Amendments to the "Rules for the Classification of Yachts Designed for Commercial Use"

RFS/008/AMN/03

Effective from 1/1/2022

List of the amendments:

Part/Chapter/Section/Paragraph amended	Reason
Pt C, Ch 2, Sec 6, [1.5.1] Pt C, Ch 2, App 2(new) Pt C, Ch 4, Sec 1, [1.26](new) Pt C, Ch 4, Sec 2, [8](new)	to introduce new requirements for installation of lithium batteries on battery powered yachts for commercial use in line with those in the Rules for Ships and to make reference to the new edition of the Tasneef Rules for the type approval certification of lithium battery systems.

SECTION 6 EQUIPMENT

1 Electrical equipment

1.1 Transformers

1.1.1 Transformers are to comply with IEC Publication 60092-303.

1.1.2 Transformers are to be installed in well-ventilated locations.

1.1.3 The connections of transformers are to be protected against such mechanical damage, condensation and corrosion as may be reasonably expected.

1.2 Converters

1.2.1 Semiconductor converters are to conform with IEC Publication 60146.

1.2.2 Converters are to be installed so that the circulation of air around them is not impeded and so that the air temperature at their cooling inlet does not exceed the ambient temperature.

1.2.3 Natural air-cooling units are to be designed with sufficient ventilation openings or with sufficient cooling surface to radiate the heat so that totally enclosed equipment will operate within the design temperature limits.

1.2.4 Converters are not to be mounted near sources of heat such as engine exhaust pipes.

1.3 Rotating machines

1.3.1 The requirements of IEC Publication 60034 series and IEC Publication 60092-301 are to be applied.

1.4 Switchgear and control gear

1.4.1 Switchgear and control gear assemblies are to be in accordance with IEC Publication 60092-302.

1.5 Storage batteries

1.5.1 *(1/1/2022)*

~~Where lithium batteries are provided as permanently installed storage batteries, the requirements of "Rules for the certification, installation and testing of Lithium based storage batteries" are to be complied with.~~Where batteries other than Lead and Nickel-Cadmium and Nickel-Metal-Hydride batteries are installed the requirements of App 2 are to be complied with.

2 Miscellaneous equipment

2.1 Lighting fittings

2.1.1 Lighting fittings are to be so arranged as to prevent temperature rises which could damage the cables and wiring.

2.1.2 Where the temperature of terminals of lighting fittings exceeds the maximum conductor temperature permitted for the supplied cable, special installation arrangements, such as terminal boxes thermally insulated from the light source, are to be provided.

2.1.3 Lighting fittings are to be so arranged as to prevent surrounding material from becoming excessively hot.

2.1.4 Lighting fittings are to be secured in place such that they cannot be displaced by the motion of the vessel.

2.2 Heating appliances

2.2.1 Space heaters are to be so installed that clothing, bedding and other flammable material cannot come in contact with them in such a manner as to cause risk of fire. To this end, for example, hooks or other devices for hanging garments are not to be fitted above space heaters or, where appropriate, a perforated plate of incombustible material is to be mounted above each heater, slanted to prevent hanging anything on the heater itself.

2.2.2 Space heaters are to be so installed that there is no risk of excessive heating of the bulkheads or decks on which or next to which they are mounted.

2.2.3 Combustible materials in the vicinity of space heaters are to be protected by suitable incombustible and thermal- insulating materials.

2.2.4 Heating cables and tapes or other heating elements are not to be installed in contact with combustible materials. Where they are installed close to such materials, they are to be separated by means of a non-flammable material.

3 Lightning protection

3.1 General

3.1.1 Yacht which are of non metallic construction or have non metallic masts are to be fitted with lightning protection.

3.1.2 Lightning conductors are to be made of copper (strip or stranded) and are to be not less tham 70 mm2 in cross section. They are to be secured to a copper spike not less than 12 mm in diameter, projecting at least 300 mm above

the top of the mast. The lower end of the conductor is to be earthed.

3.1.3 Lightning conductors are to be installed external to the vessel. They should run as straight as possible and sharp bends should be avoided.

3.1.4 Bolted, riveted joints only are to be used. No welded connection is allowed.

3.1.5 If the hull is metallic, the lower end of the lightning conductor is to be earthed to the hull.

3.1.6 If the hull is non-metallic, the lower end of the lightning conductor is to be connected to an earthing plate of copper or other conducting material compatible with sea water, not less than 0,25 m2 in surface area, secured to the outside of the hull in an area reserved for this purpose and located below the light load water line so that it is immersed under all conditions of heel.

3.1.7 The earthing plate for the lightning conductor is to be additional to, and separate from, the earthing plate used for the power system earthing or earth bonding system.

APPENDIX 2 BATTERY POWERED YACHTS

1 General

1.1 Application

1.1.1 *(1/1/2022)*

The provisions of this Appendix apply to yachts where batteries, other than Lead, Nickel-Cadmium and Nickel-Metal-Hydride batteries, are installed to supply essential or not-essential services and emergency services, except batteries embedded in small consumer products, unless otherwise stated by Flag Administration.

1.1.2 *(1/1/2022)*

The requirements in this Appendix are applicable in particular to installations with a variety of lithium battery chemistry; since the battery technology is under development, additional requirements may be required by the Society on a case by case basis.

1.1.3 *(1/1/2022)*

The Society may consider different arrangements than those stated in this Appendix, provided that they ensure an equivalent level of safety, to be demonstrated by appropriate risk analysis techniques.

1.2 Definitions

1.2.1 *(1/1/2022)*

The following definitions and abbreviations are additional to those given in the other Parts of the Rules:

- Battery Management System (BMS): an electronic system that controls and monitors the state of the batteries by protecting the batteries from operating outside its safe operating area.
- Energy Management System (EMS): a system providing monitoring and control of the energy.
- Cell: an individual electrochemical unit of a battery consisting of electrodes, separators, electrolyte, container and terminals.
- Battery: assembly of cells ready for use as storage of electrical energy characterized by its voltage, size terminal arrangement, capacity and rate capability.
- Battery space: compartments (rooms, lockers or boxes) used primarily for accommodation of batteries.
- Battery system: the battery installation including battery banks, electrical interconnections, BMS and other safety features.
- Module: group of cells connected together either in a series and/or parallel configuration.
- State of Charge (SOC): state of charge expressed as a percentage of the rated capacity giving an indication of the energy available from the battery.
- State of Health (SOH): general condition of a battery, including its ability to deliver the specified performance compared with a new battery.
- Venting: release of excessive internal pressure from a cell/battery in a manner intended by design to preclude rupture or explosion.
- Explosion: failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled.
- Fire: the emission of flames from a cell or battery.
- Upper limit of the charging voltage: the highest allowable charging voltage as specified by the cell Manufacturer.

1.3 Documentation to be submitted

1.3.1 *(1/1/2022)*

In addition to the documents required in Sec 1, for battery powered yachts the plans and documents listed in Tab 1 are to be submitted.

The Society reserves the right to request the submission of additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the systems and components.

Table 1 : Documentation to be submitted *(1/1/2022)*

No.	A/I (1)	Document
1	A	Block diagram and electrical wiring diagram of the battery system and systems interfaced to the battery system, including control, monitoring and alarm system, emergency shutdown, etc.
2	I	Technical specification of the batteries, including technical data (electrical characteristics like voltage and capacity, discharge and recharge rates), battery chemistry and functional description of cell/battery system including at least cell/batteries configuration, safety devices (BMS), interfaces to monitoring/safety, diagnostic, including the list of controlled and monitored parameters.
3	I	Functional description of the energy management system (EMS), when required (see [2.1.3]).
4	A	A risk assessment addressing all potential hazards represented by the type (chemistry) of batteries, the evaluation of the risk factors and measures to control and reduce the identified risks. Note: for the Risk Assessment reference is to be made to Tasneef "Guide for Risk Analysis".
5	A	Test programs which is to include functional tests (alarm system, safety system, control system, etc.) as per [5.2] and further tests, if any, resulting from the Risk Assessment for the specific battery system.
6	A	Electrical load balance capable of reflecting the operational mode stated in the battery system operating philosophy (maximum designed deterioration rate is to be included).
7	A	A general arrangement plan of battery installation including the indication of structural fire protection and the safety systems **(2) (3)**.
8	I	Battery Manufacturer's instructions on active fire extinguishing system and confirmation about suitability of the proposed extinguishing agent for the specific type of batteries.
9	I	Statement of conformity of the batteries to IEC 62619, 62620, 60529 or UN 38.3, when requested by the rules.
10	I	Copy of type approval certificate of batteries and BMS, or of batteries UN 38.3 certificate when requested by the Rules.
11	I	An overall description of the battery system operating philosophy for each operational mode (including charging).
12	I	Operation and maintenance manuals including instructions for the safe connection and disconnection of the batteries (see [5.4]).
13	A	Hazardous area classification (if applicable to the specific battery chemistry) and list of certified safety type electrical equipment installed in hazardous areas (as applicable).
14	I	Test Report of battery system at cellular, modular and system level in order to identify the damage potential of a possible thermal runaway event (Propagation Test) including gas analysis and explosion analysis as applicable and depending on the safety concept adopted.
15	I	Battery system maker statement confirming the suitability of the selected fire extinguishing system and ventilation arrangement for the specific project.

(1) A: to be submitted for approval I: to be submitted for information

(2) Where a battery space is provided, based on the Risk Assessment (see [4.2]), evidence of the solution adopted for the battery space is to be given in the yacht's active (detection and fighting) and passive fire protection, gas detection system and ventilation system drawings.

(3) The plan has to show:

- the battery pack arrangement with respect of the space it is being installed in
- the clearance distances between the other ancillary equipment in the space and the battery pack.

2 System design

2.1 General

2.1.1 *(1/1/2022)*

When batteries are used as storage of power for the propulsion , steering, dynamic positioning system or as part of the main source of electrical power, an Energy Management System (EMS) according to [3.5] is to be provided.

2.1.2 *(1/1/2022)*

Where batteries are used for propulsion and steering of the ship, the system is to be so arranged that the electrical supply to equipment necessary for propulsion and steering will be maintained or immediately restored in the case of battery system failure.

2.1.3 *(1/1/2022)*

Cables connecting each battery system to the main switchboard are to be arranged as per Sec 5 [7] and Ch 3, Sec 3 [8.2].

2.1.4 *(1/1/2022)*

A Risk Assessment, to be initiated in the design phase, is to be carried out to cover, but not limited to:

- evaluation of the risk factors,
- measures to control and reduce the identified risk, including potential gas development (e.g. toxic, corrosive), fire and explosion risk and
- action to be implemented.

The outcome of the assessment will give the additional measures to be adopted for minimizing the risks related to the use of batteries and among such measures, if the battery system needs to be installed in a space assigned to batteries only.

2.1.5 *(1/1/2022)*

The risk assessment has:

- to identify risks due to external heating, fire or flooding
- to identify any fault in the battery system that may cause malfunction to essential or emergency services and measures to mitigate the related risk,
- to evaluate any risk related to the location of batteries in the same space with and other systems supporting ship's essential or emergency services, including pipes and electrical cables, distribution switchboards and so on,including but not limited to thermal runaway of the battery system, external and internal short-circuit,
- to evaluate any risk related to the location, in the same space, of batteries and other systems related to not essential services,
- to address sensor failures and alarm, control and safety systems failures (e.g. BMS and EMS failures including power and communication failures, fire detection system failures, so on),
- to assess the selected fire extinguishing and ventilation arrangement according to battery system maker guidelines considering the specific design features of the ship.

2.1.6 *(1/1/2022)*

Battery cells of different physical characteristics, chemistries and electrical parameters are not to be used in the same electrical circuit.

2.1.7 *(1/1/2022)*

The batteries are to be properly located (see [4]) and, where necessary, insulated to prevent overheating of the system.

2.1.8 *(1/1/2022)*

The minimum required degree of protection is to be, in relation to place of installation of the battery system, according to Sec 3, [4].

Where water-based fire extinguishing system is used in the battery space, IP 44 is required as a minimum (see Note 1 and Note 2).

Note 1: if other fire-extinguish systems are used, the minimum IP can be reduced as result of the risk assessment.

Note 2: where the risk assessment identifies risks from water immersion (e.g. when batteries are installed below the freeboard deck), the batteries are to have a minimum degree of protection IP XZ.

2.2 Constructional requirements

2.2.1 *(1/1/2022)*

Battery enclosure covering modules and cells are to be made of flame retardant materials.

2.2.2 *(1/1/2022)*

Each cell or battery case is to incorporate a pressure relief mechanism or is to be constructed in such a way to relieve excessive internal pressure at a value and rate that will be precluded rupture, explosion and self-ignition.

2.2.3 *(1/1/2022)*

A thermal protection device, capable to disconnect the battery in case of high temperature, is to be provided in the battery.

2.2.4 *(1/1/2022)*

The design and construction of battery modules have to reduce the risk of a thermal propagation due to a cell thermal runaway, maintaining it confined at the lowest possible level (e.g. confined within a module). This may be achieved by means of partition plates or sufficient distance in accordance with maker recommendation to prevent escalation between battery modules in case of a thermal runaway.

2.2.5 *(1/1/2022)*

Terminals are to have clear polarity marking on the external surface of the battery. The size and shape of the terminal contacts are to ensure that they can carry the maximum current. External terminal contact surfaces are to be made of conductive materials with good mechanical strength and corrosion resistance. Terminal contacts are to be arranged to minimize the risk of short circuits.

2.2.6 *(1/1/2022)*

The battery system is to be provided with a Battery Management System (BMS) according to [3.2].

2.3 Electrical protection

2.3.1 *(1/1/2022)*

The outgoing circuits of the battery system is to be protected against overload and short-circuit by means of fuses or multipole circuit breakers having isolating capabilities.

2.3.2 *(1/1/2022)*

An emergency shutdown system is to be installed and capable of disconnecting the battery system in an emergency.

2.3.3 *(1/1/2022)*

The battery system is to have means for isolating purpose for maintenance purposes. This isolating device is to be independent of the emergency shutdown arrangement.

2.4 Battery charger

2.4.1 *(1/1/2022)*

The battery charger is to be designed to operate without exceeding the limits given by the battery system Manufacturer (e.g. current and voltage level).

2.4.2 *(1/1/2022)*

The battery charger is to be interfaced with and controlled by the BMS.

Any detectable failure in the battery charger, anyway including charging/discharging failure, is to give an alarm in a continuously manned position.

3 Control, monitoring, alarm and safety systems

3.1 General

3.1.1 *(1/1/2022)*

For the purpose of these rules, unless differently state in the text, a required alarm is to be intended as an audible and visual alarm and is to be given in a continuously manned control position.

3.1.2 *(1/1/2022)*

Control, monitoring, alarm and safety systems are to comply with the requirements of Ch 3.

3.2 Battery management systems (BMS)

3.2.1 *(1/1/2022)*

The BMS and related monitoring and safety systems (see [3.4]) are to have self-check facilities.

In the event of a failure, an alarm is to be activated.

3.2.2 *(1/1/2022)*

In case the BMS needs external power supply (fed from yacht electrical distribution system) then it is to be continuously powered so that a single failure of the power supply system does not cause any degradation of the BMS functionality; an alarm is to be given in the event of failure of any power supply.

Unless the power supply is derived from different strings of batteries, one of the power supplies is to be derived from the emergency source of electrical power.

Where each battery is fitted with a BMS card, the individual cards may have a single power supply from the relevant battery.

In any case an alarm is to be given in a manned position and safety action taken in the event of loss of all the power supplies.

3.2.3 *(1/1/2022)*

The battery management system (BMS) is to:

- provide limits for charging and discharging of the battery,
- protect against over-current, over-voltage and under-voltage by disconnection of the battery system,
- protect against over-temperature by disconnection of the battery system,
- provide cell and module balancing.

3.2.4 *(1/1/2022)*

At least the following parameters are to be continuously monitored and indications are to be provided at a local control panel and in a continuously manned control position:

- system voltage,
- max, min, average cell voltage,
- max, min and average cell or module temperature,
- battery string current.

3.2.5 *(1/1/2022)*

When battery system is used as storage of power for the propulsion system or as part of the main source of electrical power, State of Charge (SOC) and State of Health (SOH) of the batteries are to be displayed at a continuously manned control station.

3.3 Alarm system

3.3.1 *(1/1/2022)*

Abnormal conditions which can develop into safety hazards are to be alarmed before reaching the hazardous level.

3.3.2 *(1/1/2022)*

Any abnormal condition in the battery system is to initiate an alarm.

3.3.3 *(1/1/2022)*

At least the following conditions or events have to initiate an alarm at a local control panel and in a continuously manned control position:

- safety intervention of the BMS of the battery system,
- high ambient temperature,
- failure of cooling system or leakage of liquid cooling system,
- low ventilation flow inside battery room,
- overvoltage and undervoltage,
- cell voltage unbalance,
- high cell temperature,
- other safety protection functions.

Other possible abnormal conditions are to be considered on the basis of the outcome of the Risk Assessment (see [2.1.6]) and relevant mitigating measures are to be adopted.

3.3.4 *(1/1/2022)*

When batteries are used as storage of power for the propulsion or dynamic positioning systems or as part of the main source of electrical power, an alarm is to be given on the bridge when State of Charge (SOC) reaches minimum required capacity for ship intended operations.

3.4 Safety system

3.4.1 *(1/1/2022)*

The safety systems are to be:

- designed so as to limit the consequence of internal failures (e.g. failure in the safety system is not to cause shut down of battery system)
- self-monitoring,
- capable of acting on the controlled system following the fail-to safety principle,
- capable of detecting sensor malfunctions.

3.4.2 *(1/1/2022)*

The safety systems are to be activated automatically in the event of identified conditions which could lead to damage of the battery system. Activation of any automatic safety actions is to activate an alarm. Anyway, the risk of unsafe lock or stop of the propulsion system or of blackout due to safety system activation shall be addressed in the Risk Assessment. Manual override of safety functions is not to be possible.

3.4.3 *(1/1/2022)*

Voltage of any one of the single cells is not to exceed the upper limit of the charging voltage as specified by the cell Manufacturer. The battery charger is to be stopped when the upper limit of the charging voltage is exceeded for any one of the single cells.

3.4.4 *(1/1/2022)*

An emergency shutdown (ESD) system is to be arranged as a separated hardwired circuit and it is to be independent from the control system.

3.4.5 *(1/1/2022)*

Activation means of the ESD are to be provided locally, from outside the battery space, and from a continuously manned control station.

3.4.6 *(1/1/2022)*

When battery installation is used as storage of power for the propulsion, steering or dynamic positioning systems or as part of the main source of electrical power, the emergency shutdown is also to be located on the bridge.

3.4.7 *(1/1/2022)*

When battery installation is used as storage of power for the propulsion, steering or DP systems or as part of the main source of electrical power, in case of over temperature in the battery system, an alarm and a request of manual load reduction is to be given on the bridge at a temperature lower than the one causing intervention of the BMS. As an alternative an automatic load reduction system may be provided. Its intervention is to generate an alarm.

3.4.8 *(1/1/2022)*

Other possible abnormal conditions, which could lead to damage or additional hazards to battery system, are to be considered on the basis of the outcome of the Risk Assessment.

3.4.9 *(1/1/2022)*

Sensors are to be designed to withstand the local environment.

3.4.10 *(1/1/2022)*

The enclosure of the sensor and the cable entry are to be appropriate to the space in which they are located.

3.4.11 *(1/1/2022)*

Cables to be operable under fire conditions (e.g. where required as result of the Risk Assessment), are to be of a fire-resistant type complying with IEC Publication 60331 series.

3.5 Energy Management system

3.5.1 *(1/1/2022)*

When required per [2.1.1], an energy management system (EMS) is to be provided complying with the requirements of Chapter 3 consisting of several levels of controls and alarm functions, such as:

- monitoring and alarm functions of all power sources, inverters and disconnectors;
- voltage and power control for DC distribution system;
- available power and charge/discharge status of the storage energy source;
- interface with Power Management System (PMS) for combinations of AC and DC distribution systems;
- inverter control for the overall system.

The energy management system (EMS) is to be independent from the battery management system (BMS) for lithium batteries. However, EMS can be integrated in the PMS.

The energy management system is to be continuously supplied and a failure is to initiate an alarm in a manned location.

3.5.2 *(1/1/2022)*

The EMS is to be capable to provide at least the following information on the bridge:

- energy available from batteries (SOC),
- power available from batteries,
- time or range for which the battery can provide energy according to actual operational conditions,
- alarm for minimum capacity reached,
- battery state of health (SOH).

4 Location

4.1 General

4.1.1 *(1/1/2022)*

Batteries are to be arranged aft of collision bulkhead and in such a way that danger to persons and damage to vessel due to failure of the batteries (e.g. caused by gassing, explosion, and fire) is minimized.

4.1.2 *(1/1/2022)*

Batteries are not to be located in a battery box on the open deck exposed to sun and frost.

They are to be located where they are not exposed to excessive heat, extreme cold, spray, steam, shocks or excessive vibration or other conditions which would impair their safety, performance or accelerate deterioration.

4.1.3 *(1/1/2022)*

Batteries are to be located in such a way that the ambient temperature remains within the Manufacturer's specification at all times.

4.1.4 *(1/1/2022)*

Batteries are to be suitably housed by means of compartments (rooms, lockers or boxes) which are to be properly constructed and efficiently ventilated and cooled, as necessary, in such a way to keep the battery system at a specified set of environmental conditions. Depending on installation Risk Assessment that shall be issued, this requirement shall be partially waived.

4.1.5 *(1/1/2022)*

Battery system is to be arranged following the Manufacturer's prescriptions in particular to prevent

cascade effects in case of a thermal runaway (e.g. partition plates or distance in accordance with Manufacturer's recommendations).

4.1.6 *(1/1/2022)*

Batteries, used as storage of power for the propulsion, steering, dynamic positioning systems, or as part of the main source of electrical power, are to be located in a battery space placed within the borders of the main machinery space or adjacent to it. Exceptions will be evaluated on a Risk Assessment basis.

4.1.7 *(1/1/2022)*

Depending on the battery chemistry, it may be necessary to define a hazardous area for the installation of appropriate equipment (see Tab 1 No. 6).

4.2 Battery space

4.2.1 *(1/1/2022)*

When required, based on [4.1.6] or the Risk Assessment (see [2.1.6]), a space assigned to batteries only is to be foreseen.

4.2.2 *(1/1/2022)*

Access to this space is to be through self-closing doors. As an alternative normally closed doors with alarm may be considered.

4.2.3 *(1/1/2022)*

External hazards, such as fire and water ingress are to be taken into account in the Risk Assessment, in order to assess the risk associated with an external event (e.g. a fire spreading from adjacent rooms to the battery space, water flooding and so on) and possible countermeasures (e.g. suitable segregation of the battery space).

No heat sources or high fire risk equipment are to be located in battery spaces.

4.2.4 *(1/1/2022)*

A fire detection system and a fixed fire extinguishing system appropriate to the battery chemistry are to be provided in the battery space.

The type is to be chosen following the battery Manufacturer's instructions.

Examples of fire extinguishing systems may be a powder or a gas based or water-based fixed fire extinguishing system provided that the suitability of the extinguishing agent for the specific type of batteries is confirmed by the battery Manufacturer.

Automatic release is only acceptable for small, not accessible, battery spaces.

Where an automatic release of fire extinguishing media is accepted, its activation is to be confirmed by more than one sensor.

4.2.5 *(1/1/2022)*

The battery spaces are to be fitted with a forced ventilation system of extraction type, which is to be:

- independent from any other ventilation system serving other ship's spaces,
- provided with manual stop, fitted outside the space to be ventilated and capable of being operated in all the weather and sea conditions, independent from the automatic and or remote control system,
- provided with indication of ventilation flow and of battery space ambient temperature. In case of low ventilation rate or high ambient temperature, an alarm is to be activated,
- with a capacity (rate) according to battery manufacturer guidelines on the basis of the gas release identified in the gas analysis or propagation test,
- fitted with inlet from open air,
- fitted with exhaust outlet to open air far from accommodation and machinery ventilation inlets,
- fitted with non-sparking fan driven by a certified safe type electric motor fans in case the ventilation duct is considered to contain explosive atmosphere in case of thermal runaway.

4.2.6 *(1/1/2022)*

Appropriate means to maintain the battery working temperature within the Manufacturer's declared limits are to be provided (e.g. by means of liquid cooled solutions or ventilation systems provided with control of air temperature).

4.2.7 *(1/1/2022)*

Battery modules with liquid cooling are to be designed such that the risk of a cooling liquid leakage inside the module is minimized. Pumps' failures are to be addressed in the risk assessment [2.1.7].

4.2.8 *(1/1/2022)*

In case of liquid cooled solutions, a ventilation system is anyway required to extract possible gases or vapours in consequence of a battery abnormal condition.

4.2.9 *(1/1/2022)*

Depending on the battery chemistry, a gas detection system, for the gases that may be emitted from the battery system in the event of a serious fault, may be requested as an outcome of the risk assessment.

In this case an alarm at 30% of LEL and automatic disconnection of batteries and all electrical equipment non certified of safety type for the specific hazardous area, gas, vapor are to be provided.

A failure in the gas detection system is to be alarmed but is not to cause above mentioned automatic disconnections.

4.2.10 *(1/1/2022)*

Depending on the battery chemistry, appropriate ventilation to prevent the formation of explosive atmospheres in the battery space (e.g. to limit the concentration of flammable gasses and thereby reduce the risk for fire) is to be provided.

At this purpose the highest rate of gas emissions is to be considered.

4.2.11 *(1/1/2022)*

Depending on the battery chemistry, when a hazardous area is to be considered, mechanical exhaust non-sparking fan driven by a certified safe type electric motor, and inlet from open air are to be arranged.

4.2.12 *(1/1/2022)*

Battery spaces are to be insulated in way of other spaces as indicated in Tab 2.

4.2.13 *(1/1/2022)*
Battery spaces are to be considered as spaces not normally manned.

4.2.14 *(1/1/2022)*
The battery space is not to contain other systems supporting essential or emergency services, including piping and electric cables serving such systems, in order to prevent their loss upon possible failures (e.g. thermal runaway) in the battery system.

Table 2 *(1/1/2022)*

	Bulk-head	Control Station	Corridor	Accomoda-tion spaces	Stairways	Service spaces (low risk)	Machinery Space of cat A	Machinery Space	Service spaces (high risk)	Open deck	Muster stations
Li Bat-tery Space	A60	A15	A30	A15	A0	A60	A0	A30	A0	A60	
Li Bat-tery Space Below	A60	A60	A30	A60	A0	A60	A0	A30	A0	A60	
Li Bat-tery Space Above	A60	A0	A0	A0	A0	A60	A0	A0	A0	A60	

5 Testing

5.1 General

5.1.1 *(1/1/2022)*
Batteries systems are to be tested by the Manufacturer.

5.1.2 *(1/1/2022)*
Batteries are to be subjected to functional and safety tests according to IEC Publication 62619 and 62620 or UN 38.3 or in accordance with other equivalent national or international standards.

5.1.3 *(1/1/2022)*
On yachts with LH of at least 24m (according to ISO 8666), when the aggregate capacity of a battery system exceeds the rating of 20 kWh, the battery system is to be of a type approved in accordance with the Society "Rules for the type approval certification of lithium battery systems".

5.2 Testing and inspection at Manufacturer premises

5.2.1 *(1/1/2022)*
Battery systems are to be tested by the Manufacturer according to a test program proposed by the Manufacturer to be approved by the Society and which is to include at least functional tests of battery system/BMS and control, monitoring and safety systems and further tests, if any, resulting from the Risk Assessment.

5.2.2 *(1/1/2022)*
As a minimum, the tests and inspections listed in Table 3 are to be carried out. A tests report shall be issued.

Table 3 *(1/1/2022)*

Item	Test/inspection
1	Examination of the technical documentation, as appropriate, and visual inspection
2	Functional test of the BMS, including safety functions and applicable alarms listed in [3.3.3]
3	Dielectrical strength (high voltage test) **(1)**
4	Insulation resistance test **(1)**
5	Sensor failure test (e.g. power supply failure, disconnection, short circuit)
6	Emergency shutdown (ESD) functional test
7	Communication failure between BMS and battery charger

(1) Refer to Tasneef Rules for Yachts Designed for Commercial Use Pt C, Ch 2, Sec 8, [5.6.4] and [5.6.5]. In order to prevent damages to the electronic components of the battery system, the electronic components can be disconnected during the high voltage test.

Item	Test/inspection
8	Testing of the cooling system when submitted to acceptance testing together with the battery system
9	Check of test certificate for prescribed degree of protection
(1)	Refer to Tasneef Rules for Yachts Designed for Commercial Use Pt C, Ch 2, Sec 8, [5.6.4] and [5.6.5]. In order to prevent damages to the electronic components of the battery system, the electronic components can be disconnected during the high voltage test.

5.3 Testing and inspection after installation on board

5.3.1 *(1/1/2022)*

After installation, and after any important repair or alteration which may affect the safety of the arrangement, following a check of compliance with the plans, the battery system is to be subjected to tests and inspections, to the satisfaction of the Surveyor in charge.

5.3.2 *(1/1/2022)*

Performance tests are to be carried out on the battery system; the test program is to include functional tests as per Tab 4 and further tests, if any, resulting from the Risk Assessment.

Table 4 *(1/1/2022)*

Item	
1	Insulation resistance test
2	Test of the functionality of the battery system and BMS and its auxiliaries, including alarms, and safety functions, emergency stop, including simulation of changes in parameters and simulation of sensor failure and of communication failure (e.g. with battery charger)
3	Test of the functionality of the auxiliary services in the battery space (e.g. ventilation, liquid cooling, gas detection, fire detection, leakage detection)
4	Verification of proper calculation and indication of SOC and SOH (when required per [3.2.5]) **(1)**
5	Verification of correct regulation of charging and discharging currents
6	Verification of the functionality of the EMS (when required per [2.1.3])
7	Test of the independent disconnecting device per [2.3.3]
(1)	Tests for the verification of the battery SOH are to be carried out (e.g. complete charge/discharge cycle or other methods as per Manufacturer's indications).

5.4 Plans to be kept on board

5.4.1 *(1/1/2022)*

An operation manual is to be kept on board which includes at least:

- charging procedure,
- normal operation procedures, including instructions for the safe connection and disconnection of the batteries,
- emergency operation procedures,
- estimated battery deterioration (ageing) rate curves, considering modes of operation.

5.4.2 *(1/1/2022)*

A maintenance manual for systematic maintenance and functional testing is to be kept on board which includes at least:

- tests on all the equipment affecting the battery system (e.g. instrumentation, sensors, etc.),
- recommended test intervals to reduce the probability of failure,
- recommended survey plan (annual and renewal surveys),
- functional tests of control, monitoring, safety and alarm system,
- verification of the State of Health (SOH),
- instructions for Software Maintenance.

SECTION 1 GENERAL REQUIREMENTS

1 Definitions

1.1 Accommodation spaces

1.1.1 Spaces used for public spaces, corridors, stairs, lavatories, cabins, offices, hospitals, cinemas, games and hobby rooms, barber shops, pantries containing no cooking appliances and similar spaces.

1.2 A class divisions

1.2.1 Divisions formed by bulkheads and decks which comply with the following criteria:

a) they are constructed of steel or other equivalent material or alternative forms of construction to be in compliance with the requirements of this Section;

b) they are suitably stiffened;

c) they are insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature, within the time listed below:

- class "A-60" .....60 min
- class "A-30" .....30 min
- class "A-15".....15 min
- class "A-0".....0 min

d) they are so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test.

Tasneef will require a test of a prototype bulkhead or deck in accordance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity or temperature rise. The products indicated in Tab 1 may be installed without testing or approval.

1.3 B class division

1.3.1 Divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

a) they are constructed of approved non-combustible materials and all materials entering into the construction and erection of B class divisions are non-combustible, with the exception that combustible veneers may be permitted provided they meet the other appropriate requirements of this Chapter;

b) they have an insulation value such that the average temperature of the unexposed side will not rise more than 140° C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225° C above the original temperature, within the time listed below:

- class "B-15" .....15 min
- class "B-0" .....0 min

c) they are so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test.

Tasneef will require a test of a prototype division in accord-ance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity or temperaturise.

In order to be defined as B class, a metal division is to have plating thickness not less than 2 mm when constructed of steel.

1.4 Bulkhead deck

1.4.1 The uppermost deck up to which the transverse watertight bulkheads are carried.

Table 1

Classification	Product description
class “A - 0” bulkhead	A steel bulkhead with dimensions not less than the minimum dimensions given below: • thickness of plating: 4 mm • stiffeners 60 x 60 x 5 mm spaced at 600 mm or structural equivalent
class “A - 0” deck	A steel deck with dimensions not less than the minimum dimensions given below: • thickness of plating: 4 mm • stiffeners 95 x 65 x 7 mm spaced at 600 mm or structural equivalent

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1.20 Steel or other equivalent material

1.20.1 Any non-combustible material which, by itself or due to insulation provided, had structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g. aluminium alloy with appropriate insulation).

1.21 Sauna

1.21.1 A hot room with temperatures normally varying between 80°-120°C where the heat is provided by a hot surface (e.g. by an electrically heated oven). The hot room may also include the space where the oven is located and adjacent bathrooms.

1.22 Alternative forms of construction

1.22.1 Any combustible material may be accepted if it can be demonstrated that the material, by itself or due to insulation provided, has structural and fire integrity properties equivalent to A or B Class divisions, or steel as applicable, at the end of the applicable fire exposure to the standard fire test.

1.23 Service spaces

1.23.1 Service spaces: spaces used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, storerooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces.

1.24 Standard fire test

1.24.1 A test in which the specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve in accordance with the Fire Test Procedures Code.

1.25 Vehicle Spaces

1.25.1 Spaces containing vehicles or craft with fuel in their tanks for their own propulsion.

1.26 Battery charging station

1.26.1 *(1/1/2022)*

A permanently (fixed) integrated element of the vessel electrical plant for the recharging of plug-in equipment. A fixed charging station provides electrical conversion, monitoring, or safety functionality. Standard electrical sockets or outlets are not to be considered fixed charging stations.

2 Documentation to be submitted

2.1

2.1.1 The Interested Party is to submit to Tasneef the documents listed in Tab 2.

Table 2 : Documentation to be submitted

No	I/A **(1)**	Document **(2)**
1	A	Structural fire protection, showing the method of construction and the purpose of the various spaces of the yacht
2	A	Natural and mechanical ventilation systems showing the penetrations of class divisions, location of dampers, means of closing, arrangements of air conditioning rooms
3	A	Means of escape
4	A	Automatic fire detection systems and manually operated call points
5	A	Location of fire pumps and fire mains (with indication of pump head and capacity), hydrants and fire hoses

(1) A: to be submitted for approval in four copies
I : to be submitted for information in duplicate

(2) Plans are to be schematic and functional and to contain all information necessary for their correct interpretation and verification such as:

- service pressures
- capacity and head of pumps and compressors, if any
- materials and dimensions of piping and associated fittings
- volumes of protected spaces, for gas and foam fire-extinguishing systems
- surface areas of protected zones for automatic sprinkler and pressure water-spraying, low expansion foam and powder fire-extinguishing systems
- capacity, in volume and/or in mass, of vessels or bottles containing the extinguishing media or propelling gases, for gas, automatic sprinkler, foam and powder fire-extinguishing systems
- type, number and location of nozzles of extinguishing media for gas, automatic sprinkler, pressure water-spraying, foam and powder fire-extinguishing systems.

All or part of the information may be provided, instead of on the above plans, in suitable operation manuals or in specifications of the systems.

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SECTION 2 FIRE PREVENTION

1 Engine space arrangement

1.1

1.1.1 The boundary of the engine space is to be arranged in order to contain the fire-extinguishing medium so that it cannot escape.

1.1.2 Combustible materials and flammable liquid excluding fuel oil necessary for the propulsion engines are not to be stowed in the engine space.

1.1.3 Machinery spaces of category A and engine spaces are to be ventilated to prevent the build-up of explosive gases.

1.1.4 For yachts with wooden hulls, particular attention is to be paid in order to adopt adequate means to avoid oil absorption into the structures.

1.1.5 In order to contain the oil, it may be acceptable to fit a drip tray in way of the engine. The use of the engine bearers as a means of containment of the oil may be accepted provided that they are of sufficient height and have no limber holes.

Efficient means are to be provided to ensure that all residues of persistent oils are collected and retained on board for discharge to collection facilities ashore.

1.1.6 Means are to be adopted for the storage, distribution and utilisation of fuel oil in order to minimise the risk of fire.

1.1.7 Fuel oil, lubricating oil and other flammable liquids are not to be stored in fore peak tanks.

1.1.8 Fuel oil tanks situated within, or adjacent to, the boundaries of category A machinery spaces are not to contain fuel oil having a flashpoint of less than 60ºC.

1.1.9 Every fuel oil pipe which, if damaged, would allow oil to escape from a storage, settling or daily service tank situated above the double bottom is to be fitted with a cock or valve directly on the tank. Such cock or valve is to be capable of being closed locally and from a safe position outside the space in which such tanks are fitted in the event of fire occurring in the space (see also Ch 1, Sec 9, [9.6.3]).

1.1.10 Means are to be provided to stop fuel transfer pumps, fans, oil fired boilers and separators from outside the machinery space.

2 Liquid petroleum gas for domestic purposes

2.1

2.1.1 Where gaseous fuel is used for domestic purposes, the arrangements for the storage, distribution and utilisation of the fuel is to be such that, having regard to the hazards of fire and explosion which the use of such fuel may entail, the safety of the yacht and the persons on board is preserved. The installation is to be in accordance with App 1 or other recognised national or international standards.

Hydrocarbon gas detectors and carbon monoxide detectors are to be provided.

2.1.2 Open flame gas appliances fitted on board for cooking, heating or any other purpose are to be in compliance with recognised international standards.

2.1.3 Materials which are fitted close to open flame cooking and heating appliances are to be non-combustible, except that the exposed surfaces of these materials are to be protected with a finish having a class 1 surface spread of flame rating when tested in accordance with ASTM D 635.

Where combustible materials or other materials which do not have a class 1 surface spread of flame rating are fitted, they are not to be placed unprotected within the following distances of a standard cooker:

a) 400 mm vertically above the cooker, for horizontal surfaces, when the vessel is upright;

b) 125 mm horizontally from the cooker, for vertical surfaces.

2.1.4 Curtains or any other suspended textile materials are not to be fitted within 600 mm of any open flame cooking, heating or other appliance.

2.1.5 After the completion of the installation on board, the system is to be checked at operating pressure by means of a pneumatic test.

When all leakage has been repaired, all appliance valves are to be closed and the cylinder shut-off valve opened.

When the gauge registers that the system is pressurised, the cylinder valve is to be closed.

It is to be verified that the pressure reading value remains constant for at least 15 minutes.

2.1.6 An open flame gas appliance provided for cooking, heating or any other purpose is to comply with the requirements of EC Directive 90/396/EEC or equivalent.

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8 Batteries charging station

8.1

8.1.1 *(1/1/2022)*

Batteries charging: movable/Portable batteries, of a type other than Lead and Nickel-Cadmium batteries (including batteries fitted on onboard equipment, toys, appliances etc.), during the charging process shall be placed in a well ventilated area onboard which is either an open deck, or in a continuously manned area or an area which is covered by a gas, smoke and heat detection system and an automatic fixed fire extinguishing system.

In all other cases the relevant requirements of Pt C Ch 2 App 2 will be applied on a risk assessment base.