DRAFT INTERNATIONAL STANDARD

ISO/DIS 17449

ISO/TC **22**/SC **11** Secretariat: **ANSI**

Voting begins on:
2014-08-25

Voting terminates on:
2014-11-25

Road vehicles — Safety glazing materials — Test methods for properties of electrically heated glazing

Véhicules routiers — Vitrages de sécurité — Méthodes d'essai pour les propriétés des vitrages chauffés électriquement

ICS: 43.040.65

Reference number
ISO/DIS 17449:2014(E)

Road vehicles—Safety glazing materials –Test methods for performance of electrically heated glazing

1. Scope

This International Standard provides the test methods for circuit continuity and heating power, driving visibility, electrical attachment bond performance, electrical attachment bending performance, hot spot identification and heating uniformity, defrosting efficiency, high voltage durability, low temperature performance and long term humidity durability, for all electrically heated safety glazing materials in a road vehicle. This standard provides test protocols for the static performance of an electrically heated glazing material, it is not representative of in-vehicle performance.

2. Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents 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.

IEC 51-2	Direct acting indicating analogue electrical measuring instruments and their accessories Parts 2 - Special requirements for ammeters and voltmeters
ISO 3538	Road vehicles —Safety glazing materials —Test methods for optical properties.
ISO 15082	Road vehicles —Tests for rigid plastic safety glazing materials
ECE R125	Uniform provisions concerning approval of motor vehicle with regards to the forwards field of vision of the motor vehicle driver

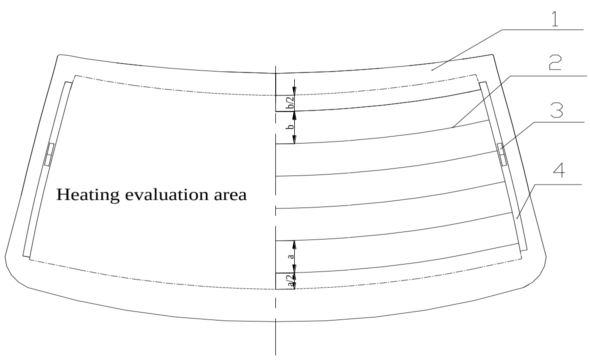
3. Terms and definitions

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

3.1 Heating evaluation area:

For Type 1 specified in 3.6, in absence of specific requirements and for a glazing equipped with heating circuits formed by about evenly distanced conductive lines and bus bars near to the glass edges, the heating evaluation area is represented by an area formed by the inner border of the bus bars and along the heater lines by imaginary lines running outside and parallel to the outermost conductors at a distance half of that to the next closest heating conductor. The size of this generated area is calculated using CAD, see figure 1. For other specifically designed heaters with e.g. circular shaped heater, product specification can be referenced for the heating evaluation area.

For Type 2 specified in 3.7 and Type 3 specified in 3.8, in absence of specific requirements, the heating evaluation area refers to vision area specified in ECE R125.



Key

1 Glass

2 Heating circuits

3 Electrical attachment

4 Bus bar

Fig. 1, Heating evaluation area of Type 1

3.2 Electrical attachment：The components used for connecting to the vehicle power supply.

3.3 Defrosting: Elimination of frost or ice from the exterior of the glazing by heating at specified voltage.

3.4 Defrosting efficiency: A ratio of the melted area to the heating evaluation area after supplying specified voltage for the specified period of time at specified ambient condition.

3.5 Hot spot: Any area on outer surface of the whole part that exceeds the maximum temperature defined in the product specification after the part is supplied with specified voltage for the specified heating time period at the specified ambient condition.

3.6 Type **1:**Heater circuit consisting of conductors applied to the inside surface of a tempered or laminated safety glass or a plastic safety glazing parts by means of a screen print, ink jet or other method.

3.7 Type 2: Heater circuit consisting of discrete conductor lines applied to the inside of a laminated safety glazing by incorporation of metal wires or any other suitable method.

3.8 Type 3: Heater circuit utilizing a transparent conductive film applied to one of the inner surfaces of a laminated safety glazing.

4. Conditioning of test parts

Unless otherwise specified, parts to be tested shall be conditioned prior to testing under the following conditions and for at least 4 hours:

— Ambient temperature: 23℃ ± 2℃
—Atmospheric pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar)
— Ambient relative humidity: (50±20)%

5. Specimens

Test specimens shall be production parts.

6. Application of test

For certain types of safety glazing material, it is not necessary to carry out all the tests specified in this International Standard. Test items for a certain type of electrically heating glazing are suggested in Table 1.

Table 1

No.	Test item	Paragraph	Type		
			1	2	3
1	Circuit continuity and heating power	7.1	×	×	×
2	Driving visibility	7.2	×	×	×
3	Electrical attachment bond performance	7.3	×	×	×
4	Electrical attachment Bending performance	7.4	×	—	—
5	Hot spot identification and heating uniformity	7.5	×	×	×
6	Defrosting efficiency	7.6	×	×	×
7	High voltage durability	7.7	×	×	×
8	Low temperature performance	7.8	×	×	×
9	Long term humidity durability	7.9	—	×	×
× Test required. — Test needs not be carried out.					

7. Requirements

7.1 Circuit continuity and heating power

7.1.1 Purpose of test

The purpose of this test is to determine whether the heating system circuit has the correct continuity between elements and heating power conforms to the product specification.

7.1.2 Apparatus

a) Variable direct current (DC) power supply, rated at a minimum of 1.5 times the voltage and 1.5 times the current specified for the parts to be tested.
b) Voltage meter, conforming to IEC 51-2, with an Accuracy Class of 1.
c) Ampere meter, conforming to IEC 51-2, with an Accuracy Class of 1.
d) Heat sensitive paper.
e) Projector conforms to ISO 3538.
f) Thermal camera, with range 0 to 100°C, accuracy +/-0.5°C, can measure and record the tested area with a spatial resolution of 2 mm.

7.1.3 Procedure

7.1.3.1 Circuit continuity

For Type 1 parts, supply the voltage defined in product specification to the electrical attachments of the part. Lay heat sensitive paper across the heating wires. Optionally, use a thermal camera to check the part after power is supplied.

For Type 2 parts, supply the voltage defined in product specification to the electrical attachments of the part. Set the part vertically between the projector and a display screen. Light is projected through the part to the display screen. Wires with light shadow on the screen are broken wires.

For Type 3 parts, supply the voltage defined in product specification to the electrical attachments of the part, record value of ampere meter.

7.1.3.2 Heating power

In absence of special requirements, heating the part for 30 minutes, and read the electrical current value shown on the ampere meter.

7.1.4 Expression of results

7.1.4.1 Circuit continuity

For Type 1 parts, check the colour change in the paper or in thermal camera due to heat. Make record of broken heating wires.
For Type 2 parts, check the shadow of the part on the screen. Make record of broken wire position on the part.
For Type 3 parts, calculate the resistance according to the voltage measured at the attachments and the corresponding current as measured in 7.1.3.2, and determine the continuity.
7.1.4.2 Heating power
Calculate the heating power according to the voltage measured at the electrical attachments and the corresponding current measured in 7.1.3.2.

7.2 Driving visibility

7.2.1 Purpose of test
The purpose of this test is to determine whether driving visibility of the heating glass meets the requirements of the product specification.
This test is applicable only for parts whose transparent area is heated.

7.2.2Apparatus
Steel ruler and reading microscope with respective accuracy of 0.5mm and 0.001mm.

7.2.3 Procedure
For Type 1 parts, measure the width and length of wires, and the distance between two adjacent wires.
For Type 2 parts, measure the wire width or diameter, count the number of wires for one centimetre wide in cross direction.
For Type 3 parts, measure luminous light transmittance according to ISO3538.
For part used as windscreen, secondary image and optical distortion shall be checked according to ISO3538 while specified voltage being supplied.

7.2.4 Expression of results
For Type 1 part, the driving visibility is expressed as the maximum width of wires, minimum distance between two adjacent wires and the ratio of the total opaque wires area to heating evaluation area.
For Type 2 part, driving visibility is expressed as the width or diameter of wire and wire density (wires/cm).
For Type 3 part, driving visibility is expressed as the luminous light transmittance according to ISO3538.
For part used as windscreen, secondary image and optical distortion while specified voltage being supplied shall be recorded.

7.3 Electrical attachment bond performance

7.3.1 Purpose of test
The purpose of this test is to determine whether the electrical attachments meet, after being subjected to mechanical forces, the requirements of the product specification.

7.3.2 Apparatus
a) Force meter with accuracy of 0.1N.
b) Stopwatch.

7.3.3 Procedure
7.3.3.1 Apply the force to the electrical attachment as defined in product specification, maintain the force for 30 seconds.
7.3.3.2 Check the circuit continuity and calculate the heating power according to Paragraph 7.1 after pulling.

7.3.4 Expression of results
Record circuit continuity, heating power and mechanical damage of the attachment after pulling.

7.4 Electrical attachment Bending performance

7.4.1 Purpose of test

The purpose of this test is to determine whether the electrical tag attachments attached directly to the surface of the glass meets, after being bent a specified number times, the requirements of the product specification.

7.4.2 Procedure

Bend the electrical tag attachments forward or backward in an angle of 45°±2° five times within 10 seconds, but not less than 8 seconds. Fig. 2 gives two examples for one time bending.

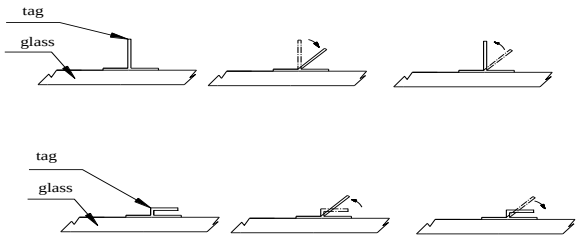


Fig. 2 One time bending (forward and backward)

7.4.3 Expression of results

Record mechanical damage of the tag attachment after bending.

7.5 Hot spot and heating uniformity

7.5.1. Purpose of test

The purpose of this test is to determine whether the test part, after having been heated for a specified period of time, meets the requirements of the product specification.

7.5.2 Apparatus

Thermal camera, with range 0°C to 100°C, accuracy +/- 0.5°C, capable to measure and record the tested area with a spatial resolution of 2 mm.

7.5.3 Procedure

7.5.3.1 This test shall be carried out at ambient temperature 23°C ± 2℃, or as defined in product specification.

7.5.3.2 Connect part to the power supply specified in 7.1.2a., supply the specified voltage to the electrical terminals of the part.

7.5.3.3 In absence of special requirement, heating the part for 30 minutes. Turn on the thermal camera, set the emissivity to a level appropriate to the outside surface substrate. Observe the temperature on the whole part from the outer surface. Mark the location on the part, and save the picture. Record the highest and lowest temperature within the area formed by outer most heating wires or area with coating.

7.5.4 Expression of results

The hot spot is expressed as the location where the hot spot occurs. The heating uniformity is expressed as the difference between the highest and lowest temperature.

7.6 Defrosting efficiency

7.6.1 Purpose of test

The purpose of this test is to determine whether the heating system's ability to remove frost or ice from exterior surface of the glazing, at low temperature, meets the requirements of the product specification.

7.6.2 Apparatus

a) Low temperature chamber, having temperature accuracy of 2℃.

b) Sprayer (Table 2).

c) Support frame, with thermal insulation and the ability to support the part at the design installation angle.

Table 2 Spray-gun characteristics

Characteristic	Specifications
Nozzle diameter Operating pressure Nominal flow rate Projection cone diameter at 200mm from nozzle	1.7mm (340±20)kPa[1)] 395ml/min 300mm
1 kPa=10^{-2}bar	

7.6.3 Procedure

7.6.3.1 Install the part on the support frame to match the actual status on the vehicle, put the part together with the support into low temperature chamber.

7.6.3.2 Adjust the velocity of the air cooling in the chamber as low as possible and in any case less than 8 km/h. In absence of special requirements, cooling the chamber to -18℃+/-3℃, maintain the temperature for at least 5h.

7.6.3.3 Spray water on to the part exterior surface. Direct the spray evenly at a right angle to the part surface, with a 200mm distance between the nozzle and part. Spray to achieve a density of 0.044g /cm^2 on part surface. The water can be sprayed several times. Once the water flow ca n be seen on the part surface, keep the part at -18℃+/-3℃ for few minutes, then continue to spray.

7.6.3.4 After spraying is complete, keep the part at -18℃+/-3℃.

7.6.3.5 In absence of special requirements, supply the part with the specified voltage for 30 minutes, record the defrosting pattern and calculate the melting area.

7.6.4 Expression of results

The defrosting efficiency is expressed by the ratio of the melting area to the heating evaluation area.

T_D= (D2/D1) X 100……………………………. (1)

In the formula:

T_D –defrosting efficiency, %;

D1-heating evaluation area, cm^2;

D2-melting area, cm^2.

7.7 High voltage durability

7.7.1 Purpose of test

The purpose of this test is to determine whether the part meets, after being exposed to high voltage for a specified period of time, the requirements of the product specification.

This test is only applicable for heaters designed for continuous operation.

7.7.2 Procedure

7.7.2.1 Connect the part to the DC power specified in 7.1.2a, in absence of special requirements, supplied with 2 times the nominal voltage for 1 minute.

7.7.2.2 Check the circuit continuity and calculate the heating power according to Paragraph 7.1.