INTERNATIONAL STANDARD

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Small craft — Backfire flame control for petrol engines

Navires de plaisance — Anti-retour de flamme pour moteurs à essence

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Contents

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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 13592 was prepared by Technical Committee ISO/TC 188, *Small craft*.

Small craft — Backfire flame control for petrol engines

1 Scope

This International Standard specifies the minimum requirements for construction and testing of engines and devices to prevent the propagation of backfire flames from permanently installed inboard petrol engines to the surrounding atmosphere in small craft of length of the hull up to and including 24 m.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests*.

3 General requirements

3.1 Petrol engines shall be designed to prevent, or be equipped with a device to prevent, the propagation of backfire flame from within the engine air intake system to the surrounding atmosphere.

3.2 Where backfire flame propagation is prevented by means of a flame arrester consisting of one or more component parts, this device shall

a) provide access for inspection and cleaning;

b) have no openings in the arrester or its connection to the air induction system through which a backfire flame can pass;

c) be constructed so that component parts cannot be misaligned during assembly or installation to an extent that will impair its effectiveness;

d) include a permanent and prominent means of identification as described in clause 7;

e) provide means of securely fastening both the flame arrester to the air intake and the component parts to each other. When clamps are used, they shall be affixed to one of the major component parts in such a manner that they cannot be easily removed, and no springs shall be used for the purpose of clamping.

3.3 A flame arrester adapter, if required, shall

a) provide for direct attachment to the air induction system;

b) be attached permanently to the flame arrester. Examples of permanent attachment would be bond, weld, rivet or threaded fastener with thread upset after assembly. No loose pieces shall be used between the flame arrester and the engine air inlet that could be left out.

3.4 For each design of an engine incorporating a backfire flame control, the air and fuel induction system shall be capable of meeting the requirements in this International Standard.

Where a particular design of the engine air and fuel induction system consists of variations so that it may be utilized in similar engines of a particular manufacturer, these variations shall also be in conformity with the requirements of this International Standard.

A change in the design or construction of an engine air and fuel induction system that was capable of complying with these requirements shall be re-evaluated and retested when appropriate.

4 Testing

4.1 Each design of the flame arrester shall be tested to determine conformity with this International Standard.

4.2 Where a particular design consists of various combinations of parts, three sample assemblies need to be tested; they shall be representative of the flame-arresting performance of the cross-section of assemblies of the design.

4.3 The test of the samples representative of each design shall conclusively indicate that, when such backfire flame arresters are subjected to the test procedures of 6.1 to 6.4, the design prevents propagation of the backfire flame to the surrounding atmosphere without failure, damage or permanent deformation.

4.4 A change in the design or construction of an arrester that has passed tests as specified in 6.1 to 6.4 requires that the arrester be retested if the change cannot be considered and accepted under 4.2.

5 Physical examination

The backfire-flame-arrester assembly together with a stock carburettor designed to be used, or the engine air and fuel induction system, shall be examined for compliance with the following requirements of this International Standard.

5.1 Inspect all submitted samples for evidence of imperfections and consistency with production drawings.

5.2 Inspect the assembly to confirm that the flame arrester or induction system can be inspected and cleaned in service.

5.3 Inspect the assembly as installed for the existence of any possible by-pass openings, such as fasteners and joints.

5.4 Verify that the fasteners of the assembly are permanently secured.

5.5 Verify that the component parts can only be assembled properly, and without misalignment, on the engine.

6 Test procedure

The devices or systems shall withstand the effects of each of the following tests without failure.

NOTE — A new item may be used for each test.

6.1 Vibration test

The backfire flame arrester or system assembly used for this test shall be mounted on a stock carburettor or induction system, or simulated carburettor or induction system, for the type of assembly used in service secured by a rigid adapter directly to the surface of the vibration table in its normal operating position.

The carburettor and backfire-flame-arrester assembly or induction system shall be subject to 24 h of vibration, with 8 h in each of the x, y and z planes, at a peak-to-peak amplitude of 1,00 mm-1,05 mm. The test set-up shall be automatically cycled at a gradually increased and decreased rate between 10 Hz and 60 Hz every four minutes.

6.2 Shock test

The set-up used for the vibration test shall be used for this test including the test fixture, carburettor and backfire-flame-arrester assembly or induction system.

Securely mount the set-up to the surface of a shock machine.

Subject it to 5000 vertical impacts of 98 m/s² (10 g), having a shock duration of 20 ms ± 2 ms measured at the zero reference line of a half-sine shock pulse.

6.3 Explosion test

The backfire flame arrester assembly and carburettor or the engine air and fuel induction system used for the vibration and shock tests shall be used for this test and be subjected to 50 test repetitions.

The backfire-flame-arrester assembly or induction system shall be attached to the test stand as shown in figure 1 in a manner simulating a normal installation. An engine may be used in place of the lower chamber of the test stand for testing induction systems. Prior to the tests, the carburettor or induction system shall be carefully checked for any openings that could permit flame passage, and all throttle and choke butterflies shall be locked in the full open position. Other carburettor or induction system openings, such as fuel line, vacuum advance connections, etc., shall be sealed.

Where provisions are made on the backfire flame arrester assembly or induction system for the connection of oil-breather tubing, such lines shall be left disconnected during the tests.

Using whatever adapter may be required, the carburettor with the attached backfire flame arrester assembly or the induction system shall be secured directly to the upper end of a chamber, to be referred to as the lower chamber with an internal bore of 50 mm ± 2 mm and a length of 600 mm ± 10 mm according to figure 1.

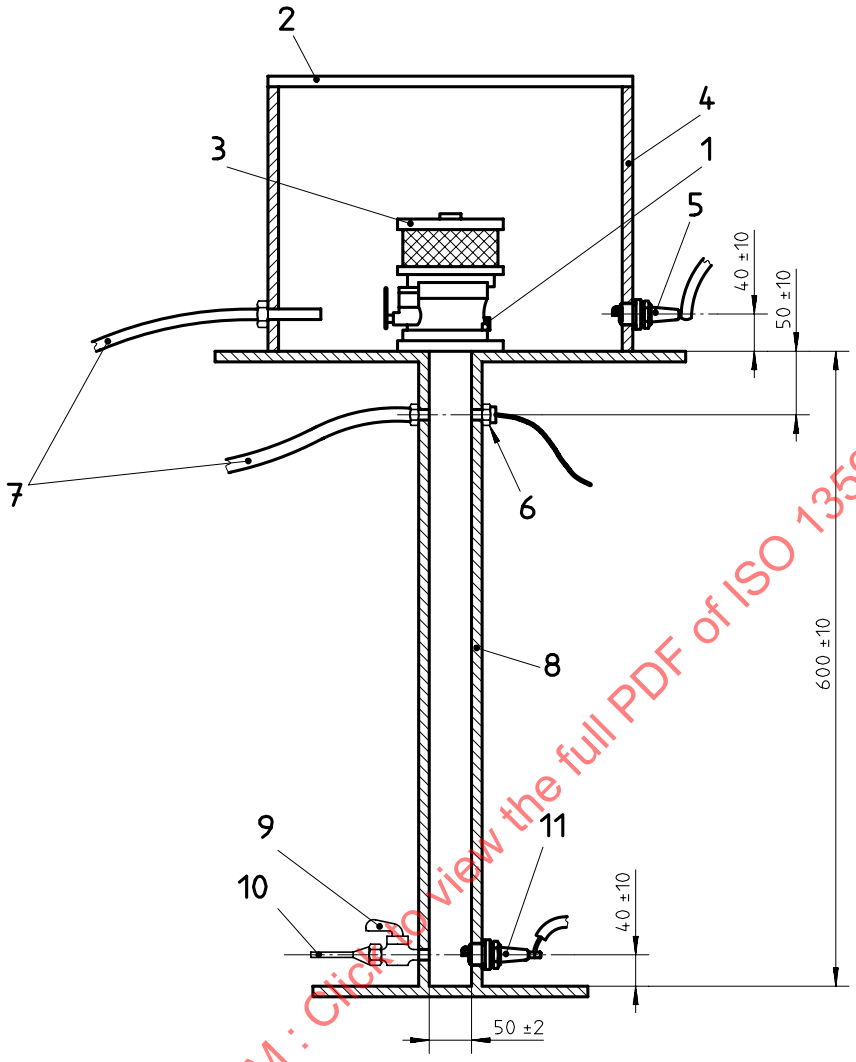
The lower chamber shall be closed at the lower end (see figure 1).

The method of attachment between the flame arrester and the carburettor or induction system shall be in accordance with the manufacturer's requirements. The carburettor or induction system shall be directly and fully open to the lower chamber, with no restriction to gas flow. For evaluation of induction systems, an engine can be used in place of the lower chamber, with alterations to introduce the combustible mixture and ignition source.

6.3.1 In accordance with figure 1, a provision shall be made at the base of the lower chambers for the introduction of a premixed propane gas/air mixture. The mixing of the propane and air shall not be accomplished within the chamber.

The propane/air explosive mixture used for these tests shall be generated through the use of flow meters and a suitable premixing chamber, designed and arranged so that a controlled homogenous explosive mixture is fed up to the lower chamber for a flame arrester and to the upper and lower chambers for an air induction system during all tests. A suitable control valve shall be provided at the gas/air inlet fitting to permit immediate extinguishing of the mixture, should it continue to burn after ignition. Flame arresters shall be provided in all connecting fittings between the explosion chamber and mixing chamber to prevent effective flame propagation through the lines to the mixing chamber.

Dimensions in millimetres



Key

1 Carburettor or induction system
2 Hinged cover or rubber flap
3 Flame arrester
4 Upper chamber
5 Spark plug
6 Static pressure transducer
7 Gas sampling connections for gas/air ratio meter
8 Lower chamber (iron pipe)
9 Shut-off valve
10 Gas/air feed from mixing chamber (for air induction systems)
11 Spark plug (2 required)

Figure 1 — Explosion test apparatus

6.3.2 Two spark plugs, set with a gap of 0,7 mm-0,8 mm, shall be provided at the base of the lower chamber directly adjacent to the gas/air inlet fitting. A dual ignition system capable of simultaneously firing both spark plugs with a minimum peak voltage of 25 000 V shall be provided.

A similar spark plug shall be provided in the upper chamber.

6.3.3 An upper chamber with a minimum volume of 25 L shall be provided around the flame arrester or engine air and fuel induction system during all the tests.

At least one side of the upper chamber shall be made of transparent plastic to permit good observation of the backfire-flame-arrester assembly or induction system at the time of ignition.

A hinged cover or flexible flap shall be installed at the top of the upper chamber to provide pressure relief (see figure 1).

6.3.4 The instrumentation shall include the following:

a) gas analyser for monitoring the propane/air mixture in the upper and lower chambers;

b) pressure transducer in the lower chamber with an amplifier and oscilloscope to monitor the relative severity of each test explosion;

c) flow meters to monitor the gas and air flow rates.

6.3.5 The tests shall be conducted in accordance with the following procedure.

a) Before initiating the tests, the flow of propane and air shall be adjusted so as to provide the mixture that, when ignited, produces the maximum explosive pressure recorded in the lower chamber.

b) When this mixture is present in both the lower and upper chambers, the mixture in the lower chamber shall be ignited. The maximum pressure of each explosion in the lower chamber shall be recorded.

c) 50 valid test explosions shall be conducted at not less than 80 % of the maximum explosive pressure recorded according to a).

d) After the mixture in the lower chamber has been ignited, the spark plug in the upper chamber shall be fired to verify the existence of an explosive mixture in the upper chamber.

e) Following each test, the upper and lower chambers shall be purged of all unburned gases and the next test conducted.

6.3.6 There shall be no ignition of the propane/air mixture in the upper chamber as a result of the explosion in the lower chamber in each of fifty consecutive valid tests.

6.3.7 The following are invalid tests that must be repeated:

a) any test explosion of less than 80 % of maximum pressure;

b) any test when the upper chamber fails to ignite after firing the upper spark plug.

6.4 Corrosion test

The backfire flame arrester assembly or air and fuel induction system shall be exposed to a neutral salt spray (NSS) test for a period of 240 h, defined as the NSS test in ISO 9227:1990, subclause 5.1.

After the test, the flame arrester must be cleaned and be capable of passing the physical examination specified in 5.3, 5.4 and 5.5.