SLOVENSKI STANDARD
oSIST prEN 13124-1:2022

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Okna, vrata, polkna in obešene fasade - Odpornost proti eksploziji - Preskusna metoda - 1. del: Tlačni sunek

Windows, doors, shutters and curtain walling - Explosion resistance - Test method - Part 1: Shock tube

Fenster, Türen, Abschlüsse und Vorhangfassaden - Sprengwirkungshemmung - Prüfverfahren - Teil 1: Stoßrohr

Fenêtres, portes, fermetures et façades rideaux - Résistance à l'explosion - Méthode d'essai - Partie 1: Tube à effet de souffle (shock tube)

Ta slovenski standard je istoveten z: prEN 13124-1

ICS:

13.230	Varstvo pred eksplozijo	Explosion protection
91.060.50	Vrata in okna	Doors and windows

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EUROPEAN STANDARD

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ICS 13.230; 91.060.50

Will supersede EN 13124-1:2001

English Version

Windows, doors, shutters and curtain walling - Explosion resistance - Test method - Part 1: Shock tube

Fenêtres, portes, fermetures et façades rideaux - Résistance à l'explosion - Méthode d'essai - Partie 1: Tube à effet de souffle (shock tube)

Fenster, Türen, Abschlüsse und Vorhangfassaden - Sprengwirkungshemmung - Prüfverfahren - Teil 1: Stoßrohr

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 33.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 13124-1:2022) has been prepared by Technical Committee CEN/TC 33 “Doors, windows, shutters, building hardware and curtain walling”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13124-1:2001.

In comparison with the previous edition, the following technical modifications have been made:

— inclusion of façade testing;

— inclusion of hazard classes and the measurement connected to them;

— addition of term 3.5.3 “internal pressure”;

— clarification of the requirements for test setup and its connection to the test sample;

— editorial changes.

The EN 13124 series of standards *Windows, doors, shutters and curtain walling — Explosion resistance — Test method* currently consists of:

— *Part 1: Shock tube;*

— *Part 2: Range test.*

1 Scope

This document specifies a conventional test procedure to permit classification of the explosion resistance of windows, doors, shutters, together with their infills, as well as curtain walling elements.

This document concerns a method of test against blast waves generated using a shock tube facility to simulate detonation events. This document considers high explosive detonations in the order of 100 kg to 2 500 kg TNT equivalent at distances from about 35 m to 50 m, described by the fixed loading levels EPR0 to EPR4. Scenarios characterized by variable blast parameters for further high explosive detonations and gas or chemical explosions can also be specified.

This document covers only the behaviour of the complete test specimen including infill, frame and fixings as tested.

This document gives no information on the ability of the surrounding wall or building structure to resist the direct or transmitted forces.

If the windows, doors, shutters and curtain walling components are intended for specific conditions of climate, specific test conditions can be required.

Requirements for the performance of opening and locking mechanisms or for testing in an open condition can also be specified.

This document gives no information on the behaviour of the test specimens subjected to other types of loading.

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.

prEN 13123-1:2022, *Windows, doors, shutters and curtain walling — Explosion resistance — Requirements and classification — Part 1: Shock tube*

EN 13164, *Thermal insulation products for buildings — Factory made extruded polystyrene foam (XPS) products — Specification*

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:

— IEC Electropedia: available at https://www.electropedia.org/

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

3.1
test specimen
window, door, shutter or curtain walling, which is prepared and submitted for testing

3.2
attack face
face of the test specimen, which is designed to face the explosion

3.3
rear face
opposite side of the test specimen to the attack face

3.4
explosion pressure resistance
EPR
resistance offered by the test specimen against a defined pressure wave, characterized by peak positive reflected pressure, peak positive specific impulse and positive duration

3.5
pressure wave
explosion pressure pulse loading on the test specimen

Note 1 to entry: The pressure recorded and referred to is the reflected pressure experienced by the test specimen when it is positioned at the end of the shock tube.

3.5.1
peak positive pressure
p_{max}
initial peak positive pressure above the ambient atmospheric pressure at the time of arrival of the pulse at the test specimen

3.5.2
reflected pressure
pressure that occurs when a blast wave strikes the surface of a target, which obstructs the flow

Note 1 to entry: The shock wave moving through the air impacts the test specimen and is reflected producing a pressure on the surface of the test specimen having a higher value than would have occurred within an unobstructed flow.

3.5.3
internal pressure
pressure that is recorded in the test cubical

Note 1 to entry: For closed windows, this pressure is measured at the rear surface of the mounting frame. For open windows, the pressure is measured one metre behind the inner face of the test sample. This will be measured from the inner glass or the inner face of the door.

3.5.4
duration
duration of the first positive phase of the pressure trace (t_+)

3.5.5
pressure trace
t_+
graph of the pressure plotted against time

Note 1 to entry: See prEN 13123-1:2022, Figure 1.

3.5.6
peak positive specific impulse
***i*+**
parameter that is derived from the area under the pressure trace during the first positive phase duration

Note 1 to entry: See hatched area in prEN 13123-1:2022, Figure 1.

3.5.7
minimum duration of the positive phase
***t*Δ**
duration of the equivalent pressure trace

Note 1 to entry: This is derived by a triangle having the same impulse area as the defined pressure trace and the same peak positive reflected pressure.

Note 2 to entry: i.e. t_Δ = two times peak positive specific impulse divided by peak positive reflected pressure expressed as

$$t_\Delta = \frac{2 \cdot i_+}{p_{max}}$$

3.6
witness panel
panel of deformable material positioned behind the test specimen in order to register the incidence of material forcibly detached from the test specimen during test

Note 1 to entry: The composition and location of the witness panel is described in 5.4 (d).

3.7
perforation
holes in the foil, cartridge paper or plain surface of the witness panel caused by impact of any material as a result of the blast

3.8
united dimension of glass fragments
dimension of a glass fragment determined by adding its width and length and thickness.

Note 1 to entry: Glazing dust and slivers are all other smaller particles.

4 Requirements

Classification requirements for the explosion resistance of windows, doors, shutters and curtain walling are given in prEN 13123-1:2022.

Additional requirements with respect to special conditions for surface temperatures or other boundary conditions should be agreed between the test client and the test facility prior to a test as being suitable for the purpose.

The test client should also specify any additional requirements for the locking and opening mechanisms or whether the test specimen is to be tested in the open condition.

For the classification of the test specimen one successful test is required.

5 Apparatus

5.1 Pressure generating device

It is a shock tube or similar device capable of reproducing the effects of a plane shock wave from a high explosive, gas or chemical explosion.

5.2 Connections

Connections are the fixings, which integrate the test specimen into the test specimen support. They shall allow the test specimen to be installed in a manner representative of its built condition without imposing abnormal stresses. The test client should provide installation instructions for the test including the number, specification and location of fixings and these should be included in the test report.

The fixings should not be more ductile or weaker than in a real installation. Furthermore, the fixings should not be stiffer or stronger than in real installation.

5.3 Test specimen support

The test specimen support shall be a frame or construction through which the test specimen (window, door or curtain walling) and the fixings may be securely attached to the shock tube. It shall:

a) Be sufficiently strong to resist the explosive forces without imparting deformations to the test specimen that do not represent real situations as defined by the test client. This has to be demonstrated by the test facility.

b) Be closed on all sides and prevent passage of pressure other than through deformation of the test specimen. Internal pressure has to be recorded by a pressure gauge and should be documented in the test report. In case of close windows, this internal peak overpressure should be no bigger than 10 % of the peak positive reflected pressure and the difference between internal and external peak overpressure should not be less than the classified peak positive reflected pressure. In addition, the reduction of the peak positive specific impulse due to the internal pressure should be less than 10 %. The internal pressure has to be documented in the test report.

c) All and any additional or purpose-made frames, supports, connections, fixing points methods, technical or functional conditions and their designs shall be agreed between the test client and the test facility prior to a test as being suitable for the purpose and should be part of the test report.

d) Accept mounting of pressure gauges next to the attack face.

5.4 Equipment for measuring

Equipment shall comprise:

a) Thermometers suitable for measuring the ambient air temperature and the temperature of the attack and the rear face of the test specimen, taking into account variations due to shade, sunlight or other weather conditions to an accuracy of ± 1°C. Measurements have to be taken at the time of the test.

b) A barometer suitable for measuring the ambient air pressure outside the shock tube to an accuracy of ± 0,2 kPa.

c) Gauges are instrumentation systems for measuring and recording the pressure history of the blast pulse. These shall be: gauges incorporating piezoelectric/piezoresistive or equivalent pressure transducers capable of responding to variations in pressures within 0,1 ms and recording pressures

to an accuracy of ± 5 % of the peak positive reflected pressure throughout the range of pressures and durations to be experienced.

d) Witness panels shall be deployed behind each test specimen. These panels shall be parallel to the plane of the specimen and shall be placed at a horizontal distance of 3,0 m ± 0,15 m measured from the rear face of the glazed components of the test specimen to the front face of the witness panel. The witness panel shall cover the full area projected behind the specimen and extend down to the floor of the test setup. The witness panel shall have a width at least that of the test specimen, and a height extending from the level of the collecting mat to 200 mm above the top of the test specimen, or the ceiling of the reaction structure if less. The witness panels shall meet the following specification:

   1) at least 35 mm thick extruded polystyrene foam in accordance with EN 13164 with a compressive strength of 300 kN/m^2.

   2) Test facilities may consider facing the front face of the polystyrene foam witness panels with either aluminium foil, not more than 0,025 mm thick, or with cartridge paper of weight between 100 g/m^2 and 150 g/m^2 to aid the recording of fragment impacts.

   3) To accommodate high-speed photography, a hole no greater than 150 mm × 150 mm may be made in the top or bottom corner of the witness panel within an area bounded by one third of the height and width of the panel.

6 Test specimen

The test specimen shall be representative of the relevant window, door, shutter or curtain walling element. For curtain walling systems, the dimension of the specimen shall be sufficiently large to ensure that all elements of the full system are evaluated. Care should be taken to ensure that all joints between the wall and the window or door have protection, which is at least equal to that of the window or door.

The test client shall supply drawings showing dimensions and all other details of the test specimen to scale, together with description and composition of all materials (including full details of the build-up especially the types and subtypes of any interlayers) and fixings.

The drawings are part of the documentation in the test report identifying the analysed test specimen.

The method of fixing to the test specimen support and the test boundary conditions shall be agreed between the test facility and the test client. The attack face shall be clearly marked.

7 Procedure

7.1 Installation

Install the test specimen in the test specimen support, ensuring that:

a) The alignment/relationship between all components is correct.

b) The fixings do not create abnormal stresses in the test specimen.

c) No unrequested opening exists between/around the test specimen and the test specimen support.

d) The hardware, mechanisms, movable sashes and door leaves are operable.

e) The method of fixing and type/quantity of fixings used are identical in all respects to the intended application.