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**Small craft — Ventilation of  
petrol engine and/or petrol tank  
compartments**

*Petits navires — Ventilation des compartiments contenant des  
moteurs à essence et/ou des réservoirs à essence*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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

This third edition cancels and replaces the second edition (ISO 11105:1997), which has been technically revised.

The main changes compared to the previous edition are as follows:

- definitions have been added under [Clause 3](#);
- several clauses of the standard have been re-organized for clarity;
- [subclauses 4.4, 4.6, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 6.2, 6.4, 6.6, 6.7, 6.8](#) and [6.9](#) have been added;
- [subclauses 4.1, 4.2, 4.5, 4.7, 5.1, 5.2, 6.3, 6.10](#) have been amended;
- [Table 2](#) has been added;
- [Annex A](#) has been added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Small craft — Ventilation of petrol engine and/or petrol tank compartments

**IMPORTANT** — The colours represented in the electronic file of this document can be neither viewed on screen nor printed as true representations. For the purposes of colour matching, see ISO 3864-4 which provides colorimetric and photometric properties together with, as a guideline, references from colour order systems.

## 1 Scope

This document specifies requirements for the ventilation of petrol engine and petrol tank compartments in small craft having petrol engines for propulsion, electrical generation or mechanical power, to prevent the accumulation of explosive gases in these compartments. Personal watercraft are not covered in this document.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8846:1990, *Small craft — Electrical devices — Protection against ignition of surrounding flammable gases*

ISO 11192:2005, *Small craft — Graphical symbols*

ISO 10088:2013, *Small craft — Permanently installed fuel systems*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1 habitable space

space surrounded by permanent structure in which there is provision for any of the following activities: sleeping, cooking, eating, washing/toilet, navigation, steering

Note 1 to entry: Spaces intended exclusively for storage, open cockpits with or without canvas enclosures and engine rooms are not included.

### 3.2 net compartment volume

volume that results from subtracting the volume of the *permanently installed* (3.4) items of equipment and accessories from the total, or gross, compartment volume

### 3.3 open to the atmosphere

<compartment or space> having at least 0,34 m<sup>2</sup> of permanent open area directly exposed to the atmosphere for each cubic meter of *net compartment volume* (3.2)

**3.4**  
**permanently installed**

securely fastened so that tools, such as wrenches and screwdrivers, must be used for removal

**3.5**  
**craft**  
**small craft**

recreational boat, and other watercraft using similar equipment, of up to 24 m length of hull ( $L_H$ )

Note 1 to entry: The length of hull is defined in ISO 8666:2016.

**3.6**  
**ventilation**

changing of air within a compartment by natural or powered means

Note 1 to entry: Ventilation can be affected by dilution of contaminated air, by local exhaust of contaminated air, or by introduction of fresh air.

**3.7**  
**weather enclosure**

removable covering intended to be used when the boat is occupied

## 4 General requirements

**4.1** Natural ventilation shall be provided in petrol tank compartments, except when the remaining volume is less than 3 l, in accordance with [Clause 5](#).

**4.2** Powered ventilation and natural ventilation shall be provided in petrol engine compartments in accordance with [Clauses 5](#) and [6](#).

**4.3** The ventilation duct sizes and airflow requirements shall be calculated based on net compartment volumes.

**4.4** Ventilation ducts shall be self-draining.

**4.5** Compartments or spaces containing fixed petrol engines and/or fixed petrol tanks shall be separated from habitable spaces. This requirement is met where the structure fulfils the following:

- a) the boundaries are continuously sealed (e.g. welded, brazed, glued, laminated or otherwise sealed);
- b) penetrations for cables, piping, etc. are closed by fittings, seals and/or sealants;
- c) access openings such as doors, hatches, etc. are equipped with fittings so they can be secured to minimize the flow of gas or vapours in the closed position.

The effectiveness of the boundary joints or sealing may be demonstrated either by documentation or visual inspection.

**4.6** If storage compartments for portable tanks are provided, the storage compartment shall be open to the atmosphere or shall be fitted with a natural ventilation system according to [Clause 5](#).

**4.7** External openings of ventilation intakes and exhausts shall be located according to ISO 10088:2013.

**4.8** Ventilation supply and exhaust ducts shall not open directly into a habitable space.

**4.9** Ventilation ducts or openings shall terminate on the exterior of the craft and outside of weather enclosures.

**4.10** The minimum internal cross-sectional area of ventilation ducting for petrol tank compartments shall be at least 1 134 mm<sup>2</sup>.

**4.11** The minimum internal cross-sectional area of ventilation ducting for petrol engine compartments shall be at least 3 161 mm<sup>2</sup>.

**4.12** Exterior openings for intake and exhaust ducts shall be separated to minimize recirculation. If intake and exhaust ducts are mounted side by side, a barrier shall be placed between the openings.

**4.13** The minimum internal cross-sectional area of terminal fittings for flexible ventilation ducts installed to meet the requirements of 5.3 shall not be less than 80 % of the required internal cross-sectional area of the flexible ventilation duct. Ventilation openings (i.e. louvers, grates, grills, etc.) shall meet the required minimum cross-sectional area as calculated under 5.3. The 20 % allowable cross-sectional area reduction is only permitted at attachment points of terminal fittings to the ducting.

**4.14** Only ignition-protected items in accordance with ISO 8846:1990 shall be installed in compartments, lockers or housings that contain:

- petrol engines;
- petrol fuel tanks;
- petrol fuel line connections.

**4.15** Compartments or spaces are considered connected when the aggregate area is more than two percent of the area between the compartments that require ventilation. This volume shall be added to the volume of the compartment or space requiring ventilation or shall be ventilated separately.

## 5 Natural ventilation systems

**5.1** Unless open to the atmosphere, each compartment in a craft shall have a natural ventilation system if:

- it contains a permanently installed petrol engine; or
- it contains a permanently installed petrol tank.

[Table 2](#) summarizes the minimum compartment ventilation requirements.

**5.2** Natural ventilation shall be achieved by an airflow in a compartment by the following:

- a supply opening or duct from the atmosphere; and
- an exhaust opening or duct to the atmosphere.

Each exhaust opening or duct shall originate in the lower one-third of the compartment with its opening above the normal accumulation of bilge water.

Each supply opening or duct and each exhaust opening or exhaust duct in a compartment shall be located above the normal accumulation of bilge water.

Compartment air intake and exhaust duct openings shall be separated by at least 600 mm, compartment dimensions permitting.

5.3 The combined area of intake openings and/or intake ducts and the combined area of exhaust openings or exhaust ducts shall have a minimum internal cross-sectional area calculated as follows:

$$A = 3\,300 \ln(V/0,14) \tag{1}$$

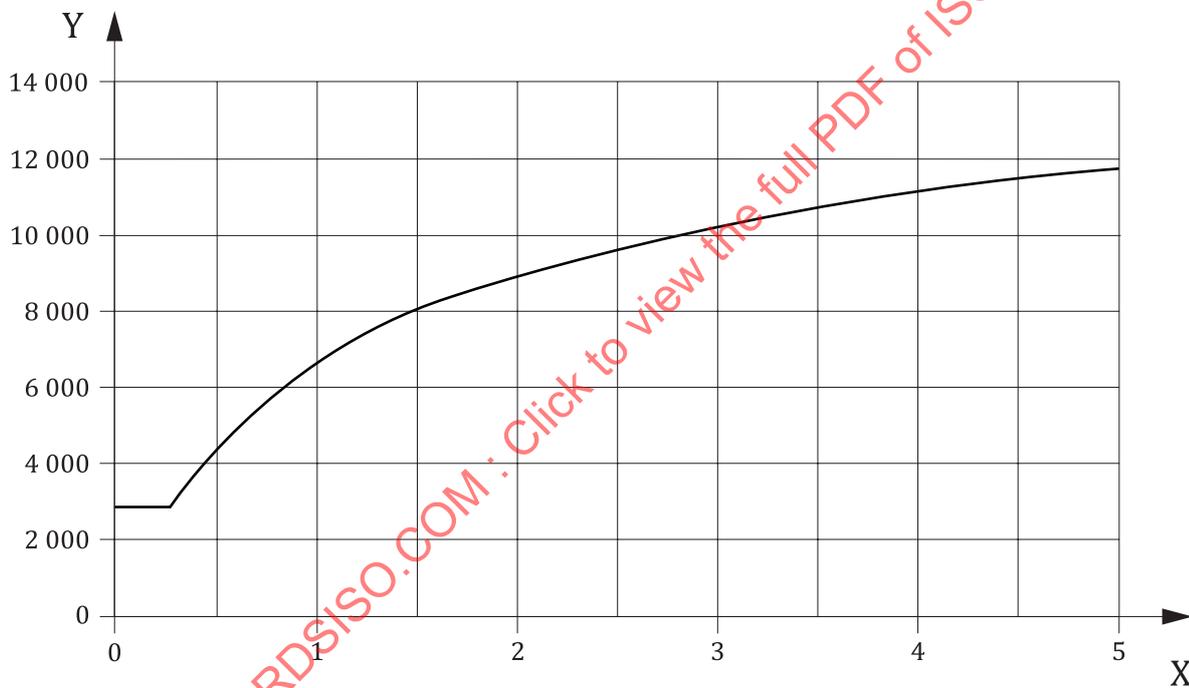
where

*A* is the minimum combined internal cross-sectional area of the openings or ducts, in square millimeters;

*V* is the net compartment volume equal to the total compartment volume minus the volume of permanently installed components in it, in cubic meters.

Corresponding graphs are given in [Figure 1](#) and [Figure 2](#).

5.4 The exhaust of the natural ventilation system may be part of the powered ventilation system.

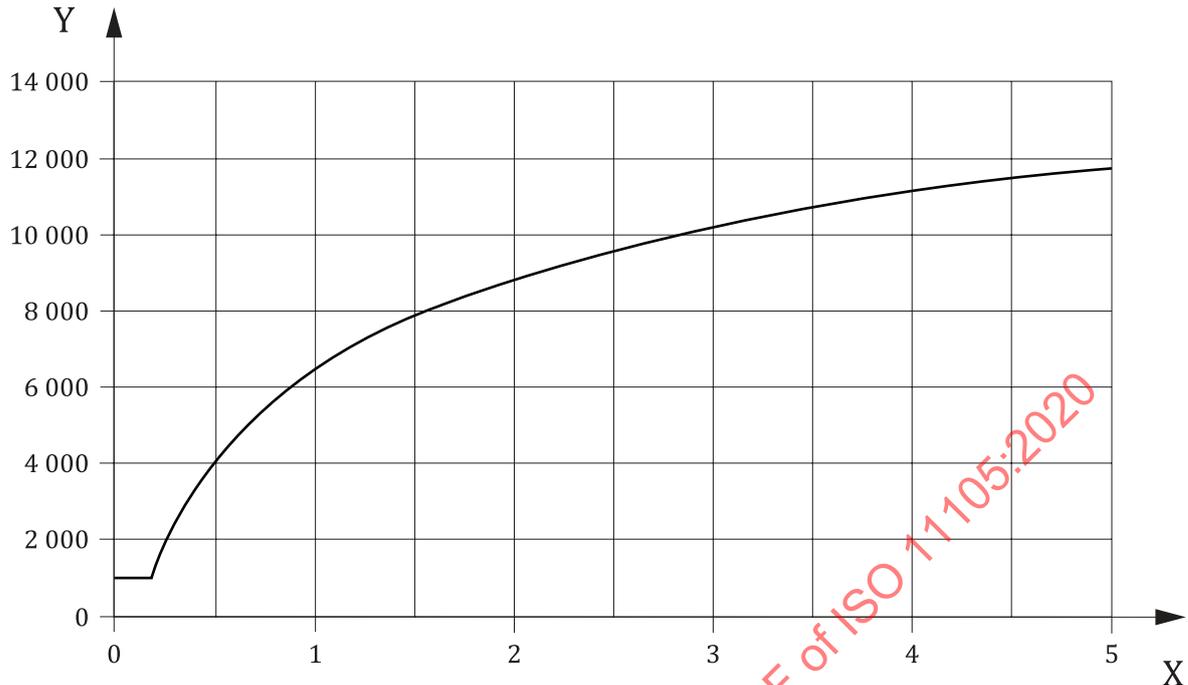


**Key**

X compartment volume, m<sup>3</sup>

Y opening size, mm<sup>2</sup>

**Figure 1 — Natural ventilation opening size for petrol engine compartments**

**Key**X compartment volume, m<sup>3</sup>Y opening size, mm<sup>2</sup>**Figure 2 — Natural ventilation opening size for petrol tank compartments****6 Powered ventilation systems**

**6.1** Unless open to the atmosphere, each compartment containing a permanently installed petrol engine shall be ventilated by removing air from the compartment to the atmosphere outside the craft by an exhaust blower system.

[Table 2](#) summarizes the minimum compartment ventilation requirements.

**6.2** There shall be at least one powered blower for each petrol engine used for propulsion.

**6.3** Each exhaust blower or combination of blowers shall be rated at an airflow capacity  $q_r$  not less than that given in [Table 1](#). Blower rating shall be determined according to [Annex A](#).

A corresponding graph is given in [Figure 3](#).

**Table 1 — Blower capacity**

$V$ m <sup>3</sup>	$q_r$ m <sup>3</sup> /min
<1	1,5
$1 \leq V \leq 3$	$1,5 \times V$
>3	$0,5 \times V + 3$

NOTE More than one blower can be used to achieve the required capacity.

6.4 The powered ventilation system shall not be automatically activated by the vapor detector, if installed.

6.5 There shall be a visual indicator, other than switch position, at each blower switch location to indicate that power (voltage) is applied to the powered ventilation system.

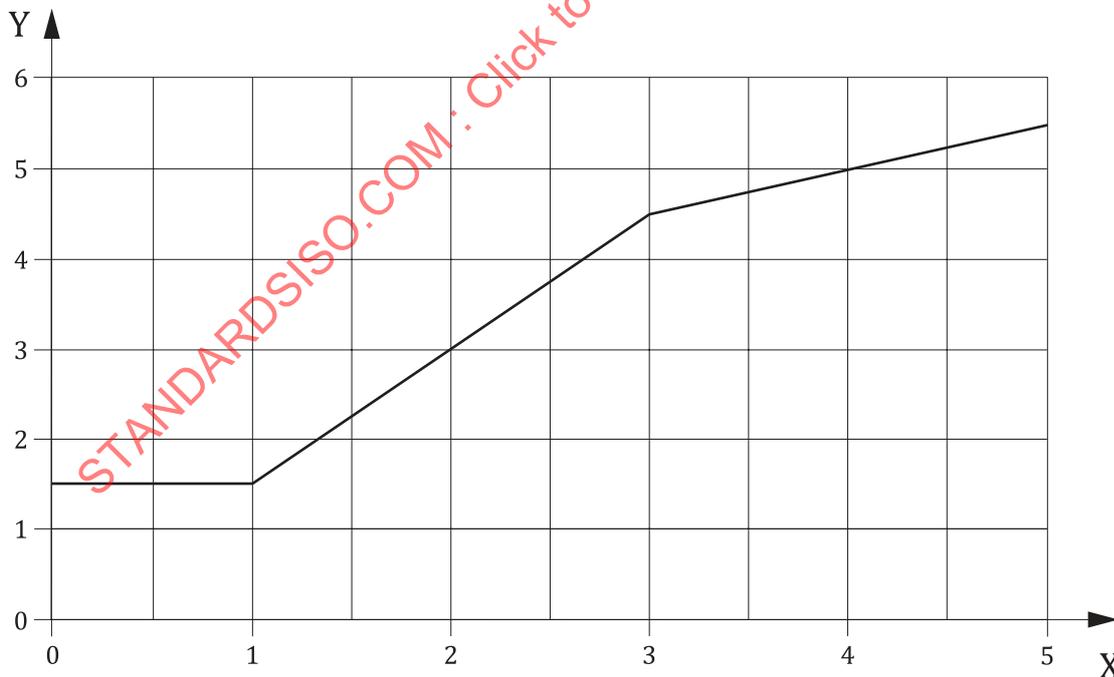
6.6 Multiple blowers shall operate simultaneously.

6.7 Each blower shall be provided with its own dedicated overcurrent protection.

6.8 As installed, the blower system(s) shall exhaust air from the craft at a rate in accordance with the blower system performance curve in [Figure 3](#) when the engine is not operating and the blower is operating at the electrical system's voltage.

6.9 Blowers shall be installed with ducts whose intake openings are:

- permanently fixed;
- located in the lower one-third of the compartment;
- above the normal level of accumulated bilge water;
- self-draining so that any water will drain from the ducting,
- as nearly as practicable below the engine(s) that it serves;
- separated from other natural ventilation ducts by 600 mm, or as compartment dimensions permit.



**Key**

X compartment volume, m<sup>3</sup>

Y airflow, m<sup>3</sup>/min

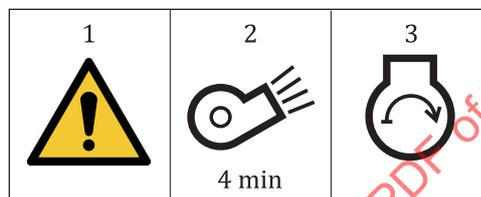
**Figure 3 — Powered ventilation blower capacity**

**6.10** Air intake openings inside a compartment shall be separated from exhaust duct openings inside the compartment by at least 380 mm, compartment dimensions permitting.

**6.11** Each craft that is required to have an exhaust blower shall have a label that

- is located as close as practicable to each ignition switch;
- is in plain view of the operator;
- has the symbols in accordance with ISO 11192:2005, depicted in [Figure 4](#), or at least the following information in a language acceptable in the country of sale:

**WARNING — Operate blower for 4 min before starting engine.**



The symbols are: ISO 7010-W001, ISO 7000-1597 and ISO 7000-1387.

The text "4 min" shall be at least 5 mm high.

**Figure 4 — Symbols**

**Table 2 — Minimum compartment ventilation requirements**

	Natural ventilation system required	Powered ventilation system required
Compartment with permanent petrol tank	Yes	No
Compartment with portable petrol tank	Yes	No
Compartment with permanent petrol engine	Yes	Yes
Compartments open to the atmosphere	No	No

## 7 Owner's manual

The following information shall be included in the owner's manual.

- When portable petrol tank storage locations are provided by the boat manufacturer, the locations shall be identified.
- Do not obstruct or modify the ventilation system.
- Operate blower when the craft is below cruising speed.
- Explanation of symbols.

- The following statements:
  - Before starting the engine:
    - check engine compartment bilge for petrol or vapors,
    - operate blower for four minutes,
    - verify blower operation.

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