INTERNATIONAL STANDARD

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Small craft — Electrical devices — Protection against ignition of surrounding flammable gases

Navires de plaisance — Équipements électriques — Protection contre l'inflammation des gaz inflammables environnants

Reference number
ISO 8846:1990(E)

Foreword

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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.

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Annex A of this International Standard is for information only.

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Small craft — Electrical devices — Protection against ignition of surrounding flammable gases

1 Scope

This International Standard describes test methods and requirements for the design of electrical devices to be used on small craft so that they may be operated in an explosive atmosphere without igniting surrounding flammable gases. It does not require explosion-proof or explosion-protected electrical apparatus as defined in IEC 79-0. [1]

This International Standard does not cover ignition protection procedures for products or components that may operate in hydrogen and air mixtures. Nor does it cover mechanisms of ignition from external sources, such as static electricity, lightning or other factors not related to the apparatus under test.

2 Definitions

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

2.1 flammable hydrocarbon mixture: Mixture of propane and air (per cent by volume) between the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) that will explode if ignited by any means. Tests using propane and air are considered to cover marine fuel and air mixtures between the LEL and UEL.

2.2 ignition-protected device: Device that complies with the requirements of one of the test programmes given in clause 3.

2.3 ignition source

(1) Any electrical contacts, commutator or brush assembly, or collector ring and brushes that may produce electrical arcs of ignition-capable energy.

(2) Resistor or other component or surface that may operate at a temperature sufficient to ignite a flammable mixture.

2.4 normal operating conditions: Any operating conditions of the device, including the maximum achievable overload up to 400 % of the rated current (circuit breakers, switches and the like) and a stalled rotor condition for any motor with the circuit protected by an overcurrent protective device specified by the product manufacturer.

3 Test programme

3.1 The external surface temperature test shall be carried out according to clause 4.

3.2 Electrical devices which can generate sparks or arcs under operation (switches, relays, generators, fuses, distributors, cranking motors, etc.) shall be tested according to clause 5 if they can be considered sealed and according to clause 6 if they are non-sealed.

3.3 Electrical devices showing an increase of the external surface temperature of more than 100 °C above ambient under operation shall be tested according to clause 4. Electrical devices not rated for continuous operation and wired with momentarily operated switches, such as engine-cranking motors, propulsion unit trim motors and other intermittently operated devices, are exempt from this test.

4 External surface temperature test

4.1 The electrical device shall be placed in a closed, thermally insulated air-circulating oven having an initial temperature of 60 °C ± 2 °C. Suitable heating shall be provided in addition to that generated by the component in order to keep the temperature in the oven constant at 60 °C ± 2 °C.

4.2 The test voltage supply shall be adjusted within the range of 80 % to 120 % of the nominal system voltage giving the greatest temperature increase.

4.3 The electrical device shall be operated continuously for a minimum of 7 h in the mode in which it draws its maximum current.

4.4 The maximum allowable surface temperature is 200 °C, measured at any point on the electrical device exterior.

5 Test method — Sealed devices

Electrical devices which under operation can produce sparks or arcs shall be tested according to 5.1 and 5.2 if they are considered so tight that no surrounding gases can penetrate into them.

5.1 Equipment

A water chamber, as shown in figure 1, is needed.

5.2 Test procedure

5.2.1 Submerge the electrical device to be tested in a water chamber at ambient temperature, changing its attitude if necessary so that all possible sources of leaks are at the top and are 340 mm to 370 mm below the water surface. Submerged time is 15 min for each attitude change.

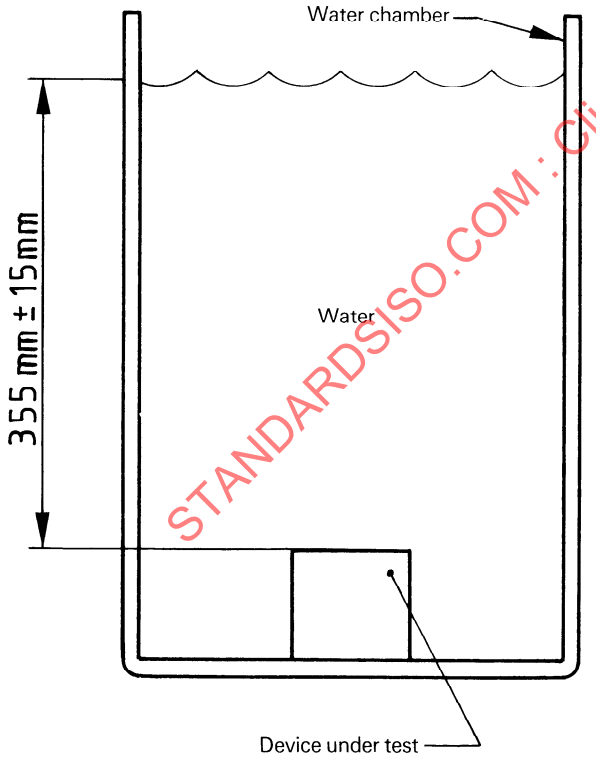


Figure 1 — Water chamber for sealed devices

5.2.2 Observe the electrical device under test carefully throughout the test duration for a leak as evidenced by the generation of a bubble or stream of bubbles.

5.2.3 If bubbles are observed coming out of the electrical portion of the device, the electrical device shall not be considered sealed and shall be tested under clause 6.

5.2.4 If no bubbles are observed, remove the electrical device from the water chamber and dry its exterior.

5.2.5 Dismantle the electrical device for internal inspection.

5.2.6 If no water is found inside the electrical device, it shall be accepted as a sealed ignition-protected device. If water is found, it shall be tested according to clause 6.

6 Test method — Non-sealed devices

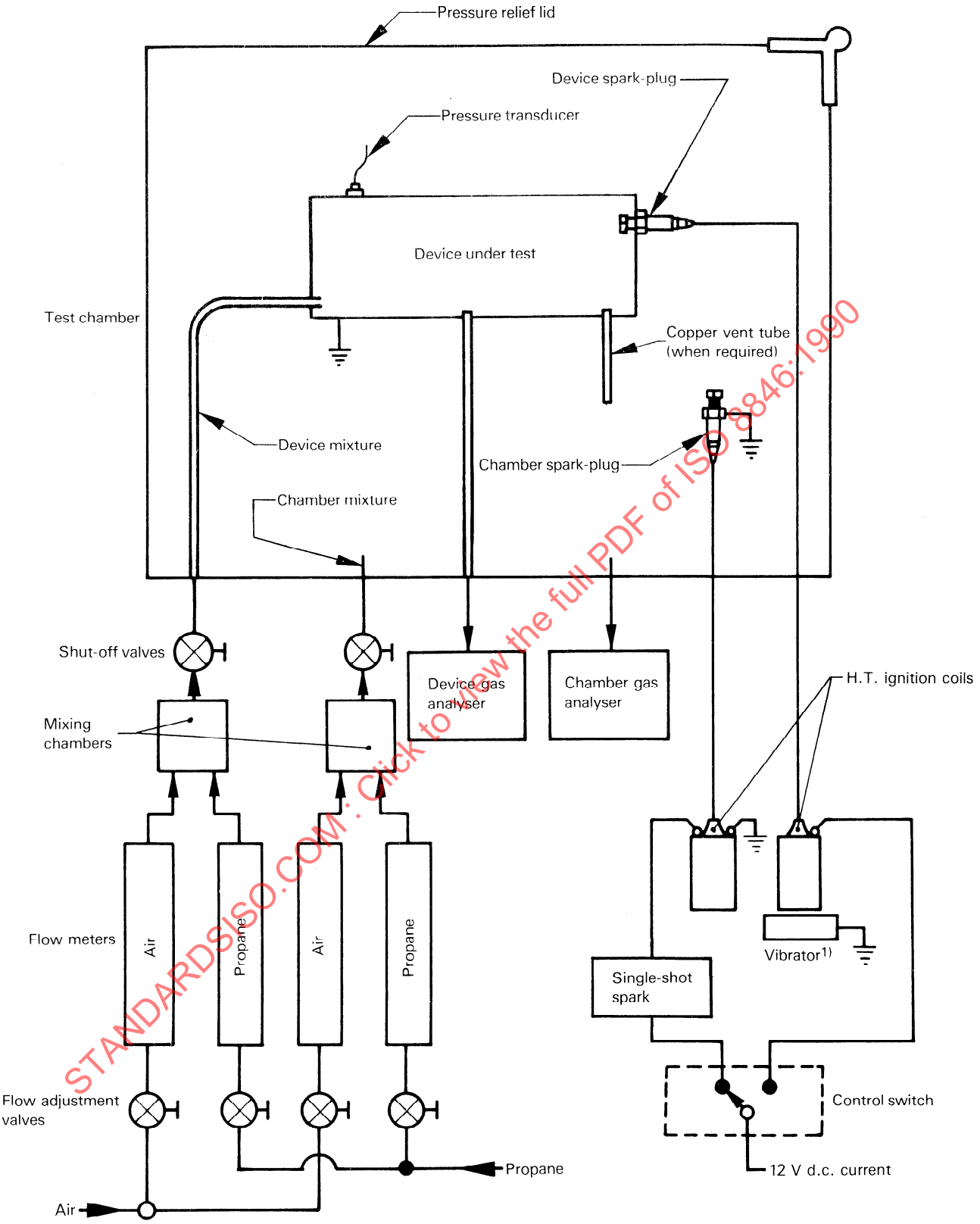
Testing according to 6.1 to 6.4 shall be carried out on electrical devices which under operation can produce sparks or arcs and are considered to be open so that surrounding gases can penetrate into them. Electrical devices which after testing according to clause 5 have been found to be non-sealed shall also be tested as in 6.1 to 6.4.

6.1 Equipment

A test assembly as shown in figure 2 for large non-sealed electrical devices or figure 3 for small non-sealed electrical devices is needed. The test chamber shall be equipped with a pressure-relief lid.

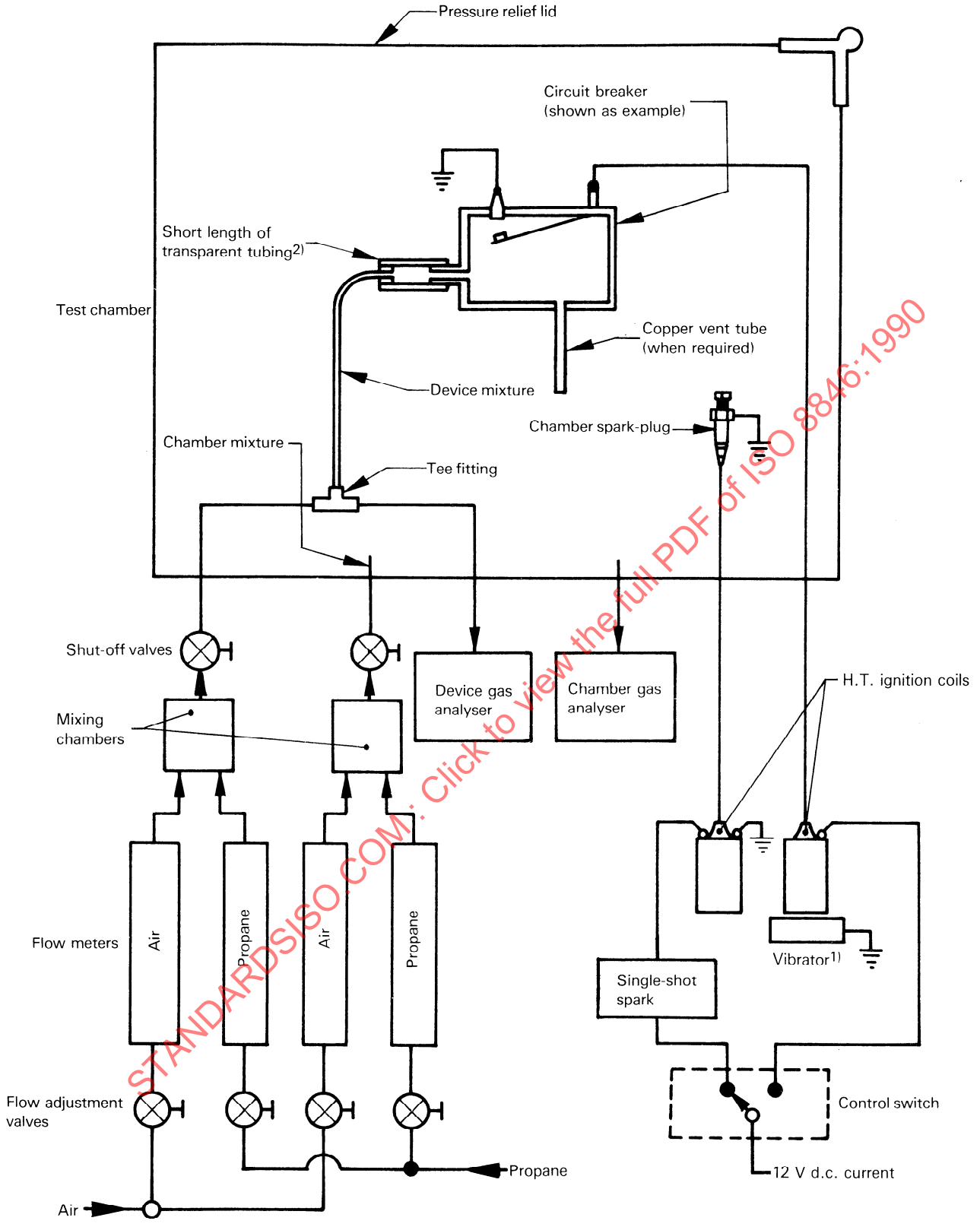
6.2 Electrical device preparation

6.2.1 Provide means of allowing a combustible mixture of propane and air into the electrical device via a 150 mm minimum length of rigid or flexible tubing having an inside diameter of 1,5 mm to 6,5 mm, the selection to be based on the minimum inside diameter that can maintain a test rate which allows a minimum of two electrical device ignitions per minute. The tubing supplying the mixture sample from the device to the analyser (see figure 2) shall have a 1,5 mm inside diameter, and a minimum length of 150 mm.



1) Multiple or single-shot spark option.

Figure 2 — Test assembly for large non-sealed electrical devices



1) Multiple or single-shot spark option.

2) Use pressure transducer if space is available.

Figure 3 — Test assembly for small non-sealed electrical devices

6.2.2 Electrical devices that do not contain openings large enough to allow the mixture in at the required rate shall have a vent in the form of a copper tube of 150 mm minimum length installed in the electrical device with the free end open to the chamber. The inside diameter of the copper vent tube shall be the same as that required to feed the electrical device.

6.2.3 Electrical devices which are too small for direct installation of both the tube feeding the electrical device and that supplying the electrical device gas analyser require a tee fitting to join the tubes from which a single 150 mm minimum length 1,5 mm inside diameter, rigid or flexible tubing can then enter the electrical device (see figure 3).

6.2.4 The electrical device contacts or a separately mounted spark-plug or spark-plug-like item is required to provide a gap across which a spark can jump. The gap size need only be large enough consistently to ignite the specified mixture. However, where possible a 2,5 mm gap is preferred. The spark gap provided shall be installed as close as possible to the part in the electrical device from which the arc would normally originate. Electric motors, for example, shall have a spark-plug mounted at the commutator end of the motor.

6.2.5 The test chamber ignition system shall be a single-shot spark system to ensure that the surrounding mixture is easily ignitable.

6.2.6 Confirmation of ignition within the electrical device can usually be detected by the noise produced. If the pop or bang is not clearly audible, make provisions to check the pressure rise in the electrical device or use the observed flash or combustion seen through a 20 mm maximum length, 6,5 mm maximum inside diameter, supply tubing (see figure 3). The transparent tube shall connect to the electrical device through a hole large enough to transmit the combustion into the transparent tube without being quenched.

6.3 Test procedure

6.3.1 Fill the test chamber with a mixture of 4,75 % (V/V)± 0,25 % (V/V) propane to air. This test chamber mixture ratio is to be maintained during all test cycles.

6.3.2 Fill the electrical device with a mixture ratio determined by varying the ratio to produce the maximum pressure rise as indicated by the pressure transducer. This mixture ratio shall then be used throughout the test. If the smallest practicable pressure transducer cannot be installed due to the limited space available, a mixture ratio of 4,25 % (V/V)± 0,25 % (V/V) propane to air shall be used and combustion determined by the flash of combustion seen through the transparent tubing supplying the propane-air mixture to the device (see figure 3).

6.3.3 After establishing the proper mixture, stop the filling process and ignite the device mixture with a spark. If any attempt to ignite the device mixture fails, purge the device and chamber by returning to step 6.3.1, and repeat only steps 6.3.1 to 6.3.4. Do not rerun the entire test.

6.3.4 Confirm combustion in the electrical device.

6.3.5 Repeat steps 6.3.1 to 6.3.4, nine additional times in succession.

6.3.6 Ignite the test chamber mixture with the single-shot spark after each ten device ignitions to confirm that it is highly combustible. If any attempt to ignite the mixture in the test chamber fails, purge the electrical device and chamber and repeat steps 6.3.1 to 6.3.4, only for that ten-cycle segment of the test procedure. Do not rerun the entire test.

6.3.7 Repeat steps 6.3.1 to 6.3.6 four additional times in succession. If no ignition in the test chamber occurs as a result of the electrical device ignition (step 6.3.3), the electrical device shall be considered to be ignition-protected.

6.4 Special notes for non-sealed electrical devices

6.4.1 Cranking motors

When testing cranking motors, the pinion gear shall be placed in the position it would occupy when the motor portion is energized. If the motor portion can be energized with the pinion both retracted and extended, the cranking motor shall be tested with the pinion in both positions.

6.4.2 Distributors

Modify the distributor rotor contact to increase the spark gap to 2,5 mm. Connect components as necessary to provide a spark across the gap. Install a high tension lead to any one of the remaining towers, terminating in an earth. Align the distributor rotor contact with the tower's electrode. The distributor test shall consist of five extended-firing cycles. Each extended-firing cycle shall consist of maintaining the spark for an additional 5 min after ignition of the distributor mixture as described in 6.3.1 to 6.3.3. If the chamber mixture ignites, the distributor shall be considered to have failed.

6.4.3 Intrinsically safe devices

An electrical device, as covered by IEC 79-11[2], which produces low-energy sparks during normal operation may be considered to be an intrinsically safe device. An intrinsically safe device is defined as one in which the electrical power flow at the maximum operating condition is at a sufficiently low level such that the device cannot in any way release an amount of thermal energy capable of igniting a gaseous mixture as defined in 6.4.3.1.

6.4.3.1 Such devices are not normally exempt from testing according to this International Standard because the level of power flowing through any device is dependent on the impedance of the shared circuit components and on the source of electrical potential. In addition, inductive, capacitive and voltage variations plus multiple installations and parallel operation can all change the energy flow through a device.

6.4.3.2 If the parameters of use are known, do not vary, and the maximum energy conditions are strictly defined, the physical test of such a device may be waived. If the absolute maximum release of energy, at the sparking members within the device, is no greater than 0,24 mJ, the device is acceptable for use in explosive atmospheres.

7 Marking

7.1 Evidence of compliance with this International Standard shall be indicated by the marking "ISO 8846" together with the word "MARINE", arranged in any suitable manner.

7.2 Marking shall be as durable as practicable.

Annex A
(informative)

Bibliography

[1] IEC 79-0:1983, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements.*

[2] IEC 79-11:1984, *Electrical apparatus for explosive gas atmospheres — Part 11: Construction and test of intrinsically-safe and associated apparatus.*