
**Ships and marine technology —
Design and test requirements for
small steel hatches using electrical
trace heating**

STANDARDSISO.COM : Click to view the full PDF of ISO 24319:2022



STANDARDSISO.COM : Click to view the full PDF of ISO 24319:2022



COPYRIGHT PROTECTED DOCUMENT

© ISO 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword.....	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Design	2
4.1 Structure.....	2
4.1.1 Types of heated small steel hatches.....	2
4.1.2 Sealing rubber stripe.....	6
4.1.3 Other.....	6
4.2 Performance.....	6
4.2.1 Weather-tightness.....	6
4.2.2 Anti-icing.....	6
5 Materials	6
5.1 Hatch cover.....	6
5.2 Trace heater cable.....	7
6 Quality of manufacture	8
6.1 Appearance.....	8
6.2 Anti-rust and surface treatment.....	8
6.3 Installation of trace heater cable.....	8
7 Test	8
7.1 Weather tight test.....	8
7.1.1 Flushing test.....	8
7.2 Anti-icing test.....	8
7.2.1 Test purpose.....	8
7.2.2 Test device.....	8
7.2.3 Test condition.....	9
7.2.4 Test procedure.....	10
7.2.5 Pass/fail criteria.....	10
8 Designation	10
Annex A (informative) Nominal dimension, closing device and hinge position arrangement of heated small steel hatches	12
Annex B (informative) Type selection for trace heater cable and layout of trace heating device	14
Bibliography	16

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).

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).

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.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 8, *Ship design*.

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.

Ships and marine technology — Design and test requirements for small steel hatches using electrical trace heating

1 Scope

This document specifies the design, materials, quality of manufacture, test and designation of electrical trace heating for small steel hatches onboard vessels sailing in low temperature environments (below $-10\text{ }^{\circ}\text{C}$).

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 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

IACS UR S26, *Strength and Securing of Small Hatches on the Exposed Fore Deck*

3 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

heated small steel hatch

hatch made of steel installed onboard vessels, sailing in *low temperature environments* (3.4), enabling people to open normally by adding heat through the *trace heater cable* (3.3)

3.2

trace heater

device designed for the purpose of producing heat on the principle of electrical resistance and typically composed of one or more metallic conductors or an electrically conductive material, suitably electrically insulated and protected

Note 1 to entry: This can be in the form of a *trace heater cable* (3.3), heater panel or heated pad.

[SOURCE: IEC 60519-10:2013, 3.115]

3.3

trace heater cable

circular to flattened cable shaped construction with one or more discrete or continuous electrically insulated heating elements

Note 1 to entry: This cable is able to self-regulate its heating output power due to ambient temperature.

[SOURCE: IEC 60519-10:2013, 3.116]

3.4

low temperature environment

water with the lowest mean daily low temperature below $-10\text{ }^{\circ}\text{C}$, such as the Arctic Ocean, St. Francis Bay, North Baltic, Okhotsk, Bohai and North Yellow Sea

Note 1 to entry: In general, these waters are covered by regional sea ice during winter.

[SOURCE: IMO MSC.385 (94), 1.2.12^[2], modified]

4 Design

4.1 Structure

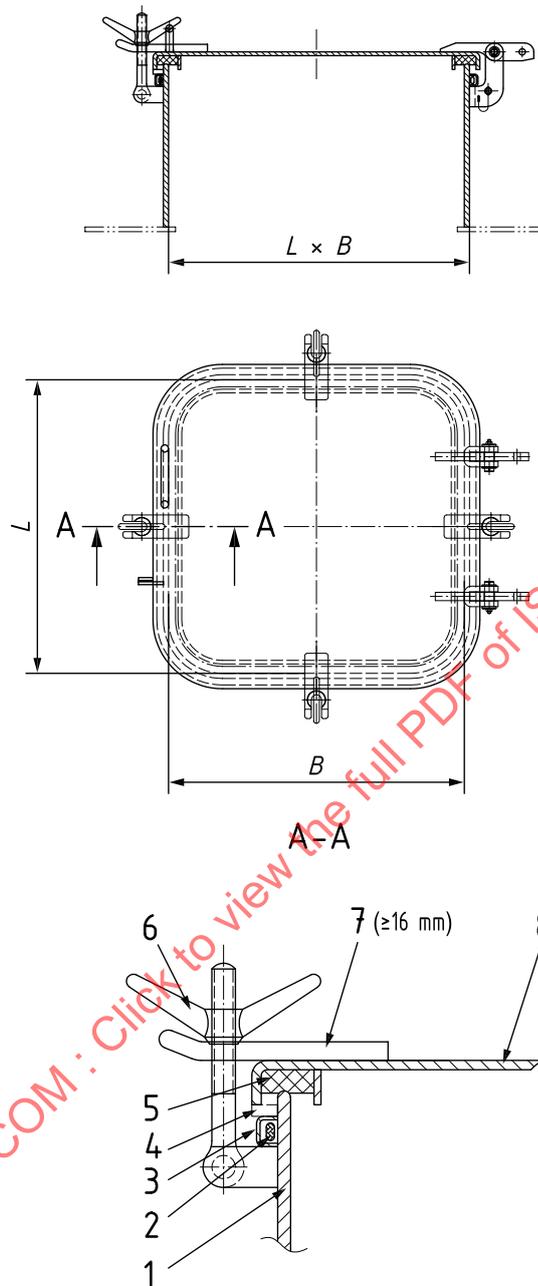
4.1.1 Types of heated small steel hatches

The heated small steel hatches are classified into three types, as shown in [Table 1](#) and from [Figure 1](#) to [Figure 3](#).

Table 1 — Types of heated steel hatches

Type	Definition
A	heated small steel hatch whose locking mode is butterfly nut open
B	heated small steel hatch whose locking mode is wedge handle open
C	heated small steel hatch whose locking mode is hand wheel linkage open

STANDARDSISO.COM : Click to view the full PDF of ISO 24319:2022

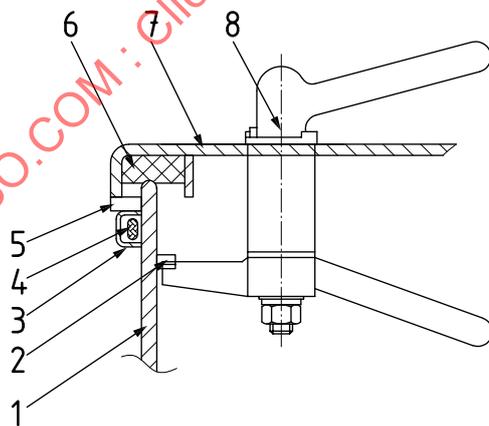
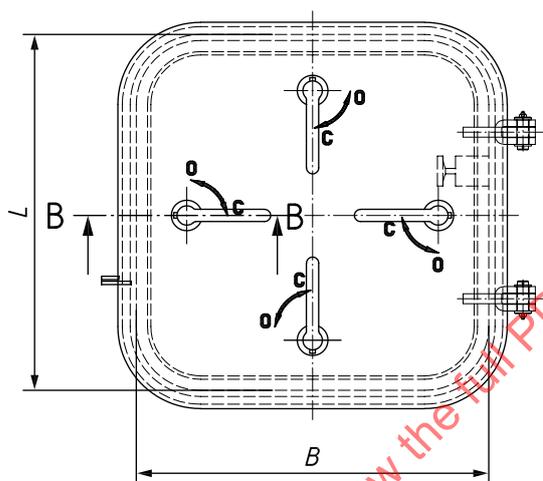
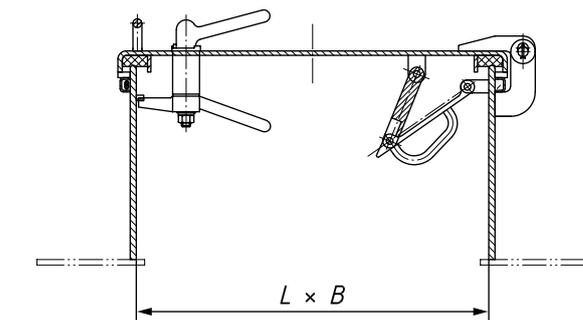


Key

- | | | | |
|---|--|-----|--------------------------------|
| 1 | coaming | 6 | wing nut clamp (typical shape) |
| 2 | electrical self-regulating trace heating cable | 7 | press plate |
| 3 | protect housing | 8 | cover |
| 4 | metal load-bearing plate | B | breadth |
| 5 | sealing rubber stripe | L | length |

NOTE This figure is only a typical form, and the closing devices are determined according to the specification of the heated small steel hatch. For the closing devices and hinges position arrangement, refer to [Annex A](#).

Figure 1 — Type A

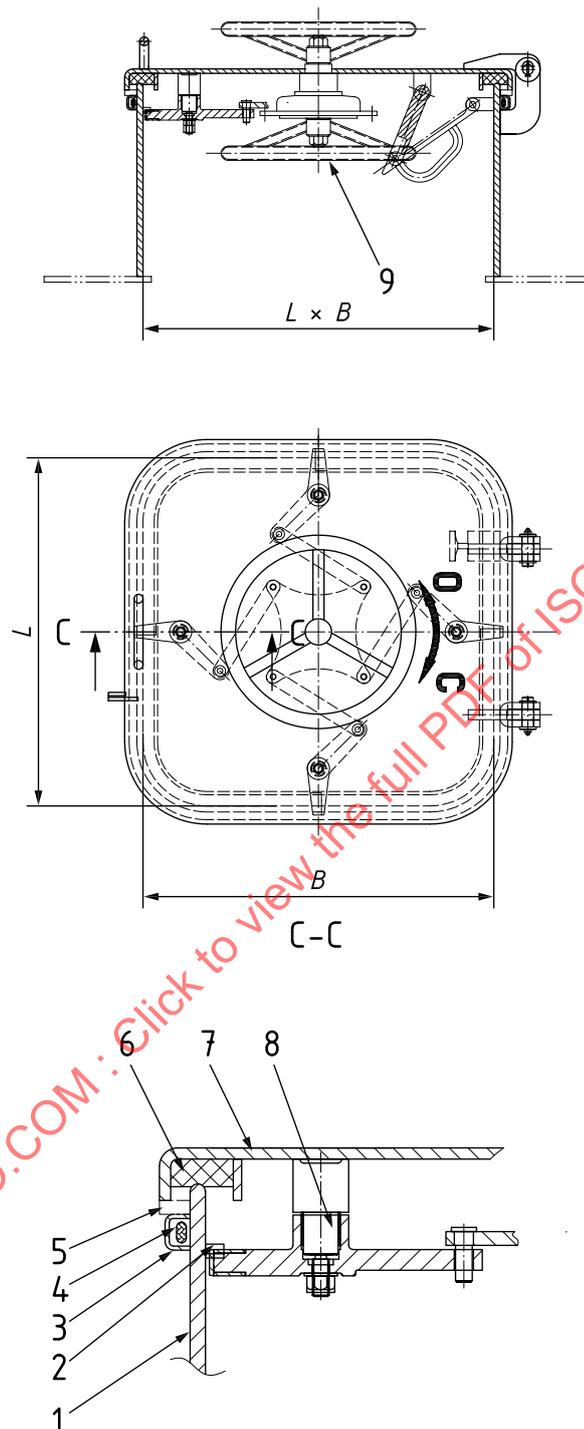


Key

- | | | | |
|---|--|-----|-----------------------|
| 1 | coaming | 6 | sealing rubber stripe |
| 2 | wedge | 7 | cover |
| 3 | protect housing | 8 | wedge handle |
| 4 | electrical self-regulating trace heating cable | B | breadth |
| 5 | metal load-bearing plate | L | length |

NOTE This figure is only a typical form, and the closing devices are determined according to the specification of the heated small steel hatch. For the closing devices and hinges position arrangement, refer to [Annex A](#).

Figure 2 — Type B



Key

- | | | | |
|---|--|-----|------------|
| 1 | coaming | 7 | cover |
| 2 | wedge | 8 | clip |
| 3 | protect housing | 9 | hand wheel |
| 4 | electrical self-regulating trace heating cable | B | breadth |
| 5 | metal load-bearing plate | L | length |
| 6 | sealing rubber stripe | | |

NOTE This figure is only a typical form, and the closing devices are determined according to the specification of the heated small steel hatch. For the closing devices and hinges position arrangement, refer to [Annex A](#).

Figure 3 — Type C

4.1.2 Sealing rubber stripe

The section dimension of sealing rubber stripe is 45 mm × 20 mm (see [Figure 4](#)), and allowable initial compression is 2 mm.

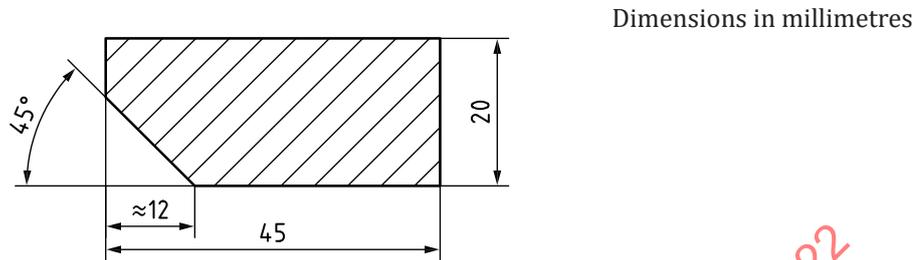


Figure 4 — Cross-section dimension of sealing rubber stripe

The sealing rubber stripe shall be installed on the cover plate as shown in [Figure 2](#), fixed with a baffle and shall be glued on the cover plate with marine glue.

Ensure that there is a metal load-bearing plate on or near the centre line of each closing device, and the compression of the sealing rubber stripe is less than 4 mm.

4.1.3 Other

Balancing blocks or spring hinges can be provided for the hatch cover when necessary, to facilitate the opening of the hatch cover.

When the interior of the heated small hatch needs to be filled with insulation material, it should be protected by the sealing plate. The size of clear opening of the heated small hatch should not be affected, whether or not insulation material is installed.

When the heated small hatch is located in accordance with the requirement of IACS UR S26, its cover, coaming and fastening shall also satisfy the requirements of IACS UR S26.

4.2 Performance

4.2.1 Weather-tightness

The heated small steel hatch should be weather-tight.

4.2.2 Anti-icing

The heated small hatch should be anti-icing for the cover coaming and shall be opened in a low temperature.

5 Materials

5.1 Hatch cover

The coamings and covers shall be manufactured by weldable steel with minimum tensile strength of 235 N/mm² or equivalent shipbuilding-quality steel. The low temperature performance of the material shall conform to the specifications or shall not be lower than the material grade of the hull at the installation position.

The hatch-seal retaining bars, hinges, press plates and ancillary fittings shall be manufactured by weldable steel with minimum tensile strength of 235 N/mm². The low temperature performance of the

material shall meet the specifications or shall not be lower than that of the material grade of the hull at the installation position.

Bolts and pins shall be made of corrosion resistant materials with minimum tensile strength of 235 N/mm², which can work normally in a low temperature environment.

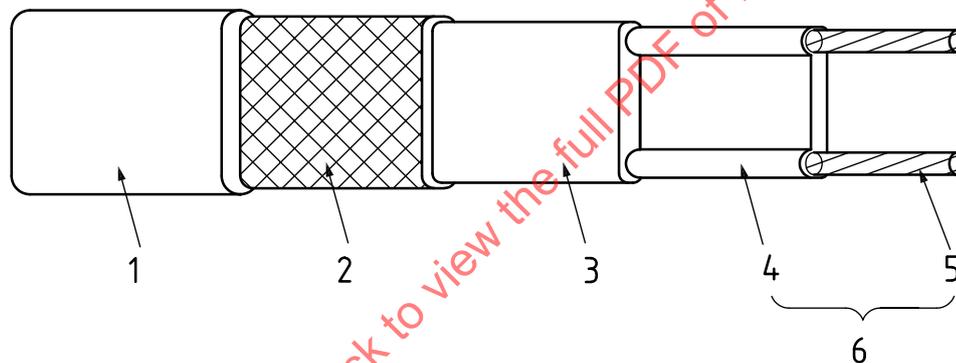
The elastic material of sealing rubber stripe shall meet the requirements of a low temperature environment. The sealing rubber stripe shall work normally in the normal temperature and low temperature alternating cycle environment, and provide effective and lasting sealing and re-sealing performance when the heated small steel hatch is tightened.

Neutral lubricating grease is applied to the movable part of small steel hatches, and it shall work normally in a low temperature environment.

Small steel hatch can be filled inside with insulating material according to the actual condition. The insulating material should operate normally in a low temperature environment.

5.2 Trace heater cable

The structure of trace heater cable^[3] is shown in Figure 5.



Key

- 1 outer sheath
- 2 metal shielding layer
- 3 insulating layer
- 4 thermal resistor
- 5 conductor
- 6 core tape

Figure 5 — Structure of trace heater cable

The trace heater cable is made up of a conductor, thermal resistor, insulating layers and a metal shielding layer that is covered with outer sheath (non-metallic).

The core tape consists of a thermal resistor and conductor. The conductor is made of multiple twisted or braided tinning or nickel-copper wire, and the section shape of core tape is dumbbell or flat circle.

The insulating layer may be high density polyethylene (HDPE), fluorinated ethylene propylene (FEP), perfluoroalkoxy alkane (PFA), or other proven materials.

The metal shielding layers shall be braided with galvanized copper wire or other wire material. The braiding layer shall be evenly and smoothly covered with insulating layer.

The outer sheath may be HDPE, FEP, PFA, or other proven materials.

6 Quality of manufacture

6.1 Appearance

There should be no burrs or sharp edges on the surface of small hatch cover; the weld should be smooth without defects such as blowhole, crack, slag inclusion, flying edge and unfused; all sharp edges should be round corners with a radius of 3 mm.

6.2 Anti-rust and surface treatment

Steel hatch cover and coaming shall not be deformed. The grade of rust-removing shall be Sa2.5 or St3 in accordance with ISO 8501-1. A layer of anti-rust primer shall be applied to prevent subsequent corrosion. The movable parts should be coated with neutral lubricating grease. The stainless-steel parts should be passivated, and the treated surface should always be silver-white.

6.3 Installation of trace heater cable

In order to gain the good heating conductivity, the installed trace heater cable shall fit closely to the heated small steel hatch over the whole length.

The trace heater cable shall not be cut until it has been fastened on the heated small steel hatch, so that the specific heating power is not affected by cutting the wrong length on site. After cutting, the ends shall be effectively protected against moisture (e.g. by self-adhesive tape or a blanking cap).

The installation radius of trace heater cable should be according to the minimum bending radii which shall be given by the supplier^[3].

7 Test

7.1 Weather tight test

7.1.1 Flushing test

The heated small steel hatch should be installed on the simulated deck, and the flushing test should be carried out. The pressure at the nozzle outlet should not be less than 0,2 MPa. The distance between the nozzle and the test site should not be less than 1,5 m. The diameter of the nozzle should not be less than 12 mm, and the flushing time should not be less than 3 min. The inner surface shall be free of water stains or droplets.

7.2 Anti-icing test

7.2.1 Test purpose

The purpose of the test is to evaluate whether the heated small steel hatch is capable of preventing formation of icing and operate (open or close) properly when subjected to low temperature operating conditions.

7.2.2 Test device

Test devices include an insulation meter (500 V megohmmeter), adjustable low temperature laboratory, blower with constant wind speed, steel hatch for test, temperature sensor and wind speed sensor.

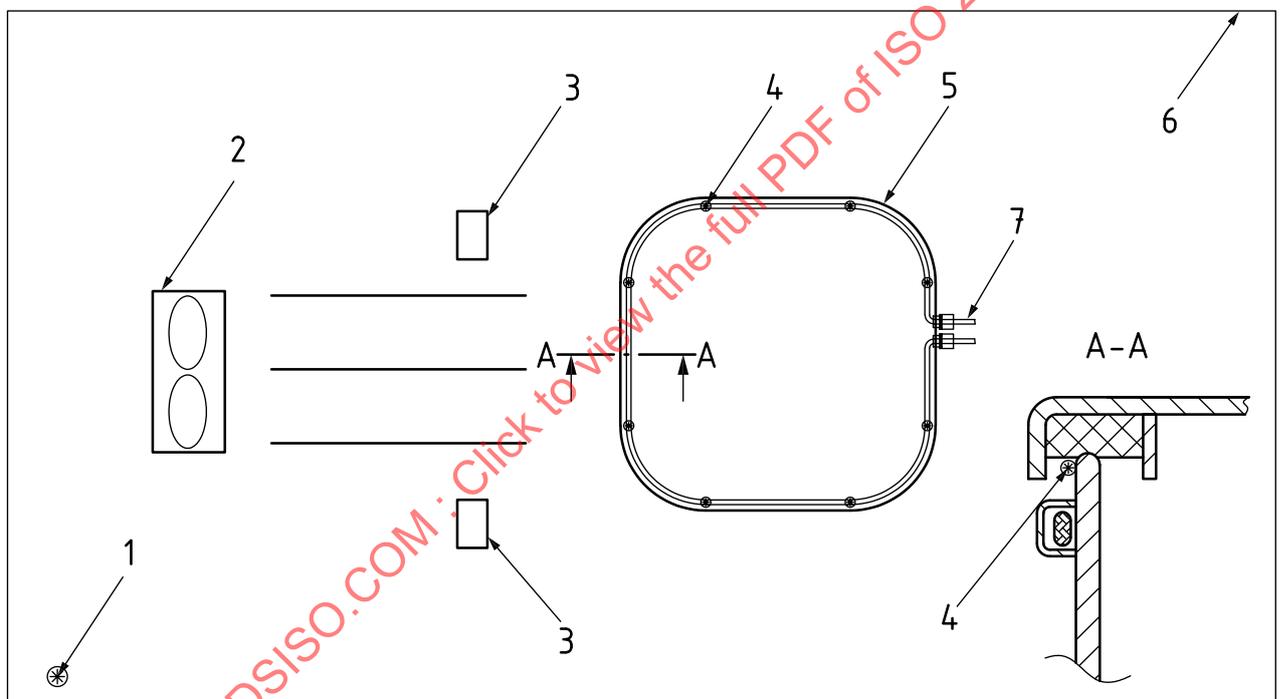
7.2.3 Test condition

The temperature stabilization shall be guaranteed:

- a) Ambient temperature: When the temperature is between $-10\text{ }^{\circ}\text{C}$ and $-25\text{ }^{\circ}\text{C}$, the temperature should be kept constant during the test. Once the constant range is within $\pm 2\text{ }^{\circ}\text{C}$ over a period of 30 min, it shall be considered as stabilized. When the temperature reduces to $-25\text{ }^{\circ}\text{C}$, the range can be extended to $\pm 3\text{ }^{\circ}\text{C}$;
- b) Specimen temperature: Once the temperature does not change by $\pm 2\text{ }^{\circ}\text{C}$ over a period of 60 min, it shall be considered as stabilized.

The temperature sensor should be evenly arranged on the small steel hatch coaming away from trace heating unexposed to the air. See [Figure 6](#) for details. And the number of temperature sensors should not be less than 9.

The wind speed sensor should be installed within 10 cm in front of the small steel hatch and within 10 cm above and below. See [Figure 6](#) for details.



Key

- 1 temperature sensor in laboratory
- 2 blower
- 3 wind speed sensor
- 4 temperature sensors on the coaming
- 5 heated small steel hatch
- 6 low temperature laboratory
- 7 trace heater cable

Figure 6 — State diagram of in-lab anti-icing test

7.2.4 Test procedure

- a) After the installation of heated small steel hatch is complete, the insulation state of the trace heater cable shall be measured by an insulating meter. Generally, the measured value should not be less than 20 MΩ^[4].
- b) Check whether the heated small steel hatch is ready according to 7.2.3. Especially, the temperature sensors on cover coaming shall be installed on the windward side.
- c) Turn on the refrigerator in the room and open the blower. When the temperature is below 0 °C, turn on the electric resistance trace heating power supply and heat the small steel hatch.
- d) When the ambient temperature of the laboratory reaches the set temperature (which is determined by both the manufacturer and the buyer), record the ambient temperature at this time and the coaming temperature which keeps constant within 1 min.
- e) Record the observed data according to Table 2.
- f) Repeat steps a) to e) above three times.
- g) After test is complete, the insulation state of the trace heater cable shall be measured by an insulating meter. Generally, the measured value should not be less than 20 MΩ^[4].

Table 2 — Test data record of heated small steel hatch

Test	Power	Type	Ambient temperature	Temperature									Test duration
				Sensor									
				1	2	3	4	5	6	7	8	9	
First test													
Second test													
Third test													

7.2.5 Pass/fail criteria

Stabilized specimen temperature value excluding minimum and maximum values from 9 sample points shall be constantly stable above 0 °C. If all three times tests are passed, then it can prove that the heated small steel hatch can achieve the function of anti-icing.

8 Designation

The heated small steel hatch conforming to this document should be designated as follows, in the order given:

- a) denomination: heated small steel hatch;
- b) code number of this document: ISO 24319;
- c) type: A, B or C;
- d) mark of trace heater cable: E;
- e) nominal dimension, as specified in Table A.1;
- f) ambient temperature, as specified in Table B.1.

EXAMPLE The designation for type A heated small steel hatch whose nominal dimension is 830 mm × 830 mm, and the ambient temperature is -10 °C is as follows.

Heated small steel hatch ISO 24319 -AE-830 × 830-(-10 °C)

STANDARDSISO.COM : Click to view the full PDF of ISO 24319:2022

Annex A (informative)

Nominal dimension, closing device and hinge position arrangement of heated small steel hatches

Nominal dimensions are listed in [Table A.1](#).

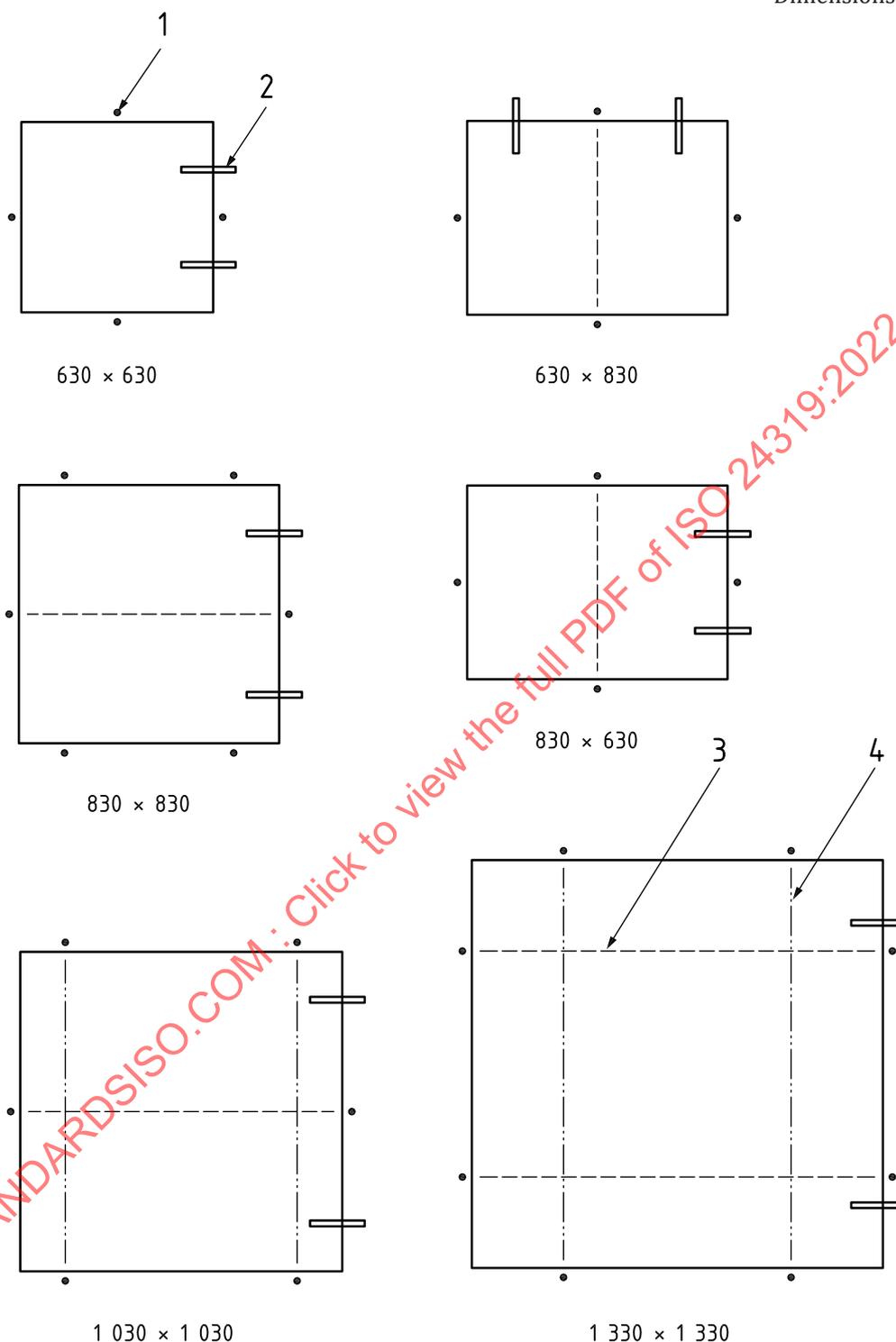
Table A.1 — Nominal dimension

Dimensions in millimetres

Type	Name	Nominal dimensions <i>L × B</i>
A	heated small steel hatch whose locking mode is butterfly nut open	630 × 630, 630 × 830, 830 × 830, 830 × 630, 1 030 × 1 030, 1 330 × 1 330
B	heated small steel hatch whose locking mode is wedge handle open	
C	heated small steel hatch whose locking mode is hand wheel linkage open	

Closing device and hinge position arrangement of the heated small steel hatches are shown in [Figure A.1](#).

Dimensions in millimetres



Key

- 1 closing device
- 2 hinge
- 3 main stiffener
- 4 secondary stiffener

Figure A.1 — Closing device and hinge position