
**Ships and marine technology — Testing
specification for walkways using
electrical resistance trace heating**

STANDARDSISO.COM : Click to view the full PDF of ISO 21539:2019



STANDARDSISO.COM : Click to view the full PDF of ISO 21539:2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

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
Fax: +41 22 749 09 47
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 requirements	2
5 Test method	2
5.1 Test purpose	2
5.2 Test facility requirements	2
5.3 Test conditions	2
5.3.1 General	2
5.3.2 Test temperature	2
5.3.3 Test wind	3
5.4 Test specimen requirements	3
5.4.1 General requirement	3
5.4.2 Dimension	3
5.4.3 Installation	3
5.5 Test procedures	4
5.5.1 General	4
5.5.2 Test procedure — Option 1	4
5.5.3 Test procedure — Option 2	5
5.6 Pass/fail criteria	6
6 Test report	7
Bibliography	8

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. 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. 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 4, *Outfitting and deck machinery*.

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 — Testing specification for walkways using electrical resistance trace heating

1 Scope

This document specifies a test method to assess the performance of walkways using electrical resistance trace heating to provide anti-icing in low temperature environments, when installed for exterior applications. It includes requirements for the test facility, the test conditions, the test specimens, the test procedures and the test report.

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.

IEC/IEEE 60079-30-1, *Explosive atmospheres — Part 30-1: Electrical resistance trace heating — General and testing requirements*

IEC/IEEE 60079-30-2, *Explosive atmospheres — Part 30-2: Application guide for design, installation and maintenance*

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

heated walkway

heated passage on the deck of ships sailing in low-temperature regions enabling pedestrians to pass more safely by adding heat through a thermal fluid

Note 1 to entry: The thermal fluid can be heated oil, steam or water.

3.2

anti-icing

prevention of ice formation on protected surfaces

3.3

ambient temperature

temperature of the air in the test chamber

3.4

flush-mounted

walkway installation where the air flow is highly restricted or prevented

3.5

raised

walkway installation that is elevated, which allows an air flow directly below the walkway

4 Design requirements

Walkways should be designed and constructed using materials that withstand the foreseeable conditions of use. In particular, at least the following details shall be considered:

- a) dimensioning and selection of components (including fixings, connections, supports and foundations) shall ensure sufficient rigidity and stability;
- b) all parts shall be resistant to environmental effects (such as due to climate, chemical agents, corrosive gases) e.g. by the use of a corrosion resistant material or with the aid of a suitable protective coating;
- c) heated walkways that contain heat tracing and are installed in hazardous areas shall comply with IEC/IEEE 60079-30-1 and IEC/IEEE 60079-30-2.

NOTE Material selection can be covered in statutory requirements of national/local authorities and/or in IACS requirements for the intended applications.

5 Test method

5.1 Test purpose

The purpose of the test is to evaluate whether or not the heated equipment is capable of preventing the formation of ice and can operate (function) properly when subjected to low temperature operating conditions.

5.2 Test facility requirements

- a) The test facility shall have the ability to maintain the specified temperature within the permissible range indicated in [5.3.2](#), in the available volume.
- b) The wind generated by the refrigerating machine installed inside the cold chamber shall not affect the specimen.
- c) A wind-speed control system installed inside the cold chamber shall allow to generate a wind at constant speed.
- d) All sensors shall be calibrated according to manufacturer directions for the planned test conditions.

5.3 Test conditions

5.3.1 General

The ambient temperature, wind speed, heating media and test-specimen temperature shall be recorded during the test. The test conditions shall be selected based upon the desired performance of the equipment.

5.3.2 Test temperature

5.3.2.1 General

The equipment shall be tested at the temperatures agreed upon between the manufacturer and the purchaser. The test temperature shall be observed after the test-specimen temperature is stabilized according to [5.3.2.2](#).

The temperature of the blowing air delivered to the test specimen shall be within ± 2 °C of the test condition temperature during the steady state. Where, due to the size of the test chamber, it is not feasible to maintain these tolerances, the tolerances may be widened to ± 3 °C down to -25 °C.

A temperature sensor shall be installed between the wind generator and the test specimen to measure the ambient temperature.

5.3.2.2 Temperature stabilization

- a) Ambient temperature: once the ambient temperature does not change by ± 2 °C over a period of 30 min, it shall be considered as stabilized.
- b) Specimen temperature: once the specimen temperature does not change by ± 2 °C over a period of 60 min, it shall be considered as stabilized.

5.3.2.3 Temperature sensors

- a) Spatial resolution of temperature measurements shall be sufficient to identify cold spots on the surface of the test piece. No less than 9 sample points shall be used.
- b) Technical evidence shall be provided to identify the coldest spots to be used as sample points.
- c) The 9 sample points shall be located at the coldest spots on the specimen. Sample points shall not be located within 50 mm of the perimeter. Any temperature sensor used in the testing shall be calibrated according to its manufactures directions for the planned test conditions.
- d) Temperature sensors (e.g. thermal imagery or thermo couples) shall be properly adjusted for the emissivity of the material, if applicable, and verified with a secondary measurement.

5.3.3 Test wind

The equipment shall be tested at each wind speed as agreed upon between the manufacturer and the purchaser.

- a) Wind sensors shall be installed within 10 cm in front of the specimen and within 10 cm above and below, as applicable.

NOTE Depending on the type of wind tunnel used, a lower sensor may not be required.

- b) Wind speed control should maintain the flow rate within 10 %. The wind sensor must be calibrated by an organization acceptable to the competent authority or classification society involved.

5.4 Test specimen requirements

5.4.1 General requirement

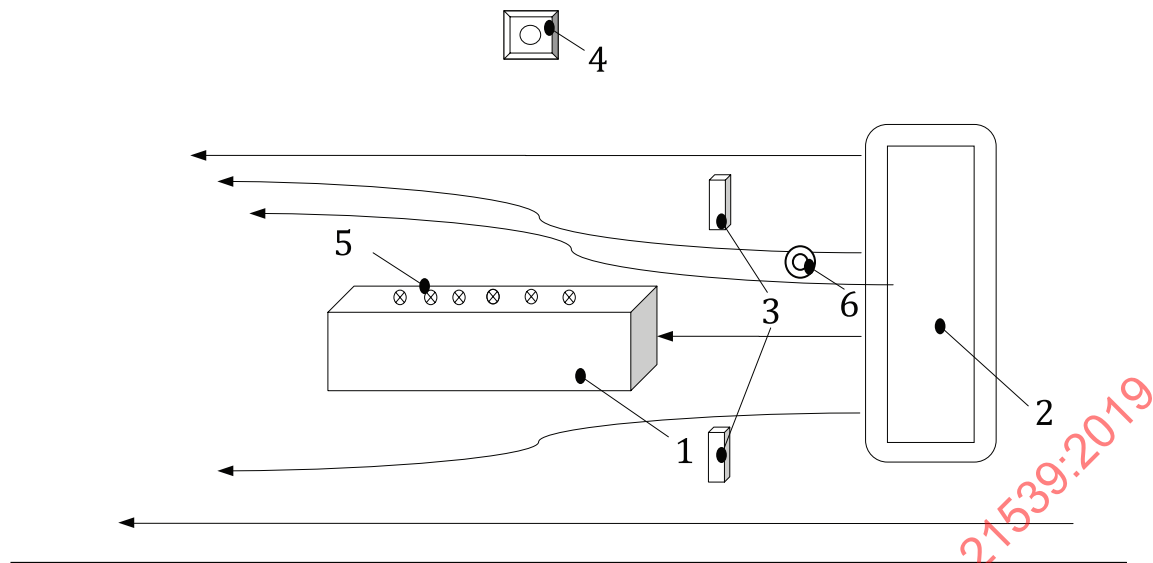
Test specimen shall be installed inside the test facility as specified in [Figure 1](#), in a manner that does not aid the performance of the specimen.

5.4.2 Dimension

The surface of test specimen should be 1 000 mm by 1 000 mm.

5.4.3 Installation

The specimen shall be installed as shown in [Figure 1](#).



Key

- 1 heated walkway
- 2 wind generator
- 3 wind sensor
- 4 remote temperature sensor
- 5 contact temperature sensor
- 6 ambient temperature sensor

Figure 1 — State diagram of walkway specimen installation

5.5 Test procedures

5.5.1 General

The heated walkway specimens shall be tested using the test procedure specified in 5.5.2. However, the test procedure given in 5.5.3 shall be used when taking into consideration a special event or accident as per the requirements agreed upon by the parties. See Figure 2.

5.5.2 Test procedure — Option 1

- a) The test specimen shall be installed parallel to the wind flow inside the cold chamber. Walkways shall be tested with air flows above and below. Flush-mounted walkway installations can be tested with air flow only on the upper surface.
- b) The test specimen shall be visually inspected and electrically and mechanically checked.
- c) Good workmanship of the test specimen and conformity with the manufacturer's drawings and specifications shall be assessed by visual inspection.
- d) Check the conditions of the measuring equipment and install it according to the test conditions given in 5.3.
- e) The calibration and functionality of all measuring equipment shall be verified before the test begins.
- f) Lower the ambient temperature of the test chamber to 5 °C. Once temperature stabilization has been achieved for both the chamber and the test specimen, turn on the electric power of the heating media.

- g) Turn on the wind generator as required to meet the test conditions (see 5.3.3). The wind speed towards the specimen shall be maintained throughout the test.

NOTE The wind generator starts operating before lowering the ambient temperature of the cold room to the target temperature, because it may not start operating unless warmed up in low temperature.

- h) Set the ambient temperature of the cold chamber to the specified temperature(s) (refer to Figure 2).
- i) Once the temperature stabilization has been achieved at the specified testing temperature, record the ambient temperature of the cold chamber and the specimen surface temperature per 5.3.2.3, at 1 min intervals until stabilization is achieved, thermal images and wind speed, as required.
- j) For additional testing temperatures, repeat procedures h) and i).

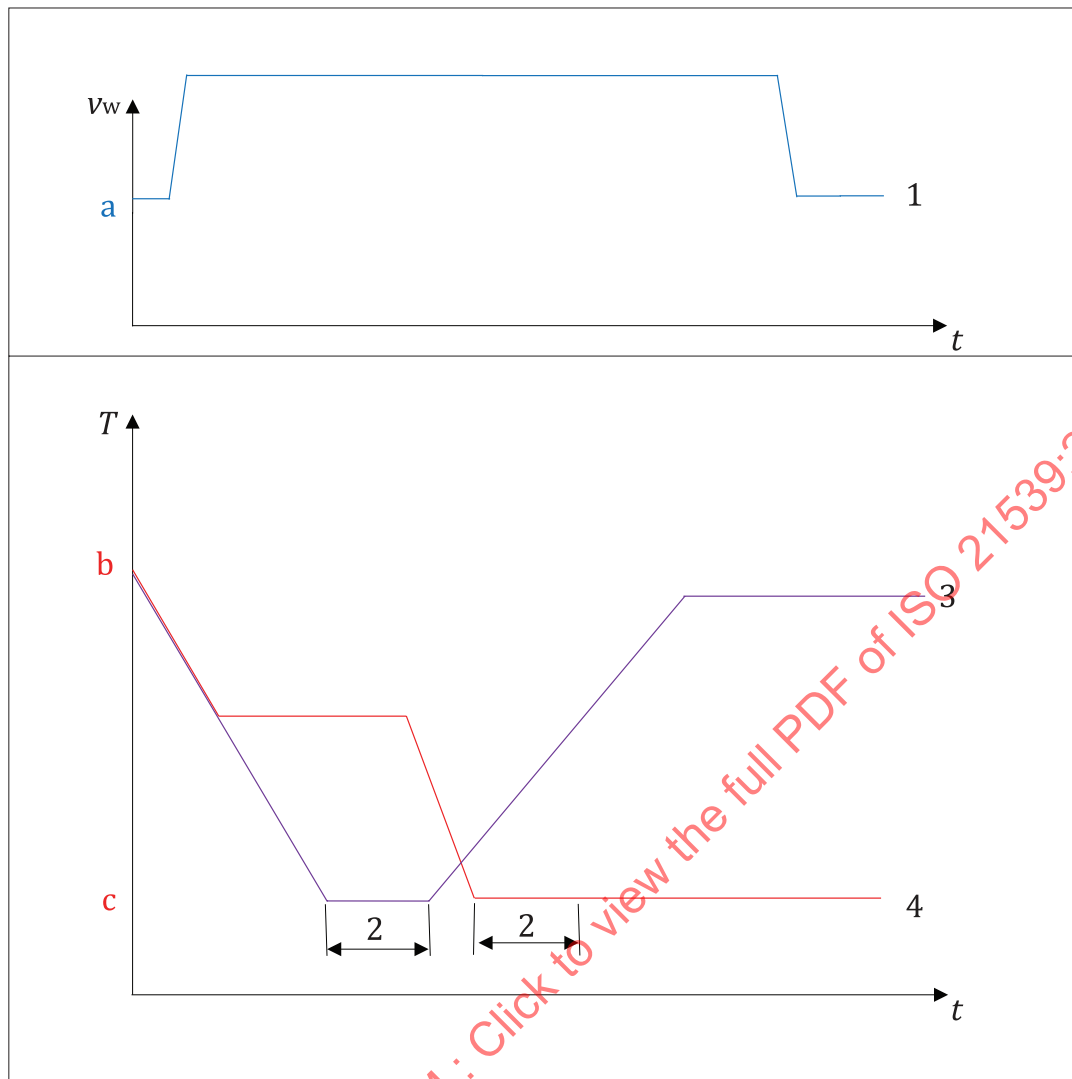
5.5.3 Test procedure — Option 2

- a) The test specimen shall be installed parallel to the wind flow inside the cold chamber. Walkways shall be tested with air flows above and below. Flush-mounted walkway installations can be tested with air flow only on the upper surface.

- b) The test specimen shall be visually inspected and electrically and mechanically checked.

NOTE Good workmanship of the test specimen and conformity with the manufacturer's drawings and specifications can be assessed by visual inspection.

- c) Check the conditions of the measuring equipment and install it according to the test conditions given in 5.3.
- d) The calibration and functionality of all measuring equipment shall be verified before the test begins.
- e) Turn on the wind generator as required to meet the test conditions (see 5.3.3). The wind speed towards the specimen shall be maintained throughout the test.
- f) The wind generator should start operating before lowering the ambient temperature of the cold room to the target temperature, because it may not start operating unless warmed up in low temperature.
- g) Set the ambient temperature of the cold chamber at the specified testing temperature.
- h) Once the temperature stabilization has been achieved at the specified testing temperature, the heating media shall be energized.
- i) Record the ambient temperature of the cold chamber and the test specimen surface temperature per 5.3.2.3, at 1 min intervals until stabilization has been achieved (refer to Figure 2).
- j) Once stabilization has been achieved, record the ambient temperature of the cold chamber, the test-specimen surface temperature per 5.3.2.3, thermal images and wind speed, as required.



Key

- v_w wind speed (m/s)
 - t time (min)
 - T test temperature ($^{\circ}\text{C}$)
 - a wind speed condition
 - b ambient room temperature ($^{\circ}\text{C}$)
 - c temperature condition ($^{\circ}\text{C}$)
 - 1 wind speed graph
 - 2 stabilized time
 - 3 temperature graph (Option 2)
 - 4 temperature graph (Option 1)
- Curve 4: the plateau portion should be aligned to 5°C .

Figure 2 — Schematic testing procedures

5.6 Pass/fail criteria

The stabilized value of the test-specimen temperature, excluding the lowest and highest values obtained from the 9 sample points, shall be constantly stable above 0°C .

6 Test report

The test report shall include the following information:

- a) test description:
 - the name of the testing laboratory, the date of the test, a unique test reference and report identification number, flush mounted type or raised type;
- b) the names of the sponsor/customer, the manufacturer;
- c) a record of the test details:
 - technical evidence of sample points, specimen temperature, ambient temperature, wind speed;
- d) manufacture's product description:
 - details of any component (as applicable) e.g. material type, size, material thickness, heating element type, coating type,
 - test specimen serial number (if applicable);
- e) report:
 - thermographic report (remote sensor), temperature graph (contact sensor);
- f) image:
 - thermal image, still (optical) image;
- g) list of measuring devices, with types and models:
 - temperature sensor, thermal camera, anemometer, data logger;
- h) other:
 - rated voltage,
 - specimen temperature.