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**Small craft — Electrical devices —
Lightning protection**

iTeh STANDARD PREVIEW
*Navires de plaisance — Dispositifs électriques — Protection contre la
foudre*
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10134 was prepared by Technical Committee ISO/TC 188, *Small craft*.

Annex A forms an integral part of this International Standard.

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Small craft — Electrical devices — Lightning protection

1 Scope

This International Standard establishes the requirements for the design, construction and installation of lightning protection equipment when fitted on small craft of less than 24 m length of hull.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1 air gap: Interruption of a conductive path by a distance not to exceed 2 mm in order to prevent the passage of low-voltage current without interrupting the flow of lightning current.

2.2 air terminal: Upper part of the lightning protection system, terminating in a sharp point, intended to intercept lightning discharges.

2.3 lightning ground plate: Means to conduct the electrical current from a craft's conductive elements to the water in which the craft floats.

2.4 lightning protective mast: Conductive structure or means for electrical connection of an air terminal to the lightning ground plate.

2.5 protection zone: Zone below a grounded air terminal, mast or overhead ground wire which is substantially immune to direct strokes of lightning.

NOTES

1 Complete protection from equipment damage or personal injury is not implied.

2 A lightning protection system offers no protection when the craft is out of water and is not intended to afford protection if any part of the craft comes in contact with power lines while afloat or ashore.

3 General requirements

3.1 Protection of persons and small craft from lightning is dependent upon a combination of design and maintenance of equipment and on personal behaviour. The basic guides contained in this International Standard shall be considered and used in designing and installing a lightning protection system. However, in view of the wide variation in structural design of craft and the unpredictable nature of lightning, specific recommendations cannot be made to cover all cases.

3.2 To provide an adequately grounded conductor or lightning protective mast, the entire circuit from the top of the mast to the ground shall have a mechanical strength and conductivity not less than that of an 8 mm² copper conductor, and the path to ground followed by the conductor shall be essentially straight.

3.3 If there are large metal objects such as tanks, engines, deck winches, stoves, etc. in proximity to the grounding conductor, there will be a strong tendency for sparks or sideflashes to jump from the grounding conductor to the metal object at the closest point. To prevent damage from such sideflashes, an interconnecting conductor at least equal to 8 mm² copper (see 4.2.1) shall be provided at all places where they are likely to occur.

3.4 Large metallic objects which are not part of the electrical system of the craft and which are not already grounded due to their own functional or other requirements may be grounded directly to the ground plate, provided that it is not practical to interconnect with the lightning conductor or bonding systems as specified in 5.4.

3.5 Where a lightning protection system is installed on a craft, the owner's manual shall include information as indicated in annex A.

4 Materials

4.1 Corrosion resistance

The material used in a lightning protective system shall be resistant to corrosion. If, as in certain installations, it is impractical to avoid a junction of dissimilar metals, the corrosion effects can be reduced by the use of suitable platings or special connectors which are available for such purposes.

4.2 Wire conductors

4.2.1 Wire conductors shall be copper of not less than 8 mm² cross-sectional area or offer conductivity equal to or greater than that of 8 mm² copper wire.

4.2.2 The size of any strand of a bare copper wire shall be not less than 0,71 mm². Insulated copper wires shall have at least 19 strands.

4.2.3 The thickness of metal ribbon or strip shall be at least 1 mm.

5 Installation

5.1 Conductive joints

Conductive joints shall be made and supported so as not to damage the conductors and to provide conductivity equal to that of the conductor.

5.2 Lightning protective mast height

A lightning protective mast shall be of a height to provide the desired protection zone in accordance with 5.2.1, 5.2.2 or 5.2.3 as appropriate.

5.2.1 For a mast height not exceeding 15 m above the water, the base radius is approximately equal to the mast height, h (see figure 1).

5.2.2 For mast heights over 15 m, the protection zone is based on the striking distance of the lightning stroke. Since the lightning stroke may strike any grounded object within the striking distance of the point from which final breakdown to ground occurs, the zone of protection is defined by a circular arc (see figure 2).

The radius of the arc is the striking distance (30 m). The arc passes through the top of the mast and is tangent to the water. If more than one mast is used, the zone of protection is defined by arcs to all masts.

5.2.3 The protection zone afforded by any configuration of masts or other elevated, conductive and grounded objects can readily be determined graphically. Increasing the height of a mast above the striking distance will not increase the protection zone.

5.3 Lighting protective mast alternatives

5.3.1 If the mast is of non-conducting material, the associated lightning or grounding conductor shall:

- a) be essentially straight;
- b) be securely fastened to the mast;
- c) extend at least 150 mm above the mast;
- d) terminate in an air terminal; and
- e) be led as directly as practicable to the grounding connection as described in 3.2.

5.3.2 A radio antenna or outrigger may serve as a lightning protective mast, if meeting the requirements of 3.2.

NOTES

3 Non-conducting antenna masts with spirally wrapped conductors are not considered suitable for lightning protection purposes.

4 Because a loading coil presents a high impedance to the flow of lightning current, the portion of an antenna above the bottom of a loading coil is not effective as a lightning protective mast.

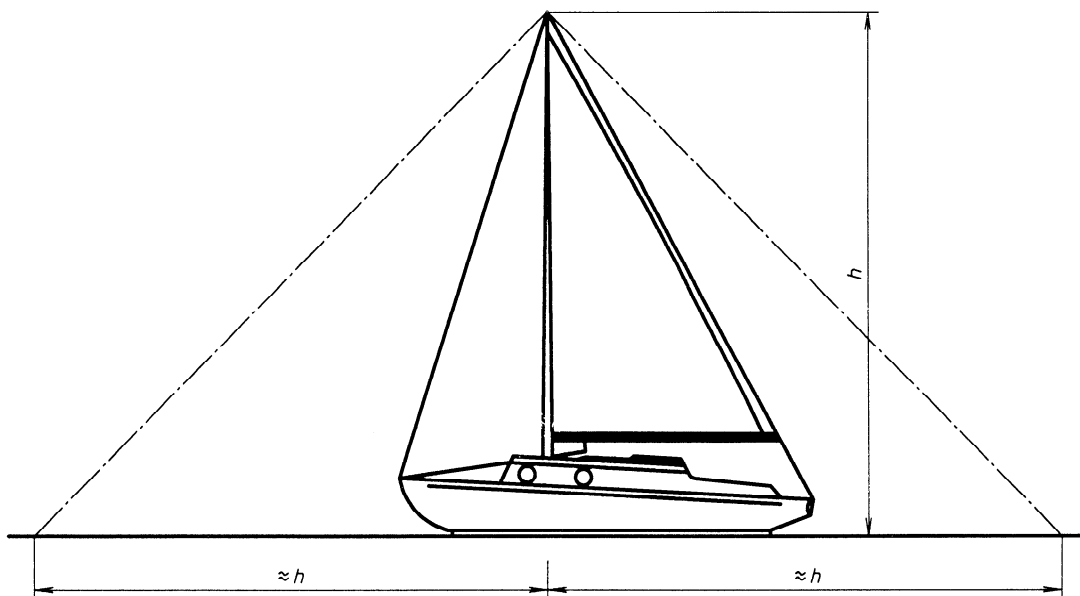
5.4 Interconnection of metallic masses

5.4.1 Metallic masses aboard craft which are a permanent part of the craft or are permanently installed within or about the craft, and whose function would not be seriously affected by grounding, shall be made a part of the lightning-conductor system by interconnection with it or connection through an air gap.

An exception may be made for comparatively small size metallic masses.

5.4.2 The object of interconnecting the metal parts of a craft with the conductor is to prevent damage from sideflashes, especially in the case of rather extensive metal objects that are nearby. The main principle to be observed in the prevention of such damage is to identify on a craft the places where sideflashes are most likely to occur and to provide metallic paths for them.

5.4.3 To minimize flow of lightning discharge current through engine bearings, it may be preferable to connect engine blocks directly to the ground plate rather than to an intermediate point on the lightning conductor.



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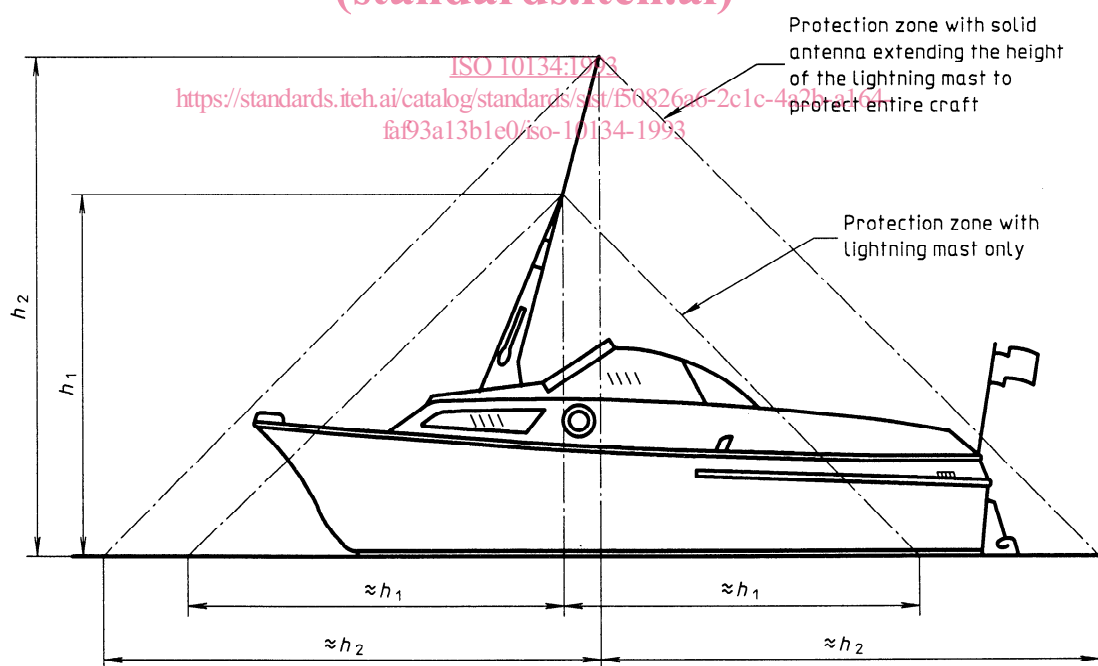


Figure 1 — Craft with mast not exceeding 15 m above water

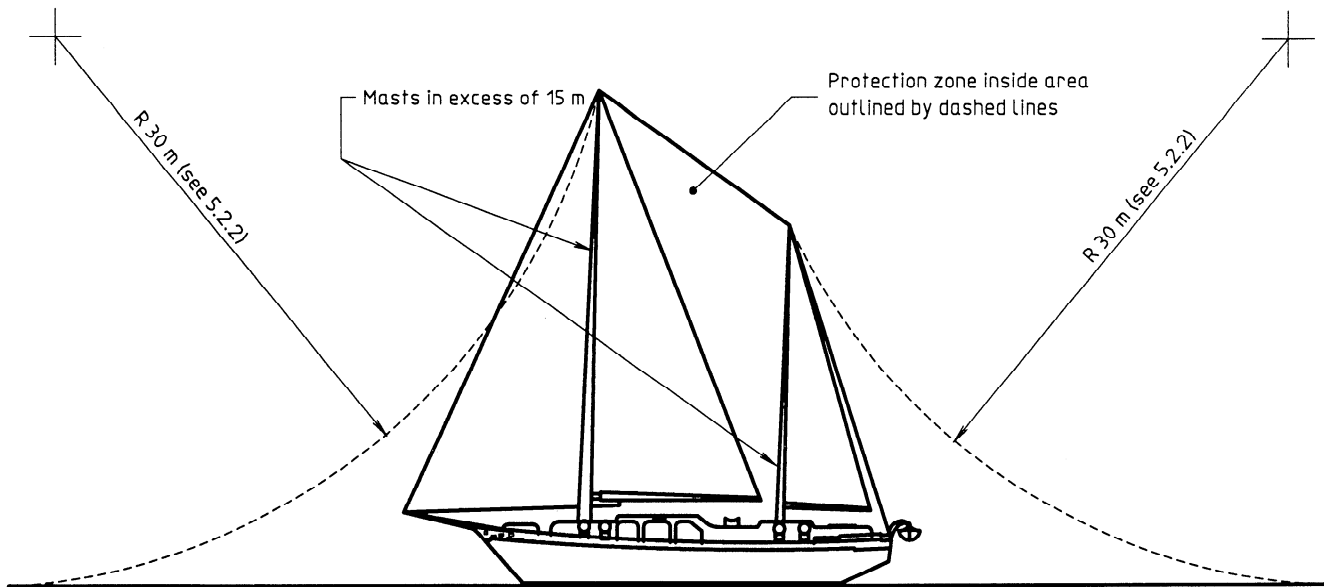


Figure 2 — Craft with mast(s) in excess of 15 m above water

5.5 Exterior bodies of metal

Metal situated wholly on the exterior of the craft shall be electrically connected to the grounding conductor.

Exterior metal bodies on a craft include any large masses such as horizontal guardrails, handrails on cabin tops, smokestacks from galley stoves, electric winches, davits, metal signal masts and metallic hatches.

5.6 Interior bodies of metal

Metal situated wholly in the interior of craft and which at any point comes within 2 m of a lightning conductor shall be electrically connected to this lightning conductor.

Interior bodies of metal include engines, water and fuel tanks, and control rods for steering gear or reversing gear. It is not intended that small metal objects such as compasses, clocks, galley stoves, medicine chests and other parts of the craft's hardware be grounded.

5.7 Exterior/interior bodies of metal

Metal which projects through cabin tops, decks or sides of craft above the sheer shall be connected to the nearest lightning conductor at the point where the metal emerges from the craft and shall be grounded at its lower or extreme end within the craft.

5.8 Lightning ground connection

5.8.1 A lightning ground connection for a craft may consist of any metal surface which is submerged in the water, in any conditions of heel or trim, and which has an area of at least 0,1 m².

5.8.2 Metallic rudder surfaces, metal centreboards and keels, or the ground plate for radio transmitters may be used for lightning ground connection.

5.8.3 A metal hull itself constitutes an adequate lightning ground plate.

6 Vessels with metal hulls

If there is electrical continuity between metal hulls and masts or other metallic superstructure of adequate height in accordance with clause 5, no further protection against lightning is necessary.

7 Sailboats with non-metallic hulls

7.1 Metallic stays and shrouds, metallic masts, and sail tracks on non-metallic masts shall be grounded.

7.2 Grounding of other objects on sailboats shall be in accordance with clause 5.

7.3 Multihull craft shall provide a lightning ground connection in accordance with 5.8 for each hull that has items to be grounded, attached, or fitted to it.

8 Power boats with non-metallic hulls

8.1 Power boats may be adequately protected by a grounded radio antenna, outrigger, or other grounded lightning protective mast in compliance with clause 5, provided the height of the mast conforms to that described for the protection zone.

8.2 Interconnection and grounding of metallic masses shall be in accordance with clause 5.

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Annex A (normative)

Owner's manual

A.1 General

If a lightning protection system is installed on a craft, the owner's manual shall include information about maintenance of the system and instructions about the personal behaviour of occupants.

A.2 Maintenance

Information about the items in A.2.1 to A.2.3 shall be included in the owner's manual.

A.2.1 Whip-type radio antennas shall not be tied down during a lightning storm if they have been designed as a part of the lightning protection system.

A.2.2 If a craft has been struck by lightning, compasses, electrical and electronic gear shall be checked to determine whether damage or change in calibration has taken place.

A.2.3 If a craft has been struck by lightning, the lightning protection system shall be inspected for physical damage, system integrity and continuity to ground.

A.3 Precautions for occupants during lightning storm

The basic purpose of protection against lightning is to ensure personal safety. Therefore information about the following precautions shall be included in the owner's manual.

A.3.1 Occupants shall remain inside a closed boat, as far as practical.

A.3.2 Occupants shall **not** be in the water. Arms and legs shall **not** be dangled in the water.

A.3.3 Consistent with safe handling and navigation of the craft, occupants shall avoid making contact with any items connected to a lightning protection system and especially in such a way as to bridge between these items. For example, it is not recommended for an operator to be in contact with reversing gear levers and a spotlight control handle at the same time.

A.3.4 Occupants should avoid contact with metal parts of a sailboat's rigging, spars, fittings and railings.

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