22-420

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part H Electrical Installations

Rules for the Survey and Construction of Steel Ships
Part H 2022 AMENDMENT NO.1
Guidance for the Survey and Construction of Steel Ships
Part H 2022 AMENDMENT NO.1

Rule No.45 / Notice No.31 30 June 2022
Resolved by Technical Committee on 26 January 2022

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NIPPON KAIJI KYOKAI

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part H Electrical Installations

2022 AMENDMENT NO.1

Rule No.45 30 June 2022

Resolved by Technical Committee on 26 January 2022

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

Rule No.45 30 June 2022
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part H ELECTRICAL INSTALLATIONS

Chapter 1 GENERAL

1.1 General

Paragraph 1.1.7 has been amended as follows.

1.1.7 Ambient Conditions~~*~~

(-1 and -2 are omitted.)

3 Ambient temperatures for electrical equipment installed in environmentally controlled spaces are to comply with following requirements:

(1) Where electrical equipment is installed within environmentally controlled spaces the ambient temperature for which the equipment is to be suitable may be reduced from 45 °C and maintained at a value not less than 35 °C provided:

(a) The equipment is not for use for emergency services or automatic and remote control systems.

(b) Reduced ambient temperatures are to be controlled by at least two air conditioning units (including refrigerating units, hereinafter referred to as the same) which can work at a 45 °C ambient temperature. In the event of the loss of any one air conditioning unit, all remaining units are to be capable of maintaining such reduced ambient temperatures.

(c) The equipment is able to be initially set to work safety within a 45 °C ambient temperature until such a time that the lesser ambient temperature may be achieved; the cooling equipment is to be rated for a 45 °C ambient temperature.

(d) If the temperature rise over the upper limit of these reduced ambient temperatures, audible and visual alarms are to be activated at continually manned spaces (e.g. navigation bridges or machinery control rooms).

(2) In accepting a lesser ambient temperature than 45 °C, it is to be ensured that electrical cables for their entire length are adequately rated for the maximum ambient temperature to which they are exposed along their length.

(3) Air conditioning units used for cooling and maintaining the lesser ambient temperature are to be classed as one of the electrical installations necessary to provide normal operational conditions of propulsion and safety specified in **3.2.1-2.**

Paragraph 1.1.8 has been amended as follows.

1.1.8 Maintenance Records of Batteries~~*~~

1 As for batteries fitted for use of the services necessary to provide normal operational conditions of propulsion and safety of the ship, maintenance records ~~included necessary~~ including at least the following information ~~required by the Society~~ are to be kept on board.

(1) Type and manufacturer's type designation

(2) Voltage and ampere-hour rating

(3) Location

(4) Equipment and/or system(s) served
(5) Maintenance/replacement cycle dates
(6) Date(s) of last maintenance and/or replacement
(7) For replacement batteries in storage, the date of manufacture and shelf life

(Note)

Shelf life is the duration of storage under specified conditions at the end of which a battery retains the ability to give a specified performance.

2 Procedures are to be put in place to ensure that where batteries are replaced that they are of an equivalent performance type.

3 Where vented type batteries replace valve-regulated sealed type batteries, it is to be ensured that the requirements specified in **2.11** are complied with.

(Note)

(1) A vented type battery is one in which the cells have a cover provided with an opening through which products of electrolysis and evaporation are allowed to escape freely from the cells to atmosphere.

(2) A valve-regulated sealed type battery is one in which cells are closed but have an arrangement (valve) which allows the escape of gas if the internal pressure exceeds a predetermined value.

1.2 Testing

1.2.1 Shop Tests*

Sub-paragraphs -1 and -4 have been amended as follows.

1 The electrical equipment specified below is to be tested in accordance with the respective requirements in this Part at the place of manufacture or at other locations having adequate apparatus for testing and inspections. However, to implement the tests, in lieu of traditional ordinary surveys where the Surveyor is in attendance, the Society may approve other survey methods which it considers to be appropriate. In addition, tests for any equipment with small capacities as specified in **(4)** and **(5)** are to be conducted as deemed appropriate by the Society.

(1) Rotating machines for propulsion and their respective control equipment
(2) Ship service generators (main, auxiliary and emergency)
(3) Main and emergency switchboards
(4) Motors for auxiliary machinery specified in **1.1.6-1(1)** to **1.1.6-1(3), Part D** (hereinafter referred to as “motors for essential services” in this Part)
(5) Controlgears for those motors specified in **(4)** above
(6) Transformers for power and lighting of single phase 1 *kVA* or more and three phase 5 *kVA* or more. However, those transformers used only for special services such as those ones for Suez Canal Search Lights, etc. are to be excluded
(7) Semiconductor converters for power of not less than 5 *kW* and their respective accessories that are used for supplying power to the electrical equipment specified in **(1)** to **(3)** above
(~~7~~8) Other electrical equipment as deemed necessary by the Society

2 Any electrical equipment used for auxiliary machinery for specific use for those ships specified in **1.1.6-1(4)** and **1.1.6-1(5), Part D** as well as those deemed necessary by the Society are to be tested in accordance with the respective requirements in this Part.

3 For those electrical equipment manufactured by mass production, test procedures suited to their production methods, notwithstanding the requirements given in **-1**, may be applied subject to Society approval.

4 Electrical equipment and cables shown in the following items **(1)** to **(6)** are to be subjected to type tests for each type of products. However, in cases where it is inadequate to deal with them under the requirements for type tests (e.g. those used only for specific ships or purposes with little possibility of continued use, or items for which the acquisition of individual test/inspection certificates is desired), tests and inspections of individual products may be accepted in place of type tests when requested by application.

(1) Fuses
(2) Circuit breakers
(3) Electromagnetic contactors
(4) Explosion-protected electrical equipment
(5) Cables for power, lighting and internal communications
(6) Semiconductor converters for power of not less than 5 *kW* that are used for ~~supplying power to~~ the electrical equipment specified in **-1(~~1~~4)** ~~to~~and **(5)** above

5 Electrical equipment and cables having a certificate considered acceptable to the Society may be exempted partially or wholly from the tests and inspections.

Chapter 2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

2.1 General

2.1.3 Construction, Materials, Installations, etc.*

Sub-paragraphs -11 and -12 have been added as follows.

11 Electrical equipment allowed in paint stores and adjacent areas are to be in accordance with **Table H2.2**. Switches, protective devices, motor control gear of electrical equipment installed in a paint store are to interrupt all poles or phases and preferably are to be located in non-hazardous space.

12 Installation of electrical and electronic equipment in engine rooms protected by fixed water-based local application fire-fighting systems (FWBLAFFS) are to comply with following requirements (see **Fig. H2.1**):

(1) Electrical and electronic equipment enclosures located within areas protected by FWBLAFFS and those within adjacent areas exposed to direct spray are to have a degree of protection not less than IP44, except where evidence of suitability is submitted to and approved by the Society.
(2) The electrical and electronic equipment within adjacent areas not exposed to direct spray may have a lower degree of protection provided evidence of suitability for use in these areas is submitted taking into account the design and equipment layout, e.g. position of inlet ventilation openings, cooling airflow for the equipment is to be assured.
(3) Additional precautions may be required to be taken in respect of:
    (a) Tracking as the result of water entering the equipment
    (b) Potential damage as the result of residual salts from sea water systems
    (c) High voltage installations
    (d) Personnel protection against electric shock

Table H2.2 to Table H2.18 have been renumbered to Table H2.3 to Table H2.19, and Table H2.2 has been added as follows.

Table H2.2 Electrical Equipment Allowed in Paint Stores and Adjacent Areas

Areas		Permitted electrical installations
(a)	Paint stores	(1) The certified safe type equipment specified below at least with respect to gasses and vapours of group *II*B and of temperature class *T*3 as well as their associated cables - intrinsic safety type (*Exi*) - flameproof type (*Exd*) - pressurized type (*Exp*) - increased safety type (*Exe*) - special protection type (*Exs*) (2) Cables (through-runs or terminating cables) of armoured type or installed in metallic conduits are to be used. (3) Non-sparking type ventilation fans. Protection screens of not more than 13 *mm* square mesh are to be fitted in the inlet and outlet ventilation openings of the ducts fitted with such fans on the open deck.
(b)	Inlet and exhaust ventilation ducts	
(c)	Areas on open decks within 1 *m* of inlet and exhaust ventilation openings	(1) Electrical equipment and cables permitted for those areas specified in **(a)** and **(b)** (2) Electrical equipment with a type of protection '*n*' (*Exn*) (3) Electrical equipment of those types which ensure the absence of sparks or arcs and which no parts of such equipment haves operating temperatures which can cause the ignition of gases or vapours of those flammable liquids being stored as well as their associated cables (4) Electrical equipment with simplified pressurized enclosures or vapour proof enclosures (minimum degree of protection is IP55) and which no parts of such equipment have operating temperatures which can cause the ignition of gases or vapours of those flammable liquids being stored as well as their associated cables
(d)	Areas on open decks within 3 *m* of exhaust mechanical ventilation openings	
(e)	Enclosed spaces having direct openings (without closable openings, such as doors) into paint stores	These spaces may be considered as non-hazardous, provided that: (1) Doors to paint stores are gastight doors with self-closing devices; (2) Paint stores are provided with independent natural ventilation systems which are deemed appropriate by the Society; and, (3) Warning notices are fitted adjacent to paint store entrances stating that such stores contain flammable liquids.

Notes:

1. The paint stores and inlet and exhaust ventilation ducts are classified as Zone 1 and areas on open deck as Zone 2, as defined in *IEC* 60092-502:1999.
2. A watertight door may be considered as being gastight.

Table H2.~~2~~3 Limits of Temperature Rise for Rotating Machines
(Omitted)

Table H2.~~3~~4 Values of F_1
(Omitted)

Table H2.~~4~~5 Minimum Clearances and Creepage Distances inside Terminal Boxes of Rotating Machines
(Omitted)

Table H2.~~5~~6 Tests for Rotating Machines
(Omitted)

Table H2.~~6~~7 Testing Voltages
(Omitted)

Table H2.~~7~~8 Minimum Values of Test Voltages and Insulation Resistance
(Omitted)

Table H2.~~8~~9 Minimum Air Clearances for Busbars
(Omitted)

Table H2.~~9~~10 Instruments for *d.c.* Generator Panels
(Omitted)

Table H2.1~~0~~1 Instruments for *a.c.* Generator Panels
(Omitted)

Table H2.1~~1~~2 Limits of Temperature Rise of Electrical Appliances for Switch Boards
(Omitted)

Table H2.1~~2~~3 Minimum Clearances and Creepage Distances for Control Appliances
(Omitted)

Table H2.1~~3~~4 Limits of Temperature Rise of Controlgears for Motors
(Omitted)

Table H2.1~~4~~5 Current Ratings of Cables (for continuous service)[(1)]
(Omitted)

Table H2.1~~5~~6 Correction Factor for Various Ambient Temperatures
(Omitted)

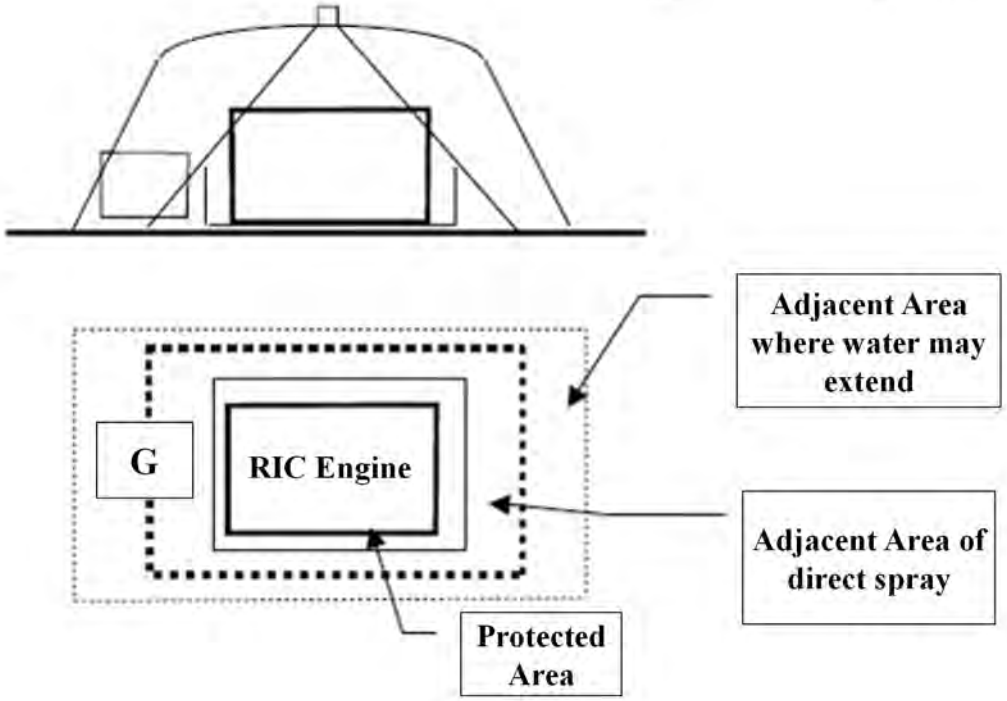
Table H2.1~~6~~7 Limits of Temperature Rise of Transformers
(Omitted)

Table H2.1~~7~~8 Minimum Air Clearances
(Omitted)

Table H2.1~~8~~9 Minimum Insulation Resistance
(Omitted)

Fig. H2.1 has been added as follows.

Fig. H2.1 Areas Protected by Fixed Water-based Local Application Fire-fighting Systems, etc.



Notes:

1. Protected space: Is a machinery space where a FWBLAFFS is installed.
2. Protected areas: Areas within a protected space which is required to be protected by FWBLAFFS.
3. Adjacent areas:
   (a) Areas, other than protected areas, exposed to direct spray.
   (b) Areas, other than those specified in (a) above, where water may extend.

2.2 System Design - General

2.2.5 Feeder Circuits

Sub-paragraph -5 has been amended as follows.

5 Final sub-circuits of ratings exceeding 1~~5~~6 *A* are not to supply more than one appliance.

2.2.7 Lighting Circuits*

Sub-paragraph -2 has been amended as follows.

2 The number of lighting points supplied by final sub-circuits of ratings ~~15~~16 *A* or less is not to exceed:

(1) 10 for those circuits up to ~~50~~55 *V*
(2) 14 for those circuits from ~~51~~56 *V* up to ~~130~~120 *V*
(3) 24 for those circuits from ~~131~~121 *V* up to 250 *V*

In cases where the number of lighting points and total load currents are invariable, a number of points greater than those specified above may be connected to final sub-circuits provided that aggregate load currents do not exceed 80 % of the ratings of protective devices in such circuits.

Paragraph 2.2.10 has been amended as follows.

2.2.10 Circuits for Electric Heating and Cooking Equipment

1 Each item of electric heating and cooking equipment is to be connected to separate final sub-circuits. However, up to 10 small electric heaters of an aggregate current rating not exceeding 1~~5~~6 *A* may be connected to a single final sub-circuit.

2 Electric heating and cooking equipment are to be controlled by multipole linked switches mounted in the vicinity of the equipment. However, small electric heaters connected to final sub-circuits of ratings not exceeding 1~~5~~6 *A* may be controlled by a single-pole switch.

2.4 Rotating Machines

Paragraph 2.4.3 has been amended as follows.

2.4.3 Limits of Temperature Rise*

Temperature rise of rotating machines are not to exceed those values given in **Table H2.~~2~~3**, in cases where they are operated continuously at rated loads or operated intermittently according to their duties. Temperature rise of static exciters for *a.c.* generators are to comply with the requirements given in **2.5.10-~~2~~1(1)**.

2.4.4 Modification of Limits of Temperature Rise*

Sub-paragraphs -1 and -3 have been amended as follows.

1 In cases where ambient temperatures exceed 45 °C, limits of temperature rise are to be decreased by the difference from those values given in **Table H2.~~2~~3**.

2 (Omitted)

3 In cases where ambient temperatures do not exceed 45 °C, limits of temperature may be increased by the difference from those value given by **Table H2.~~2~~3**. In such cases, ambient temperatures are not to be set below 40 °C.

2.4.11 Shafts of Rotating Machine*

Sub-paragraph -4(1) has been amended as follows.

4 The shafts of generators are to comply with the following requirements:

(1) The diameters of generator shafts, in the length from those sections in cases where rotors are fixed to the shaft ends of prime movers, are not to be less than those values obtained from the formula specified in **6.2.2, Part D**.

In such cases, the values H, N_0 and F_1 used in that formula mean as follows:

H : Output of rotating machines at maximum continuous rating (*kW*)

N_0 : Number of revolutions of rotating machine shaft at maximum continuous rating (*rpm*)

F_1 : Factor given in **Table H2.~~3~~4**

However, in cases where bearings are arranged on both sides of generators, the diameter of shafts around those couplings on prime movers may be reduced gradually to 0.93 times those diameters obtained from the aforementioned formula.

((2) and (3) are omitted.)

2.4.12 Clearances and Creepage Distances inside Terminal Boxes

Sub-paragraph -1 has been amended as follows.

1 Clearances and creepage distances inside terminal boxes of rotating machines are not to be less than the values given in **Table H2.~~4~~5**. Furthermore, the clearances and creepage distances for the terminal boxes of rotating machines with rated voltages exceeding 500 *V* are to be adequate for the working voltage and to give consideration to the specifications of the terminal boxes.

2.4.14 *A.C.* Generators

Sub-paragraph -3 has been amended as follows.

3 In cases where generators are driven at rated speeds, giving rated voltages and they are subjected to sudden changes of symmetrical loads within the limits of specified currents and power factors (see **2.4.15-~~3~~-1(2)**), voltages are not to fall below 85 % nor exceed 120 % of the rated voltages. Voltages of such generators are then to be restored to within ± 3 % of their rated voltage in a period of not more than 1.5 *seconds*. However, in the case of emergency generators, such voltage values may be increased to ± 4% in a period of not more than 5 *seconds*.

Paragraphs 2.4.15 has been amended as follows.

2.4.15 Shop Tests*

1 Rotating machines are to be tested in ~~accordance with the requirements given in this 2.4.15-2 to -13~~ the following **(1)** to **(12)** in accordance with **Table H2.~~5~~6**. In addition, all tests are to be carried out in accordance with *IEC* 60092-301:1980/AMD2:1995. However, those tests required by **~~-6~~(5)** and **~~-8~~(7)** below may be omitted subject to the Society's permission for each generator or motor which is produced in series having identical type with their unit. ~~In addition~~Furthermore, those tests required by **~~-5~~(4)** below may be omitted for each generator or motor which is of small capacity and which is produced in a series of identical types with their unit.

~~2~~(1) (Omitted)

~~3~~(2) (Omitted)

~~4~~(3) (Omitted)

~~5~~(4) Overcurrent or excess torque tests for rotating machines are to be carried out in accordance with **2.4.5** and such machines are to have the capability to withstand such tests (see *IEC* 60034-1:2017).

~~6~~(5) Steady short-circuit tests for synchronous generators are to be carried out and comply with the requirements given in **2.4.6-2**. However, the duration of a steady short-circuit may be of any time delay which will be fitted in the tripping device for selective tripping where precise data showing such time delay is available in accordance with the following **(~~1~~a)** and **(~~2~~b)**. The manufacturer's simulation model for the generator and the voltage regulator may be used where this has been validated through tests of identical types of the same model.

(~~1~~a) In order to provide sufficient information to the party responsible for determining the discrimination settings in the distribution system where the generator is going to be used, the generator manufacturer is to provide documentation showing the transient behavior of the short-circuit current upon a sudden short-circuit occurring when excited~~,~~ and running at nominal speed.

(~~2~~b) The influence of the automatic voltage regulator is to be taken into account, and the setting parameters for the voltage regulator are to be noted together with the decrement curve. Such a decrement curve is to be available when the setting of the distribution

system's short-circuit protection is calculated. The decrement curve need not be based upon physical testing.

~~7~~(6) Overspeed tests for rotating machines are to be carried out and comply with the requirements given in **2.4.7** (see *IEC* 60034-1:2017). Such tests, however, are not applicable to squirrel cage motors.

~~8~~(7) After rotating machines are run continuously under actual load methods at their rated output voltages, frequencies, and those duties for which they are being rated until their temperatures have reached a steady state, the temperature rise of each part is to be measured and is not exceed the value given in **2.4.3** (see *IEC* 60034-1:2017). In cases where it is considered to be acceptable by the Society, such tests may be carried out in accordance with separately specified procedures.

~~9~~(8) The high voltage levels specified in **Table H2.~~6~~7** are to be applied for a period of 1 *minute* between live parts and frames of rotating machines, with those cores and windings not undergoing testing connected to such frames (see *IEC* 60034-1:2017). In the cases of machines with rated voltage above 1 *kV*, tests are to be carried out in accordance with the requirements given in **2.17.6-4**. Furthermore, where those temperature rise tests specified in ~~8~~**(7)** above are applied, high voltage tests are to be carried out after the test.

~~10~~(9) Immediately after those high voltage tests specified in ~~9~~**(8)** above have been performed, the insulation resistance of such rotating machines is to be measured in accordance with **Table H2.~~7~~8** and all values are not to be less than any of those specified in **Table H2.~~7~~8**. In addition, during such measuring, temperatures of rotating machines are to be near operating temperature. However, in cases where this is difficult, appropriate methods of calculation may be used instead.

~~11~~(10) (Omitted)

~~12~~(11) (Omitted)

~~13~~(12) (Omitted)

Table H2.6 has been amended as follows.

Table H2.~~6~~7 Testing Voltages

(Table is omitted.)

Notes:

(1. to 3. are omitted.)

4. In the case of semiconductor elements for exciters, the requirements ~~for semiconductor converters for power~~ given in **2.12** are to be applied.

2.5 Switchboards, Section Boards and Distribution Boards

2.5.4 Busbars*

Sub-paragraph -5 has been amended as follows.

5 Air clearances (phase-to-phase, pole-to-pole and phase-to-earth) of non-insulated busbars are not to be less than the values given in **Table H2.~~8~~9**.

Table H2.8 has been amended as follows.

Table H2.~~8~~9 Minimum Air Clearances for Busbars

Rated voltage (*V*)	Air clearance (*mm*)
250 or less	15
over 250 to 690 inclusive	20
over 690 to 1,000 inclusive	~~35~~25

Paragraphs 2.5.6 and 2.5.7 have been amended as follows.

2.5.6 Measuring Instruments for *d.c.* Generators

Ship service *d.c.* generator panels are to be at least provided with the instruments given in **Table H2.~~9~~10**.

2.5.7 Measuring Instruments for *a.c.* Generators

Ship service *a.c.* generator panels are at least to be provided with the instruments given in **Table H2.1~~0~~1**.

Paragraph 2.5.10 has been amended as follows.

2.5.10 Shop Tests*

~~**1**~~ Switchboards are to be tested and inspected in accordance with the requirements given in ~~this **2.5.10**~~ the following **(1)** to **(4)**. However, those tests required by ~~**2**~~**(1)** below may be omitted subject to the Society's permission for each switchboard which is produced in series having the identical type with its first unit.

~~**2**~~(1) Temperature rises of switchboards are not to exceed those values given in **Table H2.1~~1~~2** under the specified currents and/or rated voltages, except in those cases specified in the chapters of this Part.

~~**3**~~(2) (Omitted)

~~**4**~~(3) (Omitted)

~~**5**~~(4) (Omitted)

2.7 Control Appliances

2.7.1 Clearances and Creepage Distances

Sub-paragraphs -2 and -3 have been amended as follows.

2 Minimum clearances and creepage distances of control appliances (*e.g.*, electromagnetic contactors, control switches, terminal boards) are not to be less than those values given in **Table H2.1~~2~~3** if such appliances are designed and constructed in consideration of moisture, dust, etc. or if they are operated in ambient conditions not affected by extremely high humidity and heavy deposit of dusts.

3 Minimum clearances and creepage distances of small control appliances having rating currents not exceeding 1~~5~~6 *A* may be shortened to values deemed appropriate by the Society, depending on the degree of protection of the enclosures of such appliances or those ambient conditions in which such appliances are installed.

Table H2.12 has been amended as follows.

Table H2.1~~2~~3 Minimum Clearances and Creepage Distances for Control Appliances

Rated insulating voltage (*V*) (*d.c* & *a.c.*)	Clearance (*mm*)						Creepage[3][4](*mm*)					
	Less than ~~15~~16 *A*[5]		~~15~~16 *A* or over and 63 *A* or under[5]		Exceeding 63 *A*[5]		Less than ~~15~~16 *A*[5]		~~15~~16 *A* or over and 63 *A* or under[5]		Exceeding 63 *A*[5]	
	L-L[1]	*L-A*[2]	*L-L*[1]	*L-A*[2]	*L-L*[1]	*L-A*[2]	*a*	*b*	*a*	*b*	*a*	*b*
Not exceeding 60	2	3	2	3	3	5	2	3	2	3	3	4
Exceeding 60 and 250 or under	3	5	3	5	5	6	3	4	3	4	5	8
Exceeding 250 and 380 or under	4	6	4	6	6	8	4	6	4	6	6	10
Exceeding 380 and 500 or under	6	8	6	8	8	10	6	10	6	10	8	12
Exceeding 500 and 660 or under	6	8	6	8	8	10	8	12	8	12	10	14
Exceeding 660 and 800 or under	10	14	10	14	10	14	10	14	10	14	14	20
Exceeding 800 and 1,000 or under	14	20	14	20	14	20	14	20	14	20	20	28

Notes:
(Omitted)

2.8 Controlgears for Motors and Magnetic Brakes

Paragraph 2.8.4 has been amended as follows.

2.8.4 Shop Tests*

~~1~~ Controlgears for motors are to be tested in accordance with the requirements given in ~~this 2.8.4~~ the following **(1)** to **(4)**. However, those tests required by ~~2~~**(1)** below may be omitted subject to the Society's permission for each controlgear and magnetic brakes which is produced in series having identical type with its first unit.

~~2~~(1) (Omitted)
~~3~~(2) (Omitted)
~~4~~(3) (Omitted)
~~5~~(4) (Omitted)

2.9 Cables

Paragraph 2.9.1 has been amended as follows.

2.9.1 General

Cables are to comply with one of *IEC* ~~*Publication* 60092~~ standards listed in the following **(1)** to **(7)** or any equivalent thereto. However, cables such as flexible cables, fibre-optic cables, etc. used for special purposes may be accepted provided they comply with relevant standards deemed appropriate by the Society or any equivalent thereto. Installation of cables is to comply with the requirements given in this **2.9**.

(1) *IEC* 60092-350:2020
(2) *IEC* 60092-352:2005
(3) *IEC* 60092-353:2016

(4) *IEC* 60092-354:2020
(5) *IEC* 60092-360:2014
(6) *IEC* 60092-370:2019
(7) *IEC* 60092-376:2017

Paragraph 2.9.9 has been amended as follows.

2.9.9 Current Rating of Cables

The current rating of cables is to comply with the following **(1)** to **(5)**.

(1) The current rating of cables for continuous service is not to exceed the values given in **Table H2.14~~4~~5**.

(2) The current rating of cables for short-time services (30 *minutes* or 60 *minutes*) may be increased by multiplying the value given in **Table H2.14~~4~~15** by the following correction factor.

correction factor: $\sqrt{1.12/(1-exp(-ts/0.245/d^{1.35}))}$

ts : 30 or 60 (*min*)

d : overall diameter of the finished cable (*mm*)

(3) The current rating of cables for intermittent services (for periods of 10 *minutes*, of which 4 *minutes* are with constant loads and 6 *minutes* without any loads at all) may be increased by multiplying the value given in **Table H2.14~~4~~15** by the following correction factor.

correction factor: $\sqrt{\frac{1-exp\,(-10/0.245/d^{1.35})}{1-exp\,(-4/0.245/d^{1.35})}}$

d : overall diameter of the finished cable (*mm*)

The current rating for other intermittent ratings is to be deemed appropriate by the Society.

(4) In cases where more than 6 cables belonging to the same circuit are bunched together, a correction factor of 0.85 is to be applied.

(5) In cases where ambient temperatures are different from those specified in **(1)** to **(3)**, the correction factor in **Table H2.1~~5~~6** may be applied.

Paragraph 2.9.11 has been amended as follows.

2.9.11 Precaution against Fire*

1 (Omitted)

2 (Omitted)

~~**3** Where cables used for the services specified in the following **(1)** to **(11)**, including their power supplies, pass through high fire risk areas other than those which they serve, they are to be so arranged that a fire in any of these areas or zones does not affect the operation of the service in any other area or zone.~~

~~(1) General alarm systems~~

~~(2) Fire alarm systems~~

~~(3) Fixed fire-extinguishing systems and their medium release alarms~~

~~(4) Fire detection systems~~

~~(5) Control and power systems to power operated fire doors and status indication for all fire doors~~

~~(6) Control and power systems to power operated watertight doors and their status indication~~

~~(7) Emergency lighting~~

~~(8) Public address systems or other equivalent means of communication~~

~~(9) Remote emergency stop/shutdown of equipment specified in **2.2.13-1**~~

~~(10) Emergency fire pump~~

~~(11) Low location lighting systems~~

~~**4** In addition to the requirements given in **-3** above, the installation of cables connected to emergency fire pumps is to comply with the following **(1)** and **(2)**:~~

~~(1) The cables are not to pass through machinery spaces containing main fire pumps or their respective power sources and prime movers; and~~

~~(2) The cables may pass through other high fire risk areas mentioned in **-3** above only if they are fire resistant types which comply with standards deemed appropriate by the Society, and run continuous through such areas so as to maintain fire integrity.~~

~~**5** Interconnecting cables between generators and main switchboards are to be routed clear of fuel oil purifier spaces, above other engines driving generators and fuel oil purifiers except in any of the following **(1)** to **(3)**:~~

~~(1) Cables connected to multiple generators or main switchboards which are separated into at least two groups throughout their length as far apart as practicable;~~

~~(2) Fire resistant cables which comply with the standards deemed appropriate by the Society; or~~

~~(3) Cables protected by fire prevention measures deemed appropriate by the Society.~~

3 Electrical services required to be operable under fire conditions are as follows:

(1) Control and power systems to power-operated fire doors and status indication for all fire doors

(2) Control and power systems to power-operated watertight doors and their status indication

(3) Emergency fire pump

(4) Emergency lighting

(5) Fire and general alarms

(6) Fire detection systems

(7) Fire-extinguishing systems and fire-extinguishing media release alarms

(8) Low location lighting

(9) Public address systems or other equivalent means of communication

(10) Remote emergency stop/shutdown arrangements for systems which may support the propagation of fire and/or explosion specified in **2.2.13-1**

4 Where cables for services specified in **-3** above including their power supplies pass through high fire risk areas, they are to be so arranged that a fire in any of these areas or zones does not affect the operation of the service in any other area or zone. This may be achieved by either of the following measures:

(1) Cables being of a fire resistant type complying with *IEC* 60331-1:2018 for cables of greater than 20 *mm* overall diameter, otherwise *IEC* 60331-21:1999+AMD1:2009 or *IEC* 60331-2:2018 for cables with an overall diameter not exceeding 20 *mm*, are installed and run continuous to keep the fire integrity within the high fire risk area (see **Fig. H2.2**).

(2) At least two-loops/radial distributions run as widely apart as is practicable and so arranged that in the event of damage by fire at least one of the loops/radial distributions remains operational.

(3) Systems that are self monitoring, fail safe or duplicated with cable runs as widely separated as is practicable may be exempted.

(4) Cables are to be laid within insulated steel pipes or steel ducts whose fire protection is equivalent to *A*-60 or more.

5 The electrical cables to the emergency fire pump are not to pass through the machinery spaces containing the main fire pumps and their source(s) of power and prime mover(s). They are to be of a fire resistant type, in accordance with **-4(1)** above, where they pass through other high fire risk areas.

6 The definition for “high fire risk areas” in case of **-4** and **-5** above is the following:

(1) Machinery spaces as defined by **3.2.30, Part R**, except spaces having little or no fire risk as defined by paragraphs (10) of Regulation 9.2.2.3.2.2 of *SOLAS* Chapter II-2. (Including the

interpretations for tables 9.3, 9.4, 9.5, 9.6, 9.7 and 9.8 given in *MSC*/*Circ*.1120 as amended by *MSC*.1/*Circ*.1436 and *MSC*.1/*Circ*.1510)

(2) Spaces containing fuel treatment equipment and other highly flammable substances

(3) Galley and Pantries containing cooking appliances

(4) Laundry containing drying equipment

(5) Spaces as defined by paragraphs (8), (12), and (14) of Regulation 9.2.2.3.2.2 of *SOLAS* Chapter II-2

7 Means are to be provided so that fire resistant cables are easily distinguishable.

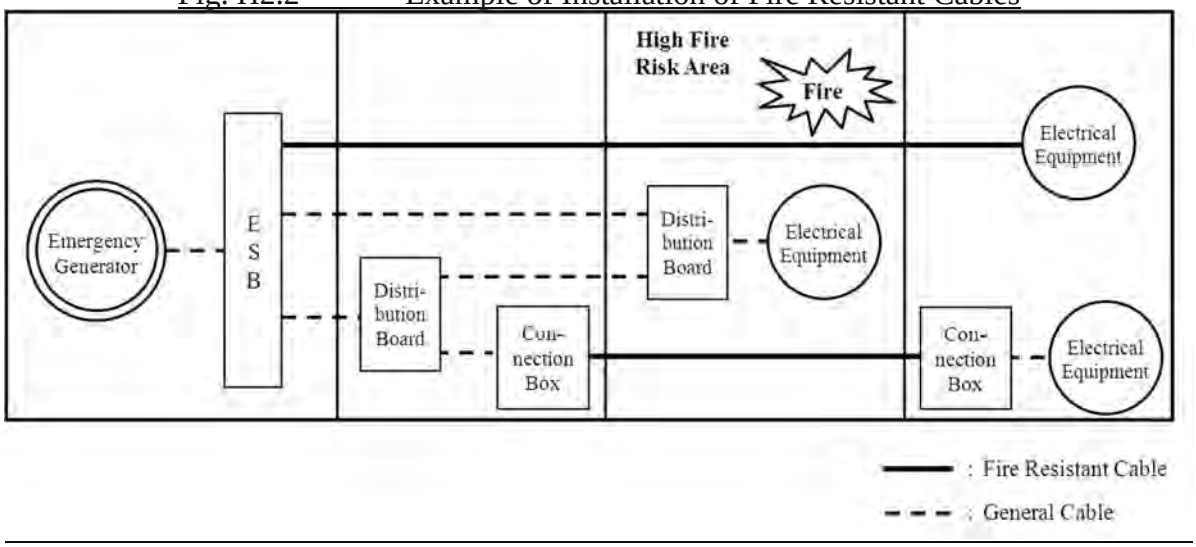
8 For special cables, requirements in the following standards may be used:

(1) *IEC* 60331-23:1999: Procedures and requirements - Electric data cables

(2) *IEC* 60331-25:1999: Procedures and requirements - Optical fibre cables

Fig. H2.2 has been added as follows.

Fig. H2.2 Example of Installation of Fire Resistant Cables



2.10 Transformers for Power and Lighting

Paragraph 2.10.3 has been amended as follows.

2.10.3 Temperature Rise

Temperature rises of transformers are not to exceed those values given in **Table H2.1~~6~~7** during any continuous operation at rated outputs.

2.10.4 Modification of the Limits of Temperature Rise*

Sub-paragraphs -1 and -3 have been amended as follows.

1 In cases where ambient temperatures exceed 45 °C, limits of temperature rise are to be decreased by the difference from those values given in **Table H2.1~~6~~7**.

2 (Omitted)

3 In cases where ambient temperatures do not exceed 45 °C, limits of temperature rise may be increased by the difference from those values given by **Table H2.1~~6~~7**. In such cases, ambient temperatures are not to be set below 40 °C.

Paragraph 2.10.6 has been amended as follows.

2.10.6 Shop Tests

1 Transformers are to be tested in accordance with the requirements in ~~this **2.10.6**~~ the following **(1)** to **(4)**. However, those tests required by ~~**2**~~**(1)** may be omitted for those transformers which are produced in a series of identical types from the second unit onward subject to Society approval.

~~**2**~~(1) (Omitted)

~~**3**~~(2) (Omitted)

~~**4**~~(3) (Omitted)

~~**5**~~(4) (Omitted)

2.11 Accumulator Batteries

2.11.1 General*

Sub-paragraph -1 has been amended as follows.

1 The requirements given in this **2.11** apply to all permanently-installed vented type secondary batteries. ~~Vented type secondary batteries are those ones in which electrolytes can be replaced and which may release gases when they are being charged and/or overcharged.~~ However, the requirements specified in **2.11.5-4** are also applicable to valve-regulated sealed type batteries.

2.11.5 Ventilation*

Sub-paragraph -4 has been added as follows.

4 The ventilation arrangements for installation of vented type batteries which have charging power higher than 2 *kW* are to be such that the quantity of air expelled is at least equal to:

$Q = 110 \times I \times n\ (l/h)$

I : Maximum current delivered by the charging equipment during gas formation, but not less than 25 % of the maximum obtainable charging current in amperes

n : Number of cells in series

Q : Quantity of air expelled in litres/hour

The ventilation rate for compartments containing valve-regulated sealed type batteries may be reduced to 25 % of that given above.

2.12 Semiconductor Converters for Power

Paragraph 2.12.4 has been added as follows.

2.12.4 Shop Tests*

1 The converters and accessories specified in **1.2.1-1(7)** are to be tested in accordance with the following **(1)** to **(5)**. However, those tests required by **(1)** below may be omitted, subject to Society approval, for products which are produced in a series of identical types from the second unit onward.

(1) Temperature rise tests for converters and their accessories are to be carried out under normal working conditions. In addition, the temperature rise for the interiors of converters is not to exceed manufacturer specified values while the temperature rise for the exteriors of converters (*e.g.* the connecting parts of busbars and cables for switchboards as well as coils, contactors and resistors) is not to exceed the values specified in the requirements given in

2.8.3. Furthermore, temperature test methods for semiconductor element connections are to be as deemed appropriate by the Society.

(2) Instruments, switching devices and protective devices fitted in converters are to be checked for normal operation under operating conditions.

(3) High voltage tests specified in *IEC* 60146-1-1 or *IEC* 61800-5-1

(4) High voltage tests between live parts and earths for accessories charged with auxiliary circuit potential are to be in accordance with the requirements given in **2.8.4(3).**

(5) Immediately after such high voltage tests have been carried out, insulation resistance between live parts of converters and their accessories and earths is not to be less than 1 *MΩ* when tested with *d.c.* voltages of at least 500 *V*.

2.14 Wiring Accessories

2.14.4 Socket-outlets and Plugs

Socket-outlets and plugs are to comply with the following **(1)** to **(5)**:

Sub-paragraph (3) has been amended as follows.

(3) Socket-outlets of rated currents exceeding ~~15~~16 *A* are to be provided with switches so interlocked that plugs cannot be inserted or withdrawn in cases where switches are in the “on” position.

2.16 Explosion-protected Electrical Equipment

2.16.2 Selection of Explosion-protected Construction

Constructions for explosion-protected electrical equipment used in hazardous areas on board ships are to be selected from the following explosion-protected types:

Sub-paragraphs (8) and (9) have been added as follows.

(8) Type of protection ‘*n*’

(9) Special protection type

2.17 High Voltage Electrical Installations

Paragraph 2.17.3 has been amended as follows.

2.17.3 Construction and Location*

(-1 to -11 are omitted.)

12 The degree of protection applying to enclosures of high voltage electrical equipment is to be provided with a degree of protection appropriate to the location, as a minimum the requirements of *IEC* 60092-201:2019. Particularly rotating machines, transformers, high voltage switchboards, high voltage control boards and converters are to comply with the following:

((1) to (3) are omitted.)

13 High voltage switchboards and high voltage control boards are to be ~~of an enclosed type and~~ constructed according to the *IEC* 62271-200:2011. In addition, high voltage switchboards are to be of metal - enclosed type in accordance with *IEC* 62271-200:2011 or of the insulation - enclosed type in accordance with the *IEC* 62271-201:2014. Furthermore, the high voltage sections are to be equipped with doors that are either locked by key or some other equivalent means.

(-14 to -21 are omitted.)

22 In general, phase-to-phase air clearances and phase-to-earth air clearances between non-insulated parts are not to be less than the values given in **Table H2.1~~7~~8**. In **Table H2.1~~7~~8**, intermediate values may be accepted for nominal voltages provided that the next higher air clearance is observed. In the case of smaller distances, an impulse voltage test carried out in accordance with paragraph 4.2 of *IEC* 62271-1 and it is confirmed to have sufficient insulation performance.

23 Creepage distances between live parts and between live parts and earthed metal parts are to be in accordance with *IEC* 60092-503:2007 for the nominal voltage of the system, the nature of the insulation material and the transient overvoltage developed by switch and fault conditions.

(-24 to -27 are omitted.)

28 High voltage switchboards and control boards are to be internal arc classified in accordance with *IEC* 62271-200:2011. In cases where they are accessible by authorized personnel only, *Accessibility Type A* is sufficient. *Accessibility Type B* is required if they are accessible by non-authorized personnel.

29 The installation and location of high voltage switchboards and control boards, ~~including their clearance to the ceiling (deckhead),~~ are to correspond with its internal arc classification and classified sides (front, lateral and rear). In addition, the clearance between the switchboard and the ceiling/deckhead above is to meet the requirements of the internal arc classification according to *IEC* 62271-200:2011.

(-30 is omitted.)

2.17.4 Protective Devices, etc.

Sub-paragraph -6 has been amended as follows.

6 Dry type transformers are to comply with *IEC* 60076-11:2018, while liquid cooled transformers are to comply with the applicable Parts of the *IEC* 60076 Series. Oil immersed transformers are to be provided with the following alarms and safety devices.

((1) to (3) are omitted.)

2.17.5 Cables

Sub-paragraphs -1 and -3 have been amended as follows.

1 High voltage cables are to be constructed in accordance with the *IEC* 60092-353:2016 and *IEC* 60092-354:2020 or other equivalent ~~S~~standard.

2 (Omitted)

3 The segregation of high voltage cables is to be as follows:

(1) (Omitted)

(2) Where high voltage cables of different voltage ratings are installed on the same cable tray, the air clearance between cables is not to be less than the minimum air clearance for the higher voltage side as given in **Table H2.1~~7~~8**. However, high voltage cables are not to be installed on the same cable tray for the low voltage cables.

(-4 to -6 are omitted.)

2.17.6 Testing*

Sub-paragraphs -3 and -4 have been amended as follows.

3 A power-frequency voltage test is to be carried out on any high voltage switchboards and high

voltage control boards. The test procedure and voltages are to be according to the *IEC* 62271-200:2011 section 7 / routine test.

4 In addition to the tests normally required for rotating machinery, a high frequency high voltage test in accordance with *IEC* 60034-15:2009 is to be carried out on the individual coils in order to demonstrate a satisfactory withstand level of the inter-turn insulation to steep fronted switching surges.

2.18 Tests after Installation On Board

2.18.1 Insulation Resistance Test

Sub-paragraphs -1 and -3 have been amended as follows.

1 In the case of circuits of electric propulsion, auxiliary power and lighting, insulation resistance between conductors and earths as well as between conductors is to be measured and its value is not to be less than those values specified in **Table H 2.1~~8~~9**.

2 (Omitted)

3 The insulation resistance of generators and motors under working temperatures is to be those values specified in **Table H2.~~7~~8**.

Chapter 3 DESIGN OF INSTALLATIONS

3.2 Main Sources of Electrical Power and Lighting Systems

Paragraph 3.2.5 has been added as follows.

3.2.5 Generators and Generator Systems, Having the Propulsion Machinery as their Prime Mover, not Forming Part of the Main Source of Electrical Power

Generators and generator systems, having the ship's propulsion machinery as their prime mover but not forming part of the ship's main source of electrical power (hereinafter referred to as "shaft driven generator systems, etc."), may be used whilst the ship is at sea to supply electrical services required for normal operational and habitable conditions provided that:

(Note)

"Generators and generator systems, having the ship's propulsion machinery as their prime mover but not forming part of the ship's main source of electrical power" are those whose operation does not meet the requirements of *IEC* 60092-201:2019, paragraph 8.1.1.

(1) There are sufficient and adequately rated additional generators fitted, which constitute the main source of electrical power specified in **3.2.1-1**, meeting the requirements of *IEC* 60092-201:2019 paragraph 8.1.1.

(2) Arrangements are fitted to automatically start one or more of the generators within a period of 45 seconds, constituting the main source of electrical power specified in **3.2.1-1**, in compliance with **3.2.1-2** and also upon the frequency variations exceeding ± 10% of the limits specified in **(3)** and the event of any shaft driven generator systems, etc. being stopped.

(3) Within the declared operating range of shaft driven generator systems, etc. the specified limits for the voltage variations in *IEC* 60092-301:1980/AMD2:1995 and the frequency variations in **Table H2.1** can be met.

(4) The short circuit current of the shaft driven generator systems, etc. is sufficient to trip the circuit-breaker taking into account the selectivity of the protective devices for the distribution system.

(5) Where considered appropriate, load shedding arrangements are fitted to protect the generators against sustained overload.

(6) In those ships having remote control of the ship's propulsion machinery from the navigating bridge means are provided, the following requirements are to be complied with:

(a) Means are provided, or procedures be in place, so as to ensure that supplies to essential services are maintained during manoeuvring conditions in order to avoid a blackout situation.

(Note)

A "blackout situation" means that the main and auxiliary machinery installations, including the main power supply, are out of operation but the services for bringing them into operation (e.g. compressed air, starting current from batteries etc.) are available.

(b) The declared operating range is to be shown on navigation bridges, and devices to indicate the condition of shaft driven generator systems, etc. are to be established.

3.3 Emergency Sources of Electrical Power

3.3.3 Kind and Performance of Emergency Sources of Electrical Power*

Emergency sources of electrical power are to be either generators or accumulator batteries or uninterruptible power systems, which are to comply with the following:

Sub-paragraph (3) has been amended as follows.

(3) In cases where emergency generators are uninterruptible power systems, the requirements are ~~as deemed appropriate by the Society~~ to be in accordance with **Annex 3.3.3(3)**.

Chapter 5 ADDITIONAL REQUIREMENTS FOR ELECTRIC PROPULSION PLANTS

5.2 Propulsion Electrical Equipment and Cables

Paragraph 5.2.4 has been amended as follows.

5.2.4 Temperature Rise of Rotating Machines

In cases where variable speed propulsion rotating machines are fitted with integral fans and have to be operated at speeds below rated speeds at full-load torque, full-load current, full-load excitation or the like, temperature limits according to **Table H2.~~2~~3** of **2.4.3** are not to be exceeded.

Annex 3.3.3(3) has been added as follows.

Annex 3.3.3(3) UNINTERRUPTIBLE POWER SYSTEM UNITS

1.1 General

1.1.1 Application

This annex to uninterruptible power system (hereinafter referred to as "UPS") units, as defined in *IEC* 62040-3:2011, apply when providing an alternative power supply or transitional power supply to the emergency sources of power specified in **3.3, Part H**. Any batteries and semiconductor converters combined with UPS units are to be in accordance with those requirements specified in **2.11** and **2.12, Part H** as practicable.

1.1.2 Definitions

Definitions of the terms used in this annex are as follows:

(1) UPS means sources of electrical power with semiconductor converters, switches and batteries, used for maintaining continuity of loads in cases of input power failure.(*IEC* 62040-3:2011)

(2) Off-line UPS units mean those electrical power devices in which output loads are powered from bypass lines under normal operation and which are only transferred to inverters if such bypass supply falls or goes outside preset limits.

(3) Line interactive UPS units means those systems specified in **(2)** above which are attached to equipment which controls voltage vibrations.

(4) On-line UPS units mean those systems which supply electrical power to loads via inverters without any power interruption.

1.2 Design

1.2.1 Construction

1 UPS units are to be constructed in accordance with *IEC* 62040:2017, *IEC* 62040-2:2016, *IEC* 62040-3:2011, *IEC* 62040-4:2013 and/or *IEC* 62040-5-3:2016, as applicable, or acceptable and relevant national or international standards.

2 The operation of UPS units is not to depend on any external services.

3 The type of UPS unit (off-line, line-interactive, on-line) is to be appropriate for the power supply requirements of the relevant connected loads (see **2.1.2-3, Part H**).

4 UPS units are to have external bypass circuits.

5 UPS units are to have self-monitoring functions, and audible and visual alarms are to be activated in those spaces where crew members are normally stationed (e.g. navigation bridges and machinery control spaces) in the following cases:

(1) Power supply failures (abnormal voltage or frequency)

(2) Earth faults

(3) Operation of battery protective devices

(4) Discharge of batteries

(5) Operation of bypass circuits for on-line UPS units

1.2.2 Arrangements

1 UPS units are to be suitably located for use in emergency situations.

2 In case where UPS units utilising valve regulated sealed batteries are provided with the ventilation arrangements in accordance with the requirements of *IEC* 62040-1:2017, *IEC* 62040-2:2016, *IEC* 62040-3:2011, *IEC* 62040-4:2013 and/or *IEC* 62040-5-3:2016, the Society may approve the location of such UPS units in the compartment where normal electrical equipment are

located.

1.2.3 Performance

1 Output power is to be maintained for the duration time required for relevant connected equipment as specified in **3.3.2, Part H.**

2 No additional circuits are to be connected to any UPS units unless their battery capacity is more than the total capacity of the output power specified in **-1** above.

3 On the restoration of input power, the ratings of any charging units are to be sufficient to recharge the batteries while maintaining the output supply to the load equipment.

4 In cases where supplying to loads via inverters from the batteries in UPS, maximum permitted voltage fluctuations on the output side of the circuit may be taken as those specified in **Table H2.1(a)** or **H2.1(b)**, **2.1.2-3, Part H** respectively, notwithstanding any voltage drops of such batteries.

1.3 Testing

1.3.1 Shop Tests

1 UPS units of 50 *kVA* and over are to be tested at places of manufacturer or at other works. In addition, tests for semiconductor converters are to be carried out in accordance with those requirements specified in **1.2.1-1, Part H.**

2 Appropriate tests are to be carried out in accordance with the following items to demonstrate that UPS units are suitable for its intended environment.

(1) Functionality, including operation of alarms
(2) Temperature rise
(3) Ventilation rates
(4) Battery capacities

3 UPS units which are connected to equipment requiring a continuous supply of power even in at times of UPS input power failure are to be checked to verify that this operational condition can be maintained.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 July 2022.
2. Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction is before the effective date.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part H Electrical Installations

2022 AMENDMENT NO.1

Notice No.31 30 June 2022

Resolved by Technical Committee on 26 January 2022

Notice No.31 30 June 2022
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

Part H ELECTRICAL INSTALLATIONS

Amendment 1-1

H1 GENERAL

H1.1 General

Paragraphs H1.1.7 and H1.1.8 have been deleted.

~~**H1.1.7 Ambient Conditions**~~

~~In the case of electrical installations, except those used for emergency services or automatic and remote control systems, which are installed in enclosed spaces having air conditioning units and are able to be initially set to work safely within a 45 °C ambient temperature, the upper limit of those ambient temperatures specified in **Table H1.1**, **Part H of the Rules** may be reduced to any value not less than 35 °C subject to the following requirements:~~

~~(1) Reduced ambient temperatures are to be controlled by at least two air conditioning units (including refrigerating units, hereinafter referred to as the same) which can work at 45 °C ambient temperature. In the event of the loss of any one air conditioning unit, all remaining units are to be capable of maintaining such reduced ambient temperatures.~~

~~(2) If the temperature rise over the upper limit of these reduced ambient temperatures, audible and visual alarms are to be activated at continually manned spaces, *e.g.*, navigation bridges or machinery control rooms.~~

~~(3) Air conditioning units are to be regarded as one of the electrical installations specified in **H3.2.1-3(2).**~~

~~**H1.1.8 Maintenance Records of Batteries**~~

~~In **1.1.8, Part H of the Rules**, the wording "the services necessary to provide normal operational conditions of propulsion and safety of the ship" means those specified in **H3.2.1-3** and the wording "the information required by the Society" means those in the followings.~~

~~(1) Type, manufacture's type designation and rating~~

~~(2) Installation Location~~

~~(3) Equipment or systems which are being served~~

~~(4) Date of manufacture and expiration date~~

~~(5) Maintenance procedures (including those procedures regarding replacements)~~

~~(6) The blank space to write maintenance records in~~

H1.2 Testing

H1.2.1 Shop Tests

Sub-paragraph -7 has been deleted.

~~**7** In the electrical appliances and cables specified in **1.2.1-4, Part H of the Rules** in cases where it is inadequate to deal with them under the requirements for type tests (*e.g.* those used only for specific ships or purposes with little possibility of continued use, or items for which the acquisition of individual test/inspection certificates is desired), tests and inspection on individual product items may be accepted by application in place of type tests.~~

H2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

H2.1 General

H2.1.3 Construction, Materials, Installations, etc.

Sub-paragraph -5 has been deleted, and Sub-paragraph -6 has been renumbered to Sub-paragraph -5.

~~**5 Electrical installations in paint lockers and adjacent areas are to be in accordance with Table H2.1.3-7.**~~

~~**6**~~**5** Electrical installations recognized as suitable for installation in acetylene stores are to be certified as being of the safe type explosion-protected electrical equipment specified in **2.16.2(1)** to **(4), Part H of the Rules** as well as being of Gas and Vapour Group *II*C, Temperature Class *T*2 or higher. In addition, cables associated with such equipment are considered to be part of the equipment.

Table H2.1.3-7 has been deleted as follows.

Table H2.1.3-7 Electrical Installations Permitted in Paint Lockers and Their Adjacent Areas

Areas		Permitted electrical installations
(a)	Paint lockers	(1) Certified safe type equipment specified below at least with respect to gasses and vapours of group *II*B and of temperature class *T*3 as well as their associated cables - intrinsic safety type (*Exi*) - flameproof type (*Exd*) - pressurized type (*Exp*) - increased safety type (*Exe*) (2) Through run cables (3) Non-sparking type ventilation fans complying with **R4.5.4-1(2)**. Protection screens of not more than 13 *mm* square mesh are to be fitted in the inlet and outlet ventilation openings of the ducts fitted with such fans on the open deck.
(b)	Inlet and exhaust ventilation ducts	
(c)	Areas on open decks within 1 *m* of inlet and exhaust ventilation openings	(1) Electrical installations permitted for those areas specified in **(a)** and **(b)** (2) Electrical equipment with a type of protection '*n*' as well as their associated cables (3) Electrical equipment of those types which ensure the absence of sparks or arcs and which no parts of such equipment haves operating temperatures which can cause the ignition of gases or vapours of those flammable liquids being stored as well as their associated cables (4) Electrical equipment with simplified pressurized enclosures or vapour proof enclosures (minimum degree of protection is IP55) and which no parts of such equipment have operating temperatures which can cause the ignition of gases or vapours of those flammable liquids being stored as well as their associated cables
(d)	Areas on open decks within 3 *m* of exhaust mechanical ventilation openings	
(e)	Enclosed spaces having direct openings (without closable openings, such as doors) into paint lockers	These spaces may be considered as non-hazardous, provided that: (1) Doors to paint lockers are gastight doors with self-closing devices; (2) Paint lockers are provided with independent natural ventilation systems which are deemed appropriate by the Society; and, (3) Warning notices are fitted adjacent to paint locker entrances stating that such lockers contain flammable liquids.

H2.4 Rotating Machines

H2.4.15 Shop Tests

Sub-paragraphs -3 and -5 have been amended as follows.

(-1 and -2 are omitted.)
3 The wording "separately specified procedures" referred to in **2.4.15-~~8~~1(7), Part H of the Rules** means as follows:
((1) and (2) are omitted.)
(-4 is omitted.)
5 In those commutation tests specified in **2.4.15-~~4~~1(3), Part H of the Rules**, any sparks arising between commutator segments and brushes in *d.c.* machines are categorized into eight types as shown in **Fig. 2.4.15-3**, and categories 5 through 8 are deemed to be harmful.
(-6 and -7 are omitted.)

H2.5 Switchboards, Section Boards and Distribution Boards

H2.5.10 Shop Tests

Sub-paragraphs -3 to -5 have been amended as follows.

3 The wording "auxiliary apparatus" referred to in **2.5.10-~~4~~1(3), Part H of the Rules** means the indicator lights, small transformers, relays, etc. which are connected between different poles or phases.
4 In the requirements given in **2.5.10-~~4~~1(3), Part H of the Rules**, instruments and auxiliary apparatuses can be removed for high voltage tests of switchboards. However, it is necessary to carry out a high voltage test on individual instrument and auxiliary apparatus, and to comply with the requirements given in **2.5.10-~~4~~1(3), Part H of the Rules**.
5 Except where otherwise specified, the requirements given in **2.5.10-~~4~~1(3), Part H of the Rules** need not be applied to electronic equipment or apparatuses incorporated into switchboards that are not directly connected to the main circuit of the switchboard and the main power distribution circuits on board the ship.

H2.9 Cables

H2.9.11 Precaution against Fire

Sub-paragraphs -5 to -8 have been deleted.

~~**5** The wording "high fire risk areas" in case of **2.9.11-2** and **-3, Part H of the Rules** generally means those places as specified below:~~
~~(1) Machinery spaces of category *A*.~~
~~(2) Galleys.~~
~~(3) Laundries (however, only laundries containing drying equipment in the case of **2.9.11-3, Part H of the Rules**).~~
~~(4) Cargo holds specified in **4.8, Part H of the Rules**.~~
~~(5) Spaces specified in **9.2.3-2(9)** and **9.2.4-2(9), Part R of the Rules**. However, lockers and store-rooms are to be excluded.~~

(6) Machinery spaces as defined in **3.2.30, Part R of the Rules**, except spaces containing generators and major electrical units, refrigerating, stabilizing, ventilation and air conditioning machinery and trunk to such spaces, provided they are not handling or using flammable liquids.

(7) The following **(a)** and **(b)**, in case of **2.9.11-3, Part H of the Rules:**

(a) Spaces containing fuel treatment equipment and other highly flammable substances; and

(b) Pantries containing cooking appliances (except devices specified in **R3.2.1(1)** and **(2), Part R**).

6 The wording "standards deemed appropriate by the Society" in **2.9.11-2**, **-4** and **-5, Part H of the Rules** means the current standards of the *IEC* as listed below:

(1) *IEC* 60331-1 for cables whose diameters exceed 20 *mm*; and

(2) *IEC* 60331-21 or *IEC* 60331-2 for cables whose diameters do not exceed 20 *mm*.

7 Installation of the cables in high fire risk areas in order not to "affect the operation of the service in any other area or zone" in accordance with **2.9.11-3, Part H of the Rules** may be achieved by employing the means specified in either the following **(1)** or **(2)**. However, with regard to electrical cables to emergency fire pumps listed in **2.9.11-3(10), Part H of the Rules**, attention is to be paid to the requirement of **2.9.11-4, Part H of the Rules**.

(1) In cases where cables are installed in the high fire risk areas specified in **-5**, fire resistant cables which comply with the "standards deemed appropriate by the Society" specified in **-6** are to be installed and run continuously so as to maintain fire integrity (*See* **Fig. H2.9.11-1**); otherwise, cables are to be laid within insulated steel pipes or steel ducts whose fire protection is equivalent to ***A-60*** or more.

(2) The measures specified in either the following **(a)**, **(b)** or **(c)** are taken:

(a) Self-monitoring of short-circuits and line open faults;

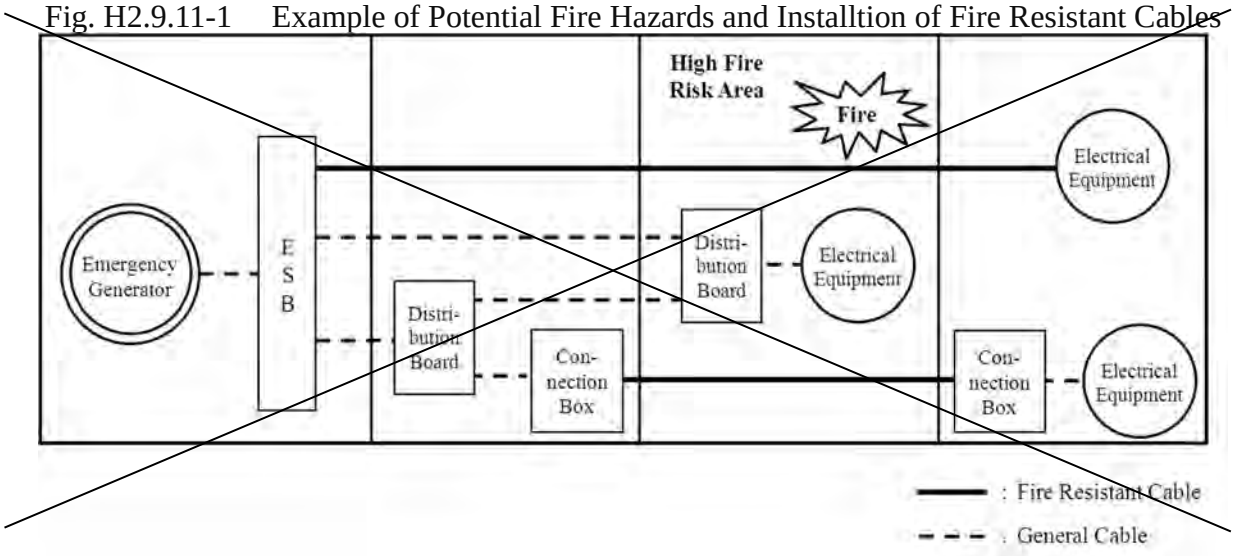
(b) Preservation of the function against short-circuits and line open faults; or

(c) Duplication with the cable runs separated as widely as is practicable.

8 Means are to be provided so that fire resistant cables installed in accordance with the requirements given in **2.9.11, Part H of the Rules** are easily distinguishable.

Fig. H2.9.11-1 has been deleted as follows.

Fig. H2.9.11-1 Example of Potential Fire Hazards and Installtion of Fire Resistant Cables



H2.10 Transformers for Power and Lighting

H2.10.4 Modification of the Limits of Temperature Rise

The wording "in those cases where deemed appropriate by the Society" in **2.10.4-2, Part H of the Rules** means that limits of temperature rise may be modified as follows:

Sub-paragraph (1) has been amended as follows.

(1) In cases where forced cooling is provided and the temperatures of cooling water at the inlets of air coolers are not higher than 32 °C, limits of temperature rise may be set 13 K higher than those limits specified in **Table H2.1~~6~~7, Part H of the Rules**.

H2.10.6 Shop Tests

Sub-paragraph -3 has been amended as follows.

3 Calculations for voltage regulation specified in **2.10.6-~~3~~1(2), Part H of the Rules** may be performed using the following method.

(Omitted)

H2.11 Accumulator Batteries

H2.11.5 Ventilation

Sub-paragraph -2 has been deleted, and Sub-paragraphs -3 and -4 have been renumbered to Sub-paragraphs -2 and -3.

1 (Omitted)

~~**2** The capacity of exhaust ventilation of battery compartments is to be greater than or equal to the value obtained by the following formula:~~

~~Exhaust capacity $Q = 110 \times I \times n$ (*litre / h*)~~

~~I : maximum charging current at end (in cases where no specific limitations are imposed, charging currents in a period of 10 *hours* is to be regarded as the standard)~~

~~n : number of batteries~~

~~**3**~~**2** (Omitted)

~~**4**~~**3** (Omitted)

H2.12 Semiconductor Converters for Power

Paragraph H2.12.4 has been added.

H2.12.4 Shop Tests

1 Regarding the temperature rise tests for semiconductor element connections mentioned in **2.12.4-1(1), Part H of the Rules**, temperature rise measurements for individual element parts such as cooling fins, cases and coolant parts, etc. may be accepted. However, such temperature rise tests may be carried out on the aforementioned element parts only in cases where manufacturers specify in advance that the temperature rise of semiconductor element connections will not exceed their maximum allowable temperature if the temperature rise of their parts is within allowable limits.

2 With respect to **2.12.4-1(2), Part H of the Rules**, tests which may inadvertently inflict serious damage on the protective devices of semiconductor elements may be omitted in cases where the

proper operation of semiconductor element protective fuses, etc. can be confirmed.

3 With respect to **2.12.4-1(3), Part H of the Rules**, test voltages for high voltage tests may be in accordance with **Table H2.12.4-1.** The test voltage is to be applied for one minute; however, one second may be allowed for products produced in a series of identical types from the second unit onward.

Table H2.12.4-1 Test voltages for high voltage tests

Rated *a.c.* voltage (*V*)	Test voltage	
	a.c. r.m.s (*V*)	*d.c* (*V*)
≤ 50	1,250	1,770
100	1,300	1,840
150	1,350	1,910
300	1,500	2,120
600	1,800	2,550
1,000	2,200	3,110
> 1,000	3,000	4,250
3,600	10,000	14,150
7,200	20,000	28,300
12,000	28,000	39,600
17,500	38,000	53,700

Note:

1. Interpolation is permitted.

H3 DESIGN OF INSTALLATIONS

H3.2 Main Sources of Electrical Power and Lighting Systems

Paragraph H3.2.1 has been amended as follows.

H3.2.1 Main Sources of Electrical Power

1 Generators driven by main propulsion machinery (hereinafter referred to as "shaft driven generator systems") are to comply with the following requirements **(1)** to **(7)** if they are provided as one of the main sources of electrical power specified in **3.2.1-1, Part H of the Rules**:

(1) Voltage fluctuations (see *IEC* 60092-301:1980) and frequency fluctuations of shaft driven generator systems are to be maintained within those specified limits given in **Table H3.2.1-1** under all weather conditions during sailing and maneuvering as well as when vessels are stopped and are in crash astern conditions.

((2) to (7) are omitted.)

~~**2** Shaft driven systems are to comply with the following requirements **(1)** to **(5)** if they are provided on board ships in addition to 2 sets of those main sources of electrical power required by **3.2.1-1, Part H of the Rules**.~~

~~(1) Voltage and frequency fluctuations of shaft driven generator systems are to be maintained within those specified limits given in **Table H3.2.1-1** under their operating ranges which are to be previously arranged.~~

~~(2) Generating capacities of those generators specified in **3.2.1-2, Part H of the Rules** are to be capable of being maintained under their operating ranges which are to be previously arranged.~~

~~(3) In the event of any shaft driven generator systems being stopped and their frequency~~

~~exceeding those limit given in (1) above, automatic changeovers to other main generating sets are to be carried out within a period of 45 *seconds*. In such cases, those means specified in H3.2.1-5 are to be taken to ensure ship safety.~~

~~(4) In those ships which have bridge control devices for their main propulsion machinery, the following requirements are to be complied with:~~

~~(a) Measures which allow the continued operation of those installations for the prevention of blackouts specified in H3.2.1-3 to be provided, or such systems to allow the operation of such measures without fail are to be established.~~

~~(b) Those operating ranges which have been previously arranged are to be shown on navigation bridges, and devices to indicate the condition of shaft driven generating systems are to be established.~~

~~(5) Shaft driven generator systems are to be capable of providing sufficient short circuit currents to trip generator circuit-breakers taking into account any selective tripping of protective devices for distribution systems on board.~~

~~3~~2 (Omitted)

~~4~~3 (Omitted)

~~5~~4 (Omitted)

H3.2.2 Number and Ratings of Transformers

Sub-paragraph -2 has been amended as follows.

2 The capacities of those transformers specified in -1 above are to be such that any power feeding for those services specified in **H3.2.1-~~3~~2**, even in the event of failure on one set of transformers, is available. Furthermore, at least minimum habitable conditions are to be secured regarding any equipment related to cooking, heating, provision refrigeration, mechanical ventilation, sanitary and fresh water services.

H3.3 Emergency Sources of Electrical Power

H3.3.3 Kind and Performance of Emergency Sources of Electrical Power

Sub-paragraph -3 has been deleted.

~~**3** The wording "are as deemed appropriate by the Society" in **3.3.3(3), Part H of the Rules** means **Annex H3.3.3-3.**~~

Annex H3.3.3-3 has been deleted.

~~Annex H3.3.3-3 GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF UNINTERRUPTIBLE POWER SYSTEM UNITS~~

~~1.1 General~~

~~1.1.1 Application~~

~~This Guidance is to apply to uninterruptible power system (hereinafter referred to as "UPS") units installed in ships as emergency sources of electrical power. Any batteries and semiconductor converters combined with UPS units are to be in accordance with those requirements specified in 2.11 and 2.12, Part H of the Rules as practicable.~~

~~1.1.2 Definitions~~

~~Definitions of the terms used in this Guidance are as follows:~~

~~(1) UPS means sources of electrical power with semiconductor converters, switches and batteries, used for maintaining continuity of loads in cases of input power failure.~~

~~(2) Off-line UPS units mean those electrical power devices in which output loads are powered from bypass lines under normal operation and which are only transferred to inverters if such bypass supply falls or goes outside preset limits.~~

~~(3) Line interactive UPS units means those systems specified in (2) above which are attached to equipment which controls voltage vibrations.~~

~~(4) On-line UPS units mean those systems which supply electrical power to loads via inverters without any power interruption.~~

~~1.2 Design~~

~~1.2.1 Construction~~

~~**1** UPS units are to be constructed in accordance with *IEC* 62040 or acceptable and relevant national or international standards.~~

~~**2** The operation of UPS units is not to depend on any external services.~~

~~**3** The type of UPS unit (off-line, line-interactive, on-line) is to be appropriate for the power supply requirements of the relevant connected loads. (See 2.1.2-3, Part H of the Rules)~~

~~**4** UPS units are to have external bypass circuits.~~

~~**5** UPS units are to have self-monitoring functions, and audible and visual alarms are to be activated in those spaces where crew members are normally stationed (e.g., navigation bridges and machinery control spaces, etc.) in the following cases:~~

~~(1) Power supply failures (abnormal voltage or frequency)~~

~~(2) Earth faults~~

~~(3) Operation of battery protective devices~~

~~(4) Discharge of batteries~~

~~(5) Operation of bypass circuits for on-line UPS units~~

~~1.2.2 Arrangements~~

~~**1** UPS units are to be suitably located for use in emergency situations.~~

~~**2** In cases where the batteries combined with UPS units are of a sealed type, the Society may approve the location of such UPS units in compartments with normal electrical equipment, after taking into account the characteristics of the batteries and any ventilation arrangements to such compartments.~~

~~**1.2.3 Performance**~~

~~**1** Output power is to be maintained for the duration time required for relevant connected equipment as specified in **3.3.2, Part H of the Rules**.~~

~~**2** No additional circuits are to be connected to any UPS units unless their battery capacity is more than the total capacity of the output power specified in **-1** above.~~

~~**3** On the restoration of input power, the ratings of any charging units are to be sufficient enough to recharge the batteries while maintaining power supplies to loads.~~

~~**4** In cases where supplying to loads via inverters from the batteries in UPS, maximum permitted voltage fluctuations are to comply with **H3.3.3-2.**~~

~~**1.3 Testing**~~

~~**1.3.1 Shop Tests**~~

~~**1** UPS units of 50 *kVA* and over are to be tested at places of manufacturer or at other works. In addition, tests for semiconductor converters are to be carried out in accordance with those requirements specified in **1.2.1-1, Part H of the Rules**.~~

~~**2** Appropriate tests are to be carried out in accordance with the following items to demonstrate that UPS units are suitable for its intended environment.~~

~~(1) Functionality, including operation of alarms~~

~~(2) Temperature rise~~

~~(3) Ventilation rates~~

~~(4) Battery capacities~~

~~**3** UPS units which are connected to equipment requiring a continuous supply of power even in at times of UPS input power failure are to be checked to verify that this operational condition can be maintained.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 1 July 2022.
2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships for which the date of contract for construction is before the effective date.

Amendment 1-2

H2 ELECTRICAL INSTALLATIONS AND SYSTEM DESIGN

H2.9 Cables

H2.9.11 Precaution against Fire

Sub-paragraph -1(2) has been amended as follows.

1 In cases where the installation work of cables in enclosed spaces or semi-enclosed spaces of ships meet either of the following requirements, such work may be regarded as complying with the requirements given in **2.9.11-1, Part H of the Rules**. However, item **(2)(c)** below is to be approved by the Society in accordance with the requirements given in **Part 7 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**. Furthermore, in cases where the use of cables is limited to specific applications, approval by the Society may be given on a case-by-case basis.

((1) is omitted.)

(2) In cases where bunched cables are installed, the following requirements are to be complied with:

(a) In cases where flame retardant cables in a bunched condition which have passed the test of Category *A*, *IEC* 60332-3-22:2018 are to be used.

((b) and (c) are omitted.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 July 2022.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.