected through a socket-outlet and a plug.

However, in special cases, the Electricity Supervision may permit another way of connection.

.6 For current ratings of flexible cables the provisions in § 1881 apply.

§ *1841.* *Parallel connection of cables.*

.1 Cables can only be parallel-connected when:

- They have equivalent cross-sections.
- The conductor cross-section is 10 mm^2 or above.
- They have equivalent lengths.

- They are of the same type.

- They have common protection.

.2 Jointing of parallel-connected cables is not permitted.

.3 Parallel-connected single-core cables are to be laid closely together and in such a way that necessary ventilation is obtained.

.4 Parallel-connection of flexible cables is not permitted.

.5 Two-, three- and four-core cables can, when the conductors have equivalent cross-sections, be used as single-core cables. The conductors are to be permanently connected at both ends. Correspondingly, a four-core cable can be used as a two-core cable.

§ *1843. Special provisions for A.C. installations.*

.1 Generally,a.c. current-carrying conductors are to be laid up under a common sheath or in a common conduit.

.2 The neutral conductor is to have an adequate cross section to carry the fault current resulting from a single phase short circuit and to prevent the protection devices to operate within 1 second. Such currents must not cause temperature rises in excess of that permitted for the cable type or the surroundings.

However, the cross-section is not to be less than that of the phase-conductor for cross-sections of 16 mm^2 and less. For larger cross-sections the cross-section of the neutral conductor is to be at least 50% of the cross-section of the phase-conductor, but not less than 16 mm^2.

The neutral conductor is to have synonymous colour coding in all accessible parts of switchboards, boxes, etc.

.3 Cables used for parallel-connection of three phase circuits are to contain all phase-conductors and possible neutral conductors.
However, single-core cables may be used when special circumstances make it necessary, provided that:

- Such cables have no braiding or armouring of magnetic material.

- The cables of the same circuit are laid so that the bunch is not divided by any magnetic material. They have to be laid under the same clips or in the same conduit. Cable penetrations and glands are to be made of non-magnetic material if each and all the cables do not lie together in the penetration or gland.

- Cables for parallel-connection are to be installed in such a way that equal sharing of the current is obtained.

§ *1851. Installation of cables.*

.1 Cables are to be installed in such a way that they are accessible, however, see .2 and .3.

.2 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 plating is removed. However, single cables for wall-lamps, socket-outlets and switches in dry areas may be installed behind wall panels which are not easy to remove. Such panels are to be of non-combustible material. These installations must not be covered over without permission from the Electricity Supervision.

G u i d a n c e:

The requirement that panels or deck-platings are to be "easily removable" means that the panels or the deck-platings have to be hinged or fixed by screws in such a way that they can be taken down without difficulty. Such panels or deck platings should be able to be taken down without damaging the interior.

.3 Cables may be laid in conduits or ducts. Conduits and ducts are to be of ample size and have bending radii large enough for cables to be easily drawn in and replaced. The total external cross-sections of the cables are not to be more than 40% of the internal cross-section of the conduits/ducts.

.4 Cables are not to be installed in or covered over by thermal insulation, but they may be led the shortest way through such insulation.

Cables laid along outer-decks, bulkheads or the hull, are to lie on the inside of thermal insulation.

G u i d a n c e:

Cables passing through thermal insulation in refrigeration or freezer rooms are to be embedded in inserts of materials preventing condensation penetration, e.g. wooden material or plastic.

.5 Cables are to be suitably spaced and/or be satisfactorily protected, against heating stresses from heat sources such as, e.g. boilers, heated oil tanks, steam, exhaust and other heated pipes, besides, see § 1835.1.

G u i d a n c e:

The requirement concerning suitable spacing is usually fulfilled when the distance from the heat source concerned is at least 30 cm.

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

Such pipes, railings and similar are not normally permitted as supports for cables.

.7 Cables are to be laid in such a way that they are not subject to destructive mechanical stresses caused by the movement of the ship, different load conditions, temperature variations etc.

Cables are as far as possible not to be laid across expansion gaps. Where this cannot be avoided, the cables are to be laid in a bend of radius at least 12 times the outer diameter of the largest cable.

.8 Cables are not to be subject to destructive stresses, during their installation.

§ *1855.* *Fixing of cables.*

.1 Cables are to be satisfactorily fixed to the support.

G u i d a n c e:

The requirement concerning satisfactory fixing will usually be fulfilled when the cables are clamped as follows:

- For cables entering enclosures and conduits, the nearest clip 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 clips 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 sheath only)	Cables with copper, bronze or steel-wire braid or armour	Mineral insulated cables with copper or stainless steel sheath
	8	200	250	300
8	13	250	300	370
13	20	300	350	450
20	30	350	400	450
30		400	450	450

.2 Solid clips, saddles or bands of corrosion-proof metal or other equivalent material are to be used as fixing devices. However, fixing devices in dry areas in accommodation quarters may be of non-corrosion-proof metal or other, but they must be of at least flame-retardant material.

For mineral-insulated cables and for fixing to aluminium supports, fixing devices which do not cause corrosion are to be used.

.3 Clips, saddles, bands and supports are not to have sharp edges against the cables.

The deflection of the external sheath of the cable caused by the fixing device is not to be of more than 5% of the external diameter of the cable.

.4 Clips, saddles and bands are to be fixed by screws. However, nail-screws may be used in accommodation quarters.

.5 Provisional fixing devices and suspensions for cables during the course of installation, are to be such that the cables are not exposed to destructive stresses.

§ *1861.* *Mechanical protection of cables.*

Cables are to be installed in such a way that they are not subject to destructive mechanical stresses. Where this cannot be obtained in an installation which in itself gives satisfactory protection, the cables are to be protected with:

a. Solid covers of steel-plates or -profiles, or

b. Solid steel pipes in which the cables are laid.

Cables laid in the following places are always to have such protection.

- Below floor-plates in engine and boiler rooms.

- On open decks in the cargo hold area and in cargo holds.

The thickness of the protection covers is to be of at least 4 mm.

The wall thickness of the protection pipes is to be of at least 2.5 mm.

Cables laid on aluminium supports may have a corresponding protection of aluminium. The thickness is to be of at least 4 mm.

§ *1863. Cable bridges and ladders.*

.1 Cable bridges and ladders 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 they have an aluminium support, the cable bridges and ladders may be made of aluminium.

On open decks and in cargo holds the material thickness of the cable bridges and ladders is to be of at least 4 mm.

.2 Cable bridges and ladders are to be constructed and installed in such a manner that they do not absorb forces or transfer stresses caused by the ship's movements, different load conditions, temperature variations etc.

.3 Cable bridges, 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, and are to have sliding support for the rest.

For cable bridges, pipes and ducts placed up to 2 m above the deck, the expansion/compression possibility is to be at least 10 mm for every 10 m section length. For cable bridges, pipes and ducts placed higher than 2 m above the deck the expansion possibility has to be correspondingly enlarged.

The cables are to be installed in such a way that elongation and compression are prevented. Only bending movements are permitted.

.4 The free (movable) ends of cable bridges, pipes and ducts are to be connected to the next section by a flexible steel plate on which the cables are to be clamped. The steel plate is to be bent to a form having three radii of at least 12 times the cable diameter.

G u i d a n c e:

The distance between the ends of the cable bridges, pipes and ducts will then be 35 - 48 times the diameter of the largest cable.

.5 For expansion boxes, the provisions in § 1865.6 apply.

§ *1865.* *Cable conduits and ducts.*

.1 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, they may be made of aluminium. Concerning cable pipes and ducts in dry areas in accommodation quarters, see .12.

.2 Conduits and ducts are to have a smooth internal surface, and are not to have sharp edges against the cables.

.3 Conduits are to have at least the following average wall thicknesses:

External diameter of the pipe (in)	Minimum wall thickness (mm)
5/8	1.5
3/4	1.5
1	1.8
1 1/4	1.8
1 1/2	2.0
2	2.0
2 1/2	3.0
3	3.2
3 1/2	3.2
4	3.4
5	3.6

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

Ducts are to have at least corresponding average wall thicknesses based upon the external cross-section of the duct.

Conduits which have an internal diameter exceeding 304.8 mm (12 in) are not permitted. The same applies to ducts which have a larger equivalent cross-section.

.4 Pipes and conduits on open decks and in water and fuel-oil tanks are to have at least the following average wall thicknesses:

Internal diameter of pipe (mm)	Minimum wall thickness (mm)
$D \leqq 57,0$	4,0
$57,0 < D \leqq 152,4$	4,5
$152,4 < D \leqq 304,8$	5,5

Ducts are to have at least corresponding wall thicknesses based upon the internal equivalent cross-section of the duct.

G u i d a n c e:

Two concentric pipes should be used through tanks containing combustible liquids and in cargo holds containing combustible loads.

.5 Conduits and ducts are to be installed in such a way that water accumulation is avoided.

.6 Connection and drawing boxes are to be of steel or cast iron, and are to have corrosion protection equivalent to that of the conduits. They are to have at least the same wall thickness as the conduits. However, for aluminium conduits, boxes of aluminium alloy may be used.

Concerning conduit installations in accommodation quarters, see .12.

.7 Cables installed in common conduits or ducts, are to be constructed in such a way that they cannot cause damage to each other.

.8 Cables laid in conduits or ducts which have a horizontal length exceeding 10 m or a vertical length exceeding 3 m, are to have braiding or armouring of bronze wire or steel wire.

.9 Joints of conduits and conduit connections to boxes, switchboards, enclosures etc. are to be of threaded construction or of other construction specially approved by the NVE. This does not apply to expansion connections.

.10 Conduits, ducts and boxes are to be securely fixed to a strong and stable support, and in such a way that they are not subject to vibrations.

.11 For conduits and ducts, the provisions in § 1863.2 apply.

For boxes for expansion connections the provisions in .6 apply.

.12 Instead of hot-dip-galvanized steel conduits or steel ducts, according to § 1865.3, conduits of aluminium or of at least flame-retardant plastic material, or hot-dip-galvanized steel conduits with less wall thickness, may be used in dry areas in accommodation quarters providing special provisions are given by the NVE.

Otherwise, the provisions stated above apply as far as they are applicable.

Concerning single-core cables in conduit installations, see § 1871.

G u i d a n c e:

The NVE. Directorate of Electricity, has, in Communication no. 1/76, stated temporary provisions for plastic conduit installations.

The NVE, Directorate of Electricity, has, in Communication no. 2/76, stated provisions for conduit installations which have a special spring system.

.13 Connections and drawing boxes are to be readily available.

.14 Flexible steel conduits are generally not permitted for cable installation. However, the Electricity Supervision may, when conditions make it necessary, permit flexible steel conduits which have at least a 1 mm plastic sheath, to be used for short distances.

§ *1867.* *Cable penetrations of bulkheads and decks.*

.1 Penetrations of watertight bulkheads and decks are to be watertight and of a construction approved by the Sjøfartsdirektoratet (the Norwegian Maritime Directorate).

.2 Penetrations of bulkheads and decks, which should be fire-proof according to the provisions in SOLAS 1960, are to be able to withstand a fire test in accordance with SOLAS 1960, Chapter II, Regulation 35.

.3 Penetrations of other bulkheads and decks and of other constructions are to have linings which prevent the cable from being damaged.

§ *1869.* *Branching off and splicing of cables.*

.1 Branching off and splicing are to be in boxes or on boards suitable for the purpose, and which have proper connection terminals.

.2 Boxes and boards are to be easily accessible. In dry areas in accommodation quarters boxes which have an enclosure of at least IP 44 may be concealed behind wall and ceiling panels. The location is then to be plainly indicated on 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.

§ *1871.* *Installation of single-core cables in conduits.*

.1 Pipes for single-core cables are to be of steel, hot-dip-galvanized or equivalent corrosion-protection, of aluminium or of flame-retardant plastic, see § 1865.12. The conduits are to have smooth internal surfaces and are not to have sharp edges against the cables.

.2 Conduits are to have dimensions as stated in § 1865.3, however, see § 1865.12. The largest conduit dimension permitted is 2 inches.

.3 Conduits are to be of ample size and are to have bending radii large enough for the cables to be easily drawn in and replaced. The total external cross-section of the cable is not to be more than 40% of the internal cross-section of the conduits.

.4 Conduits are to be installed in such a way that water accumulation is avoided.

.5 Conduits are not to be installed in, or covered with thermal insulation, but may be led the shortest way through such insulation.

Conduits laid along outer-decks, bulkheads or the hull, are to be laid on the inside of possible thermal insulation.

.6 Conduits are to be fitted at a distance of at least 30 cm, from heat sources.

.7 Conduits are to be installed in such a way that the cables are not subject to destructive mechanical stresses caused by the movements of the ship, load conditions, temperature variations etc.

.8 Conduits are not to have horizontal lengths exceeding 10 m or vertical lengths exceeding 3 m.

.9 Provisional laying of cables while the installation is in progress, is to be carried out in such a way that the cables are not subject to destructive stresses.

.10 Cable splicing and branching off and transition to other types of installations are to be in roomy connection boxes or boards. The same applies to other outlets.

At such outlets, boxes are to be installed flush with the panels, unless other specially approved constructions are used.

Boxes are to have lids or suitable covers.

.11 For connecting and drawing boxes, the provisions in § 1865.6 and .13 apply.

.12 For conduit splices and conduit connections to boxes, switchboards, enclosures etc. the provisions in § 1865.9 apply.

.13 For fixing of conduits and boxes, the provisions in § 1865.10 apply.

.14 Cables belonging to the same circuit are to be installed in the same conduit. Cables belonging to different circuits are not to be laid in the same conduit, however, see § 1831.7.

§ *1873.* *Terminations for cables.*

.1 Conductor ends are to be terminated in a way which is suitable for the connection terminals.

.2 Cable sheaths are not to be stripped back more than is absolutely necessary. This also applies to the stripping of conductor insulation.

Cables are to be terminated in a box or a board, etc. suitable for the purpose.

.3 Cable cores are to have an insulation sleeving of at least flame-retardant material if they are likely to be subject to

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

Insulation sleevings must have temperature durability corresponding at least to the temperature class of the cable.

.4 For terminations of mineral-insulated cables, the special provisions stated at the time of approval apply.

§ *1881.* *Current rating of cables.*

.1 Cables to each consumer or group of consumers are to have cross-sections at least corresponding to the current rating of the equipment/the sum of the equipment, according to the provisions in the following.

.2 The highest continuous load is not to exceed the values stated in the tables I-V. These apply for ambient temperatures not above 45°C. Correction factors according to table VI are to be used for higher ambient temperatures.

Correction factors according to table VI may be used for ambient temperatues other than 45°C.

Correspondingly,for intermittent operation and short time operation, correction factors according to table VII-IX may be used.

For cables which have different temperature classes and which are laid together, the current rating is to be based upon the lowest temperature class.

G u i d a n c e:

Fuses subject to long-lasting load, e.g. thermal load, should not be loaded with more than 80% of the rated current.

.3 Current rating tables for cables, cfr. § 1807.

Table I			
Cables which have temperature class 60°C Current rating in A			
mm^2	1-core	2-core	3-and 4-core
1	8	7	6
1½	12	10	8
2½	17	15	12
4	22	19	15
6	29	25	20
10	40	34	28
16	54	46	38
25	71	60	50
35	87	75	61
50	105	89	74
70	135	115	95
95	165	140	115
120	190	160	135
150	220	185	155
185	250	215	175
240	290	245	205
300	335	285	235

Table II			
Cables which have temperature class 75°C Current rating in A			
mm^2	1-core	2-core	3-and 4-core
1	13	11	9
1½	17	14	12
2½	24	19	17
4	32	27	22
6	41	35	29
10	57	48	40
16	76	65	53
25	100	85	70
35	125	105	88
50	150	130	105
70	190	160	135
95	230	195	160
120	270	230	190
150	310	265	215
185	350	300	245
240	415	355	290
300	475	405	335

Table III			
Cables which have temperature class 80°C Current rating in A			
mm^2	1-core	2-core	3-and 4-core
1	15	13	11
1½	19	16	13
2½	26	22	18
4	35	30	25
6	45	38	32
10	63	54	44
16	84	71	59
25	110	93	77
35	140	120	98
50	165	140	115
70	215	185	150
95	260	220	180
120	300	255	210
150	340	290	240
185	390	330	275
240	460	390	320
300	530	450	370

Table IV			
Cables which have temperature class 85°C Current rating in A			
mm^2	1-core	2-core	3-and 4-core
1	16	14	11
1½	20	17	14
2½	28	24	20
4	38	32	27
6	48	41	34
10	67	57	47
16	90	77	63
25	120	100	84
35	145	125	100
50	180	155	125
70	225	190	160
95	275	235	195
120	320	270	225
150	365	310	255
185	415	355	290
240	490	415	345
300	560	475	390

Table V			
Cables which have temperature class 95°C Current rating in A			
mm^2	1-core	2-core	3-and 4-core
1	20	17	14
1½	23	20	17
2½	32	27	22
4	42	36	29
6	55	47	39
10	75	64	53
16	100	85	70
25	135	115	95
35	165	140	115
50	200	170	140
70	255	215	180
95	310	265	215
120	360	305	250
150	410	350	285
185	470	400	330

.4 For cables with more than 4 cores, the current rating is:

$$I_n = \frac{I_1}{\sqrt[3]{n}}$$

I_n = Current rating for cable with n cores, A

I_1 = Current rating for cable with 1 core, A

n = The number of cores

The formula applies when there is an equal load on all cores.

This also applies to cables in conduits.

.5 Correction factors for ambient temperatures different from 45°C, cfr. .2.

Table VI

Temperature class of the cable	Correction factors for ambient temperature						
	35°C	40°C	45°C	50°C	55°C	65°C	75°C
60	1,29	1,15	1,0	0,82	0	0	0
75	1,15	1,08	1,0	0,91	0,82	0,58	0
80	1,13	1,07	1,0	0,93	0,85	0,66	0
85	1,12	1,06	1,0	0,94	0,87	0,71	0,50
95	1,10	1,05	1,0	0,95	0,89	0,77	0,63

.6 The current ratings in the tables I-V are based upon 6 cables, which are expected to be fully loaded simultaneously, being laid together in one of the following formations:

Groups of 6 cables in one layer:

Groups of 6 cables in two layers:

When several cables are laid together, the correction factor 0,85 is to be used for each and all.

.7 For parallel-connected cables the current rating is not to be higher than the sum of the current ratings for the separate cables.

.8 For cables each supplying only one intermittently operated motor with intermittence factor of maximum 0.4 and intermittence period of maximum 10 minutes, the correction factors stated in table VII may be used.

Table VII

Sum of cross-section q of all conductors in the cable, mm^2		Correction factor
Cables with metallic sheath/ braid/armour	Cables without metallic sheath/ braid/armour	
$q \leq 4$	$q \leq 5$	1,10
$4 < q \leq 7$	$5 < q \leq 8$	1,15
$7 < q \leq 17$	$8 < q \leq 16$	1,20
$17 < q \leq 42$	$16 < q \leq 25$	1,25
$42 < q \leq 110$	$25 < q \leq 42$	1,30
$110 < q$	$42 < q \leq 72$	1,35
	$72 < q \leq 140$	1,40
	$140 < q$	1,45
		1,50

G u i d a n c e:

The intermittence factor denotes the ratio between the time a load is connected during an operation period - the intermittence period - and the entire operation period.

.9 For cables each supplying only one motor with short-time operation, the correction factors stated in the tables VIII **and** IX may be used.

Table VIII 1-hour service

Sum of cross-section q of all conductors in the cable, mm^2		Correction factor	Minimum period of rest between full-load periods, minutes
Cables with metallic sheath/ braid/armour	Cables without metallic sheath/ braid/armour		
$q \leq 80$	$q \leq 230$	1,05	60
$80 < q \leq 170$	$230 < q \leq 400$	1,10	100
$170 < q \leq 290$	$400 < q$	1,15	120
$290 < q \leq 430$		1,20	140
$430 < q$		1,25	160

Table IX ½-hour service

Sum of cross-section q of all conductors in the cable, mm^2		Correction factor	Minimum period of rest between full-load periods, minutes
Cables with metallic sheath/ braid/armour	Cables without metallic sheath/ braid/armour		
$q \leqq 18$	$q \leqq 75$	1,05	30
$18 < q \leqq 40$	$75 < q \leqq 125$	1,10	45
$40 < q \leqq 65$	$125 < q \leqq 185$	1,15	60
$65 < q \leqq 95$	$185 < q \leqq 245$	1,20	70
$95 < q \leqq 135$	$245 < q \leqq 320$	1,25	80
$135 < q \leqq 175$	$320 < q \leqq 400$	1,30	90
$175 < q \leqq 230$	$400 < q$	1,35	105
$230 < q \leqq 290$		1,40	115
$290 < q \leqq 350$		1,45	125
$350 < q$		1,50	140

.10 For the dimensioning of cables to a distribution switchboard supplying several motors which will not be in operation simultaneously, a diversity factor of less than one may be used.

G u i d a n c e:

a. For cable to a distribution switchboard supplying winch and crane motors, the values in table X may be used as recommendations.

Table X

Number of winch or crane motors	Continuous current for which the cable is rated
2	The sum of the motors' full-load currents.
3	100% of the largest motor's and 50% of the other motors' full-load currents, or for identical motors 67% of the sum of their full-load currents.
4	100% of the largest motor's and 50% of the other motors' full-load currents, or for identical motors 62% of the sum of their full-load currents.
5	100% of the largest motor's and 50% of the other motors' full-load currents, or for identical motors 60% of the sum of their full-load currents.
6	58% of the sum of the motors' full-load currents.

b. For cables to cargo-handling gear which has several motors for different purposes, the dimensions may be based upon a continuous current calculated by help of the following formula, instead of the values in table X:

$$I_{cont} = 1.2\sqrt{\frac{1}{T}\sum_{t=0}^{t=T} I^2 \cdot t}$$

I_{cont} = The calculated continuous current, A

T = The duration of the load cycle, in seconds.

I = The r.m.s. value of the current consumption at each second during the load cycle.

It is assumed that the variation of the current consumption during a load cycle is known, and that the load cycle is of maximum 5 minutes duration.

.11 For the dimensioning of cables to distribution switchboards for lighting and heating, a diversity factor of 1 is to be used.

§ *1883.* *Protection of cables.*

Fuses for cables are not to have a rated current exceeding the current rating for the cable concerned.

Overcurrent relays are to be set in such a way that the releasing current does not exceed 125% of the current rating of the cable concerned. Concerning protection for cables supplying motors, see § 1885.

G u i d a n c e:

When using fuses as protection against overcurrent it must be taken into consideration that most of the fuses (Diazed, Neozed and high rupturing capacity fuses) have a theoretical minimum melting current of 1.4 times the rated current of the fuse. If a fuse with a rated current equal to the maximum current rating of the cable concerned is chosen, the cable might be loaded with 140% of the current rating for long periods.

When using miniature circuit-breakers, it must be taken into consideration that miniature circuit-breakers with a L-characteristic curve, have the same releasing characteristic curve as melting fuses. For miniature circuit-breakers which have a G-characteristic curve, the rated current is the maximum current to which the miniature circuit-breaker can be permanently loaded without releasing.

§ *1885. Protection of cables supplying motors.*

.1 The cable supplying a motor or the main cable supplying a group of motors may be considered as protected against over-load when each motor has the following type of protection:

a. Thermal relay in each insulated phase (pole), set not higher than the rated current of the motor, or

b. Temperature detectors in the motor windings with ancilliary equipment giving equivalent protection of the cable.

c. Other equivalent approved equipment.

The cable to each motor (the branch cable) is to have a cross-section at least corresponding to the rated current of the motor.

The main cable is to have a cross-section at least corresponding to the sum of the rated currents of the motors, however, see § 1881 concerning diversity factors.

.2 The main cable and branch cables are to be protected against short-circuit by means of back-up fuses in each insulated phase (pole), a back-up multipole fused circuit-breaker or a back-up multipole circuit-breaker.

When thermal relays are fitted the nearest back-up fuses are not to have a rated current higher than that accepted for the relays. The same applies to the releasing current for the nearest back-up circuit-breaker.

.3 For single-core cables in switchboards, conduits etc., the provisions in .1 - .2 apply.

SECTION 19. SWITCHGEAR, CONTROL GEAR, FUSE-GEAR, PLUGS AND SOCKET-OUTLETS.

§ *1901.* *Rating of switchgear and control gear.*

.1 Switchgear and control gear are to have rated current in accordance with the full-load current of the circuit, taking into consideration the type of the load and the load factor. However, switches with lower rated current are permitted on apparatus and in lighting circuits when specially approved.

.2 Switchgear and control gear are to be designed for the number of making and breaking operations which may be expected.

§ *1903.* *Construction of switchgear and control gear.*

.1 Switchgear and control gear utilising combustible liquids are not permitted. Liquids containing poly-chlorinated bi-phenyls (PCB) are also not permitted.

.2 Handles are to be located in an easily accessible place and mounted in such a way that operation can be carried out without danger of accidental contact with unprotected unisulated live parts.

.3 Undervoltage and closing coils are to be such that closing can be effected when the voltage and the frequency are within the range of 85-110% of the rated values, and are not to cause tripping when the voltage and/or the frequency fall to 65% of the rated value.

.4 The temperature rise of the individual parts are to be such that no damage occurs in normal use, either to the equipment itself, to adjacent parts or to the cables connected to it, and also, so that the equipment can be operated without danger.

G u i d a n c e:

The following temperature rises at full load may be used as guide lines:

Making and breaking contacts, laminated copper	30°C
Making and breaking contacts, solid bronze or copper	60°C
Making and breaking contacts, solid, silver plated .	75°C

Insulated windings, at rated voltage and frequency, measured by increase of resistance:

Class A insulation	60°C
Class E insulation	75°C
Class B insulation	85°C
Class F insulation	110°C
Class H insulation	135°C
Terminals for connection of external cables of max. 85°C temperature class	40°C

Higher temperatures may be permitted for cables of higher temperature class; also for other cables, when the cable ends are satisfactorily protected with insulating sleevings of heat-resistant and flame-retardant material.

Handles, made of metal	15°C
Handles, made of insulating material	25°C

These temperature rises, in particular for windings, are lower than those specified in IEC recommendations for low-voltage control gear, when corrected for 43°C ambient temperature (IEC Publication No.158-1 (1970) Part 1: Contactors). At 45°C ambient temperature, the above values for windings correspond to the maximum, continuous, operating temperature for the respective insulation classes, as defined for insulating materials in § 2301 and IEC Publication No. 85 (1957).

It is recommended that lower temperature rises than specified above are used, in particular, for important equipment.

§ 1907. *Additional requirements for circuit-breakers.*

.1 Circuit-breakers are to have a making and breaking capacity sufficient for the maximum short-circuit currents to which they might be subject, however, see § 1621.6.

G u i d a n c e:

The special conditions in installations on board ships often make the choice of circuit-breaker dependent upon the requirement for the making capacity.

.2 Circuit-breakers with rated current exceeding 16 A are to be of the trip-free type.

Only one automatic remaking trial is permitted after the tripping of a circuit-breaker.

.3 Circuit-breakers are to have relays for tripping by overcurrent and short-circuit in each insulated phase (pole).

The tripping function of such relays is to be independent of voltage variations.

.4 Short-circuit relays may be time-delayed. The time delay is not to exceed 1 second.

.5 Overcurrent relays are to be time-delayed.

.6 When combined secondary overcurrent and short-circuit relays with semiconductors are used, direct-acting, electromagnetic short-circuit relays are also to be installed.

.7 The circuit-breaker with its relays and control gear is to be constructed in such a way that it will not automatically reclose when an auxiliary part of the control circuit, such as a fuse, is replaced after that part (fuse) has functioned.

G u i d a n c e:

This means that relays, which have functioned by the tripping of an auxiliary fuse must not cause the circuit breaker to be reconnected when the fuse is replaced.

.8 Generator circuit-breakers are to be released by the opening of a control-current circuit.

However, this does not apply when direct-acting primary relays are used.

§ *1911.* *Additional requirements for fused circuit-breakers.*

.1 Fused circuit-breakers are to have fuses in each phase (pole) of the supply side. The characteristics are to be such that the fuses operate when the short-circuit current exceeds the breaking capacity of the circuit-breaker. The fuses are to protect the circuit-breaker from damage when switched on against a short-circuit.

On overcurrent and short-circuit currents not exceeding the breaking capacity of the circuit-breaker, the release is to be effected by the relay equipment and not by the fuses.

.2 The additional requirements for circuit-breakers, § 1907, apply as far as they are applicable.

§ *1913.* *Additional requirements for fuse-switches.*

The fuse-link contacts are not to be used as the making and breaking contacts of the switch.

§ *1915.* *Additional requirements for motor control gear.*

.1 Motor starters and control gear are to have a making and breaking capacity corresponding at least to the starting currents of the motor, or possible current when reversing.

.2 For motors installed in separate enclosures, the following maximum temperature rises are permitted:

- Enclosure surface : 105°C
- Outlet air : 155°C

§ *1921.* *Fuse-gear.*

.1 Fuse-links are to have sufficient breaking capacity to break the short-circuit currents which may occur. They are to be constructed in such a way that external arcs do not occur when the fuse blows. Damage to the fuse-link on its contacts are not to occur. (Melting of the fuse-link conductor is not considered as damage.) Fuse-links are to be of non-combustible, non-hygroscopic material.

.2 Fuse-gear is to be constructed in accordance with the requirements in IEC-Publication 269-1, or in accordance with the requirements in CEE-Publication 16.

G u i d a n c e:

Diazed, Neozed and high rupturing capacity fuses are to be constructed in accordance with these requirements.

.3 For fuse-bases, the insulating materials and dimensions are to comply with the requirements in SECTION 23. Multipole fuse-bases are to have a partition of insulating and at least flame-retardant material, unless the construction is such that insertion and removal of the fuses cannot cause short-circuits.

.4 Concerning temperatures, the same applies as for switch-gear, see § 1903.4.

.5 Fuse-links and fuse-bases are to be marked with the maker's name, type, rated voltage and rated current and other information necessary for their use.

.6 Fuse-gear not exceeding 63 A may be of the Diazed or the Neozed type.

G u i d a n c e:

Fuse-bases in accordance with these types are such that insertion of fuse-links with higher rated current than permitted is impossible.

.7 Using fuses which have been tampered with and fuses which have higher rated current than permitted for the circuit concerned, is forbidden.

.8 Fuse-gear is not permitted to be loaded higher than its rated current.

§ *1925. Plugs and socket-outlets.*

.1 Socket-outlets are to be constructed in such a way that insertion of plugs with rated current lower than that of the socket-outlet is impossible. Adapters which make it possible to use plugs with rated current lower than that of the socket-outlet, are forbidden. However, plugs with rated current 10 A and approved special plugs with lower rated current intended for small apparatus, are permitted to be connected to two-pole socket-outlets with rated current up to 16 A.

.2 Socket-outlets and plugs with rated current not exceeding 63 A in A.C. installations, and with rated current not exceeding 16 A in D.C. installations, are to be constructed for making and breaking the rated current by insertion and withdrawal of the plug, unless they are interlocked with switchgear, so that the plug can only be inserted and withdrawn when the switch is in "off" position.

Socket-outlets with rated current above 63A A.C. or 16A D.C. as the case may be, are to be proveded with such interlocks.

.3 Socket-outlets are to be provided with earth contacts.

Exempt from this requirement are:

- Socket-outlets installed in dry areas in accommodation quarters which have insulating floor covering, and where earthed parts are not available.

- Socket-outlets supplied through an insulating transformer for razors.

- Socket-outlets in D.C. installations with a system voltage of maximum 55 V.

- Socket-outlets in A.C. installations with a voltage of maximum 50 V between the phases and maximum 30 V to earth.

Socket-outlets are not permitted in bathrooms and shower-bathrooms.

However, socket-outlets supplied through separate isolating transformers may be permitted to be used for razors in bathrooms, provided that they are installed in such a way that they are not subject to splashing.

.4 Socket-outlets are not permitted on enclosed car-decks.

However, socket-outlets for connection of welding equipment are permitted. Such socket-outlets are not to be used when there are cars on the car-deck. They are then to be disconnected from the distribution installation and all phases (poles) are to be earthed. The disconnection and the earthing are to be effected by the same change-over switch.

In addition, socket-outlets for connection of refrigerating equipment and similar on vehicles are permitted. Such socket-outlets are to be supplied through isolating transformers. These transformers are only to be used for this purpose and are to have rated power of maximum 25 kVA. Each transformer may supply a maximum of 5 socket-outlets.

The socket-outlets are to be interlocked, allowing connection and disconnection of equipment to be made only when the interlocking switch is in "off" position. In addition, the interlocking is to be such that connection cannot be made before the vehicle is earthed, and such that disconnection is effected automatically if the earth-connection is broken. Socket-outlets are to be located at least 1.5 m above the deck level.

.5 Class I equipment which is not permanently connected is to have a flexible cable provided with an earth conductor and is to have a plug provided with earthing-contacts.

A plug with earthing-contacts is not to be used for connection of equipment without the equipment being earthed by the plug. Class II equipment may have a plug provided with earthing-contacts, but not a flexible cable provided with an earth conductor.

.6 One plug only is to be connected to one flexible cable. Extension cables are to be provided with connectors. Plugs on extension cables are to be inserted into fixed socket-outlets only.

Branch plugs for more than 2 branchings are not permitted. Branch plugs are permitted to be inserted into fixed socket-outlets only.

.7 Plugs for insertion into lamp holders are forbidden.

.8 When different voltages or types of currents are used, socket-outlet equipment for these is to be constructed in such a way that plugs for one voltage or one type of current can only be inserted into socket-outlets for this voltage or type of current.

G u i d a n c e:

The requirement that plugs and sockets are to be constructed in such a way that a plug for one voltage or type of current cannot be inserted into a socket-outlet for another voltage or type of current, usually entails that for plugs and socket-outlets for use in other locations than in accommodation quarters, CEE-standardized round shaped pin socket-outlets have to be used. (Cee-Publication no. 17, 2 edition of 1966 and IEC-Publication no. 309 A of 1973).

SECTION 20. MOTORS.

§ 2001. *Construction.*

.1 Motors are to be constructed in accordance with the Norwegian Standards for rotating machines or corresponding international standards, but adapted to the special operating conditions on board ships, as stated in §§ 1210-1217.

G u i d a n c e:

The corresponding international standards are IEC-recommendations. Construction according to other national standards will be considered in each separate case.

.2 The manufacturer must, when requested by the Electricity Supervision, submit a test report including all the necessary specifications in accordance with the standards which are used.

.3 The Electricity Supervision may require an inspection and the testing of motors during construction.

§ 2011. *Location.*

Larger motors must usually be installed with their shafts in the fore and aft direction.

§ 2021. *Motors for special ventilation plants.*

.1 Concerning motors for ventilation plants for battery-rooms, see § 1453.

.2 Motors for exhaust fans for car decks, located in ventilation ducts, are to be of explosion-protection construction.

The fan is not to cause sparking.

G u i d a n c e:

The danger from petrol vapour is the conclusive factor in the requirement concerning explosion-protection construction.

SECTION 21. HEATING APPARATUS.

§ 2101. *Switchgear.*

Heating apparatus is to be controlled by means of multipole switches or multipole change-over switches appropriate and readily accessible. Thermostats are not permitted to be used as switches in this connection.

§ 2105. *Location.*

Heating apparatus is to be constructed and installed in such a way that it cannot give adjacent combustible objects a temperature exceeding 80°C during normal use, and in such a way that the surroundings are not damaged.

In special operating conditions when the temperature during normal use exceeds 80°C, the installation is to be carried out in accordance with special provisions stated by the NVE.

Heating apparatus is not to be covered, and coating with dust is to be prevented, see §§ 2121-2131.

G u i d a n c e:

The requirement concerning special operation conditions applies, among other things, to saunas.

§ 2107. *Excess temperature protection - thermal cutout.*

Heating apparatus is to be provided with a device operating in such a way that the apparatus is switched off before dangerous temperatures occur, unless the apparatus is specially approved without such a device. The cut out device is to have free-tripping and manual resetting. When thermostats are provided additionally to the excess temperature protection, these are to operate independently of each other. A fault in one of them or in its supply connections is not to put the other out of operation.

§ 2111. *Space heaters.*

.1 Space heaters are to have surface temperature not exceeding 150°C.

.2 The temperature rise on the different parts are not to exceed:

Enclosure parts against the bulkhead	60°C
Operating handles, if of metal	35°C
Operating handles, if of insulating material ...	60°C
Other accessible parts	130°C
Surface of heating elements inside enclosures with through air convection	280°C
Terminals for connection of external cables with temperature class of maximum 85°C	40°C

Higher temperatures may be permitted for cables with higher temperature class, and for other cables when the cable terminations are satisfactorily protected with insulating sleeving of heat-resistant and at least flame-retardant material.

G u i d a n c e:

The temperatures are to be measured by means of fine-wired thermo-elements, so chosen and located that they have a minimum influence upon the temperatures which are to be measured.

.3 Space heaters are to have an inclined top-plate fitting closely against the bulk-head, or a corresponding shield, so designed and protected that combustible articles, clothes and similar are prevented from coming too close. Shields and other protection have to be designed and located in such a way that adjacent bulk-heads etc. are not heated in a non-permissable way.

.4 Space heaters are to be permanently installed on bulk-heads. They are to have at least 1 m free air-space above, unless they are approved for a shorter distance. The location is to be such that doors are prevented from coming too close to the heater.

Space heaters are not to be installed above each other.

.5 Space heaters combined with installations for supply of fresh air are to be designed in such a way that the excess-temperatures stated in .2 are not exceeded even if the air supply is stopped. The excess-temperature protection devices are only to be available with the aid of tools.

.6 Space heaters are to be marked with a warning against covering. Additionally, radiation-type heaters are to have additional marking indicating that there has to be free space for a distance of 1 meter in front of the heater.

The letter height on warning marks is to be at least 3 mm.

G u i d a n c e:

The warning text may be:

"Må ikke tildekkes" - "Must not be covered" and "Foran ovnen må det i stråleretningen være fritt rom i en avstand av minst 1 m." -

"In front of the heater there must be a free space for at least 1 m in the radiation direction."

§ 2115. *Hot air heating plant.*

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

.2 Fan motors are not to be installed in hot air ducts.

.3 The fan is to be running before the heating elements are switched on, and the heating elements are to be automatically switched off when the fan stops. If the heating capacity is so large that the surface temperature of the plant is likely to exceed 80°C with the fan stopped, the plant and the hot air ducts are to be mounted in such a way that combustible parts are not exposed to temperatures exceeding 80°C, and the surroundings are not damaged.

.4 If the heating capacity is as large as stated in .3, the fan must, during ordinary operation, be kept running sufficiently long after disconnection of the elements for the surface temperature not to exceed 80°C.

.5 The air inlet is to be located in such a way that the incoming air is as clean as possible.

The air inlet is to be provided with a dust filter. The filters are to be so arranged that they will not be set on fire by the heating elements.

.6 A device indicating clegging of the filters is to be fitted.

The filters are to be readily accessible for cleaning and replacing.

Instructions concerning cleaning are to be fitted in a proper place.

§ 2121. *Heating cable installations - general.*

.1 A heating cable is to be regarded as a heating apparatus.

Heating cables are to be of manufacture and type approved by the NVE for use on board ship.

.2 The maximum system voltage permitted is 250 V.

.3 Heating cable installations are not to be fused higher than 63 A.

.4 Heating cable installations are to have earth leakage circuit-breakers with tripping current not above 30 mA.

.5 Heating cables are normally to have cold connection terminations.

Connections are to be made in metal boxes.

For connection to a supply circuit, heating cable tails may, for a short distance, usually not longer than 20 cm, be laid in bulk heads. For longer distances they are to be laid in steel conduits in accordance with the requirements in § 1865.

If, for special reasons, hot terminations have to be used, they are to be connected in metal boxes of sufficient size to prevent harmful heating, and the tail lengths must not exceed 8 cm.

.6 Heating cables are not to be laid in plastic conduits.

.7 For installations of heating cables in flammable or hazardous areas, special permission from the NVE is required in advance. An application for permission, is to be submitted, in duplicate, through the Electricity Supervision.

§ 2125. *Heating cable installations in deck and floor.*

.1 Heating cables are to be laid in the floor/the deck. They are to be moulded down in concrete or laid in hot-galvanized steel conduits of at least least 5/8 in. diameter. The conduit installations are to meet the requirements in § 1865 as far as these are applicable.

The heating cables or the conduit installation must not be covered before the Electricity Supervision has inspected and given its permission, and the insulation resistance has been measured and found to be in accordance with the requirements in § 1250.

.2 The distance between the moulded down heating cables or the conduits in which the heating cables are laid, and the top surface of the floor, is to be at least 5 cm. However, in dry accommodation quarters, this distance may be reduced to 3 cm.

.3 The maximum permitted loads are:

- For cables in conduits: 17 W/m.
- For cables moulded down in concrete or similar: 22 W/m

However, this does not apply if the NVE has stated other values for the approval of the cable.

.4 Maximum permitted W/m^2 is:

- In areas for permanent occupation by people: 100 W/m^2
- In areas for short-period occupation by people: 200 W/m^2 (net floor area).
- On decks: 100 W/m^2.

§ *2131.* *Heating cable installations in doors for freezer rooms, drain pipes and similar.*

.1 The maximum load permitted is 15 W per meter frame or respective conduit lengths.

.2 Heating cables in doors for freezer rooms are to be laid in closed ducts or similar made of, or lined with, non-combustible material.

§ *2140.* *Galley equipment.*

.1 Galley equipment is normally to be of a construction which has insulated heating elements.

.2 The temperature rise on the different parts must not exceed:

Enclosure parts against bulkheads and decks ..... 50°C
Operating handles, if of metal ..... 25°C
Operating handles, if of insulating material ..... 50°C
Other accessible surface parts, except hotplates .. 50°C

Hotplates and heating elements: no limit, but the construction and the temperatures are to be such that damage and hazards are avoided when the equipment is used as intended.

Terminals for connection of external cables with temperature class of maximum 85°C ..... 40°C

Higher temperatures may be accepted for cables with higher temperature class, and for other cables when the cable terminations are satisfactorily protected with insulating sleevings of heat-proof and at least flame-retardant material.

.3 Control gear is to be installed in such a way that it is not subject to non-permissable stresses.

G u i d a n c e:

The requirement entails that switches, signal lamps etc. in the galley on board certain ships have to be installed in enclosures apart from the equipment itself, and located in such a way that they are not subject to harmful stresses during washing and other cleaning, overboiling, soiling and heating stresses of the galley equipment itself. Such enclosures are usually to be installed on bulk-heads. With "certain ships" is here meant cruise ships and other ships where the galley is large and intensively used.

.4 Deep-fat friers and high frequency ovens are to satisfy the NEMKO Regulations for the apparatus concerned. They must normally be approved by NEMKO.

Guidance:

In the Rules of the Norwegian Ship Control, requirements are laid down for galley equipment. For installations on board passenger ships, the requirements in SOLAS chapter II, rule 103.g also apply.

§ 2145. *Water Heaters.*

.1 Water heaters are normally to be of a construction which has insulated heating elements. The use of electrode heaters will require special written permission from the Electricity Supervision in each case.

.2 Water heaters are normally to be fitted with thermostats. These are to be located and adjusted in such a way that the water will not boil.

Thermal cutout, level switch or similar is to be located and adjusted in such a way that dry-boiling is prevented.

.3 For excess-temperatures, the requirements in § 2140.2 apply.

§ 2151. *Oil heaters.*

.1 Oil heaters are normally to be separate units. Installations with heating elements in oil tanks require special written permission from the Electricity Supervision in each case.

.2 The surface temperature of the heating elements during normal operating conditions is to be so much lower than the ignition temperatures of the oil that there is no danger of ignition.

For excess-temperatures the requirements in § 2140.2 apply.

.3 The detectors of excess-temperature protection are to lie close up to the heating elements and are to cause disconnection of these when they become overheated.

.4 Oil heaters are to be fitted with thermostats. These are to be located and adjusted in such a way that the oil temperature during normal operating conditions is maintained at a correct level.

SECTION 22. LIGHTING EQUIPMENT.

§ 2211. *Switchgear.*

.1 Lighting equipment is to be controlled by multi-pole switches, suitably placed and readily accessible.

However, single-pole switches may be used for permanently installed lighting equipment with incandescent lamps if located more than 2 m from accessibly earthed parts in dry spaces in accommodation which has insulating floor covering.

For lighting equipment used as guide lights or similar, multi-pole switches are not required.

G u i d a n c e:

In the same category are the blue lights which, according to the Rules of the Norwegian Ship Control, are required in cabins on board fishing boats.

.2 Lighting equipment in cargo holds, tunnels and similar must have the switch located outside the room.

§ 2215. *Lampholders and holders for discharge tubes.*

.1 For incandescent, mercury, vapour, sodium-vapour and similar discharge lamps, the following lamp-holders may be used:

Lampholder, type	Lamps
E 40	Max. 250 V " 3000 W " 15 A
E 27	Max. 250 V " 200 W " 4 A
E 14	Max. 24 V[1)] " 40 W[1)] " 2 A
E 10	For pilot lamps only Max. 24 V " 5 W " 1 A
B 22	Max. 250 V " 200 W " 4 A
B 15 s))) B 15 d)	Max. 24 V[1)] " 40 W[1)] " 2 A
B 9	For pilot lamps only Max. 24 V " 5 W " 1 A

[1)] Lampholders E 14, B 15 s and B 15 d of ceramic material are also allowed for max. 250 V, max 15 W.

Lampholders of type E 40 are to be provided with effective means for keeping the lamp fastened in the holder.

Bayonet holders where the current to the lamp contacts passes through loose helical springs, are not accepted.

.2 For discharge tubes, holders of type G5, G13 or equivalent types, in accordance with IEC Publication 61 Part 2 (1969) with later amendments and additions, may be used.

§ 2217. *Lighting fittings.*

.1 Lighting fittings, in addition to other marking, are to be conspicuously marked with the maximum permitted size of the lamp.

.2 Different voltages or types of current are not permitted in one and the same lighting fitting, unless the fitting is especially approved for such application.

.3 When different voltages or types of current are used for lighting purposes, lampholders and tube holders must be constructed in such a manner that lamps or discharge tubes for the different voltages and types of current are not interchangeable.

.4 For parts of the fitting which are in contact with the support, the excess-temperature is not to exceed 50°C. For parts which are in contact with combustible materials, the temperature is not to exceed 40°C.

.5 Starters operating with higher voltages than that of the supply circuit are to be located inside the lighting fitting.

Reactors, capacitors and starters for fluorescent tubes are to be installed in earthed metal enclosures, and arranged in such a way that the equipment obtains sufficient cooling.

Capacitors are to have discharge arrangements reducing the voltage to maximum 50 V within 1 minute after disconnection.

G u i d a n c e:

For fittings which have a metal enclosure, the enclosure of the fitting itself is acceptable as the enclosure of reactors, capacitors and starters.

.6 Lighting fittings which are specially exposed to mechanical stresses are to have a suitable substantial enclosure. If necessary, a protective grid or similar is to be arranged to protect the glass or lens. This always applies to lighting fittings in cargo-holds and exposed locations on open deck.

.7 The enclosure, including any shade of the lighting fitting is, if possible, to be made of at least flame-retardant material.

.8 The lampholders in handlamps and other portable lighting fittings are to be arranged so that they are completely imbedded in insulating materials. In addition, they must have a protective metal grid. This does not apply to handlamps which have fluorescent tubes which are specially approved without such a grid. Switches are not to be located on handlamps and on other portable lighting fittings.

§ 2225. *Lanterns.*

.1 Lanterns which are prescribed in the Rules of the Norwegian Ship Control, are to be type-approved, see § 1260.4.

Guidance:

a. Type approval of the electrical parts of lanterns is carried out by the NVE.

b. According to the "Directions for Construction, Testing and Certification of Lanterns" etc., stated by the Norwegian Maritime Directorate 1 July 1969, the lower lantern in double lantern sets is to be designated as the main lantern, the upper one as the emergency lantern.

c. Concerning lanterns generally, reference is made to the "Regulations concerning navigation facilities, equipment for use in navigation" etc. stated by the Norwegian Maritime Directorate on 1 February 1975.

.2 For lanterns which are not dealt with in item .1, the requirements for lighting equipment apply as far as they are applicable.

SECTION 23. INSULATING MATERIALS, CREEPAGE DISTANCES, CLEARANCES.

§ *2301. Insulating materials for windings.*

Insulating materials can be used according to the table below:

Insulating Class	Maximum continuous operating temperature °C
A	105
E	120
B	130
F	155
H	180

§ *2306. Insulating materials for clamps and supports for live parts.*

.1 Insulating materials are to be at least flame-retardant.

.2 Insulating materials are to be resistant to tracking.

§ *2310. Creepage distances and clearances.*

.1 Creepage distances and clearances are not to be less than the values stated in the table below:

System voltage V	Creepage distance mm	Clearance mm
up to 60	3	2,5
61-250	4,5 (6)	3 (4)
251-380	6	4
381-500	7,5	6
501-750	10	8

G u i d a n c e:

The values in the table are the same as those in a table in CEE-recommendation no. 3 of October 1964, III. Basic Rules, series c.

Where figures in the table are given in brackets, the first figure applies to creepage distances or clearances between live parts of different polarity, or between functionally insulated parts of Class II equipment. The second figure applies to creepage distances or clearances between live parts and accessible metal parts.

.2 Concerning distances (clearances) between live bus-bars and other uninsulated conductors in switchboards etc., see § 1645.

§ *2315. Insulation resistance and dielectric strength.*

Insulating materials are to have satisfactory insulation resistance and dielectric strength.

G u i d a n c e:

An insulating material is regarded as having satisfactory insulation resistance and dielectric strength when:

a) The requirements in § 9 in NEMKO's "Guide lines for testing of sheet insulation as supports for live parts in control boards and similar" are fulfilled, or

b) The requirements in IEC Publications no. 167 (1964) and 243 (1967) are fulfilled.

SECTION 26. OIL BURNING PLANTS.

§ *2601. Scope.*

The provisions in this section apply to oil burning plants in which ignition is obtained by means of electric spark-discharge across electrodes.

§ *2605. Enclosures.*

Transformers, reactors, capacitors etc. are to have enclosures of IP 54 or better. The enclosures should not be able to be opened without using tools. Enclosures are to have easily visible warning plates.

G u i d a n c e:

Approved warning plates for high voltage may be used as warning plates.

§ *2608. Ignition transformers.*

.1 Transformers with voltage exceeding 16000 V are not permitted.

.2 For transformers with secondary voltage not above 8000 V, the secondary winding may be designed:

a. Unearthed.

b. Earthed at one pole, or

c. Earthed at the neutral point.

.3 For transformers with secondary voltage above 8000 V, the secondary winding may be designed:

a. Unearthed, or

b. Earthed at the neutral point.

.4 The transformers are to be constructed in such a way that no detrimental heating of the windings will occur permanently short-circuited secondary terminals at primary rated voltage.

.5 The transformers are to be installed in such a way that the conductors or cables to the electrodes are as short as possible.

§ *2611. Circuits for oil burning plants.*

.1 Oil burning plants are to have separate supply circuits with multipole circuit-breaker, multipole fused circuit-breaker or multipole switch and fuses in each insulated phase (pole). Switchgear and fuses are to have special markings which distinctly indicate that they belong to oil burning plants.

G u i d a n c e:

The special markings may be yellow in colour on switches and fuse holders.

.2 Oil burning plants are to have protection suitable for the rated current of the installation. The protection must be such that the ignition cannot be put out of operation independently of the remainder of the installation.

.3 Oil heating plants are to be constructed or arranged in such a way that the oil supply is automatically cut off if the fan stops or the flame goes out.

Control circuits are to be designed in such a way that a break in the connections or contact failure causes the plant to stop (normally closed circuit).

G u i d a n c e:

An arrangement for automatically closing the oil supply may be a solenoid valve in the oil pipe to the burner.

.4 Oil burning plants are to have switchgear for emergency stops, see § 1708.

§ *2615. Cables.*

.1 On the secondary side of the transformer, a cable approved for the purpose is to be used. The cable is to have a rated voltage at least equal to the secondary voltage of the transformer, independent of the transformer's voltage to earth.

If a cable without a conducting screen is used it is to be laid in a metal enclosure, or in treaded steel conduits. The screen, enclosure and conduits for the cables are to be earthed.

G u i d a n c e:

Flexible steel conduit may be used as a metal enclosure according to § 1865.14.

.2 Distance clips are to be used for cables installed along the boiler.

Where it is necessary, in order to obtain flexible junctions, a flexible cable laid in a strong flexible steel conduit fitted with a plastic coating, may be used according to § 1865.14. Where there is a likelihood of heat radiation, heat resistant cables laid in a strong flexible steel conduit fitted with a plastic coating, may be used.

SECTION 27. WELDING EQUIPMENT

§ 2701. *Welding equipment.*

.1 Construction.

Welding equipment is to be constructed in a safe way so that leakage of current into the welding circuit from another circuit in which the voltage is higher, is prevented. The welding circuit with appurtenant live parts is to be adequately insulated from the enclosure of the apparatus. If the welding circuit is earthed, the earth conductor is to be connected to the same terminal as the return conductor from the workpiece. The connection terminals of the welding circuit are to be constructed or located in such a way that the terminals cannot be touched during normal working conditions.

.2 Protection.

Welding equipment is to be earthed by means of an earth conductor in the supply cable or by a separate earth conductor to the hull.

Portable welding equipment is to have an insulating supply cable entry and extra protection of the cable at the entry (insulating sleeve or similar).

G u i d a n c e:

The Norwegian Maritime Directorate has, in the Regulations for use of electric welding equipment on board ships, established requirements for the welder, the welding guard and matters concerning responsibility.

§ 2705. *The no-load voltage of welding equipment.*

The no-load voltage of welding equipment is to be as low as possible bearing in mind the welding requirements. On live electrodes where it is possible to touch the parts, the no-load voltage must not exceed the values stated in §§ 2707, 2709.

§ 2707. *The no-load voltage of manual and semi-automatic welding equipment.*

.1 A.C. welding equipment.

.1.1 The voltage on the connection terminals for the welding cable must not at any time exceed 80 V (r.m.s. value).

.1.2 During no-load conditions the no-load voltage must not

exceed 50 V (r.m.s. value). After the opening of the welding circuit, possible higher voltages must be reduced to 50 V or lower within 0.2 seconds.

.1.3 If the requirements specified in .1.1 and .1.2 above are obtained by means of an automatic protection device, it must be possible to test whether the latter works according to its purpose. The welding plant must be fitted with a monitoring device which indicates whether the protection device works correctly.

.1.4 If the protection device fails, special procedures must be adopted to ensure that the voltage on the welding cable terminals cannot exceed 50 V. This requirement must be fulfilled within 1 second.

.1.5 The devices required in .1.1 - .1.4 must operate satisfactorily under the stresses to which they may be exposed during the operation, even at an inclined angle of 30°.

.1.6 Welding plants according to .1.1-.1.5 are to be marked with "50 V" in a conspicuous position. Plants fitted with a protection device must, in addition, have a warning to the effect that the plant must not be used if the protection device fails.

.2 D.C. welding equipment.

.2.1 For equipment with a ripple exceeding 10%, the requirements in .2707.1 apply.

.2.2 For equipment with a ripple of 10% and lower, the no-load voltage is not to exceed 100 V (mean value).

G u i d a n c e:

For the purpose of the present regulations, ripple is understood to be the alternating current component of the rectified no-load voltage.

Ripple, w, may be calculated as

$$w = 100 \sqrt{k_f^2 - 1} \quad (\%)$$

The form-factor, k_f, is the ratio between the r.m.s. value and the mean value of the no-load voltage

$$k_f = \frac{Ueff}{U_m}$$

When using a sinusoidal supply voltage with no smoothing of the no-load voltage by means of capacitors or similar, the following values of

percentage ripple are obtained for the most common rectifier connections:

(1)	Single phase, centre tap connection	48%
(9)	Single phase, bridge connection	48%
(10)	Three phase, bridge connection	4.5%
(3)	Three phase, double star connection	4.5%
(2)	Three phase, star connection	18%

(The numbers of connections in parentheses agree with IEC Publication 146).

In practice, the r.m.s. value of the voltage is measured by using a voltmeter of the hot-wire electrodynamic or moving iron type, and the mean value by using a moving coil type of voltmeter.

§ 2709. *No-load voltage for automatic welding equipment.*

.1 For A.C. equipment, the no-load voltage is not to exceed 100 V (r.m.s. value).

.2 For D.C. equipment, the no-load voltage is not to exceed 100 V (mean value).

.3 Where due to technical reasons, higher no-load voltages than those given in .1 and .2 above cannot be avoided, the equipment must be fitted with a device which reduces the voltage to the permissable level within 0.2 second when the arc is extinguished.

When the plant does not have touchable live parts, such a device is not required.

SECTION 30. ADDITIONAL REQUIREMENTS FOR TANKERS.

§ *3001.* *Scope.*

.1 The requirements in this section are, in addition to the general requirements for installations on board ships, dredgers, floating cranes etc., to apply to installations on board tankers carrying cargoes of oil with a flash-point of 60°C. and below, chemicals or liquid gas.

.2 The requirements for tankers apply for ships carrying oil-cargo/dry cargo alternately.

§ *3005.* *General requirements.*

Materials used in electrical equipment are not to react dangerously to liquids or gases to which they may be exposed, and they are to be corrosion-resistant against such liquids and gases.

G u i d a n c e:

The requirement entails that copper or copper alloys are not permitted to be used as an external sheath or screen of cables, or for enclosures, in pump and compressor rooms for ammonia where ammonia vapour can occur.

§ *3011.* *Distribution systems, earthing of current-carrying parts.*

Current-carrying parts of electrical installations (circuits) in gas-hazardous areas, on and above tank decks, are not to be earthed. However, earthing of the following is permitted:

- Devices for measuring insulation using a maximum current to earth of 30 mA and a maximum inductance to earth of 60 mH. When "earth lamps" are used, these must be maximum 15 W. They are not to be permanently connected and are to be operated by means of pushbutton switches.

- Capacitors for suppression of electromagnetic noise with a maximum current to earth of 30 mA.

- Intrinsically safe circuits when designed and tested for intrinsic safety with one phase (pole) earthed.

§ *3016.* *Cables.*

.1 Cables for intrinsically safe circuits are to have copper screen or equivalent screening.

Cables for other circuits in gas-hazardous areas, on and above tank deck, are to have metal sheath, screen or armouring.

.2 For installations in accordance with § 3025, the metal sheath, screen or armouring of the cable is to have an equivalent cross section not less than 1/3 of the cable conductor's cross section. However, not less than 1 mm^2 copper.

§ *3021.* *Welding apparatus.*

Welding apparatus must not be connected or used outside the engine room unless the working space and adjacent spaces are gas-free. A signboard containing these instructions in English and Norwegian is to be fitted at each connection point for welding apparatus outside the engine room.

G u i d a n c e:

The instruction text on such a signboard may read:

"Welding apparatus must not be connected or used unless the working space and adjacent spaces are gas-free".

"Sveiseapparater må ikke tilkobles eller brukes med mindre arbeidsstedet og tilstøtende rom er gassfrie".

A suitable size for such signboards would be about 300 x 200 mm.

§ *3025.* *Installations in gas-hazardous areas.*

.1 In cargo tanks the following is permitted:

- Instrumentation equipment with intrinsically safe circuits and appurtenant cables.

.2 In cargo pump and compressor rooms, betweendeck spaces on shelter-deck-tankers when they contain cargo pipes or valves, or when they have direct connection with pump and compressor rooms, or similar spaces containing cargo pipes or tanks, the following is permitted:

- Flameproof lighting equipment with appurtenant cables. At the entrance of the room a signboard of at least 200 x 300 mm in size is to be placed, easily visible, and is to have the text (in English and Norwegian):

"Before a lighting fitting is opened, its supply circuit is to be disconnected".

"Før en lysarmatur åpnes skal dens strømtilførsel frakobles".

The lighting installation is to have a supply from at least 2 mutually independent circuits.

- Instrumentation equipment with intrinsically safe circuits and appurtenant cables.

- Other cables than those mentioned above may be laid through the room when installed in a gastight welded pipe or duct with wall thickness not less than those specified for cable pipes on deck, see § 1865.4.

.3 In betweendeck spaces on shelterdeck-tankers when not included in .2, the following is permitted:

- Equipment and installations as stated in .2.

- Other flameproof equipment and cables fulfilling the requirements in § 3016. The space is then to have continuous mechanical ventilation with at least 8 air changes per hour.

.4 In betweendeck areas above the upper deck when not included in .2, the following is permitted:

- Equipment and installations as stated in .2.

- Other flameproof equipment and cables fulfilling the requirements in § 3016.

.5 In cofferdams, ballast tanks and other spaces below the upper deck, adjacent to cargo tanks and not mentioned above, the following is permitted:

- Instrumentation equipment with intrinsically safe circuits and appurtenant cables.

In such spaces transducer boxes for echo sounders and anode boxes for impressed current systems for external cathodic protection of the hull may be permitted, together with appurtenant cables, after consideration by the NVE in each case. This applies only when the hull construction makes it impracticable to instal the equipment in a non-gas-hazardous space.

Application for such permission is to be submitted in duplicate to the Electricity Supervision.

G u i d a n c e:

The requirements for such permission are usually as follows:

- The cables are to be laid in seamless steel pipes at least 8 mm in thickness if galvanized, 10 mm if black. Black pipes are to have corrosion-protecting paint.

- The cable pipes are to be installed in such a way that they cannot break by hull deflections caused by the normal movements and different load conditions of the ship.

- The distance between pipe supports is to be maximum 25 times the pipe's outer diameter.

- The cable pipes are to be sand filled.

- Lockable switches or switches in lockable boxes for disconnection of the whole installation are to be located in a non-gas-hazardous area.

§ *3028.* *Installations on and above tank deck.*

.1 The following equipment and installations are permitted:

- Flameproof and intrinsically safe equipment.

- Cables fulfilling the requirements in § 3016.

- Non-flameproof equipment when located more than 2.4 m above the tank deck and at greater distances from gas sources than the minimum distances in the following table.

Group	Cargo		Min. total distance m	Min. horizontal distance m
a.	Oil Certain chemicals	Distance from any opening, including ventilation in- and outlets, from cargo tanks, cargo pump rooms and similar spaces containing cargo pipes or tanks.	3	3
b.	Chemicals not included in a.	Distance from any opening, including ventilation in- and outlets, from cargo tanks, cargo pump rooms and similar spaces containing cargo pipes or tanks.	4.5	4.5
c.	Liquid gas	Distance from outlet for escaping gas.	9	4.5
		Distance from any cargo tank tank hatch, cargo pipe flange and/or valve, and from any opening, including ventilation in- and outlets, from cargo pump and compressor rooms and and similar spaces containing cargo pipes or tanks.	4.5	4.5

G u i d a n c e:

Further information about the chemicals which are included in group a. and group b. in the table may be obtained from the Electricity Supervision. However, a general rule is that group a. includes chemicals with a flash-point below 60°C and boiling point above 37.8°C.

.2 Socket-outlets, without regard to the type of enclosure, are to be interlocked with switchgear.

.3 Portable equipment supplied by flexible cables must not be connected or used in gas-hazardous areas. Signboards with easily perceptible and easily readable instructions about this, are to be fitted at each end of the tank deck or at each socket- outlet on and above the tank deck and in adjacent spaces.

G u i d a n c e:

The instruction text on such signboards may read:

"Flyttbart elektrisk utstyr med strømtilførsel ved bevegelig ledning må ikke tilkobles eller brukes i områder hvor det er gassfare".

"Portable electrical equipment supplied by flexible cables is not to be connected or used in areas where there is danger from gas".

A suitable size for such signboards would be about 300 x 400 mm with lettersof about 30 mm in height. Signboards at socket-outlets may be smaller.

§ *3031.* *Installations in non-gas-dangerous rooms in the cargo tank area and adjacent to this area.*

.1 Rooms containing the following non-flameproof equipment are to have ventilation in- and outlets, at least 2.4 m above the tank deck and minimum distances from gas sources as specified in the table in § 3028:

- Equipment with enclosure IP 22, not capable of producing sparks and with internal temperature rises not exceeding 150°C.
- Equipment with enclosure of at least IP 44, with enclosure temperature rise not exceeding 150°C.
- Heating elements with temperature rise not exceeding 150°C.

.2 Rooms containing the following non-flameproof equipment are to have ventilation in- and outlets at least 2.4 m above the tank deck and minimum distances to gas sources twice those specified in the table in § 3028:

- Equipment with enclosure IP 22, capable of producing sparks or with internal temeperature rises exceeding 150°C.
- Equipment with enclosure of at least IP 44 with enclosure temperature rise exceeding 150°C.
- Heating elements with temperature rise exceeding 150°C.

.3 When shaft glands are installed in bulkheads or decks between gas-hazardous and non-gas-hazardous rooms, the lighting fittings and switches in the non-gas-hazardous rooms are to be of flameproof construction. However, the requirement does not apply to main engine rooms.

SECTION 31. ADDITIONAL REQUIREMENTS FOR MOBILE DRILLING PLATFORMS.

§ *3101.* *Scope.*

The requirements in this section apply to installations on board mobile drilling platforms in addition to the general requirements for installations on board ships, dredgers, floating cranes etc.

G u i d a n c e:

According to a declaration from the Ministry of Justice the word "ship" in the Seaworthiness Act also includes mobile drilling platforms. For mobile drilling platforms which are used for drilling for petroleum in Norwegian internal waters, in Norwegian territorial waters and in that part of the continental shelf which is under Norwegian sovereignty, the Act of 21 June 1963 relating to Exploration for and Exploitation of Submarine Natural Deposits applies, without regard to nationality. Pursuant to this Act and the Royal Decree of 25 August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources, the NVE has, on 1 December 1974, stated Regulations for electrical installations on board mobile drilling platforms. This Royal Decree has later been replaced by the Royal Decree of 3 October 1975. However, the regulations and requirements which are stated pursuant to the first mentioned Royal Decree do still apply.

§ *3107.* *Distribution systems, earthing of current-carrying parts.*

Current-carrying parts in electrical installations (circuits) in hazardous areas are not to be earthed. However, earthing of the following is permitted:

- Devices for insulation measurement using a maximum current to earth of 30 mA and a maximum inductance to earth of 60 mH. When "earth lamps" are used, these must be maximum 15 W. They are not to be permanently connected and are to be operated by means of push-button switches.

- Capacitors for suppression of electro-magnetic noise with a maximum current to earth of 30 mA.

- Intrinsically safe circuits when designed and tested for intrinsic safety with one phase (pole) earthed.

§ *3109.* *Maximum system voltages.*

The requirements in § 1302 apply. However, system voltages not exceeding 600 V A.C. and 800 V D.C. may be permitted for special installations.

§ *3111.* *Classification of areas and zone division.*

.1 The areas on board are classified into 2 main categories as regards the explosion danger:

- Hazardous areas.
- Safe areas

.2 Hazardous areas are divided into 3 zones:

- Zone 0.
- Zone 1.
- Zone 2.

.3 A safe area is an area which is not classified as an hazardous area (non-hazardous).

§ *3113.* *Zone division.*

.1 Zone 0 is understood to be an area in which inflammable gases or vapours are continuously present or present for long periods of time in sufficient amounts to cause explosion.

G u i d a n c e:

This definition of Zone 0 corresponds to the definition of "Zone 0" in IEC Publication 79-10 (1972).

Zone 0 includes such areas as the internal space of active mud-pits, pipes etc. for active mud and also the internal space of storage tanks for inflammable liquids with flash point not in excess of 60°C.

.2 Zone 1 is understood to be areas in which inflammable gases or vapours in sufficient amounts to cause an explosion are likely to occur during normal operation.

G u i d a n c e:

This definition of Zone 1 corresponds to the definition of "Zone 1" in IEC Publication 79-10 (1972).

Zone 1 includes:

a) Enclosed areas containing shale shakers, desanders, degassers, open active mud-tanks and other apparatus where the circulating mud has direct opening to the area (open systems).

b) The area within 1.5 meters (5 ft), measured horizontally, and up to 1.5 meters (5 ft) above and down to 3 meters (10 ft) below any opening on apparatus listed in a), when the equipment is located outdoors, and similarly for outlets for the ventilation plant for Zone 1.

c) Pits, ducts and similar in locations which otherwise would be classified as Zone 2 being so constructed or arranged that inflammable gases may accumulate.

d) Non-ventilated areas having direct access from Zone 2 areas, see however .4.

.3 Zone 2 is understood to be areas in which inflammable gases and vapours in sufficient amounts to cause an explosion are not likely to occur, and if they occur they will only exist for a short period of time.

G u i d a n c e:

This definition of Zone 2 corresponds to the definition of "Zone 2" in IEC Publication 79-10 (1972).

Zone 2 includes:

a) Enclosed areas containing mud-pumps and other apparatus where the circulating mud is in a closed system.

If such areas are effectively ventilated, with at least 30 air changes per hour, they may be accepted as safe areas subject to consideration in each case.

Spaces, containing pipes for mud, which are effectively ventilated with at least 10 air changes per hour, may be accepted as safe areas subject to consideration in each case. The pipes may have flanges, but no valves or similar.

Correspondingly, areas belonging to Zone 2 as mentioned above may be accepted as safe areas subject to consideration in each case, if the areas, in addition to having some continuous ventilation, are also equipped with gas detection systems and automatic increase of the ventilation capacity if gases occur.

b) The area within 15 meters (50 ft), measured horizontally, from the drill string and up to 3 meters (10 ft) above and down to 9 metres (30 ft) below the drill floor.

c) The areas around Zone 1 areas as specified in item .2 Guidance b), within 3 metres (10 ft) measured horizontally, and up to 3 metres (10 ft) above and down to 9 metres (30 ft) below such openings and outlets as mentioned.

d) The areas within 1.5 metres (5 ft), measured horizontally, from outlets for the ventilation plant of Zone 2-room, and up to 1.5 meters (5 ft) above and down to 4.5 meters (15 ft) below such outlets.

e) The drilling derrick.

.4 Enclosed areas having openings towards hazardous areas belong as a whole to the zone to which the openings lead, see however items .2 and .3. Doors and similar are in this respect regarded as openings.

Deviation from this provision may be permitted subject to consideration and judgement in each case, if special precautions are taken.

G u i d a n c e:

Such special precautions may be:

a) Controlled relative overpressure (pressurized area) of minumum 5 mm water column, are fresh-air inlets from safe areas.

b) Air-locks between the areas, with ventilation to safe areas.

.5 Certain areas and spaces may,if the conditions require this, be classified by the NVE as a more hazardous zone than stated in these Regulations.

Certain areas and spaces may also,by special circumstances and/or by special precautions, be classified by the NVE as a less hazardous zone tnan stated in these Regulations.

G u i d a n c e:

Such special precautions may be:

a) screening.

b) Special ventilation arrangements.

§ 3115. *Ventilation.*

.1 Enclosed spaces, belonging to hazardous areas, Zone 1 and Zone 2, shall be provided with efficient mechanical ventilation. The number of air changes per hour shall be at least 20 for areas in Zone 1, and at least 10 for areas in Zone 2.

The ventilation air shall be taken from safe areas outdoors. The location of the air-inlets and outlets shall be such that the entire space will have efficient ventilation. Fans and their motors must normally be installed in safe areas, so that the air-inlet ducts will have relative over-pressure. Air-inlet ducts which are designed for relative under-pressure, and of special robust construction may be allowed subject to consideration in each case.

Separate ducts are to be arranged from the air-outlets to have the ventilation air brought directly to the open air. Such ducts belong to the same zone as the spaces itself. From space in Zone 1 the ventilation air is to be brought in separate ducts back to a safe area.

The fans shall be so constructed that sparks or similar cannot arise or precautions must be taken to avoid the creation of sparks or similar.

.2 Pressurized equipment is to be ventilated through a robust duct which has the air-inlet located in a safe area.

For air-inlets etc. the requirements in .1 apply.

For pressurized equipment in Zone 1 the air is to be led back to safe areas by means of ducts.

For pressurized equipment in Zone 2 air may be brought directly out of the equipment provided that measures have been taken to prevent sparks and similar from being thrown out of the openings and able to ignite any inflammable gas or vapour present.

.3 Pressurized areas are to have a relative over-pressure of at least 5 mm water column, which is to be monitored.

For such areas in Zone 1 entrance shall be through gas-locks with ventilation to safe area.

.4 Doors leading into pressurized areas are to be fitted with a conspicuous plate with a legible text as follows, or of a similar wording:

"Ekstraventilert rom. Hold døren lukket."

"Pressurized room. Keep the door closed."

Pressurized equipment is to be fitted with a conspicuous plate with a legible text as follows, or of a similar wording:

"Kapslingen må ikke åpnes eller noe deksel fjernes, med mindre området er gassfritt, eller spenningen er koplet fra alle deler innenfor kapslingen".

"The enclosure is not to be opened or any cover removed unless the area is known to be safe, or the voltage has been switched off from all devices within the enclosure".

In addition, there are to be signs with a corresponding text in the languages commonly used on board, if these are not Norwegian or English.

.5 Enclosed spaces in safe areas adjacent to hazardous areas are generally to have mechanical ventilation with relative over-pressure.

The air is to be drawn from safe areas outdoors. If the ventilation ducts pass through hazardous areas they are to have relative over-pressure in relation to these areas. Ventilation ducts with relative under-pressure in relation to the hazardous areas they pass through, may be permitted according to a decision in each case provided the ducts are specially robust and gas-tight.

Air-outlets are normally to be located in safe areas outdoors. Air-outlets may, however, in exceptional cases be allowed to be located in Zone 2, subject to an examination of the circumstances in each case.

G u i d a n c e:

The requirement for relative over-pressure in the air-duct implies that the ventilating fan is to be located in the air-inlet of the duct.

§ *3121. Stationary installations and portable equipment which are frequently used.*

.1 In Zone 0 electrical equipment and cables are generally not permitted. In special cases, when it is necessary for the operation, the NVE will accept:

- Intrinsically safe equipment with appurtenant cables.

.2 In Zone 1, the following will normally be accepted:

- Intrinsically safe equipment.
- Flameproof equipment.
- Increased safety equipment, in outdoor locations.
- Pressurized equipment.

- Cables, see § 3123.

Pressurized equipment is to be designed in such a way or have such an arrangement or be operated in such a manner that it will have at least 5 air changes before the supply voltage is connected.

The enclosure is to have an overpressure of at least 5 mm water column.

Pressurized equipment is to be arranged for automatic disconnection of the voltage or equipped with an automatic warning device which operates in case the over-pressure falls (failure of the pressuring system).

Alternatively an arrangement where the over-pressure can be maintained by means of an auxiliary fan being automatically started if the over-pressure is reduced may be accepted. Starting of the auxiliary fan is to be indicated.

Monitoring and alarm systems, which are required according to the foregoing, are to be intrinsically safe or the components which are located in the hazardous areas are to be flameproof.

Flameproof equipment must be protected against atmospheric stresses to prevent corrosion etc. impairing the flameproofness of the equipment.

.3 In Zone 2 the following are accepted:

- Equipment as specified in Zone 0 and Zone 1.

- Increased safety equipment.

.4 Due to special circumstances the NVE may lay down other provisions than those stated in .1 - .3 concerning installations and equipment in hazardous zones, cfr. § 3113.5.

§ *3123.* *Cables.*

Cables in intrinsically safe circuits are to have copper screens or equivalent effective screening (e.g. lead sheathed and armoured). Cables for other circuits than intrinsically safe circuits are to have metal sheaths, screens or armour.

Flexible cables are not permitted in hazardous areas, except those which are necessary for the operation. The flexible cables are then to be of particularly robust construction and suitable for the purpose.

§ *3127.* *Installations and equipment which are used occasionally and under constant supervision.*

The person in charge on board may permit the use of installations and equipment which are used only occasionally and for a short period of time, and which are under constant supervision. Permission for use must be given in each separate case, after evaluation of the elements of danger and the safety precautions.

§ *3130.* *Welding apparatus.*

Welding apparatus is not to be connected or used in or near a hazardous area unless the area is gas-free. Connection points and outlets for welding apparatus are generally to be located in safe areas.

If connection points and outlets are located in or near hazardous areas, a conspicuous plate is to be fitted with a legible text as follows, or of a similar wording:

"Uttaksposten skal være frakoplet og jordet når sveising ikke pågår.

Sveiseapparatet må ikke tilkoples eller brukes med mindre arbeidsstedet og tilstøtende rom er gassfrie".

"The outlet is to be disconnected and earthed when not in use.

Welding apparatus is not to be connected or used unless the working space and adjacent rooms are gas-free".

In addition there are to be signs with a corresponding text in languages commonly used on board, if these are not Norwegian or English.

§ *3133.* *Socket-outlets, portable equipment.*

.1 Socket-outlets are generally to be located in safe areas. Socket-outlets in hazardous areas are, when not in use, to be disconnected and earthed.

.2 Portable equipment supplied by flexible cables (cords) shall not be connected or used in or near a hazardous area unless the area is gas-free. At socket-outlets in or near hazardous areas a conspicuous plate is to be fitted with a legible text as follows, or of a similar wording:

"Flyttbart elektrisk utstyr med bevegelig ledning må ikke tilkoples eller brukes i områder med gassfare".

"Portable electrical equipment supplied by flexible

cables is not to be connected or used in areas where gas danger may occur".

In addition there are to be signs with a corresponding text in the languages commonly used on board, if these are not Norwegian or English.

§ 3135. *Repair and maintenance work.*

At all entrances to hazardous areas and otherwise at suitable locations a conspicuous plate is to be fitted with a legible text as follows, or of a similar wording:

"Før reparasjons- og/eller vedlikeholdsarbeid blir påbegynt på elektriske anleggsdeler og utstyr, skal spenningen være frakoplet".

"The supply circuits are to be disconnected before any repair and/or maintenance work are started on electrical equipment or parts".

In addition there are to be signs with a corresponding text in the languages commonly used on board, if these are not Norwegian or English.

SECTION 33. TESTING OF INSTALLATIONS.

§ *3301.* *New installations.*

Before the Electricity Supervision will give its permission for new installations to be put into operation, trials, investigations, measurments etc. of the installation may be required. The owner of the installation has to provide for the testing, investigations, measurments etc.to be effected in accordance with provisions stated by the Electricity Supervision, and to the satisfaction of the Electricity Supervision.

§ *3311.* *Existing installations.*

Before the Electricity Supervision gives its permission for installations to be put into operation which have been subject to alterations, extensions, repairs, or have been out of operation for a long time; corresponding measurments etc.similar to those for new installations may be required to be effected in accordance with provisions stated by the Electricity Supervision.

G u i d a n c e:

Concerning the kind of alterations, extensions and repairs mentioned above, see Guidance to § 1021.3.

CHAPTER D. LIGHTNING CONDUCTORS.

SECTION 35. LIGHTNING CONDUCTORS.

§ 3501. *Requirement for lightning conductors on masts.*

Lightning conductors are to be installed on each mast on board all ships. However, steel and aluminium masts may be used as lightning conductors on board steel and aluminium ships.

§ 3505. *Construction and installation.*

.1 In ships fitted with wooden masts, the top of the lightning conductor is to be fitted with a round copper spike not less than 12 mm in diameter and projecting at least 150 mm above the top of the mast. A copper tape or wire with sectional area not less than 75 mm^2 is to be joined to the spike by means of copper rivets or copper clamps. When copper tape is used, the lower end of the tape is to be terminated at the point at which the shrouds are fixed to the mast, and is to be securely clamped to a copper wire with a sectional area not less than 75 mm^2. The copper wire is to be led down a shroud. Correspondingly, when copper wire is used, this is to be led down a shroud.

.2 In wooden and composite ships with wooden masts, the copper wire of the lightning conductor is to be led down and securely clamped to a copper plate not less than 0.2 m^2 in area. The copper plate is to be fixed to the side of the ship in a place where it will be immersed under all conditions afloat.

.3 In steel ships fitted with wooden masts or top-masts, the lower end of the copper wire is to be securely clamped to the nearest part of the hull of the ship.

.4 In wooden and composite ships fitted with steel or aluminium masts, each mast is to be connected to a copper plate in accordance with .2, by means of a copper wire with a sectional area not less than 75 mm^2.

.5 In steel and aluminium ships fitted with steel or aluminium masts which are insulated from the hull, each of the masts is to have a secure copper wire connection of sectional area not less than 75 mm^2 to the nearest part of the hull. Concerning construction of the connection aluminium/copper, see § 1241.6.

.6 Lightning conductor tapes and wires are to be run as straight as possible. Sharp bends are to be avoided. Connections are to be carried out by means of brass or

copper clamps, preferably of the serrated contact type. The connections are to be secured against loosening. Soldered connections are not permitted.

§ *3507.* *The resistance of the lightning conductor.*

The resistance of the lightning conductor, measured between the masthead and the point of the earth plate or hull to which the wire is connected, is not to exceed 0.02 ohm.

§ *3510.* *Earthing in dry docks and on slipways.*

When the ship is in a dry dock or on a slipway, the lightning conductor is to be earthed.

Suitable terminals are to be arranged to enable such earthing.

§ *3513.* *Requirements for lightning conductors for deck houses, chimneys and similar.*

Deck houses, chimneys and similar, when insulated from the hull, are to have wire connections to the hull as stated in § 3505.5.

CHAPTER E. LIGHT-CURRENT INSTALLATIONS.

SECTION 40. LIGHT-CURRENT INSTALLATIONS.

§ *4001.* *Light-current installations connected to heavy-current installations.*

For light-current installations supplied directly from heavy-current installations, the requirements for heavy-current installations apply.

§ *4005.* *Light-current installations insulated and separated from heavy-current installations.*

Light-current installations and equipment which have their own source of power and/or are insulated and galvanically separated from heavy-current installations, are to be constructed, fitted, protected and used in such a way that a satisfactory degree of safety is achieved. Evaluation is to be based upon the importance of the installation and the voltages.

G u i d a n c e:

The importance of the installation is here meant to mean the importance of the safety of the ship and the persons on board.

The following light-current installations are considered as important:

- Radar installations.
- Radio installations.
- Gyrocompass installations.
- Echo-sounding installations.
- Telephones between the bridge, the engine room and the steering gear room.
- Rudder indicator.
- Log systems.
- Fire-alarms.
- Crew and passenger alarm systems.
- Alarm and signal installations for watertight and fire-proof doors.
- Alarm installations for engine and boiler installations etc.

§ *4011.* *General requirements.*

The requirements in Section 12 apply as far as they are applicable.

§ *4013.* *Marking.*

The requirements in § 1255 apply as far as they are applicable.

§ *4015.* *Earthing.*

Metal parts are to be earthed in accordance with the requirements in § 1235. For the design of the earthing, the requirements in §§ 1238-1241 apply as far as they are applicable. Heavy-current installations and light-current installations are not to have common earth conductors and must have separate connections to the hull.

G u i d a n c e:

To avoid electro-magnetic noise caused by circulating currents, the conducting sheath, screen or armour of the cables should generally be earthed only at one end of the cable.

§ *4018.* *Light-current equipment combined with heavy-current equipment.*

Apparatus for heavy-current and for light-current, combined in a common apparatus is not permitted. However, such a construction may be permitted if operational conditions make it necessary. For such a combined apparatus, the requirements for heavy-current installations apply as far as they are applicable.

§ *4020.* *Current-supplies and current-supply installations.*

The requirements in §§ 1440, 1450, 1451, 1453, 1455 and 1457 apply as far as they are applicable.

§ *4025.* *Light-current cables.*

.1 Conductors are to be made of copper and are generally to be stranded.

The minimum cross section permitted is 0.5 mm^2.

.2 For insulating materials etc., the same requirements as those for heavy-current cables apply.

However, cables with rated voltage not above 60 V, may have the following average insulation thickness:

Nominal cross-section area (S) mm^2	Designation of the insulation compound			
	V 60 V 75 R 85 mm	B 80 E 85 mm	S 95 + glass braiding mm	M 95 mm
0.5 0.75	0.5	0.7	0.6 + 0.2	0.8

§ *4027.* *Current rating of light-current cables.*

For the current rating of cables, the corresponding requirements for cables in heavy-current installations apply.

Circuits with cables of sectional area 0.5 mm^2, are to have a current rating not above 1 A and short-circuit current not above 100 A. Such circuits are not to be fitted with fuses with a rated current above 10 A.

§ *4030.* *Mutual laying of light-current cables and heavy-current cables.*

Light-current cables and heavy-current cables are not to be installed in the same conduit, however, see § 1831.7. Neither are heavy-current and light-current conductors permitted in the same cable.

Light current cables and heavy-current cables may be laid together when the light-current cables are at least armoured or screened.

§ *4035.* *Requirements for degrees of enclosure.*

For degrees of enclosure in the different rooms, the requirements in § 1259 apply correspondingly.

ADDITIONS

C O N T E N T S

Act of 24 May 1929 Relating to Supervision of Electrical Installations

With Supplementary Acts of 7 April 1933, 7 May 1936, 25 June 1954 No. 3, 22 April 1966, 16 June 1972, and 26 January 1973 No. 2.

§ 1.

The present Act covers all electrical installations, but not installations for radio telegraphy and radio-telephony.

§ 2.

The Crown[1] shall prepare technical regulations governing the design, maintenance and operation of electrical installations. These regulations may contain, inter alia, provisions having the object of preventing electrical installations from exercising an unnecessarily deleterious influence upon their surroundings.

§ 3.

The Crown[2] shall, to the extent found necessary, order the public supervision of electrical installations. The persons who exercise such supervision are, in the present Act, designated the Electricity Supervision. Instructions for this body shall be prepared by the Crown.[2]

1) The Norwegian Water Resources and Electricity Board according to letter of 6 October 1971 from the Ministry of Industry and Handicraft.

2) The Norwegian Water Resources and Electricity Board in accordance with the Decree of 4 July 1929.

§ 4.

1. A charge shall be paid to the Exchequer for the supervision exercised by the Electricity Supervision, such charge being determined in accordance with a scale laid down by the Crown with the approval of the Norwegian Parliament. This scale shall contain provisions as to when and by whom the charge shall be paid. No charge is payable for light-current installations.

2. If the charge is not paid when due, annual interest shall be charged at the rate of 6%. The charge carries the same right of distraint in regard to the installation as do taxes in regard to real estate and it can be enforced in the same manner.

3. Special expenses incurred by the Electricity Supervision or local inspector in issuing, on behalf of the Broadcasting Organisation, the orders mentioned in § 7.2 sub-para. 1 of the present Act shall be refunded by the Broadcasting Organisation in accordance with a provision made by the Norwegian Water Resources and Electricity Board.

§ 5.

The Electricity Supervision shall at all times have unrestricted access to the installations under its supervision. On instructions from the Electricity Supervision the owner of the installation or his representative shall be present during the inspection, and he is obliged to provide the Electricity Supervision with all information considered necessary in order to carry out its inspection and to ensure that its orders have been fulfilled, or to calculate the charge mentioned in § 4.

§ 6.

If the Electricity Supervision finds that an electrical installation subject to supervision, or any part of such installation, is not being constructed in a secure manner or is not constructed in accordance with current regulations or in accordance with the plan specified in the official permission, if required, for the installation to be put in operation and the conditions regarding technical design contained in that permission, the Electricity Supervision has the right to prohibit the continuance of work and to require that such work be altered, renewed and improved.

§ 7.

1. When an electrical installation which is subject to supervision is in any part badly or defectively maintained or otherwise in such condition that in the opinion of the Electricity Supervision it constitutes a danger to human life or is a danger to property, the Electricity Supervision may give orders that its operation shall at once be stopped and that it shall be put into a proper condition or removed.

2. In addition, when an electrical installation as under item 1 above causes inconvenient electrical interference, the Electricity Supervision may give orders that it shall be at once put into such condition that this interference is as far as possible stopped.

   The Norwegian Water Resources and Electricity Board may, to the extent considered necessary for the protection of legitimate public interests, issue regulations to the effect that electrical installations, components or apparatus which, in the opinion of the Electricity Supervision, constitute a serious hindrance to radio reception, shall not be operated at certain periods of the day or night, unless such hindrance can be prevented by measures ordered by the Electricity Supervision pursuant to current regulations.

3. Where an order as item 1 or 2 above is not carried out without delay, the Electricity Supervision may require it to be carried out at the owner's expense. Public expenditure in this connection can be recovered under the same right of distraint upon the installation as exists upon real estate in regard to taxes and recovery can be obtained in the same manner.

§ 8.

The orders issued by the Electricity Supervision shall, in order to be valid, be made in writing or by telegram.

§ 10.

The Crown[1] may determine that owners of certain electrical installations themselves have the duty of supervising the installations connected thereto. This local inspection is subject to the control of the Electricity Supervision. In other respects the same provisions apply to local inspection as are laid down in § 5 to 9 of the present Act in regard to the Electricity Supervision; the orders for the stopping or removal of an installation § 7.1 must, however, be issued by the Electricity Supervision, while authorization for local inspection shall be issued by the owner (contractor) of the installation concerned.

§ 11.

1. The Crown[2] may order that certain types or kinds of equipment and apparatus for electrical installation shall be subject to inspection. Equipment and apparatus for which such inspection is ordered may not be sold or used in Norway until the type or kind concerned has been inspected and approved.

1) The Norwegian Water Resources and Electricity Board in accordance with Decree of 4 July 1929.

2) The Norwegian Water Resources and Electricity Board according to Royal Decree of 19 September 1975.

2. The vendor must pay a fee for the inspection in accordance with a scale laid down by the appropriate Ministry.

3. Detailed rules for the putting into effect of these provisions shall be prepared by the Crown.

§ 12.

1. The Crown[2] may order that the operation of certain electrical installations shall be undertaken by a competent technical manager, and that the construction or the maintenance of certain electrical installations shall be undertaken by an electrical contractor.

   The Crown[2] may state that competent technical managers and electrical contractors shall have qualifications as stated by the Crown. The Crown[2] may also state that electricians that work independently on the construction and maintenance of certain electrical installations and that electrical repairers who undertake or independently carry out maintenance of certain electrical apparatus, shall have qualifications as stated by the Crown. The Crown[2] may likewise state that inspectors who independently carry out inspection of certain electrical installations, shall have qualifications as stated by the Crown.

2. The Crown[2] may issue Regulations for authorization of electrical contractors and electricians working as an electrical contractor, and for the duties and rights of these.

§ 13.

All persons have the duty to keep secret the operating and trade information which may come to their knowledge by reason of their work under the present Act, as also to refrain from imitating the methods and procedures adopted and kept secret by any business owner which may thereby come to their knowledge.

§ 14. The breaking of the present Act or of the regulations or rules laid down in accordance with it or any failure to comply with an order or prohibition issued by the Norwegian Water Resources and Electricity Board, the Electricity Supervision or the local inspector (see § 10) under warrant of the present Act or Regulations, or any refusal to afford access to the Electricity Supervision, or any failure to provide the information discussed in § 5 shall be punished with fines, unless a more stringent penalty falls to be imposed in accordance with the civil penal code.

2) The Norwegian Water Resources and Electricity Board according to Royal Decree of 19 September 1975.

§ 15.

The present Act shall come into force immediately.

In the Act of 16 May 1896, § 1 and § 4 are cancelled simultaneously, see the Act of 19 July 1912. However, the Regulations for Electrical Installations stated, pursuant to the Act of 16 May 1896, § 1, and the supervision system established according to § 4 of that Act, and the Regulations concerning fees for the approval and inspection of heavy-current installations, are to remain in force until the Crown has otherwise determined.

The act applies also for Spitzbergen.

Regulations Relating to Technical Training and Education for Electrical Professions and trades.

Pursuant to § 12 of the Act of 24 May 1929 relating to the supervision of electrical installations, and in accordance with the Recommendation of 19 September 1975 proposed by the Ministry of Industry and Handicraft, the Royal Decree of 19 September 1975 stated the following Regulations relating to professional training for:

Competent technical managers

Electrical contractors Group L and H

Lift contractors

Electricians Group L and H

Power-station electricians Group A

Power station electricians Group B (line electricians)

Lift electricians

Electrical repairers and

installation inspectors

working on electrical installations etc.:

1. The operation of electrical installations of a type and size to be determined by the Norwegian Water Resources and Electricity Board (abbr. NVE) are to be undertaken by a competent technical manager, cfr. Appendix I.

2. The construction and maintenance of heavy-current installations having voltage above 42 V are to be undertaken by an electrical contractor (Group L for low and medium voltage installations, Group H for low, medium and high voltage installations), cfr. Appendix II. However, see item 3. The exemptions specified in the items 2.1 - 2.5 apply.

2.1 The competent technical manager in charge of an Electricity Supply Undertaking may undertake the construction and maintenance of the electrical installations belonging to the company he is in charge of.

2.2 The manager of the electrical section in an industrial company may undertake the construction and maintenance of the electrical installations belonging to the company if his education and practical training meet the requirements specified in Appendix I (competent technical manager), see also note 3. The manager concerned must be employed in the company and cannot at the same time undertake other electrical installation activities.

2.3 The construction and maintenance of electrical aerial lines may be undertaken by a competent technical manager, cfr. Appendix I, or another professional approved by the NVE. He has to be employed by the contracting firm concerned.

2.4 In industrial companies and similar, the Electricity Supervision or the Local Inspection may, where operational circumstances make it necessary, grant an electrician, cfr. Appendix IV, who is employed as an electrician on the staff of the company concerned, the authority to undertake the maintenance and small-scale installation work involved in the moving and replacing of machines and apparatus and other equipment connected to the existing electrical installations within the territory of that company. Installation work in connection with other refitting operations, new constructions or extension works has to be undertaken by an electrical contractor.

The activity is to be carried out by a maximum of one other electrician in addition to the electrician undertaking the activity. The Electricity Supervision may deviate from this provision when the company needs shift-working electricians.

2.5 Outside towns and built-up areas, e.g. in smaller distribution areas in country districts, the Electricity Supervision may, when finding that the circumstances so require, grant to an electrician, cfr. Appendix IV, a temporary authority to undertake the construction and maintenance of heavy-current installations having voltage above 42 V, in the area concerned. He shall undertake the work without electricians and with a maximum of one assistant.

Should there, in view of local conditions, or for any reason, be doubt about such authority being granted or whether authority already granted should be withdrawn, the matter shall be laid before the NVE.

3. The construction and maintenance of electrical installations for lifts shall be undertaken by a lift contractor, cfr. Appendix III.

The lift contractor shall carry out the activity as an independent business-man or be employed by a lift installation company. He cannot at the same time undertake the activity of another company. However, he may undertake the activity in branches of the same company in different parts of the country.

The activity shall be notified to the Local Inspection.

For maintenance activity the exemptions stated in 3.1 and 3.2 apply.

3.1 In industrial companies and similar, the Electricity Supervision or the Local Inspection may, where operational circumstances make it necessary, grant a lift electrician, cfr. Appendix IV, who is employed as a lift electrician on the staff of the company concerned, the authority to undertake the maintenance on the existing electrical lift installations.

3.2 In places where a lift contractor or a professional from a lift contracting company are not available, the Electricity Supervision or the Local Inspection may grant to an electrician the temporary authority to undertake the maintenance of electrical lift installations.

The work shall be carried out by a lift electrician or an electrician, cfr. Appendix IV.

Should there, in view of the local conditions or for any reason, be doubt about whether such authority can be granted or whether authority already granted should be withdrawn, the matter shall be laid before the NVE.

4. A person who works independently on the construction or maintenance of heavy-current installations which have a voltage above 42 V, is to be an electrician and is to be employed by the electrical contractor company concerned (Group L for low and medium voltage installations, Group H for low, medium and high voltage installations), cfr. Appendix IV. However, the exemptions stated in 4.1 and 4.2 apply.

4.1 A power-station electrician Group A may work independently on the construction and maintenance of each and all the electrical installations which belong to the Electricity Supply Undertaking which has a competent technical manager.

The power station electrician is to be employed by the Electricity Supply Undertaking concerned.

4.2 Power station electricians Group A and B, cfr. Appendix IV, may work independently on the construction and maintenance of electrical aerial lines with appurtenant electrical installations outdoors. The power station electrician shall be employed by the contracting firm concerned, or by an Electricity Supply Undertaking which has a competent technical manager.

5. A person who works independently on the construction and maintenance of electrical lift installations, and on the installations and maintenance of equipment which has a connection with the electrical installation, or is of importance for safety reasons during the operation of electrical lift installations, must be a lift electrician, cfr. Appendix IV.

However, the exemptions stated in 3.2 apply.

The lift electrician shall be employed by the lift contractor company concerned.

6. A person undertaking and/or independently carrying out maintenance of domestic electrical apparatus and equipment which are subject to compulsory control must either be an electrician, cfr. Appendix IV, or an electrical repairer, cfr. Appendix V.

The activity shall be notified to the Local Inspection.

However, the exceptions stated in 6.1 and 6.2 apply.

6.1 Maintenance of electrical apparatus subject to compulsory control and of equipment for which the NVE has approved a branch service agency, may be carried out by such a service agency.

6.2 Companies producing domestic electrical apparatus and equipment which are subject to compulsory control may, after an application to the NVE, be granted the authority to carry out maintenance of the apparatus and equipment being produced by the company concerned.

The maintenance is to be carried out by employees that can verify having sufficient qualifications.

7. A person who independently is to carry out inspection of heavy-current installations with voltage above 42 V, must be, according to the instructions laid down for local inspection, either a competent technical manager, cfr. Appendix I, or an installation inspector, cfr. Appendix VI.
The Electricity Supervision may give a dispensation, limited to a certain territory and based upon a nomination from the responsible manager of the local inspection.

The provisions do not apply to the person who is to carry out inspection of the distribution network for low and medium voltage belonging to the Electricity Supply Undertaking.

8. A person undertaking activity pursuant to these Regulations, cannot take part in other activity which prevents him from undertaking the activity in a satisfactory way. In case of doubt the decision is to be taken by the NVE.

9. When a person undertaking activities pursuant to these Regulations, leaves his job, the Electricity Supervision, or the Local Inspection may, as far as the Local Inspection is concerned, if necessary, grant to an employed professional of the company concerned a temporary authority to undertake the activity. Such authority may only be granted for 6 months duration.

10. The control of the observation of these regulations is carried out by the NVE via the Electricity Supervision and the Local Inspection and the Special Supervision in accordance with decisions from the NVE. All those who take part in such activities which are covered by these regulations have the duty of providing the information considered necessary for the control of whether the regulations are met.

11. The NVE decides which schools and courses are covered by the various provisions contained in the Appendices.

12. Training programmes and regulations (rules) for making the examinations which are specified in the Appendices, are to be established by the Ministry of Industry and Handicraft.

13. A person who does not possess the qualifications specified in the Appendices I to VI may continue his activity if he is in lawful employment when these regulations come into force.

14. The right to carry out activity pursuant to these regulations may be withdrawn by the NVE if the executant is guilty of grave or continued negligence in the practice of his activity.

15. The NVE may, in particular cases, permit exemptions from these regulations.

16. These regulations shall come into force immediately.

The provisions concerning requirements relating to technical training for foremen electricians, electrical fitters Group L and H, lift fitters, electrical contractors Group L and H, power station electricians Group A and B, lift electricians, electrical repairers and installation inspectors working on electrical installations etc. stated by the Royal Decree of 5 February 1965 and 4 July 1972 are cancelled simultaneously.

APPENDIX I

Requirements in respect of Education and Training for Competent Technical Managers.

Theoretical education	Practical training
Graduate from a Technical University See Notes 1 and 2	2 Years practical experience as an engineer (B.Sc.) either in electrical contractor companies covering both high and low voltage installations, or in Electricity Supply Undertakings which have a competent technical manager.
Graduate from a 2-year Technical School or 2-year Technical Trade School with additional course or from an equivalent school See Notes 1 and 2	Alternative 1. Must satisfy the requirements for electrician Group H or power station electrician Group A. In addition, 3 years experience as technician, either in electrical contractor companies, covering both high and low voltage installations or in Electricity Supply Undertakings which have a competent technical manager. Alternative 2. 2 years manual experience in electrical contractor companies or in Electrical Supply Undertakings. In addition, 5 years experience as technician, either in electrical contractor companies covering both high and low voltage installations, or in Electricity Supply Undertakings which have a competent technical manager.
Graduate from a 2-year Technical Trade School or from an equivalent school See Notes 1 and 2	Alternative 1. Must satisfy the requirements for electrician Group H or power station electrician Group A. In addition, 4 years experience as technician, either in electrical contractor companies covering both high and low voltage installations or in Electricity Supply Undertakings which have a competent technical technical manager. Alternative 2. 2 years manual experience in electrical contractor companies or in Electricity Supply undertakings. In addition, 6 years experience as technician, either in electrical contractor companies covering both high and low voltage installations, or in Electricity Supply Undertakings which have a competent technical manager.

Note 1.

The examination must have been passed in all cases. In addition, an approval from the NVE is required.

Note 2.

The theoretical education should have taken place in the heavy current electrical department of the school concerned. The NVE may permit exemption from this provision for engineers (B.Sc.) who have passed an examination following an electrical engineering course (light-current), a constructional course or a machinery course, when the person concerned has considerable all-round experience in the operation of Electrical Supply Undertakings which have a competent technical manager.

Note 3.

A person who is going to undertake the installation activity according to 2.2 must have had at least 1 year of experience, as mentioned above, as an engineer (B.Sc.), or 2 years as a technician in electrical contractor companies.

However, this does not apply when the person concerned has a certificate as an electrician.

APPENDIX II

Requirements in respect of Education and Training for Electrical Contractors.

Theoretical education	Practical training
Graduate from a Technical University, electrical engineering course (heavy current) See Notes 1 and 2	For electrical contractors Group L:After passing examination, 2 years experience as engineer (B.Sc.) in electrical contractor companies, low voltage. In addition, examination for electrical contractor Group L must be passed. For electrical contractors Group H: After passing examination, 2 years experience as engineer (B.Sc.) in electrical contractor companies covering both high and low voltage installations. In addition, examination for electrical contractor Group L must be passed and approval obtained from the NVE.
Graduate from a 2-year Technical School or 2-year Technical Trade School, electrical engineering course (heavy current) or from an equivalent school. In addition, candidates must have passed a 6-month course in book-keeping at an approved business school or an equivalent correspondence course. See Notes 1 and 3.	For electrical contractors Group L: Must satisfy requirements for electricians Group L. In addition, 2 years experience as technician or 4 years experience as electrician in electrical contractor companies, low voltage, of which at least 2 years must be after passing examination. In addition, examination for electrical contractor Group L must be passed. For electrical contractors Group H: Must satisfy requirements for electrician Group H. In addition, 3 years experience as technician or 5 years experience as electrician in electrical contractor companies covering both high and low voltage installations, of which at least 3 years must be after passing examination. In addition, examination for electrical contractor Group L must be passed and approval obtained from the NVE.

Note 1.

The examination must have been passed in all cases.

Note 2.

The NVE may depart from this provision for engineers (B.Sc.) who have passed an examination following an electrical engineering course for light current, provided that the person concerned has a considerable all-round experience of installation activities.

Note 3.

The body who organizes the examinations may grant exemption from the requirements regarding experience as electrician after passing the examination when the person concerned has particularly long experience as an electrician and in cases in which this requirement would be unreasonable.

APPENDIX III

Requirements in respect of Training for Lift Contractors

Theoretical education	Practical training
Graduate from a Technical University, electrical engineering course (heavy or light current) or machinery course. See Note 1.	After passing examination, 2 years experience as engineer (B.Sc.) in lift contractor companies, and approval from the NVE.
Graduate from a 2-year Technical School or 2-year Technical Trade School, electrical engineering course (heavy or light current) or machinery course, or from an equivalent school. See Note 1.	Alternative 1. Must satisfy the requirements for lift electrician. In addition, 2 years experience as technician or 4 years experience as lift electrician in lift contractor companies, of which at least 2 years must be after passing examination, and approval from the NVE. Alternative 2. 2 Years manual experience and 4 years experience as technician in lift contractor companies and approval from the NVE.

Note 1.

The examination must have been passed in all cases.

Note 2.

Electrical contractors Group L may work as lift contractors after 2 years all-round experience in lift contractor companies after having passed the examination, and approval from the NVE.

APPENDIX IV

Requirements in respect of Education and Training for Electricians Group L, Electricians Group H[1)], Power-Station Electricians Group A, power-station electricians Group B (line electricians), and Lift Electricians.

Education and practical training	Trade examination
Alternative 1 Districts with Apprentice School. 4 years apprenticeship on contract while simultaneously following normal apprentice school electrical engineering course for heavy current.	The prescribed training in accordance with an approved training programme confers the right to apply for a trade examination for the trade concerned. The trade examination must have been passed.
Alternative 2 Districts without Apprentice School. 4 years apprenticeship on contract while simultaneously following a correspondence course approved for the theoretical training of electricians in electrical trades. Testimony showing that the school work has been carried out is to be produced.	[1)] In order to be permitted to take the trade examination for electrician Group H, candidates are required to have, in addition to training as Electrician Group L, one year's approved experience as assistant in the construction of high voltage installations (cfr. rules for taking the trade examination for electricians Group H).
Where practical trade training has been taken earlier the body which organizes the trade examination may grant an appropriate reduction of the apprenticeship.	

Note 1.

Reduction of apprenticeship on account of school training.

24 months reduction for electrician Group L, power station electrician Group A and Group B and lift electrician will be given on account of:

2-year factory school (approved basic and advanced school).

To obtain full reduction, the factory school must be completed before the apprenticeship commences.

14 months reduction will be given on account of:

2- or 3-year technical school

2-year technical trade school

1-year factory school. If this school has followed the II plan, the school training must be finished by taking the final year at the apprentice school or an equivalent school. To obtain full reduction, the factory school must be completed before the apprenticeship commences.

In all schools mentioned above, the electrical engineering course for heavy current is required.

10 months reduction will be given on account of 1-year ship electrician school.

9 months reduction will be given on account of 1-year factory school, electrical engineering course for light current.

6 months reduction will be given on account of:

Elementary technical school, electrical engineering course for heavy current.

1-year factory school for mechanics.

The total reduction for schools, except for 2-year factory school (approved basic and advanced factory school) electrical engineering course for heavy current, cannot exceed 14 months. The examination must be passed in all cases.

Note 2.

A trade examination may also be taken by persons who, without having obtained apprenticeship on contract, have at least 25% longer approved experience in the trade than the apprenticeship and who at least satisfy the requirement under Alternative 2 in respect of theoretical training.

Experience shall be recorded in a work book or by means of specified documents. The total of experience time and school reduction must be at least 5 years.

Exemption from the provision concerning 25% longer experience for those who have not obtained apprenticeship on contract may be granted following application to the body which organizes the trade examination, provided the applicant can prove, by his work book or specified documents, that he has obtained practical training as required by the training programme for his trade.

Note 3.

Electricians Group L who also have a certificate as power-station electricians Group A will also satisfy the requirements for electricians Group H. Electricians in one Group may take a trade examination in another Group where they have additional experience covering the special branches of the trade in which they did not undergo training previously. This is accepted provided that the person concerned has obtained the theoretical training which is required for taking the trade examination in the other Group.

The following rules apply:

Electrician Group	May take trade test for	With additional experience
Electrician Group L	Power-station electrician Group A	1 year
	Power-station electrician Group B	1 year
	Lift electricians	2 years
Power-station Electrician Group A	Electrician Group L	1 year
Power-station Electrician Group B	Electrician Group L	2 years
	Power-station electrician Group A	1 year
Lift electrician	Electrician Group L	2 years

Note 4.

The NVE may, in special cases, grant exemptions from the requirements for power-station electricians Group B, so that specially trained personnel at an Electricity Supply Undertaking may be granted a temporary authority to undertake fault locations and fault corrections in the installations of the Electricity Supply Undertaking mentioned in 4.2

The NVE may also, in special cases, grant exemptions from the requirements for power-station electricians Group B when the Electricity Supply Undertaking has problems with the training and/or obtaining of probationary labour.

APPENDIX V

Requirements in respect of Education and Training for Electrical Repairers.

Theoretical education	Practical training
The apprentice school curriculum in electrical engineering and electrical engineering drawing, or equivalent education.	3 years experience in the maintenance of electrical apparatus and equipment which are subject to approval, together with approval by a Certificate from the Certification Committee, c/o the Association of Norwegian Electricity Supply Undertakings.

Note 1.
Reduction in apprenticeship on account of school education.

20 months reduction will be given for 2-year factory school (approved basic and advanced factory school).

12 months reduction will be given for:

2- or 3-year technical school
2-year technical trade school
1-year factory school.

In all schools the electrical engineering course for heavy current is required.

10 months reduction will be given on account of 1-year ship electrician school.

9 months reduction will be given on account of 1-year factory school, electrical engineering course for light current.

6 months reduction will be given on account of:

Elementary technical school, electrical engineering course for heavy current.

1-year factory school for mechanics.

The total reduction for schools, except for 2-year factory school (approved basic and advanced factory school) electrical engineering course for heavy current, cannot exceed 12 months. The examination must be passed in all cases.

APPENDIX VI

Requirements in respect of Education and Training for Installation Inspectors.

Theoretical education	Practical training
Graduate from a 2-year Technical School or 2-year Technical Trade School, electrical engineering course for heavy current, or from an equivalent school. See Note 1.	Must satisfy the requirements for electrician Group L. In addition to this is required: Either 1-year's experience as an assistant in installation inspection after passing the examination, or 1-year's experience as a technician in electrical contractor companies, low voltage, or 2 years experience as an electrician in electrical contractor companies, low voltage.

Note 1.

The examination must be passed in all cases.

GENERAL NOTES

Concerning item 2.

The provision "is to be undertaken by" means that the electrical contractor for independent installation work can only make use of electricians that are employees of the electrical contractor company whose work he is undertaking. Furthermore, this means that these electricians are under his charge and that he is responsible for the professional construction of the installations in accordance with the Pegulations for electrical installations in force, and that all materials and equipment which are used and which are subject to compulsory control, are approved by the Norwegian Electrical Materials Testing Station (abbr. NEMKO).

Concerning item 2.4.

The expression "where operational circumstances make it necessary" means that authority can be granted only on the basis of careful assessment of the company's need, as this authority is contingent upon the production (operation) upon which the company (enterprise) is dependent being maintained without interruption.

Enterprises which in this connection may be regarded as industrial companies are, for example:

Larger entrepreneur activities, hospitals, certain civic departments (fire-offices, road boards, water boards and sewage boards), certain public institutions, research institutions, laboratories and theatres. Similar arrangements may, under certain circumstances, also be preferred for larger business and office buildings.

Concerning item 3.

The expression "lift" signifies lifting equipment fitted inside or outside buildings which:

1. Is equipped with a chair or platform running in fixed guides;

2. Carries a load suspended directly on a rope (cable, chain) running over a block or pulley and is intended for use between two or more floors, galleries, platforms, etc. The expression "lifts" is not, however, considered to cover cranes of any kind, travelling winches or overhead trolleys, where these are intended for the transport of goods or workpieces within one and the same storey or are installed in the open air, nor does it cover conveyor belts, lifts for letters and other documents having a lifting capacity of less than 10 kg and a shaft cross-section not exceeding 0.05 m^2, or temporary installations such as lifting tackle, scaffolding lifts, etc. The same applies to lifts of special design or for special purposes (e.g. escalators, lowering equipment in theatres (scenery lifts etc.)

Concerning item 4.

The expression "electrical contractor company" signifies, in this connection, also Electricity Supply Undertakings as mentioned in 2.1, industrial companies as mentioned in 2.2, contracting firms as mentioned in 2.3, and industrial companies and similar as mentioned in 2.4.

Concerning item 5.

As far as the understanding of the statement "equipment having connection with the electrical installation or of importance for safety during operation of electrical lift installation" is concerned, attention is drawn to the problems which are stated in the training plan for the lift electrician in section B, item 2.

Concerning item 6.1

At the moment, such an approved branch service agency exists for radio and television sets.

General.

The expression "employed" signifies in these Regulations that the person concerned has a proper employee relationship to the company. This means that there exists a labour agreement between the person concerned and the company, and that the company is paying the employer-share of the national insurance premium, and deducts income-tax before payment of salary.

REGULATIONS FOR ELECTRICAL INSTALLATIONS ON BOARD DRILLING PLATFORMS USED FOR DRILLING FOR PETROLEUM IN NORWEGIAN INTERNAL WATERS, IN NORWEGIAN TERRITORIAL WATERS AND IN THAT PART OF THE CONTINENTAL SHELF WHICH IS UNDER NORWEGIAN SOVEREIGNTY

Issued by The Norwegian Water Resources and Electricity Board 1. December 1974

pursuant to § 2, first section of Royal Decree of 25. August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources, cf. delegation of authority by the Ministry of Industry and Handicrafts on 21. April 1972.

Entry into force: 1. February 1975.

Should doubt arise about the interpretation of the regulations in this translation, the original regulations in Norwegian language will be deciding.

CONTENTS

DEFINITIONS

§ 1. *Definitions.*

.1 Drilling platforms are any mobile installations, including vessels, which are equipped for drilling for petroleum.

.2 Approval: Approved by the Norwegian Water Resources and Electricity Board (NVE), the Directorate of Electricity or by the Electricity Supervision, District 1.

.3 Licensee: Anyone having been granted a reconnaissance licence or production licence pursuant to Royal Decree of 9. April 1965 or Royal Decree of 8. December 1972 relating to Exploration for and Exploitation of Petroleum in the Seabed and Substrata of the Norwegian Continental Shelf.

.4 Classification of areas, see § 20 in these Regulations.

.5 Division of areas into Zones (Zone 0, Zone 1, Zone 2), see §§ 20 and 21 in these Regulations.

.6 Flameproof enclosure: An enclosure for electrical apparatus that will withstand an internal explosion of the inflammable gas or vapour which may enter it, without suffering damage and without communicating the internal flammation to the external inflammable gas or vapour for which it is designed, through any joints or structural openings in the enclosure.

N o t e :

This definition of flameproof enclosure corresponds to the definition of flameproof enclosure in the International Electrotechnical Commission (IEC) Publication 79-1 (1971) in which construction requirements and testing regulations are stated. In this IEC-Publication the term for flameproof enclosure is «Ex d».

.7 Increased safety: A method of protection by which additional measures are applied, so as to give increased security against the possibility of excessive temperatures and of the occurrence of arcs and sparks in normal service.

N o t e :

This definition of increased safety corresponds to the definition of protection «e» (increased safety) in the IEC-Publication 79-7 (1969) in which construction requirements and testing regulations are stated.

In this IEC-Publication 79-7 (1969) the term for increased safety is «Ex e».

.8 Intrinsic safety:

.8.1 Instrinsically safe circuit: A circuit in which any spark or thermal effect produced normally (that is, by breaking or closing the circuit) or accidentally (for example, by short-circuit or earth fault) is incapable, under prescribed test conditions, of causing ignition of a prescribed gas or vapour.

.8.2 Intrinsically safe apparatus: Apparatus in which all the circuits are intrinsically safe.

N o t e :

The definition in item .8.1 of intrinsically safe circuit corresponds to the definition of an intrinsically safe circuit in IEC-Publication 79-3.

For the definition in item .8.2 of intrinsically safe apparatus reference is made to IEC-document 31 G (Central office) 12.

In the IEC-Publications the term for intrinsic safety is «Ex i».

.9 Pressurized equipment: Equipment having enclosure which is pressurized with air from a safe area in such a way that inflammable gases and vapours are prevented in penetrating into the enclosure.

N o t e :

The IEC-Publication 79-2 deals with pressurized enclosures. This publication is, however, subject to revision.

In this IEC-Publication the term for pressurized equipment is «Ex p».

GENERAL PROVISIONS

§ 2. *Survey.*

.1 The construction, maintenance and operation of electrical installations on drilling platforms, which are used for drilling for petroleum in Norwegian internal waters, in Norwegian territorial waters and in that part of the continental shelf which is under Norwegian sovereignty, are subject to public supervision.

.2 The public supervision is undertaken by the Norwegian Water Resources and Electricity Board (NVE) by authori-

ty from the Ministry of Industry and Handicrafts pursuant to Royal Decree of 25. August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources.

Note:

The Ministry of Industry and Handicrafts has in a letter of 11. July 1969 to NVE a.o. stated:

«Pursuant to Royal Decree of 25. August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources, the Ministry of Industry and Handicrafts hereby states:

1. *The Norwegian Water Resources and Electricity Board is authorized to conduct the inspection, give those orders, consents and approvals which might be necessary according to the provisions in chapter VII, Electrical Installations etc., in the above mentioned Royal Decree.*

2. *The Norwegian Water Resources and Electricity Board is authorized, in special cases, to exempt from those provisions which it is authorized to conduct the supervision of, according to item 1 above.*

3. *The Norwegian Water Resources and Electricity Board is authorized, by its supervisors to stop operation immediately in those cases where a continuation might seriously endanger life or health, cf. § 126 in the Royal Decree mentioned above. If possible, the supervisor should in such cases consult the management of the control institution to which he is assigned, before the operation is stopped.*

   The Ministry of Industry and Handicrafts is to be informed immediately in case the operation is stopped.

4. *Complaints may be raised before the Ministry of Industry and Handicrafts against decisions made by the Norwegian Water Resources and Electricity Board.»*

Within the Norwegian Water Resources and Electricity Board it is at the present the Electricity Supervision, District 1 (Norwegian: Elektrisitetstilsynet 1. distrikt, abbreviation: ET 1) which carries out inspection, gives orders, gives permissions of operation, withdraws permissions of operation, approves equipment and materials etc. Where dispensations and deviations from technical regulations etc. are concerned, decisions will be made by the Electricity

Directorate, which is the superior of the Electricity Supervision.

§ 3. *Scope.*

These Regulations, and other regulations and provisions which pursuant to these Regulations are made valid, apply to installations on board new and existing drilling platforms and their installations and equipment used for drilling as stated in § 2.1.

N o t e :

These Regulations are given by the NVE pursuant to the Royal Decree of 25. August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources, and to the letter of 21. April 1972 from the Ministry of Industry and Handicrafts to NVE, in which the Ministry decides:

«The authority presently placed upon the Ministry of Industry and Handicrafts pursuant to Chapter VII in the Royal Decree of 25. August 1967, to give the necessary regulations for electrical installations on drilling platforms is for the time being transferred to the Norwegian Water Resources and Electricity Board.»

§ 4. *Other regulations, special provisions, dispensations.*

.1 These Regulations apply in addition to the regulations in the Royal Decree of 25. August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources, Chapter VII, Electrical Installations, see § 72 of the Decree.

.2 In addition to these Regulations and the regulations mentioned in item .1, those Regulations for Electrical Installations on board Ships which at any time are in force apply as far as they are applicable.

N o t e :

At the present, the Regulations for Electrical Installations on board ships of 11. November 1975 are in force.

.3 NVE may permit, on the basis of applications in each separate case, that other provisions may apply, totally or partly.

By such an application a copy of the provisions concerned, in Norwegian or English language, may be asked for, before a final permission is granted.

N o t e :

The rules of the following classification Societies may be accepted:

— *Det norske Veritas*
— *Lloyd's Register of Shipping*
— *Bureau Veritas*
— *Germanischer Lloyd*
— *American Bureau of Shipping*

.4 NVE may issue special provisions for various installations or parts of installations.

NVE may further issue supplementary provisions concerning operation, use and maintenance of installations, materials and equipment.

.5 On the basis of applications, NVE may permit exemptions from the regulations which apply to the installation.

N o t e :

In addition to the regulations and provisions which are mentioned above some provisions concerning electrical installations and equipment are stated in Regulations issued by:

The Maritime Directorate
The Directorate of Aviation
The Directorate of Telecommunications
The Petroleum Directorate

§ 5. *The Licensee, his duties and responsibilities.*

.1 With licensee in these regulations is understood anyone having been granted a reconnaissance licence or production licence pursuant to Royal Decree of 9. April 1965 and Royal Decree of 8. December 1972 relating to Exploration for and Exploitation of Petroleum in the Seabed and Substrata of the Norwegian Continental Shelf.

.2 The licensee has the duty and the responsibility to ensure that these regulations are complied with as regards the activities.

Anyone carrying out work on the installation on behalf of the licensee has the same duty and responsibility.

In that period in which consent for the use has been granted, the licensee has the duty to ensure that the installation with appurtenant equipment is in proper working condition and meets the requirements at all times.

.3 **The licensee has the duty to ensure that the necessary permissions for operation of the installation etc. are valid at all times.**

§ 6. *Permission for operation, technical specifications.*

.1 Prior to the commencement of drilling operations — the installation is put into operation — in waters as stated in § 2.1 the licensee must acquire a written permission from the NVE for operation of the installation.

Application for permission is to be forwarded through the Martime Directorate to the NVE in ample time, so that the NVE is able to examine the technical specifications for the installation and to survey the installation before it is intended to be put into operation.

N o t e :

The permission from the NVE for operation of electrical installations on drilling platforms is to be presented before the Maritime Directorate pursuant to the delegation statement from the Ministry of Industry and Handicrafts dated 11. July 1969, gives the permission for operation of the platform pursuant to § 14 in the Royal Decree of 25. August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources. The permission from the NVE is one of the several permissions on which the permission from the Maritime Directorate is based.

.2 Together with application for permission for operation, is to be forwarded those technical specifications, circuit diagrams and other information which the NVE regards necessary for its valuation of the installation.

N o t e :

The specifications which generally are to be enclosed are as follows:

1. *A general description of the platform.*
2. *A general arrangement drawing for the platform.*

The drawing shall have the following indicated/drawn:

a) Hazardous areas are to be indicated by hatching, colouring or corresponding obvious indication. For hazardous areas, see §§ 20—35.

b) Location of electrical equipment, materials and cables in hazardous areas are to be clearly indicated.

c) — Generators. Main and emergency sets.

— *Transformers.*
— *Convertors.*
— *Accumulator batteries.*
— *Main switchboards.*
— *Emergency switchboards.*
— *Distribution switchboards (panels).*
— *Larger motors, e. g. rotary motors, draw-work motors, mud-pump motors, propulsion motors, winch motors.*
— *Cable runs and cables to the above mentioned consumers.*
— *Other larger consumers.*

d) Emergency lighting installations, cabling diagram on which the location of the luminaires etc. are to be indicated.

e) Emergency stop switches and their locations are to be indicated.

3. One-line main circuit diagrams for the installations on board.

Generators, switchboards, transformers, convertors, accumulator batteries, motors and other consumers are to be indicated on the diagrams.

Data and rated values, such as make, type, rated voltage, rated current, rated frequency, type of enclosure etc. are for each component to be indicated on the diagrams or on lists with unambigious references to the diagrams.

On the diagrams or in conjunction with the diagrams types and dimensions for cables, fuse sizes, switchgear including switchgear for motor protection and switchgear for generators, instruments etc. are also to be given. For each component make, type and rated values are to be indicated. For relays, set values for release currents and rating of the largest back-up fuse allowed are also to be indicated.

4. Multi-line circuit diagrams to the extent these give information of importance for evaluation of whether the construction is according to the provisions in the Regulations. For the equipment for emergency stop there are to be drawings/circuit diagrams showing the function.

5. *Calculations showing the short-circuit currents which may occur in the installation and information showing that the installation is sufficiently dimensioned to withstand the stresses from these. This also applies for dimensioning of bus-bars, supports for bus-bars, branch-offs etc. in main swithboards, emergency switchboards and distribution switchboards as well as for switchgear and their switching capacities.*

   Specifications for the performance of switchgear, fuses etc. are to be verified.

6. *Drawings showing the construction of main switchboards, emergency switchboards and distribution switchboards (panels).*

7. *Specifications as for the main installations and drawings/circuit diagrams showing how the emergency powersource is connected to the installation in case of failure in the main power source.*

   Description of the function is to be enclosed.

8. *For equipment and materials in hazardous areas, data and rated values are to be indicated, e. g. make, type, rated voltage, rated current, rated power etc., and also the type of enclosure. This also applies to the installations for telephone, loudspeakers, television and other lightcurrent installations having equipment located in hazardous areas.*

   Approvals and test certificates from a testing station accepted by NVE may be required for such equipment and materials.

   For intrinsically safe circuits a one-line diagram and specifications of make and type of the relay/barrier, the location of the tensor and specifications of the cables are to be forwarded.

   Furthermore system-certificates are to be submitted.

9. *Drawings showing the general layout for:*

   a) The ventilation installations in those areas where inflammable gases may accumulate, e. g. mud pit, shale shaker etc.

      On the drawings air ducts and fans, outlet- and inlet openings and directions of airflow as well as the number of air changes per hour are to be indicated.

      Drawings, circuit diagrams and other specifica-

tions for the control- and monitoring systems for the ventilation installations are to be submitted.

b) Pressurized equipment e. g. rotary motors, drawwork motors, mud-pump motors and similar. For such equipment specifications of the air-source, the materials and the dimensions of the air ducts must be forwarded.

Furthermore drawings, circuit diagrams and other specifications for the control- and monitoring systems are to be submitted.

c) Rooms for accumulator batteries.

10. Copies of relevant approvals/certificates from classification societies or national authorities.

.3 Technical specifications, drawings etc. are generally to be forwarded in at least one copy.

For installations which have previously been surveyed such specifications will not be demanded, unless substantial alterations of the installations have taken place since the last survey.

N o t e :

If the licensee or anyone acting on his behalf would like to receive approved drawings, circuit diagrams etc. in return, additional number of copies for this purpose are required.

.4 Permission for operation of installation is given in writing. The permission is generally given for one season at a time and not for a period exceeding 12 months, see § 8 concerning survey.

§ 7. *Cessation of, and withdrawal of permission for operation.*

.1 If orders or prohibitions are not complied with or if correction of defects or other information are not reported within a given time limit, the permission for operation ceases automatically.

.2 NVE may decide to revoke the permission for operation of installations or parts of installations if:

a) In case of serious or repeated violations of the provisions in:

— Royal Decree of 25. August 1967 relating to Safe

Practice etc. in Exploration and Drilling for Submarine Petroleum Resources,

— these Regulations, or

— other regulations or rules which are made valid pursuant to these Regulations.

b) If the licensee or anyone acting on his behalf prevents or refuses the NVE access to the installations which are subject to survey by the NVE.

c) By violations of the provisions of the regulations stated in a) if the violation in question is not corrected within such reasonable time limit as stipulated by the NVE.

.3 NVE may order immediate disconnection of an electrical installation, or parts of it, if the installation or parts of it are in such a condition that the operation of it can involve danger to human life or health. Such orders can be given to the person in charge on board.

N o t e :

The instruction concerning the whichdrawal of consent to use a drilling platform and its installations and equipment and the order of immediate cessation of the operations by one of the supervisors has been laid down by the Ministry of Industry and Handicrafts 1. June 1971.

§ 8. *The survey.*

Survey of electrical installations on board drilling platforms is to take place:

— Before a drilling platform is put into operation in waters as mentioned in § 2, regardless of the drilling platform previously having been in operation in these waters, and later

— as often as the NVE regards necessary, however at least once every 12 months.

N o t e :

In the case of new installations, survey may take place at the yard and at the sub-contractors to the extent this is found to be necessary.

§ 9. *Survey reports.*

After survey has taken place a survey report is prepared.

Any defects which were found during the survey of the installation will be pointed out in the survey report.

A time limit will be given for correction of the defects.

A notification indicating how the defects have been corrected, item by item according to the survey report, must be sent through the Maritime Directorate to NVE within the time limit given.

Concerning orders, see otherwise the Royal Decree of 25. August 1967 relating to Safe Practice etc. in Exploration and Drilling for Submarine Petroleum Resources, Chapter I, § 3.

§ 10. *Charge — survey fee.*

For the survey carried out by the NVE the licensee is to pay a charge/fee to the Treasury according to settled regulations.

N o t e :

The charge is to cover the expences connected to the survey including travel, survey, examination of technical specifications, making out of reports, etc.

The Regulations concerning such fees are stated by the Ministry of Industry and Handicrafts.

§ 11. *Orders and prohibitions, complaint.*

Any order or prohibition issued by the NVE must, in order to be valid, be made in writing, by telegram or telex.

Decisions made by the NVE in accordance with these Regulations may be complained to the Ministry of Industry and Handicrafts. Such complaint shall not have a delaying effect unless the authority which made the decision declares that the carrying through of the decision totally or partly is to be delayed until the complaint is settled. For the delay, special terms may be made.

N o t e :

Regulations concerning complaints, time limit for complaints etc. are stated in the Act of February 10. 1967 relating to Procedure in Administrative Cases.

§ 12. *Penalties.*

Failure to obey these Regulations or an order or prohibition made in pursuance of them shall be punished with penalties in accordance with the general civil Penal Code of 22. May 1922, §§ 352 and 339 unless more severe punishment is appropriate under other provision of the law.

§ 13. *Entry into force.*

These Regulations enter into force on 1. February 1975.

CLASSIFICATION OF AREAS, ZONE DIVISION, VENTILATION

§ 20. *Classification of areas and zone division.*

.1 The areas on board are classified into 2 main categories as regards the explosion danger:

— Hazardous areas.

— Safe areas.

.2 Hazardous areas are divided into 3 zones:

— Zone 0.

— Zone 1.

— Zone 2.

.3 A safe area is an area which is not classified as hazardous area (non-hazardous).

§ 21. *Zone division.*

.1 Zone 0 is understood to be an area in which inflammable gases or vapours are continuously present or present for long periods of time in sufficient amounts to cause explosion.

N o t e :

This definition of Zone 0 corresponds to the definition of «Zone 0» in IEC Publication 79-10 (1972).

Zone 0 includes such areas as the internal space of active mud-pits, pipes etc. for active mud and also the internal space of storage tanks for inflammable liquids with flash point not in excess of 60 °C.

.2 Zone 1 is understood to be areas in which inflammable gases or vapours in sufficient amount to cause explosion are likely to occur during normal operation.

N o t e :

This definition of Zone 1 corresponds to the definition of «Zone 1» in IEC Publication 79-10 (1972).

Zone 1 includes:

a) Enclosed rooms containing shale shaker, desander, degasser, open active mud-tank and other apparatus where the circulating mud has direct opening to the room (open systems).

b) The area within 1.5 meters (5 ft), measured horizontally, and up to 1.5 meters (5 ft) above and down to 3 meters (10 ft) below any opening on apparatus listed in a), when the equipment is located outdoors, and similarly for outlets for the ventilation plant for Zone 1.

c) Pits, ducts and similar in locations which otherwise would be classified as Zone 2 being so constructed or arranged that inflammable gases may accumulate.

d) Nonventilated rooms having direct access from Zone 2 areas, see however .4.

.3 Zone 2 is understood to be areas in which inflammable gases and vapours in sufficient amounts to cause explosion are not likely to occur, and if they occur they will only exist for a short period of time.

N o t e :

This definition of Zone 2 corresponds to the definition of «Zone 2» in IEC Publication 79-10 (1972).

Zone 2 includes:

a) Enclosed rooms containing mud-pumps and other apparatus where the circulating mud is in a closed system.

If such rooms are effectively ventilated, with at least 30 air changes per hour, they may be accepted as safe rooms subject to consideration in each case.

Rooms, containing pipes for mud, which are effectively ventilated with at least 10 air changes per hour, may be accepted as safe rooms subject to consideration in each case. The pipes may have flanges, but no valves or similar.

Correspondingly, rooms belonging to Zone 2 as mentioned above may be accepted as safe rooms subject to consideration in each case, if the rooms in addition to a smaller continuous ventilation are equipped with gas detection systems and automatic increase of the ventilation capacity if gases occur.

b) The area within 15 meters (50 ft), measured horizontally, from the drill string and up to 3 meters (10 ft) above and down to 9 meters (30ft) below the drill floor.

c) The areas around Zone 1 areas as specified in item .2 Note b), within 3 meters (10 ft) measured horizontally, and up to 3 meters (10 ft) above and down to 9 meters (30 ft) below such openings and outlets as mentioned.

d) The areas within 1.5 meters (5 ft), measured horizontally, from outlets for the ventilation plant of Zone 2-room, and up to 1.5 meters (5 ft) above and down to 4.5 meters (15 ft) below such outlets.

e) The drilling derrick.

.4 Enclosed rooms having openings towards hazardous areas belong as a whole to the zone to which the openings lead, see however items .2 and .3. Doors and similar are in this respect regarded as openings.

Deviation from this provision may be permitted subject to consideration and judgement in each case, if special precautions are taken.

N o t e :

Such special precautions may be:

a) Controlled relative overpressure (pressurized room) minimum 5 mm water column, and fresh-air inlets from safe areas.

b) Air-lock between the rooms, with ventilation to safe areas.

.5 Certain areas and rooms may, if the conditions require so, be classified by the NVE as a more hazardous zone than stated in these Regulations.

Certain areas and rooms may also, by special circumstances and/or by special precautions, be classified by the NVE as a less hazardous zone than stated in these Regulations.

N o t e :

Such special precautions may be:

a) Screening.

b) Special ventilation arrangements.

§ 22. *Ventilation.*

.1 Enclosed rooms, belonging to hazardous areas, Zone 1 and Zone 2, shall be provided with efficient mechanical ventilation. The number of air changes per hour shall be at least 20 for rooms in Zone 1, and at least 10 for rooms in Zone 2.

The ventilation air shall be taken from safe areas outdoors. The location of the air-inlets and outlets shall be such that the entire room will have efficient ventilation. Fans and their motors shall normally be installed in safe areas, so that the air-inlet ducts will have relative over-

pressure. Air-inlet ducts which are designed for relative under-pressure, and of special robust construction may be allowed subject to consideration in each case.

Separate ducts are to be arranged from the air-outlets to have the ventilation air brought directly to the open air. Such ducts belong to the same zone as the room itself. From rooms in Zone 1 the ventilation air is to be brought in separate ducts back to a safe area.

The fans shall be so constructed that sparks or similar cannot arise or precautions shall be taken to avoid the creation of sparks or similar.

.2 Pressurized equipment shall have air supply by a robust duct having the air-inlet located in a safe area.

For air-inlets etc. the requirements in .1 apply.

For pressurized equipment in Zone 1 the air shall be led back to safe areas by means of ducts.

For pressurized equipment in Zone 2 air may be brought directly out of the equipment provided that measures have been taken to prevent that sparks and similar can be thrown out of the openings and ignite any inflammable gas or vapour present.

.3 Pressurized rooms shall have a relative over-pressure of at least 5 mm water column, which is to be monitored.

For such rooms in Zone 1 entrance shall be through gas-locks with ventilation to safe areas.

.4 Doors leading into pressurized rooms shall be fitted with a conspicuous plate with a legible text as follows, or of a similar wording:

«Ekstraventilert rom. Hold døren lukket.
Pressurized room. Keep the door closed.»

Pressurized equipment shall be fitted with a conspicuous plate with a legible text as follows, or of a similar wording:

«Kapslingen må ikke åpnes eller noe deksel fjernes, med mindre området er gassfritt, eller spenningen er koplet fra alle deler innenfor kapslingen.
The enclosure shall not be opened or any cover removed unless the area is known to be safe, or the voltage has been switched off from all devices within the enclosure.»

Besides there shall be signs with a corresponding text in the languages commonly used on board, if these are not Norwegian or English.

.5 Rooms in safe areas adjacent to hazardous areas shall generally have mechanical ventilation with relative over-pressure.

The air shall be drawn from safe areas outdoors. If the ventilation ducts pass through hazardous areas they shall have relative over-pressure in relation to these areas. Ventilation ducts with relative under-pressure in relation to the hazardous areas they pass through, may be permitted according to decision in each case provided the ducts are specially robust and gas-tight.

Air-outlets shall normally be located in safe areas outdoors. Air-outlets may, however, in exceptional cases be allowed located in Zone 2, subject to estimation of the circumstances in each case.

N o t e :

The requirement for relative over-pressure in the air-duct implies that the ventilating fan is to be located in the air-inlet of the duct.

ELECTRICAL INSTALLATIONS IN HAZARDOUS AREAS

§ 30. *Stationary installations and portable equipment which are frequently used.*

.1 In Zone 0 electrical equipment and cables are generally not permitted. In special cases, when it is necessary for the operation, the NVE will accept:

— Intrinsically safe equipment with appurtenant cables.

.2 In Zone 1, the following will normally be accepted:

— Intrinsically safe equipment.

— Flameproof equipment.

— Increased safety equipment, in outdoor locations.

— Pressurized equipment.

— Cables, see § 31.

Pressurized equipment shall be so designed or have such an arrangement or being operated in such a manner that it will have at least 5 air changes before the supply voltage is connected.

The enclosure shall have an overpressure of at least 5 mm water column.

Pressurized equipment are to be arranged for automatic

disconnection of the voltage or equipped with an automatic warning device which operates in case the overpressure disappears (failure of the pressuring system).

Alternatively an arrangement where the overpressure can be maintained by means of an auxiliary fan being automatically started if the over-pressure is reduced may be accepted. Starting of the auxiliary fan is to be indicated.

Monitoring and alarm systems, which are required according to the foregoing, are to be intrinsically safe or the components which are located in the hazardous areas are to be flameproof.

Flameproof equipment must be protected against atmospheric stresses to prevent that corrosion etc. impair the flameproofness of the equipment.

.3 In Zone 2 are accepted:

— Equipment as specified in Zone 0 and Zone 1.

— Increased safety equipment.

.4 Due to special circumstances the NVE may lay down other provisions than those stated in .1 — .3 concerning installations and equipment in hazardous zones, cfr. § 21.5.

§ 31. *Cables.*

Cables in intrinsically safe circuits shall have copper screens or equivalent effective screening (e.g. lead sheathed and armoured). Cables for other circuits than intrinsically safe circuits are to have metal sheaths, screens or armour.

Flexible cables are not permitted in hazardous areas, except those which are necessary for the operation. The flexible cables are then to be of particularly robust constructions and suitable for the purpose.

§ 32. *Installations and equipment being used occasionally and under constant supervision.*

The person in charge on board may permit the use of installations and equipment which are used occasionally and for a short period of time, and which are under constant supervision. Permission for use is given in each separate case, after valuation of the elements of danger and the safety precautions.

§ 33. *Welding apparatus.*

Welding apparatus shall not be connected or used in or near a hazardous area unless the area is gas-free. Connec-

tion points and outlets for welding apparatus are generally to be located in safe areas.

If connection points and outlets are located in or near hazardous areas, a conspicuous plate shall be fitted with a legible text as follows, or of a similar wording:

«Uttaksposten skal være frakoplet og jordet når sveising ikke pågår.
Sveiseapparatet må ikke tilkoples eller brukes med mindre arbeidsstedet og tilstøtende rom er gassfrie.

The outlet shall be disconnected and earthed when not in use.
Welding apparatus are not to be connected or used unless the working space and adjacent rooms are gas-free.»

Besides there shall be signs with a corresponding text in languages commonly used on board, if these are not Norwegian or English.

§ 34. *Socket-outlets, portable equipment.*

.1 Socket-outlets shall generally be located in safe areas. Socket-outlets in hazardous areas shall, when not in use, be disconnected and earthed.

.2 Portable equipment supplied by flexible cables (cords) shall not be connected or used in or near a hazardous area unless the area is gas-free. At socket-outlets in or near hazardous areas a conspicuous plate shall be fitted with a legible text as follows, or of a similar wording:

«Flyttbart elektrisk utstyr med bevegelig ledning må ikke tilkoples eller brukes i områder med gassfare.
Portable electrical equipment supplied by flexible cables shall not be connected or used in areas where gas danger may occur.»

Besides there shall be signs with corresponding text in the languages commonly used on board, if these are not Norwegian or English.

§ 35. *Repair and maintenance work.*

At all entrances to hazardous areas and otherwise at suitable locations a conspicuous plate shall be fitted with a legible text as follows, or of a similar wording:

«Før reparasjons- og/eller vedlikeholdsarbeid blir påbe-

gynt på elektriske anleggsdeler og utstyr, skal spenningen være frakoplet.

The supply circuits shall be disconnected before any repair and/or maintenance work are started on electrical equipment or parts.»

Besides there shall be signs with corresponding text in the languages commonly used on board, if these are not Norwegian or English.

COMMUNICATION NO. 2/72

from the

NORWEGIAN WATER RESOURCES AND ELECTRICITY BOARD

DIRECTORATE OF ELECTRICITY

Electrical Installations on Board Ships

Design of conduit installations with fittings etc. of the FIBO-blocking system.

Some years ago permission was granted, as an exemption from the Regulations, to use fittings etc. with FIBO-blocking system in conduit installations on board ships. Permission was granted on special conditions.

Due to the experiences gained in the past, it is now necessary to lay down more detailed conditions regarding the design of such installations on board ships.

Pursuant to the Act of 24 May 1929 relating to supervision of electrical installations §2, the Royal Decree of 4 July 1929 and authorization of 6 October 1971 from the Ministry of Industry and Handicraft, NVE hereby lays down that the conditions for such installations from now on and until further notice shall be as follows:

1. Boxes are to be fastened by means of screws. The fastening screws must be secured against loosening. Where nuts or screws which are threaded into steel etc. are applied, lock washers must be used. Self tapping screws are not permitted.

   For fastening to wood, galvanized wood-screws of suitable dimensions are to be used.

2. Boxes and fittings shall be cast into one unit or the fittings must be permanently fixed to the boxes. It is not permitted merely to press the fittings into the boxes.

3. Heavy gauge galvanized steel conduits of the "thick-walled" type are to be used, see NEMKO's list of approved equipment, group 7.112. Light steel conduits, of the "thin-walled" type are not permitted.

4. The conduits are to be clamped to the supports on both sides of the boxes or sockets and not further away than 10 cm. The fastening screws are to be secured against loosening, see 1. above.

   For fastening to wood, wood-screws of suitable dimensions or other satisfactory means of fastening are required.

   Solid galvanized clamps must be used for fastening the conduits.

5. Conduit joints and the attachment of conduits to boxes, distribution switchboards etc. are to be carried out in such a way that permanent contact is established between the different metal parts.

6. No part of the conduit installation must be covered up before the Electricity Supervision gives its permission.

The Electricity Supervision requires to be informed, well in advance, when a conduit installation is ready for inspection.

Oslo, 26 April 1972

By Order

A. Johansen

F. Løvmo

COMMUNICATION NO. 1/76

from the

NORWEGIAN WATER RESOURCES AND ELECTRICITY BOARD

DIRECTORATE OF ELECTRICITY

Regulations for plastic conduit installations on board ships.

In some special cases during the last two or three years, the NVE, Directorate of Electricity has given permission for exemptions from the Regulations for electrical installations and has allowed the use of plastic conduit installations on board ships. This has particularly concerned installations on board ships of the westamaran type and similar light ships, and permission has been given on certain conditions. The NVE, Directorate of Electricity still frequently receives applications concerning the use of plastic conduit installations.

In co-operation with the Det norske Veritas, NEMKO and the NVE, the company Norwesco A/S has ordered the Norges Byggforskningsinstitutt to carry out investigations concerning expansion conditions, joint equipment etc.

On the basis of these investigations, the experience gained from the testing of plastic conduits and appurtenant equipment by NEMKO, and from the installations which are completed, the NVE, Directorate of Electricity hereby gives permission for the use of plastic conduit installations for laying cable in dry rooms in accommodation quarters on board ships, provided that no unusual circumstances occur. This permission is given pursuant to the Act of 24 May 1929 relating to supervision of electrical installations § 2, the Royal Decree of 4 July 1929, and the authorization of 6 October 1971 from the Ministry of Industry and Handicraft.

The NVE has stated temporary regulations for such installations which apply in addition to the requirements in the Regulations for electrical installations. These also apply to the new Regulations for electrical installations on board ships, coming into force during the spring of 1976. If other designs than those to which these temporary Regulations apply are intended to be used, this has to be laid before the Electricity Supervision in advance.

The temporary Regulations are:

1. Conduits, boxes, sockets, bends etc. are to be of at least flame retardant material, and are to be of a type which is approved by the NEMKO, or are to have at least corresponding dimensions and qualities. Conduits are to be stiff, except for shorter lengths where flexible conduits may be accepted in special cases.

2. Boxes, sockets, bends etc. may be of the click spring system type.

3. Boxes are to be fastened by means of screws or nails. Fastening screws are to be secured against loosening. When fastening to structural parts of aluminium takes place, self tapping screws or plate screws are not permitted.

4. The conduits are to be laid and fastened in such a way that the longitudinal variations, which may occur because of temperature variations, cannot cause damage to the conduit installations and/or its cables.

   To obtain such longitudinal variations the conduits may be laid with bends, or expansion sockets may be put into the conduit installation. Such bends may have an angle between 45^{o} and 90^{o}. When the conduit length between two boxes or between switchboard and box exceeds a standard conduit length (4 m), an expansion socket is to be inserted.

   Expansion sockets are to have a length of not less than 120 mm. The socket has to be mounted on the conduits in such a way that the part of the socket which covers each conduit has a length of approx. 40 mm. The socket is to be fixed to the support. When using expansion sockets care must be taken that the cables are laid with sufficient slack.

5. The conduits are to be satisfactorily clamped to the support by means of corrosion proof metal clamps fastened by screws or nails. When fastening to structural parts of aluminium takes place, self tapping screws or plate screws are not permitted. The maximum distance between fastening clamps is 750 mm. When conduit is inserted into boxes, the box and the conduit are to be fixed to the same structural part. The conduits are to be fastened on both sides of the box or socket at a maximum distance of 100 mm from this. At boxes the conduits are to be fastened in such a way that they cannot slip in the clamps, except due to longitudinal variations. However, a conduit between two expansion sockets is to be fastened half-way between the sockets in such a way that the conduit cannot slip in this clamp.

6. Where conduits are led through beams, frames or similar, the penetrations are to be suitably lined if there is any danger of damage to the conduits.

7. The conduits are to be installed in such a way that they are satisfactorily protected against damage during later installation and fitting work. Special efforts are to be taken to prevent conduits from being damaged during welding work etc.

   Additionally, precautions must be taken to prevent the conduit installation from being smeared by, or in any other way exposed to, rust-preventing compositions or similar which could destroy the properties of the plastic conduit.

8. Generally, it is to be taken into consideration that plastic conduit installations do not have the same mechanical properties as a conduit installation of galvanized steel conduits, e.g. plastic parts of ceiling and wall boxes are not to be the only support for equipment with weight above 1 kg. Plastic conduit installations in normal use are not to attain a temperature exceeding 60°C.

9. Special consideration is to be given when making holes for boxes in wall and ceiling panels which, according to the fire regulations in force, are to be of incombustible material.

10. During installation work efforts are to be made to maintain the temperature of the conduit and fittings as near to that which is most likely to be present during normal service and in no case below 0°C.

11. No part of the conduit installation is to be covered up before the Electricity Supervision gives its permission. The Electricity Supervision must be informed of the estimated time of the completion of the conduit installation well in advance, so that a survey can take place.

12. These temporary Regulations enter into force immediately.

Oslo, 17 February 1976.

By order

A. Johansen

F. Løvmo

COMMUNICATION NO. 4/76

from the

NORWEGIAN WATER RESOURCES AND ELECTRICITY BOARD

DIRECTORATE OF ELECTRICITY

Regulations for electrical installations on board ships.

Changes in § 1665.1 and .2. Navigation light switchboards.

In the Regulations of 1 February 1975 concerning navigational aids and equipment to be used in connection with navigation etc., the Maritime Directorate has stated provisions which are also of importance to the electrotechnical construction of navigation light switchboards, see § 25 in these Regulations.

According to this, and pursuant to § 2 in the Act of 24 May 1929 relating to the supervision of electrical installations, and the authorization of 6 October 1971 from the Ministry of Industry and Handicraft, the Norwegian Water Resources and Electricity Board hereby states that the provisions in § 1665.1 and .2 in the Regulations for electrical installations on board ships are to be as follows:

§ *1665. Navigation light switchboards.*

.1 Electrical masthead lanterns, port and starboard lanterns, stern lanterns, anchor lanterns and lanterns for ships not under command (N.U.C.) as required in the Rules of the Norwegian Ship Control, are to be connected to a special switchboard - i.e. a navigation light switchboard - by a separate circuit for each lantern. This switchboard is not to be used for other purposes. However, other lanterns which are required, according to the Rules of the Norwegian Ship Control, may be connected to the navigation light switchboard.

.2 Emergency electrical masthead lanterns, port and starboard lanterns, stern lanterns, anchor lanterns and lanterns for ships not under command (N.U.C.) as required, according to the Rules of the Norwegian Ship Control, are to be connected to a special switchboard - emergency navigation light switchboard - by a separate circuit for each lantern. The switchboard is not to be used for other purposes.

The navigation light switchboards, according to .1 and .2, are to have marking "hovedlanterner" and "reservelanterner", or other equivalent marking (e.g. "main lanterns" and "emergency lanterns".

These changed Regulations enter into force 15 November 1976.

Oslo, 15 October 1976

By order

A Johansen

F. Løvmo