SLOVENSKI STANDARD
oSIST prEN 13124-2:2023

01-oktober-2023

Nadomešča:
SIST EN 13124-2:2004

Okna, vrata, polkna in obešene fasade - Odpornost proti eksplozijam - Preskusna metoda - 2. del: Preskus v areni

Windows, doors, shutters and curtain walling - Explosion resistance - Test method - Part 2: Arena test

Fenster, Türen, Abschlüsse und Vorhangfassaden - Sprengwirkungshemmung - Prüfverfahren - Teil 2: Freilandversuch

Fenêtres, portes, fermetures et façades rideaux - Résistance à l'explosion - Méthode d'essai - Partie 2 : Essai en arène

Ta slovenski standard je istoveten z: **prEN 13124-2**

ICS:

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

oSIST prEN 13124-2:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 13124-2

August 2023

ICS 13.230; 91.060.50

Will supersede EN 13124-2:2004

English Version

Windows, doors, shutters and curtain walling - Explosion resistance - Test method - Part 2: Arena test

Portes, fenêtres et fermetures - Résistance à l'explosion -Méthode d'essai - Partie 2: Essai en plein air

Fenster, Türen und Abschlüsse - Sprengwirkungshemmung - Prüfverfahren - Teil 2: Freilandversuch

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 13124-2:2023) 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 13124-2:2004.

In comparison with the previous edition EN 13124-2:2004, the following technical modifications have been made:

— inclusion of façade testing;

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

— addition of term 3.7.3 “internal pressure”;

— addition of test procedures for open condition;

— addition 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: Arena 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 produced by high explosives in an arena test. The loading categories are defined by pressure and impulse parameters and represent free-field high explosive events caused by:

— 3 kg to 20 kg (TNT equivalent) at stand-off distances from 3 m to 9 m, described by the fixed loading levels PXR 1 to PXR 7;

— 100 kg to 500 kg (TNT equivalent) at stand-off distances from about 15 m to 30 m, described by the fixed loading levels VXR 1 to VXR 7.

It produces a classification according to prEN 13123-2:2023.

Scenarios characterized by specified blast parameters for other high explosive scenarios, can also be specified.

Blast loads which cannot be produced in an arena test might be produced by a shock tube test following prEN 13123-1:2022 and prEN 13124-1:2022.

This document is applicable to blast waves generated by explosions in an arena test facility to produce high explosive blast loads on windows, doors and shutters as well as curtain walling systems, complete with their frames, infills and fixings, for use in both internal and external locations in buildings. It gives no information on the explosion resistance capacity of the wall or other surrounding structure.

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

prEN 13123-2:2023, *Windows, doors, shutters and curtain walling — Explosion resistance — Requirements and classification — Part 2: Arena test*

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

ISO 16934, *Glass in building — Explosion-resistant security glazing — Test and classification by shock-tube loading*

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 specimen, 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
reaction structure
robust structure in which a test specimen can be mounted for blast testing

3.5
gauge block
structure providing a plane non-deforming surface positioned at the same stand-off distance as the test sample, on which reflected pressure gauges can be mounted

3.6
explosion pressure resistance
PXR/VXR
resistance offered by the test specimen against a defined blast wave, characterised by peak positive reflected pressure and peak positive specific impulse

3.7
blast wave
explosion pressure wave loading on the test specimen

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

3.7.1
positive reflected pressure
p_r
pressure that occurs when a blast wave strikes the surface of a target, which obstructs the flow

Note 1 to entry: The blast 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.

3.7.2
peak positive reflected pressure
p_{max}
pressure above the ambient atmospheric pressure at the time of arrival of the pulse at the test specimen

3.7.3
internal pressure
pressure that is recorded inside the test cubical

Note 1 to entry: For both closed and open windows, this pressure is measured 1 m behind the inner face of the test specimen. This will be measured from the inner glass or the inner face of the door.

3.7.4
pressure trace
graph of the pressure plotted against time

Note 1 to entry: See prEN 13123-2:2023, Figure 1.

3.7.5
peak positive reflected 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 13123-2:2023, Figure 1.

3.8
top corner of the test specimen
extreme point on the test specimen at which the test impulse is assessed to ensure clearing effects are managed

3.9
expected value at the test corner
expected blast parameters at the top corner of the test specimen

Note 1 to entry: The expected blast parameters at the top corner of the test specimen are the peak positive reflected pressure and the peak positive reflected specific impulse that would be expected at the top corner of the test specimen if it were mounted in a semi-infinite façade and the blast parameters at the centre of the test specimen are the specified blast parameters.

3.10
stand-off distance
horizontal distance from the centre of the charge to the face of the test specimen

3.11
charge height
vertical distance between the centre of the charge and the surface of the test range

3.12
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 6.4, d).

3.13
penetration
indentation in the foil, cartridge paper or plain surface of the witness panel caused by the impact of any material as a result of the blast

3.14
perforation
hole completely through the foil, cartridge paper or witness panel caused by the impact of any material as a result of the blast

3.15
united dimension
dimension of a particle determined by adding its width and length and thickness

3.16
open condition
condition that permits some of the test pressure to be applied on the rear face of the test specimen

Note 1 to entry: The conditions are specified by the test client.

4 Requirements

To achieve a particular class of explosion resistance, the test specimen shall:

a) be subjected to a blast pressure wave generated by the detonation of a high explosive charge. The peak positive reflected pressure and the peak positive reflected specific impulse at the centre of the test specimen shall both be within the tolerances in prEN 13123-2:2023. Additionally, the peak positive reflected specific impulse at the top corner of the test specimen shall be assessed in accordance with prEN 13123-2:2023;

b) the internal damage will be assessed against the criteria shown in Table 1 and that letter code will be appended to the explosion resistance class

and

c) if required by the test client, the external damage can be assessed against the criteria shown in Table A.1 and that letter code will also be appended to the explosion resistance class.

Classification requirements for the explosion resistance of windows, doors, shutters and curtain walling are given in prEN 13123-2:2023.

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 shall be tested in a partially open condition to replicate designs incorporating natural ventilation for example.

For the classification of the test specimen one test fulfilling the requirements of this document is required.

The test shall be performed by a competent test facility. The competent test facility performing the test shall be able to demonstrate that work is in conformity with the requirements of internationally accepted standards for test laboratories.

NOTE 1 EN ISO/IEC 17025 is a harmonized internationally accepted standard that applies.

NOTE 2 A formal accreditation by a member body of the European Accreditation Organization to EN ISO/IEC 17025 is a demonstration of conformity.

5 Apparatus

5.1 Explosive test range

It is an area of ground where a test specimen may be installed and a high explosive charge may be detonated to produce a blast pressure wave for testing the explosion resistance of windows, doors, shutters and curtain walling. The test range should be on cleared, level ground and any loose material shall be removed to ensure that damage cannot be caused by the blast wave projecting such material into the test specimen.

5.2 Reaction structure

The reaction structure shall be a construction in which the test specimen (window, door or curtain walling) and the fixings may be securely attached. 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 shall be demonstrated by the test facility;

b) either be anchored to the ground or be sufficiently heavy so that it is not moved by the blast wave;

c) the face of the structure shall be large enough to ensure clearing effects are limited. If necessary extensions may be used;

d) be closed on all sides and prevent the passage of blast pressure other than through deformation of the test specimen or if the test specimen design includes openings for ventilation purposes. Internal pressure shall be recorded by a pressure gauge and should be documented in the test report. In case of partially closed windows, this internal peak overpressure should not exceed the lesser of 10 % of the peak positive reflected pressure or 20 kPa 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 reflected specific impulse due to the internal pressure should be less than 10 %. The internal pressure shall be documented in the test report;

e) allow pressure gauges to be mounted next to the attack face and in the same plane as the test specimen. Alternatively reflected pressure gauges may be mounted in a separate gauge block;

f) in order to limit clearing effects, the test facility must verify that the loading at the corner of the test specimen is within the tolerances specified in 8.2;

g) 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.

5.3 Connections

Connections are the fixings which integrate the test specimen into the reaction structure. 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 neither be more ductile nor weaker than in a real installation. Furthermore, the fixings should not be stiffer or stronger than in a real installation.

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) pressure gauges are instrumentation systems for measuring and recording the pressure history of the blast wave. These shall be: gauges incorporating piezoelectric/piezoresistive or equivalent pressure transducers with:

   1) full scale range of 0 to 500 kPa (absolute);

   2) resonance frequency greater than 50 kHz;

   3) transducer resolution less than 0,1 kPa;

   4) nonlinearity less than 1 %.

   Gauges shall be placed on a gauge block of the same dimensions as the reaction structure and at the same distance from the charge to measure the actual pressures or sufficient gauges shall be positioned to collect pressure records from which the loading on the test specimen can be derived using suitably verified and validated blast analysis software. The gauges shall be at the same stand-off distance as the test specimen.

   At least three gauges should be deployed at each location so that any gauges providing faulty readings can be identified and those gauges' data can be discarded;

d) data recorders should have:

   1) the capability to record at a minimum sample rate of 100 samples per millisecond (100 kHz);

   2) a time base range of at least 1 000 milliseconds;

   3) a pre-trigger range of at least 100 milliseconds;

   4) a hardware (analogue) anti-aliasing, low pass band limited filter at greater than 10 kHz;

   5) a bandwidth greater than the frequency of the filter;