SLOVENSKI STANDARD
oSIST prEN 13123-1:2022

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

Windows, doors, shutters and curtain walling - Explosion resistance - Requirements and classification - Part 1: Shock tube

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

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

Ta slovenski standard je istoveten z: prEN 13123-1

ICS:

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

oSIST prEN 13123-1:2022 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 13123-1

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ICS 13.230; 91.060.50

Will supersede EN 13123-1:2001

English Version

Windows, doors, shutters and curtain walling - Explosion resistance - Requirements and classification - Part 1: Shock tube

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

Fenster, Türen, Abschlüsse und Vorhangfassaden - Sprengwirkungshemmung - Anforderungen und Klassifizierung - 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.

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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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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Contents

Page

European foreword

This document (prEN 13123-1:2022) 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 13123-1:2001.

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

— inclusion of façade testing;

— inclusion of loading of gas explosions (EPR 0), EPR1+ and user defined load class;

— editorial changes.

The EN 13123 series of standards *Windows, doors, shutters and curtain walling — Explosion resistance — Requirements and classification* currently consists of:

— *Part 1: Shock tube;*

— *Part 2: Range test.*

1 Scope

This document specifies the criteria which windows, doors, shutters as well as curtain walling elements need to satisfy to achieve a classification when submitted to the test method described in prEN 13124-1:2022.

This document concerns a method of test against blast waves generated by using a shock tube facility to simulate explosion loadings. The document considers free-field high explosive events in the order of 100 kg to 2 500 kg TNT 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 and gas explosion scenarios, reaching a classification according to prEN 13124-1:2022, can also be specified.

Load profiles which cannot be reproduced with the shock tube might be reproduced by arena testing following EN 13123-2 and EN 13124-2.

This document is applicable to blast profiles generated in a shock tube test facility used to simulate high explosive and gas explosions on windows, doors, 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.

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 13124-1:2022, *Windows, doors, shutters and curtain walling — Explosion resistance — Test method — Part 1: Shock tube*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 13124-1:2022 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

4 Requirements

Resistance to damage and pressure shall be classified in accordance with Clause 5. This issue of the test standard provides the possibility to do tests either:

a) for fixed classification levels (EPR classes); or

b) for variable scenarios with peak positive reflected pressure, peak positive specific impulse and minimum duration for further high explosive detonations and gas explosions.

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

c) be subjected to not less than the corresponding test level of each of peak positive reflected pressure, peak positive specific impulse and minimum duration specified in Clause 5, Table 1 and Figure 1, and

d) achieve a hazard class as specified in prEN 13124-1:2022, 9.2.

It is not a requirement of the test that performance in other respects such as air permeability, water tightness, wind resistance, etc. be maintained.

If the intended application of the window, door, shutter and curtain walling is such that it will be specifically subjected to climatic extremes, the test specimen shall be tested at these climatic extremes.

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

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, shutter and curtain walling.

5 Classification of the level of explosion pressure resistance (EPR)

The classification of a test specimen is permitted for both:

a) predefined classification levels (EPR0 to EPR4) with respect to peak positive reflected pressure, peak positive specific impulse and minimum required overpressure duration (Table 1). When a tested test specimen achieves a particular classification it also automatically achieves all classes characterized by lower peak pressure and lower peak positive specific impulse; and

b) variable classification levels described by peak positive reflected pressure, peak positive specific impulse and minimum required overpressure duration complementing the EPR classes to a wide range of possible classification levels suitable for various blast scenarios due to high explosive detonations and gas explosions.

Table 1 — Blast parameters of the shock wave generated in shock tube experiments

Classification code	Peak positive reflected pressure p_{max} kPa	Peak positive specific impulse i_+ kPa-ms	Minimum duration of the positive phase t_Δ ms
EPR0	25	230	18
EPR1	50	370	15
EPR1+	75	490	13
EPR2	100	900	18
EPR3	150	1 500	20
EPR4	200	2 200	22
EPRU (p_{max}/i_+)	p_{max} (definition by the user)	i_+ (definition by the user)	$2 \times i_+/p_{max}$

Allowable tolerances:

Peak positive reflected pressure 0 % and +20 %;

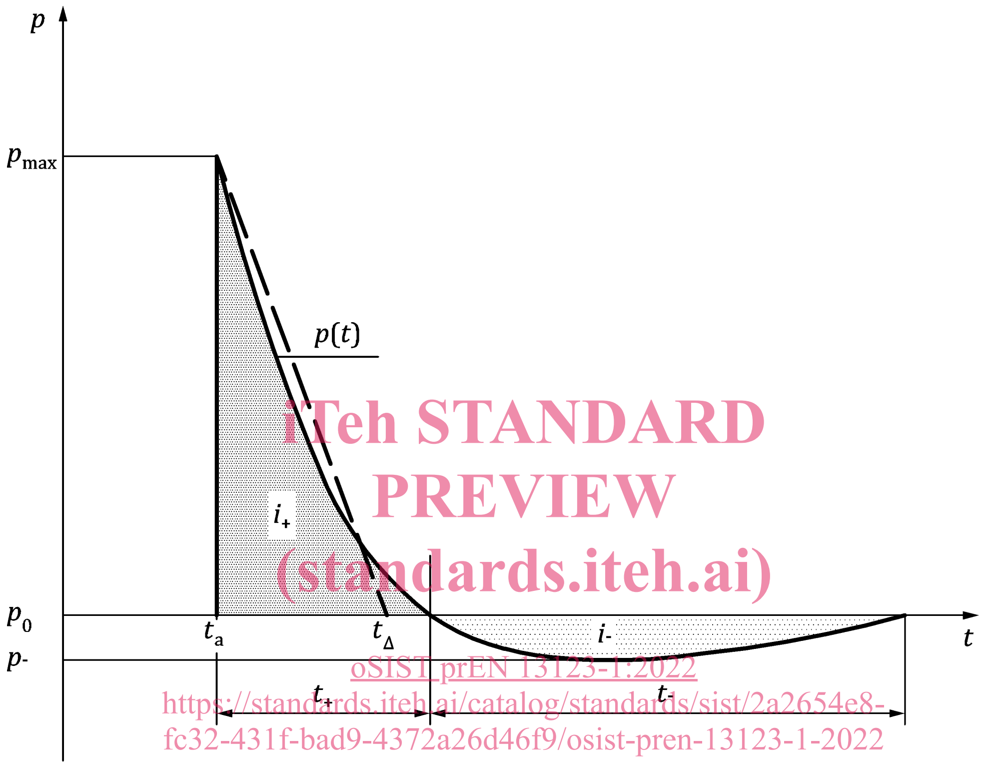
Peak positive specific impulse 0 % and +20 %

NOTE 1 The classification refers to the peak positive reflected pressure values which the test specimen experiences.

Peak positive reflected pressure, peak positive specific impulse and positive duration values shall be determined in accordance with Annex A. The decay coefficient defining the shape of the mean pressure trace should lie within the values 0 to 4.

A user defined classification level shall contain the values of peak positive reflected pressure and peak positive specific impulse.

NOTE 2 Results of the tests are further notated with a hazard class following prEN 13124-1:2022. Test results achieved under EN 13123-1:2001 with a rating EPR NS are equivalent to hazard class B, and with a rating EPR S are equivalent to hazard class C.



Key

t_a time of arrival

p_0 ambient pressure

p pressure

p_{max} peak positive reflected pressure

i_+ peak positive specific impulse

t_+ duration of positive phase

i_- peak positive specific impulse

t_- duration of negative phase

t_Δ duration of theoretical triangular shaped positive pressure profile based on p_{max} and i_+

In general, the shock tube should load the test specimen with a positive and a negative loading phase: If the shock tube is not capable to produce a significant negative phase, the test facility has to ensure that neglecting the negative phase represents a conservative loading case for the test results.

Figure 1 — Idealized pressure-time variation for a blast wave

Annex A
(normative)

Blast parameters and derivation

A.1 General

This annex sets out the procedures to be followed by the test facility to achieve consistent measurement and derivation of the test blast parameters for comparison against the classification parameters defined in requirements and classification Clause 5, Table 1.

A.2 Symbols

A decay coefficient or form parameter

$p(\mathrm{t})$ pressure, above ambient pressure, at time t

p_c classification peak pressure

p_{max} peak positive reflected pressure (maximum pressure) derived from measured test values

i_{+c} classification positive phase specific impulse

i_+ peak positive specific impulse, calculated from measured test values

t_{+c} classification positive phase duration

t_+ positive phase duration derived from measured test values

$t_{\Delta c}$ triangular duration calculated from classification values of p_c and i_{+c}

t_Δ triangular duration calculated from p_{max} and i_+

A.3 Units

Table A.1 — Units

Parameter	Unit	Remarks
pressure	kPa	equivalent unit: 1 kPa = 1 kN/m^2
duration	ms	millisecond
impulse	kPa-ms	

A.4 Mathematical relationships

The relationship between the parameters p_{max}, i_+, t_+ and t_Δ can be expressed as functions of the exponential decay shape of the idealized pressure-time trace using the following formulae:

a) the modified Friedlander formula:

$$p(t) = p_{max} \cdot \left(1 - \frac{t}{t_+}\right) \cdot e^{\left(-A \cdot \frac{t}{t_+}\right)}$$

b) the integration of the modified Friedlander formula to express the calculated impulse, which is the area under the positive phase of the pressure-time trace, as:

$$i_+ = p_{max} \cdot t_+ \cdot \left(\frac{1}{A} - \frac{1}{A^2} \cdot \left(1 - e^{-A}\right)\right)$$

c) the equivalent triangular duration for the limiting case when the value of the decay coefficient, *A*, would be zero and the trace would be a straight line, which idealised case is often used in carrying out response calculations:

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

A.5 Classification blast pulses

Figure 1 illustrates the idealized shape of a blast pulses. The classification blast pressure pulse can be calculated by using the values of p_c and i_{+c} which are the minimum permissible to achieve the appropriate classification and are related to each other and t_{+c} by the same formulae as in A.4:

a) $p(t) = p_c \cdot \left(1 - \frac{t}{t_{+c}}\right) \cdot e^{\left(-A \cdot \frac{t}{t_{+c}}\right)}$

b) $i_{+c} = p_c \cdot t_{+c} \cdot \left(\frac{1}{A} - \frac{1}{A^2} \cdot \left(1 - e^{-A}\right)\right)$

Different shape classification pulses may similarly be derived ranging from sharper curves having a steeper initial decay rate but longer final duration for *A* = 4 down towards the limiting case of a straight line corresponding to *A* = 0 when

c) $t_{+c} = t_{sc} = 2 \cdot \frac{i_{+c}}{p_c}$

In all cases, the values of all three blast parameters, peak pressure, impulse and duration and the value of the decay coefficient *A*, shall comply with Clause 5.

A.6 Method of recording test parameters

The test blast parameters shall be obtained using electronic recording equipment capable of recording and reproducing on screen and in the form of a hard copy visual trace the pressure history of the blast pulse in steps of not more than 0,1 ms (10 kHz). This shall be done for each blast gauge receiving the blast pressure experienced by the attack face of the test specimen. The pressure history shall be recorded and reproducible over the positive phase period in detail and also over the subsequent period of not less than 10 times the duration of the positive phase. The test facility may use analysis techniques to filter and/or smooth the pressure history to a mean trace. The original trace needs to be retained. If such devices are used details of the method and effect of filtering or smoothing shall be stated in the test report.