

PART VII

ELECTRICAL EQUIPMENT AND INSTALLATIONS

7.1 General

Regulation 5 requires that the electrical and control installations comply with the relevant requirements of one of the standards listed in Merchant Shipping Notice No. M.1672. When surveying installations which are not constructed to one of the classification society standards listed in Merchant Shipping Notice No. M.1672, surveyors should apply the edition of the IEE Regulations which is relevant to the age of the installation.

7.2 Plan Approval

Information relating to the principal equipment and layout of the electrical installation should be submitted at an early stage in the plan approval for a new building. Such details should include:

- (i) cable routing plans;
- (ii) location of generators, switchboards and interconnector cables.

7.2.1 Cables

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Specifications, including flame retardant standard.
- (ii) Location of principal runs of main cables.
- (iii) Location of all emergency cable runs.
- (iv) Details of fire stops in bunched cable runs over 6m vertical; over 14m horizontal in length.
- (v) Detail arrangements including segregation and marking of High Voltage cables (where applicable).
- (v) Details of cable transits for watertight and for fire resisting bulkhead penetrations.

7.2.2 Load schedules

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Main system. Indicating essential services and operational mode (i.e. at sea, manoeuvring, harbour etc.). Emergency system, indicating required service and any non-statutory services.
- (ii) Starting conditions for motors more than 25% of the generator rating are to be stated.
- (iii) Arrangements for the disconnection of non-essential services from the main switchboard and, where applicable, non-emergency services from the emergency switchboard.

7.2.3 Generation and distribution systems (main and emergency)

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Fault level calculations.
- (ii) Short circuit capacity of circuit breakers, fuses and bus-bars.
- (iii) Type and rating of circuit breakers and fuses.
- (iv) Details of protection - overload, reverse power, preference tripping and short circuit.
- (v) Generator paralleling arrangements.
- (vi) Generator control. Automatic Voltage Regulator (AVR) and metering details.
- (vii) Earth indication system details.
- (viii) Earthing of current transformer secondary windings.
- (ix) Interlocking arrangements.
- (x) Switchboard construction (dead front if above 250 volts DC or 50 volts AC).

7.2.4 Emergency stops

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Means and location of stops for ventilating fans, oil pumps and overboard discharges in way of lifeboats lowering positions.
- (ii) Interconnection arrangements between main and emergency switchboards.

7.2.5 Main generators

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Arrangements drawings showing outline and details of construction including AVR and exciter, if fitted.
- (ii) Position in ship with regard to flooding level.
- (iii) Location with respect to switchboard, fire zones and watertight bulkheads.

7.2.6 Emergency generator

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Arrangement drawings showing outline and details of construction including AVR and exciter.
- (ii) Position in ship (uppermost continuous deck, and access from open deck) and with respect to the emergency switchboard and main machinery spaces.
- (iii) Auto-start arrangements.

7.2.7 Batteries for essential and emergency services

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Battery type, manufacturer, service and rating.
- (ii) Indication of discharge at main switchboard or in the machinery control room.
- (iii) Separation of alkali and acid types.
- (iv) Instrumentation and charging arrangements.

7.2.8 Steering gear

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Details of supply, control circuits and cable runs.

7.2.9 Drencher pump, sprinkler pump

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Motor power supply, cable runs and protection arrangements.

7.2.10 Main and emergency lighting

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Position and rating of luminaries.
- (ii) Provisions of at least two separate circuits in each fire zone, main propelling space, saloons etc.
- (iii) Provisions of illuminated signs.
- (iv) Emergency lighting of maintained type.
- (v) Emergency lighting at boat stations.
- (vi) Details of any proposal to use fluorescent luminaries for outside emergency lighting (should normally be of filament type).
- (vii) Arrangements of dimming circuits in public rooms etc., if fitted.
- (viii) Type, disposition and supply arrangements of supplementary emergency lighting required by Regulation 70 for Ro-Ro ships. (These should be approved in accordance with the requirements for ships of Classes I to II(A).
- (ix) Type, disposition and supply arrangements (if applicable) of low location lighting required by Regulation for passenger ships carrying more than 36 passengers.

7.2.11 Navigation lights and access opening indicator lights

The following details may also be required as appropriate to the ship for full plan approval:-

(i) Supply arrangements including control and alarm panel for navigation lights.

(ii) Arrangements (including details of circuits), limit switches and indicator panel for the access opening indicator lights required by Regulation for Ro-Ro ships.

7.2.12 Lifts

The following details may also be required as appropriate to the ship for full plan approval:-

(i) Automatic decking arrangements (except those for goods only).

(ii) Emergency escape arrangements including safety interlocking.

(iii) Supplies to lighting in lift car and trunk (main and emergency) and to alarm.

7.2.13 Shore supply

The following details may also be required as appropriate to the ship for full plan approval:-

(i) Location and details of connection box(es).

7.2.14 Transformers

The following details may also be required as appropriate to the ship for full plan approval:-

(i) Protection (electrical) of primary windings.

(ii) Redundancy of transformers for power and lighting.

7.2.15 Plugs and sockets

The following details may also be required as appropriate to the ship for full plan approval:-

(i) Voltage of sockets for portable and transportable equipment.

(ii) Different socket arrangements for each different voltage.

(iii) Supply arrangements to refrigerated containers etc. where applicable.

7.2.16 Converters

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Details of converters (rectifiers and inverters) where used for emergency supply purposes.

7.2.17 Automation

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Details of power management system for generation and associated auxiliaries(where fitted).

7.2.18 Hazardous areas

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) All electrical equipment in hazardous areas to be listed with details of explosion protection and ingress protection, (IP).
- (ii) Copies of certification documents for all such equipment.
- (iii) Full details of all cables in hazardous areas and the separation of intrinsically safe cables from all other cables.
- (iv) For ventilation fans, details of "sparkproof" construction and details of access to fan and motor for inspection and maintenance.

7.2.19 Public address and alarm systems

The following details may also be required as appropriate to the ship for full plan approval:-

- (i) Location of loudspeakers, alarm bells, etc.
- (ii) Power supply arrangements for each system.
- (iii) Distribution circuit arrangements for each system.
- (iv) Redundancy of amplifiers, oscillators, control etc.

7.3 Safeguarding Generators etc. Against Flooding

Where reasonably practicable, installations and equipment in Class III ships should be designed and located such that services which are essential for the propulsion and safety of the ship will not fail in the event of partial flooding of the ship's machinery space. Due consideration should be given to space limitations and the intended service of the ship.

7.4 Number and Availability of Generators and Other Sources of Power

7.4.1 The requirement for Class III ships are contained in Regulations 44 and 46. For ships of other classes surveyors should be guided by the principles contained in Regulation 43(3)(a) and (b).

7.4.2 Services which may be deemed essential for safety under Regulation 43(3)(b) should be determined by consideration of the ship's intended service. Such services must be supplied by an emergency source of power in the event of failure of the source which supplies power to maintain normal operational and habitable conditions. The emergency source of power shall be either a generator or battery installation(s), of sufficient capacity to ensure safety having regard to the ship's intended service, this would generally reflect the time needed to rescue passengers and crew from a disabled ship.

7.5 Essential and Emergency Services

7.5.1 Essential services

7.5.1.1 Electrical auxiliary services necessary for maintaining the ship in normal operational and habitable condition (known as "essential services") will include those necessary for safety, propulsion, bilge and fire pumps, essential lighting, steering gear, communication and alarm systems, engine room and boiler room ventilation and essential ventilation for crew and passenger accommodation.

7.5.1.2 Where the shedding of non-essential loads is provided for then the order of shedding may be arranged to suit the owner's convenience.

7.5.2 Emergency services

7.5.2.1 Services which may be deemed essential for safety (known as "emergency services") under Regulation 43(3)(b), should be determined by consideration of the ship's intended service. Additional guidance in respect of Class III ships is given in Regulation 46.

7.6 Load Shedding

Any load shedding or other arrangements provided should not interfere with the supply to electrical services which are essential for the propulsion and safety of the ship and which must be maintained after shedding non-essential loads. The essential services where appropriate will include those auxiliaries necessary for propulsion, bilge and fire pumping, navigation lights, essential lighting, steering gear, navigational aids required by the Merchant Shipping Regulations, communication and alarm systems required for safety, watertight doors and engine and boiler room ventilation. The order in which non-essential services are disconnected may be arranged to suit the owner's convenience. Circuits supplying Bow/Stern thrusters should not normally be included in the load shedding arrangements.

7.7 Electrical Protection

7.7.1 Protective devices, either individually or in combination, should be capable of handling the maximum short circuit current that may occur at the point of installation, allowing for all the generators that can be running and connected, and including the contribution from all the motors that can be expected to be running. The shipbuilder's calculations indicating compliance with the foregoing should be considered.

7.7.2 The operating times of protective devices provided for any circuit should be such that faults will be isolated before the supply cable of the circuit has been permanently damaged.

7.7.3 It is recommended that, where practicable, isolating devices which are not designed to break current should be protected against inadvertent or malicious operation when the circuit is carrying current e.g. by interlocking. As a minimum, a notice warning that the device should not be opened under load should be displayed at the operating position.

7.7.4 The arrangements of circuits and protection supplying emergency services should be such that, as far as practicable, a fire or flood or other casualty in one fire zone or one watertight compartment will not affect the emergency services in other compartments.

7.7.5 An overload alarm should be provided for each circuit where overload protection is omitted.

7.8 Steering Gear Circuits

Cables and motors for steering gears should be protected against overcurrent of not less than a short circuit. This should be interpreted as meaning that protective devices should not operate at less than 200% of rated motor current. If, however, switching arrangements are such that more than one steering gear motor can be connected to one feeder, its over-current protection is to be similarly based on at least 200% of the sum of the rated currents of all the motors that can be connected

to the feeder. The control circuits of electrically controlled steering gear should be connected to the power circuit supplying the steering gear.

7.9 Electric Lifts

7.9.1 Arrangements should be made for an inspection of lifts, other than those used exclusively for goods, to be carried out by the lift manufacturer or another competent organisation. Satisfactory certificates or reports should be supplied before acceptance. Such lifts should be provided with acceptable means of escape for the occupants for use in the event of the failure of the primary means of escape. One lamp in each lift car, the emergency lighting in the trunk, and the alarm system should be supplied from the emergency source of power.

7.10 Portable and Transportable Electrical Apparatus

7.10.1 The effect of Regulation 47(2) is to classify all spaces of the ship, except dry areas of accommodation, such as public rooms, cabins and alleyways, as spaces where special provision should be made to ensure that the danger of electric shock is reduced to a minimum. The voltage of electrical supplies to portable and transportable electrical apparatus in all spaces, except dry areas in the accommodation, should be as low as is practicable for the application. General guidance is given in Appendix B of the IEE Regulations 1990. Attention is particularly drawn to the recommendation that 24 volts be used for hand lamps.

7.10.2 Where the supply exceeds 55 volts the use of Class I appliances is recommended in preference to Class II. (Class I appliances are provided with facilities for earthing non-current carrying parts). (Class II appliances have double insulation and/or reinforced insulation throughout and are without provision for earthing).

7.10.3 It is recognised that the limits of voltage recommended in Appendix B of the IEE Regulations 1990 are not always practicable for portable and transportable apparatus such as submersible pumps, deck scalers, refrigerated containers etc. In these cases, where 3 phase supplies up to 500 volts may be involved, the additional precautions in 7.10.3.1 and 7.10.3.2 below or a combination are recommended:

7.10.3.1 circuits which monitor the continuity of the earthed connections and automatically disconnect supply on loss of earth continuity. This arrangement will not, however, be effective when Class II apparatus is used;

7.10.3.2 each socket outlet or group of socket outlets supplied through a high sensitivity residual current circuit breaker (RCCB) (formerly termed high sensitivity current operated earth leakage circuit breaker). For this method to be fully effective the supply must be earthed at one point. In ships with unearthed systems double wound isolating transformers with one point of the secondary winding solidly earthed should be used. Particular attention is

drawn to the need to select an RCCB which is resistant to the marine environment e.g. vibration, salt atmosphere etc.

7.10.4 The supply arrangements to refrigerated containers etc. should ensure that all wandering leads are kept clear of the vehicle decks and the need for extension leads is eliminated.

7.11 Supplies to Lifeboats and Similar Craft

The electrical supply connections, if any, from the ship to any lifeboat or similar craft should be at a voltage not exceeding 55 volts direct current or 55 volts RMS ac.

7.12 Space Heaters

7.12.1 When the installation of space heaters is undertaken, it should be ensured that there will be no risk of heat causing burning or scorching to the surrounding or adjacent material.

7.12.2 It is recommended that electric space heaters are provided with thermostats to reduce the risk of overheating.

7.13 Construction of Cables

7.13.1 To meet the flame retardant characteristics cables should be at least in accordance with BS 4066: Pt 1: 1980 (1995), or IEC 332-1: 1979.

7.13.2 To meet the fire resistant characteristics cables should be either of the mineral insulated metal covered type in accordance with BS 6207 part 1: 1995 or of a type which meets test symbols CWZ (950° Celsius for 3 hours) as defined in BS 6387: 1994 and is suitable for shipboard use. Alternatively, compliance with IEC 331 is acceptable as a minimum standard.

7.14 Installation of Cables and Equipment

Main and emergency cable runs and the equipment which they supply should be separated as widely as practicable. Where main and emergency supplies are required for a particular service, e.g. the sprinkler pump, the cables should take differing routes, as far as practicable.

7.15 Precautions Against Fire and Flood

7.15.1 Emergency cable runs should be arranged so that a fire or flood in one watertight compartment or fire zone does not affect emergency services in other watertight compartments or fire zones.

7.15.2 Cable penetrations through bulkheads which are required to be fire resistant and/or watertight should be made using cable transits which have been approved for this purpose.

7.16 Precautions Against Fire and High Temperature

7.16.1 Cable runs should, as far as practicable, avoid routes which pass over or near the top of diesel engines and oil-fired equipment, or near to hot surfaces e.g. diesel engine exhaust systems. Where there is no alternative route, cables should be protected from heat and fire damage. Such fire protection could be in the form of a steel plate or trunk, due account being taken of the effects on cable rating, if appropriate.

7.16.2 Consideration should be given to the arrangements of bunched cable runs to ensure that their flame retarding characteristics are not impaired. Note: The use of unsuitable paints, trunking, casings etc. may significantly affect the fire propagation characteristics of cables. Builders proposals for fire stops in long runs of bunched cables should be considered, unless the cables are totally enclosed in cable trunks. Long cable runs may, as a guidance figure, be taken as those over 6m vertical and 14m horizontal. Where cables are installed in totally enclosed cable trunks, derating may be necessary due to lack of ventilation.

7.17 Precaution Against Collision

All cables and associated equipment supplied from the emergency source of power and, as far as practicable, main runs of cables supplied from the main source of power, should be kept within the B/5 line. Where supplies to emergency services cannot be kept within this line additional precautions e.g. duplication of supplies, should be taken to protect the services against loss of supply.

7.18 Cable Joints

Joints in cables may be accepted for repair or replacement purposes and also exceptionally to facilitate installation in new ships. Details of the jointing system, which should be a well established method, should be specially considered. Cable joints should not normally be accepted in hazardous areas, unless they are part of an intrinsically safe circuit.

7.19 Special Category Space Ventilation

Where a Regulation requires that any loss or reduction of ventilation capacity is indicated on the navigating bridge, systems based on sensing the current drawn by the fan motor are preferred, as the reliability of the flow switches previously used has been found to be unsatisfactory in marine conditions. Means which indicate that the motor is running, for example an auxiliary contact on the fan motor controller, can be accepted as a minimum requirement.

7.20 Electrical Equipment in Hazardous Areas and Spaces

7.20.1 Definitions

For the purposes of these Instructions, a hazardous area is defined in Regulation 2(2) and includes those parts of special category spaces where electrical equipment is required to be certified for use in explosive petrol/air mixtures, unless dangerous goods are to be carried, see below. Decks or platforms with openings of a sufficient size to permit penetration of petrol gases downwards are not considered to be decks on which vapour accumulate.

7.20.2 Type of equipment

7.20.2.1 Electrical equipment for use in the spaces described in paragraph 7.21.1 should be certified to at least apparatus group IIA and temperature class T3 as defined in BS 5345: Pt 1: 1989. The following types of equipment may be accepted in these spaces:

- (i) Intrinsically safe Ex i
- (ii) Flameproof Ex d
- (iii) Increased safety Ex e

(except motors)

7.20.2.2 Equipment which is required by Regulation to be enclosed and protected to prevent discharge of sparks should have a minimum degree of ingress protection IP 55 in accordance with BS EN 60529: 1992.

7.20.2.3 It is recommended that electrical equipment and cables should not be installed in the ventilation trunks serving hazardous areas. Where this cannot be avoided, adequate access for inspection and maintenance should be provided.

7.20.2.4 The appropriate apparatus group, temperature class and degree of ingress protection for electrical equipment for use in hazardous spaces will depend on the substances to be carried as cargo or stored respectively. To ensure that electrical equipment is suitable for use with all the flammable dusts, gases or vapours to which it may be exposed, electrical equipment, certified to the highest standard, (i.e. group IIC, temperature class T6 and degree of ingress protection IP 6X) should be installed. The following types of equipment may be accepted in these spaces:

- (i) Intrinsically Ex i
- (ii) Flameproof Ex d

(iii) Increased Safety Ex e

(except motors)

7.20.2.5 Attention is drawn to the special requirements for the carriage of dangerous goods in the appropriate Merchant Shipping (Fire Protection) Regulations 1998. Electrical equipment in the whole of the space in which the goods are carried, together with the associated ventilation trunks, will normally need to be certified to the highest standards mentioned above, unless the equipment and associated cables are capable of being electrically isolated by the removal of links to the operation of lockable switches.

7.20.2.6 Electrical equipment for use in the hazardous spaces should be certified to at least apparatus group IIC, temperature class T1. Equipment should be confined to luminaries of flameproof type Ex d, or increased safety type Ex e and intrinsically safe circuits.

7.20.2.7 In order to comply with Regulation 47(2)6, electrical equipment should not be installed in compartments which are intended for the storage of gas burning or welding cylinders. Regulation 66 (1) refers.

7.20.2.8 Only self-contained battery operated lamps or torches of a type which are certified for use in the flammable dusts, gases or vapours to which they may be subjected should be provided for use in hazardous areas and spaces. No facilities for connecting portable electrical equipment should be provided in hazardous areas and spaces.

7.20.3 Cables

7.20.3.1 Intrinsically safe circuits should not be run in the same multicore cable as non-intrinsically safe circuits. Different intrinsically safe circuits should not be run in the same cable without special consideration. The electrical parameters (capacitance, inductance and resistance) of cables for intrinsically safe circuits should comply with the certification documents.

7.20.3.2 Cables for intrinsically safe circuits in new ships should be segregated from all non-intrinsically safe cables by at least 50mm throughout their length. In existing ships, arrangements without cable segregation can be accepted provided that either the intrinsically safe cables or the non-intrinsically safe cables are armoured (wire, braid or tape) or metal sheathed.

7.20.3.3 Cable for non-intrinsically safe circuits in the hazardous areas should be either:

- (i) of the mineral insulated metal covered type; or
- (ii) protected by electrically continuous metal sheathing or metallic wire armour, braid or tape; or

(iii) enclosed in screwed heavy gauge steel solid drawn or seam welded and galvanised conduit. The conduit should be made gas tight with respect to hazardous areas.

7.21 Re-Survey of Electrical Installations

7.21.1 General

7.21.1.1 Surveyors should satisfy themselves that routine testing and servicing of the installation and equipment has been carried out and in particular on essential and emergency services.

7.21.1.2 Casualty investigations have shown that insufficient attention is paid to ensuring that connections and securing devices are tight. Shipowners should check connections at regular intervals so that any wear or other deterioration which could lead to loose parts overheating or disintegrating is detected and corrected before any serious consequences arise. It is recommended that all current carrying parts and connections should be so constructed and secured as to ensure their continued effectiveness when subjected to vibration. Screws and nuts securing current carrying parts should be effectively locked so that they cannot work loose due to vibration. Where connections cannot be checked e.g. because of the need to maintain supplies to essential services, shipowners and surveyors are recommended to consider the use of thermographic imaging equipment to detect poor connections by means of generated heat.

7.21.1.3 It should be established that the necessary spare gear is on board and in good condition.

7.21.2 Insulation resistance

Surveyors should be satisfied that the insulation resistance value of all cables, switchgear, generators, motors, heaters, other electrical apparatus in power circuits and all lighting circuits (including lighting fittings), are not less than the values given below. Values for essential power and all emergency services should be measured annually and the remainder of the installation within five years. Readings presented by the ship's engineers may be accepted at the surveyor's discretion. When it is necessary for values to be measured, they should be taken between all insulated poles and earth. The installation may be subdivided to any desired extent.

Nominal voltage of circuit	Minimum insulation resistance in megohms
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Below 50V	0.3
50V to 440V	1.0

Greater than 440V $\frac{\text{Nominal voltage} + 1}{1000}$

Note: Insulation resistance of intrinsically safe circuits should not normally be measured.

7.21.3 Motors and generators for essential and emergency services

The condition of stators, rotors and their windings and the electrical connections, commutators, slip rings etc. should be satisfactory. Main and emergency generators should be seen under working conditions each year.

7.21.4 Switchboards, distribution boards and motor control gear

7.21.4.1 It should be established that all switchgear is clean and circuit breaker contacts are in good condition. Sealed contacts, which are unused in some high voltage circuit breakers e.g. vacuum and sulphur hexafluoride (SF6), need little maintenance and should only be maintained in accordance with the manufacturer's instructions. The settings of protective devices and fuse ratings should be satisfactory, e.g. not excessively high. See also paragraph headed Electrical Protection below. Particular attention should be paid to ensure that there are no loose connections and parts. Reference is made to 7.21.1.2.

7.21.4.2 In addition, it is recommended that the main and emergency generator circuit breakers should be tested at least every five years. The tests should, as far as practicable, check the settings of protective devices including over-current, reverse power and preference trips. Simulation by current injection may be accepted.

7.21.4.3 Where circuit breakers are used to control equipment requiring frequent switching operations e.g. the main generators and bow thrust motors for ferries, their condition is likely to deteriorate more quickly and a more frequent program of inspection/maintenance may be required. Consequently, annual inspection and test of these circuit breakers is appropriate and should include the mechanical linkages etc. of units with sealed contacts, e.g. vacuum.

7.21.5 Electrical protection

7.21.5.1 It may be appropriate to carry out random checks on the electrical protection devices e.g. fuse rating, MCB setting, overload setting in motor starters etc.

7.21.5.2 Electric welding plant should be in accordance with Appendix B of the IEE Regulations.

7.21.6 Transforming equipment

7.21.6.1 Where transformers, rectifiers etc. are used to supply essential or emergency services the surveyor should satisfy himself regarding their general condition with particular reference to cleanliness and the tightness of connections and parts.

7.21.6.2 Where liquid immersed equipment is installed, an up to date certificate from a competent test authority testifying that the electrical characteristics of the liquid are satisfactory for the condition of service should be available to the surveyor at least every five years.

7.21.7 Electrical equipment incorporating liquid cooling

7.21.7.1 Where water circulated air coolers are fitted they should be examined and if necessary subjected to a suitable hydraulic test. Where liquid is in contact with live conductors an up to date certificate from a competent test authority testifying that the electrical characteristics of the liquid are satisfactory for the conditions of service should be available to the surveyor at least every five years. Where suitable test equipment for determining the electrical characteristics of the cooling medium is provided on board, these results may be accepted at the discretion of the surveyor.

7.21.7.2 The alarm and indicators provided e.g. temperature, flow etc., should be tested as far as is practicable.

7.21.8 Emergency services

7.21.8.1 It should be established that the operation of equipment for automatically starting and connecting the emergency generator to the emergency switchboard is satisfactory.

7.21.8.2 The emergency services required by the Regulations e.g. lighting, pumps, miscellaneous services etc., should be seen under operating conditions each year.

7.21.9 Emergency batteries

7.21.9.1 It should be established each year that the battery and associated compartment or container is clean and in good condition and that ventilation arrangements are in good order.

7.21.9.2 Any battery cell suspected of being defective should be tested for capacity and if it fails to give 80% of its rated capacity it should be considered unfit for further service. A certificate of inspection by a battery maker of repute regarding the satisfactory condition of the battery may be accepted by the surveyor. Such certificates should be supplied for inclusion in the records of the ship.

7.21.9.3 The arrangements for automatic change-over from mains supply to battery supply required by the Regulations should be checked each year.

7.21.10 Cables

It may be appropriate, depending on the age and condition of the installation to examine a sample of cables to ascertain the general condition of the whole installation. Opening up of trunks etc. should not normally be necessary, unless examination or unsatisfactory insulation resistance readings, indicate that it is required for further investigation. Particular attention should be paid to cables in areas of high ambient temperatures, e.g. near exhaust systems of diesel engines.

7.21.11 Electric lifts

7.21.11.1 Surveyors should be satisfied that electric lifts are maintained in good condition.

7.21.11.2 Inspection and maintenance of lifts should be carried out by the lift makers or other competent organisations every six months and certificates or reports made available to the surveyor. If such a certificate or report is produced or some equally satisfactory arrangement is made, surveyors need not insist on the opening up of working parts or dismantling of safety devices etc., for inspection.

7.21.12 Hazardous areas and spaces

The condition of cabling and equipment within hazardous areas and spaces should be examined each year to ensure that it is in a satisfactory condition and that no unauthorised alterations have been made. Particular attention should be paid to the insulation resistance values and electrical protection devices. Intrinsically safe circuits should not normally be subjected to an insulation resistance test.

7.21.13 High voltage equipment

Where electrical equipment at above 1000 volts is installed any arrangements which are provided to guard against unauthorised entry of personnel should be checked each year to ensure that they are satisfactory.

7.21.14 Electric propulsion machinery

The electrical equipment should be surveyed as described above.