BS EN 12101-2:2017

BSI Standards Publication

Smoke and heat control systems

Part 2: Natural smoke and heat exhaust ventilators

bsi.

National foreword

This British Standard is the UK implementation of EN 12101-2:2017. It supersedes BS EN 12101-2:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/25, Smoke, heat control systems and components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2017

ISBN 978 0 580 86290 8

ICS 13.220.20; 23.120

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2017.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12101-2

March 2017

ICS 13.220.99

Supersedes EN 12101-2:2003

English Version

Smoke and heat control systems - Part 2: Natural smoke and heat exhaust ventilators

Systèmes pour le contrôle des fumées et de la chaleur - Partie 2 : Dispositifs d'évacuation naturelle de fumées et de chaleur

Rauch- und Wärmefreihaltung - Teil 2: Natürliche Rauch- und Wärmeabzugsgeräte

This European Standard was approved by CEN on 11 January 2015.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 12101-2:2017 E

Contents

Page

European foreword ... 5
Introduction ... 6
1 Scope ... 7
2 Normative references ... 7
3 Terms, definitions, symbols and abbreviations ... 7
3.1 Terms and definitions ... 7
3.2 Symbols and abbreviations ... 11
4 Requirements ... 13
4.1 Nominal activation conditions/sensitivity ... 13
4.1.1 Initiation device ... 13
4.1.2 Opening mechanism ... 14
4.1.3 Inputs and outputs ... 14
4.2 Response delay (response time) ... 14
4.2.1 Reliability ... 14
4.2.2 Opening under (snow/wind) load ... 14
4.2.3 Low ambient temperature ... 15
4.2.4 Opening under heat ... 15
4.3 Operational reliability ... 15
4.4 Effectiveness of smoke/hot gas extraction (aerodynamic free area) ... 15
4.5 Performance parameters under fire conditions ... 15
4.5.1 Resistance to heat ... 15
4.5.2 Mechanical stability ... 16
4.5.3 Reaction to fire ... 16
4.6 Performance under environmental conditions ... 16
4.6.1 Opening under load ... 16
4.6.2 Low ambient temperature ... 16
4.6.3 Stability under wind load ... 16
4.6.4 Resistance to wind-induced vibration ... 16
4.6.5 Resistance to heat ... 16
4.7 Durability ... 17
4.7.1 Response delay (response time) ... 17
4.7.2 Operational reliability ... 17
4.7.3 Performance parameters under fire conditions ... 17
5 Testing, assessment and sampling methods ... 17
6 Assessment and verification of constancy of performance - AVCP ... 19
6.1 General ... 19
6.2 Type Testing ... 19
6.2.1 General ... 19
6.2.2 Test samples, testing and compliance criteria ... 20
6.2.3 Test sequence ... 21
6.2.4 Test reports ... 22
6.2.5 Cascading determination of the product type results ... 22
6.3 Factory production control ... 23
6.3.1 General ... 23

6.3.2 Requirements **23**
6.3.3 NSHEV specific requirements **25**
6.3.4 Initial inspection of factory and FPC **26**
6.3.5 Continuous surveillance of FPC **26**
6.3.6 Procedure for modifications **27**
6.3.7 Pre-production prototypes **27**

7 Marking, labelling and packaging **28**

Annex A (normative) **Classification** **29**
A.1 Nominal activation condition/sensitivity **29**
A.2 Response delay **29**
A.3 Operational Reliability **29**
A.4 Effectiveness of smoke/hot gas extraction (aerodynamic free area) **29**
A.5 Performance parameters under fire conditions **29**
A.6 Performance under environmental conditions **30**
A.7 Durability **31**
A.7.1 Response delay (response time) **31**
A.7.2 Operational reliability **31**
A.7.3 Performance parameters under fire conditions **31**

Annex B (normative) **Effectiveness of smoke/hot gas extraction (aerodynamic free area)** **32**
B.1 Determination of the aerodynamic free area **32**
B.2 Simple assessment procedure **32**
B.2.1 General **32**
B.2.2 Roof mounted NSHEV **32**
B.2.3 Wall mounted NSHEV **32**
B.3 Experimental procedure **33**
B.3.1 General **33**
B.3.2 Test apparatus **33**
B.3.3 Test specimen **34**
B.3.4 Test procedure **35**
B.3.5 Evaluation of test results **36**
B.3.6 Calculation of the coefficient of discharge for a family of NSHEV **37**
B.4 Test to check the aerodynamic test installations **38**
B.4.1 General **38**
B.4.2 Reference test without side wind **39**
B.4.3 Reference tests with side wind **39**
B.4.4 Evaluation of test results **39**

Annex C (normative) **Test method for operational reliability and response time** **54**
C.1 Objective of test **54**
C.2 Test conditions **54**
C.3 Test apparatus **54**
C.4 Test specimen **54**
C.5 Test procedure **54**

Annex D (normative) **Test method for opening under load** **56**
D.1 Objective of test **56**
D.2 Test conditions **56**
D.3 Test apparatus **56**
D.4 Test specimen **57**
D.5 Test procedure **57**

Annex E (normative) **Test method for low ambient temperature** **58**
E.1 Objective of test **58**

E.2 Test apparatus ... **58**
E.3 Test specimen ... **58**
E.4 Test procedure ... **58**

Annex F (normative) **Test method for stability under wind load** ... **59**
F.1 Objective of test ... **59**
F.2 Test conditions ... **59**
F.3 Test apparatus ... **59**
F.4 Test specimen ... **59**
F.5 Test procedure ... **60**
F.5.1 Wind load ... **60**
F.5.2 Vibration ... **60**

Annex G (normative) **Test method for resistance to heat** ... **61**
G.1 Objective of the test ... **61**
G.2 Test apparatus ... **61**
G.2.1 Test furnace ... **61**
G.2.2 Temperature measurement ... **61**
G.2.3 NSHEV mount ... **61**
G.3 Test specimen ... **62**
G.3.1 General ... **62**
G.3.2 NSHEV mounted to a glazed partition construction ... **62**
G.3.3 Roof mounted NSHEV as part of a continuous rooflight ... **62**
G.3.4 Wall mounted NSHEV ... **63**
G.3.5 Roof mounted NSHEV ... **63**
G.4 Test procedure ... **64**

Annex H (normative) **Mounting and fixing conditions for the SBI or small flame tests** ... **72**
H.1 General ... **72**
H.2 Class E ... **73**
H.2.1 General ... **73**
H.2.2 Small flame test in accordance to EN ISO 11925-2 ... **73**
H.3 Class A2 to class D ... **73**
H.3.1 General ... **73**
H.3.2 Single Burning Item test (SBI) ... **74**
H.4 Heat of combustion test ... **74**

Annex I (normative) **Handling changes affecting declared performances for NSHEV** ... **75**
I.1 General ... **75**
I.2 Effectiveness of smoke/hot gas extraction ... **75**
I.3 Reliability ... **75**
I.4 Opening under load ... **76**
I.5 Opening at low ambient temperatures ... **76**
I.6 Wind load ... **77**
I.7 Resistance to heat ... **77**

Annex J (informative) **Installation and maintenance information** ... **78**
J.1 Installation information ... **78**
J.2 Maintenance information ... **78**

Bibliography ... **88**

European foreword

This document (EN 12101-2:2017) has been prepared by Technical Committee CEN/TC 191 "Fixed firefighting systems", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2017, and conflicting national standards shall be withdrawn at the latest by December 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12101-2:2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

This European Standard is one of the parts of the European Standard EN 12101 covering smoke and heat control systems.

This European Standard has the general title *Smoke and heat control systems* and currently consists of the following parts:

— *Part 1: Specification for smoke barriers*;

— *Part 2: Natural smoke and heat exhaust ventilators* [the present document];

— *Part 3: Specification for powered smoke and heat exhaust ventilators*;

— *Part 4: Installed SHEVS systems for smoke and heat ventilation* [Technical Report CEN/TR 12101-4];

— *Part 5: Guidelines on functional recommendations and calculation methods for smoke and heat exhaust ventilation systems* [Technical Report CEN/TR 12101-5];

— *Part 6: Specification for pressure differential systems – Kits*;

— *Part 7: Smoke control sections*;

— *Part 8: Smoke control dampers*;

— *Part 10: Power supplies*.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

In a fire situation, smoke and heat exhaust ventilation systems create and maintain a smoke free layer above the floor by removing smoke. They also serve simultaneously to exhaust hot gases released by a fire in the developing stages. The use of such systems to create smoke-free areas beneath a buoyant layer has become widespread. Their value in assisting in the evacuation of people from buildings and other construction works, reducing fire damage and financial loss by preventing smoke damage, facilitating access for firefighting by improving visibility, reducing roof temperatures and retarding the lateral spread of fire is firmly established. For these benefits to be obtained it is essential that natural smoke and heat exhaust ventilators (referred to in this standard as NSHEV) operate fully and reliably whenever called upon to do so during their installed life. A smoke and heat exhaust ventilation system (referred to in this standard as a SHEVS) is a system of safety equipment intended to perform a positive role in a fire emergency.

1 Scope

This European Standard applies to natural smoke and heat exhaust ventilators (NSHEV) operating as part of smoke and heat exhaust systems (SHEVS), placed on the market. This standard specifies requirements and gives test methods for natural smoke and heat exhaust ventilators which are intended to be installed in smoke and heat control systems in buildings.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 54-5:2017, *Fire detection and fire alarm systems - Part 5: Heat detectors - Point detectors*

EN 54-7, *Fire detection and fire alarm systems - Part 7: Smoke detectors - Point detectors using scattered light, transmitted light or ionization*

EN 1363-1, *Fire resistance tests - Part 1: General Requirements*

EN 12101-10, *Smoke and heat control systems - Part 10: Power supplies*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 60584-1, *Thermocouples — Part 1: EMF specifications and tolerances (IEC 60584-1)*

EN ISO 1182, *Reaction to fire tests for products - Non-combustibility test (ISO 1182)*

EN ISO 1716, *Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value) (ISO 1716)*

EN ISO 11925-2, *Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test (ISO 11925-2)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
aerodynamic free area
geometric area multiplied by the coefficient of discharge

3.1.2
ambient
word used to describe properties of the surroundings

3.1.3
automatic activation
initiation of operation without direct human intervention

3.1.4
aspect ratio
ratio of length to width

3.1.5
automatic natural smoke and heat exhaust ventilator
natural smoke and heat exhaust ventilator (NSHEV) which is designed to open automatically after the outbreak of fire if called upon to do so

Note 1 to entry: Automatic natural smoke and heat exhaust ventilator (NSHEV) can also be fitted with a manual control or release device.

3.1.6
comfort position
position of a NSHEV defined by the manufacturer for the purpose of comfort ventilation

3.1.7
coefficient of discharge
c_v
ratio of actual flow rate, measured under specified conditions, to the theoretical flow rate through the NSHEV, as defined in Annex B

Note 1 to entry: The coefficient takes into account any obstructions in the NSHEV such as controls, louvres and vanes and the effect of external side wind.

3.1.8
dual purpose NSHEV
NSHEV which has provision to allow its use for comfort (i.e. day to day) ventilation

3.1.9
fire open position
configuration of the NSHEV specified by its designer to be achieved and sustained while venting smoke and heat

3.1.10
gas container
vessel containing gas in a compressed form, the energy of which, when the gas is released from the vessel, will open the NSHEV

3.1.11
geometric area
A_v
area of the opening through a NSHEV, measured in the plane defined by the surface of the construction works, where it contacts the structure of the NSHEV

Note 1 to entry: No reduction is made for controls, louvres or other obstructions.

Note 2 to entry: Specific configurations are given in Figures B.1 and B.4.

3.1.12
initiation device
device which activates the operating mechanism of the NSHEV on receipt of information from a fire detection system or thermal device

3.1.13
manually opened natural smoke and heat exhaust ventilator
NSHEV that can be opened by a manual control or release device

3.1.14
mass flux
total mass of gases crossing a specified boundary per unit time

3.1.15
natural ventilation
ventilation caused by buoyancy forces due to differences in density of the gases because of temperature differences

3.1.16
opening mechanism
mechanical device which operates the NSHEV to the fire open position

3.1.17
opening time
period between the information to open being received by the NSHEV and achieving the fire open position of the NSHEV

3.1.18
projection area
cross sectional area of the movable part (e.g. flap, window) of the NSHEV:

a) above the plane of the roof, at a right angle to the side wind flow;

b) on the wall at a right angle to the side of the wall

3.1.19
range of natural smoke and heat exhaust ventilators
NSHEV of various sizes having the same method of construction and the same type of opening mechanism

3.1.20
smoke and heat control system
arrangement of components installed in a construction works to limit the effects of smoke and heat from a fire

3.1.21
smoke and heat exhaust system
smoke and heat control system which exhausts smoke and heat from a fire in a construction works or part of a construction works

3.1.22
smoke and heat exhaust ventilation system
SHEVS
components jointly selected to exhaust smoke and heat in order to establish a buoyant layer of warm gases above cooler and cleaner air

3.1.23
natural smoke and heat exhaust ventilator (NSHEV)
product specially designed to move smoke and hot gases out of a construction works naturally under conditions of fire

Note 1 to entry: In the context of this standard smoke and hot gas movement means any motion of smoke and hot gas within and out of a construction work under the influence of thermal buoyancy, e.g. exhausting and extracting smoke and hot gas, directing and guiding smoke and hot gas.

Note 2 to entry: Typical NSHEV consist of a fixed frame or upstand and of one or more flaps to be opened in case of fire by an opening mechanism initiated by a smoke or heat sensitive initiation device.

3.1.24
thermal device
temperature sensitive device which responds to initiate a subsequent action

3.1.25
throat area
smallest cross sectional area of the flow path through the NSHEV

Note 1 to entry: See Figure G.6.

3.1.26
ventilator
device for enabling the movement of gases into or out of the construction works

3.1.27
wind deflector
any part of the NSHEV guiding the wind over the open NSHEV

3.1.28
wind sensitive control system
control system designed to control two or more banks of NSHEV on separate elevations so that only the NSHEV not subject to positive wind pressures opens in case of fire

3.1.29
walls
external building surfaces with an inclination of more than 60° relative to the horizontal

3.1.30
roofs
external building surfaces with an inclination of 60° or less relative to the horizontal shed roofs, and which continuous roof-lights, independent of the inclination angle, are considered to be part of

3.2 Symbols and abbreviations

For the purposes of this standard, mathematical and physical quantities are represented by symbols, and expressed in units as follows.

Symbol	Quantity	Unit
A_a	aerodynamic free area, expressed in square metres	(m^2)
A_{ex}	area of the exit plane of NSHEV, expressed in square metres	(m^2)
A_n	nozzle exit area (for open jet facilities); test section entrance area (for closed test section facilities), expressed in square metres	(m^2)
A_{pr}	projection area of the NSHEV for the side wind flow, expressed in square metres	(m^2)
A_{sc}	horizontal cross section area of the settling chamber, expressed in square metres	(m^2)
A_{throat}	smallest geometric cross section area through which the air flows	(m^2)
A_v	geometric area of the NSHEV, expressed in square metres	(m^2)
B	width of the open hole of the settling chamber, expressed in metres	(m)
b	width of the geometric opening of a NSHEV, expressed in metres	(m)
B_n	width of nozzle exit area in open jet facilities, width of the test section in closed test section facilities, expressed in metres	(m)
B_v	maximum width of the NSHEV in the fire open position, expressed in metres above the upper surface of the settling chamber	(m)
C_v	coefficient of discharge, dimensionless	-
C_{v0}	coefficient of discharge without side wind influence, dimensionless	-
C_{vw}	coefficient of discharge with side wind influence, dimensionless	-
d_h	hydraulic diameter of the settling chamber ($d_h = (4 A_{sc})/P$), expressed in metres	(m)
$d_{h,g}$	hydraulic diameter of the geometric NSHEV area, expressed in metres	(m)
H_n	height of nozzle exit area in open jet facilities, height of the test section in closed test section facilities, expressed in metres	(m)
H_v	maximum height of the NSHEV in the fire open position above the upper surface of the settling chamber, expressed in metres	(m)

Symbol	Quantity	Unit
h_p	profile height of a wall mounted NSHEV, expressed in metres	(m)
h_{US}	height of the NSHEV upstand, expressed in metres	(m)
h_{uwd}	height of the upper edge of wind deflectors above the roof surface, expressed in metres	(m)
L	length of the open hole of the settling chamber, expressed in metres	(m)
l	length of the geometric opening of a NSHEV, expressed in metres	(m)
$I_{u, hUS}$	turbulence intensity in flow direction at height h_{US}	-
m	ratio of geometric areas (= A_{ex}/A_v), dimensionless	-
$\dot{m}_{ing}$	mass flow rate entering the settling chamber, expressed in kilograms per second	(kg/s)
NSHEV	natural smoke and heat exhaust ventilator	-
P	perimeter length of the cross section of the settling chamber, expressed in metres	(m)
p_{amb}	ambient pressure, expressed in Pascal	(Pa)
p_d	wind stagnation pressure, expressed in Pascal	(Pa)
p_{int}	internal static pressure, expressed in Pascal	(Pa)
$p_{int, v0}$	internal static pressure without side wind, expressed in Pascal	(Pa)
$p_{int, vw}$	internal static pressure with side wind, expressed in Pascal	(Pa)
T	temperature, expressed in degrees C	(°C)
U_v	length of the boundary of the geometric area of a NSHEV, expressed in metres	(m)
V_∞	side wind velocity, expressed in metres per second	(m/s)
V_l	local air speed, expressed in metres per second	(m/s)
$V_{m, sc}$	mean velocity of the settling chamber, expressed in metres per second	(m/s)
V_n	mean nozzle velocity, expressed in metres per second	(m/s)
V_{sc}	local velocities in plane above settling chamber, see Figure B.6, expressed in metres per second	(m/s)
α	opening angle of the NSHEV, expressed in degrees and referenced to the closed flap position	-
$ß$	angle of attack, expressed in degrees	-
$ß_{crit}$	incidence angle at which the smallest value of C_{vw} obtained with side wind, occurs, expressed in degrees	-
δ	relative wall thickness (= h_{US}/d_h), dimensionless	-

Symbol	Quantity	Unit
δ_p	relative profile thickness (= h_p/d_h) of a wall mounted NSHEV, dimensionless	-
μ	contraction coefficient (= A_a/A_{ex}), dimensionless	-
θ	angle of installation of NSHEV on a roof or in a wall, expressed in degrees	-
Δp	pressure difference, expressed in Pascal	(Pa)
Δp_{v0}	reference pressure difference between the static pressure in the settling chamber and the ambient pressure without side wind, expressed in Pascal	(Pa)
Δp_{vw}	reference pressure difference between the static pressure in the settling chamber and the ambient pressure with side wind, expressed in Pascal	(Pa)
Δp_{int}	pressure difference between the static pressure in the settling chamber and the ambient pressure, expressed in Pascal	(Pa)
ΔT	temperature difference, expressed in Kelvin	(K)
ρ_{air}	density of air, expressed in kilograms per cubic metre	(kg/m^3)

4 Requirements

4.1 Nominal activation conditions/sensitivity

4.1.1 Initiation device

4.1.1.1 General

To ensure the natural smoke and heat exhaust ventilator (NSHEV) opens in the event of a fire, it shall be fitted with one or more of the following automatic initiation devices:

a) a thermal initiation device;

b) an initiation device activated by an electrical signal from a remote source, e.g. a smoke and heat detector system, the interruption of electrical power supply;

c) a pneumatic initiation device, e.g. a pneumatic signal or a loss of compressed air;

d) an initiation device able to respond to other types of release signals.

In addition, remote initiation can take place by means of a manually operated initiation device.

e) A pneumatic non fail safe NSHEV, which does not open automatically on loss of power, shall have at least a thermal device and one power source in accordance with EN 12101-10, which is mounted directly in the NSHEV, unless the required control panel monitors the lines to the NSHEV and indicates a failure.

In some specific design cases where it is suitable to initiate the NSHEV manually only, the NSHEV may be installed without an automatic initiation device.

4.1.1.2 Automatic initiation or release device

Any automatic initiation or release device shall be within the NSHEV and shall be exposed to the hot gas entering the closed NSHEV.

There are two exceptions to this requirement, where an automatic thermal initiation or release device shall not be fitted to the NSHEV.

a) If the NSHEV is to be installed as a wall mounted NSHEV:

   Adverse wind conditions may cause a NSHEV which has been opened by the automatic initiation device to inlet and not remove heat and smoke.

b) In specific design cases where it is suitable that the NSHEV shall only be manually initiated.

The response behaviour of thermal automatic initiation devices shall be in accordance with the requirements of EN 54-5:2017, 5.4.2 and tested six times under an increasing temperature rate 20 K/min.

The specimen shall be installed in a heat tunnel in its most unfavourable position. The release behaviour for each test shall conform to (Y + 37) / 0,35 ≥ X where Y is the nominal operating temperature of the thermal element and X is the release time (s). The static response behaviour of the thermal device shall be measured three times in accordance with the requirements of EN 54-5:2017, 5.3. The nominal release temperature for each test shall not vary by more than –3K to +8K.

Smoke detectors shall comply with the requirements of EN 54-7 and heat detectors with EN 54-5.

4.1.2 Opening mechanism

4.1.2.1 General

The NSHEV shall be provided with an opening mechanism with energy within the NSHEV, (e.g. gas containers, spring systems, electrical power supply) and/or with an external energy source. For the external links the manufacturer of the NSHEV shall specify the operating requirements for the initiation device and the opening mechanism, e.g. voltage, energy.

4.1.2.2 Integral gas containers

Any gas container forming an integral part of the NSHEV shall be equipped with a pressure release device to prevent an explosion if the container overheats. The energy supply shall comply with EN 12101-10.

4.1.3 Inputs and outputs

If the NSHEV is intended to operate with an external energy source it shall be equipped with inputs and/or outputs to allow connection of the NSHEV to the control panel and power supplies in accordance with EN 12101-10.

4.2 Response delay (response time)

4.2.1 Reliability

The NSHEV shall when tested in accordance with Annex C open, i.e. reach its fire open position, within 60 s after actuation.

4.2.2 Opening under (snow/wind) load

Roof mounted NSHEV shall open, reach its fire open position not more than 60 s after actuation and remain in position without an external energy supply (until reset), when tested under the snow load appropriate to its classification and under the specified side wind in accordance with Annex D.

After testing the NSHEV in accordance with Annex F it shall open into the fire open position within 60 s after actuation.

4.2.3 Low ambient temperature

When tested in accordance with Annex E the NSHEV shall open into to the fire open position within 60 s after actuation.

4.2.4 Opening under heat

The NSHEV shall when tested in accordance with Annex G open, i.e. reach its fire open position within 60 s under exposure to heat and to remain in the fire open position with not more than 10 % reduction of the throat area.

4.3 Operational reliability

The NSHEV shall when tested in accordance with Annex C open, i.e. reach its fire open position, within 60 s after actuation without damage and remain in its fire open position without an external energy supply (until reset).

4.4 Effectiveness of smoke/hot gas extraction (aerodynamic free area)

The aerodynamic free area A_a of the NSHEV shall be determined in accordance with Annex B.

Roof mounted NSHEV shall be tested without and with side wind, wall mounted NSHEV may be tested without side wind only.

In order to prevent air from flowing through the NSHEV into the fire room the aerodynamic free area A_a shall be larger than 0 m^2.

Wind deflectors subjected to atmospheric wind when the NSHEV is in the closed position and forming an integral part of the NSHEV to ensure the determined aerodynamic free area A_a shall be tested in accordance with 4.6.4.

Devices having influence on the aerodynamic performance are integral parts of the NSHEV and shall be installed in accordance with the manufacturer's instructions and shall be tested in accordance with Annex B, whether they are fixed to the NSHEV itself or to the surrounding construction.

When using the simple assessment procedure to determine the aerodynamic free area, see B.1, the side length shall not exceed 2,5 m and the aspect ratio of the geometric area shall not exceed 5:1.

Large area NSHEV may lead to plug holing, i.e. exhaust flows where smoke from the smoke layer and room air are mixed and removed and therefore the removal of smoke is decreased.

4.5 Performance parameters under fire conditions

4.5.1 Resistance to heat

The NSHEV shall open within 60 s under exposure to heat and remain in the fire open position without an external energy supply with not more than 10 % reduction of the throat area when tested in accordance with Annex G.

If the NSHEV shall be installed in a building it shall have – according to national requirements – a minimum class $B_{300}30$.

For NSHEV larger than the largest NSHEV tested in accordance with Annex G an assessment of the heat exposure effect shall be made by the testing station, to ensure that the performance is not negatively affected.

NOTE At present, maximum dimensions of the test apparatus for the heat exposure test are in the range of 4 m.

4.5.2 Mechanical stability

The reduction of the throat area shall not be more than 10 % reduction when tested in accordance with Annex G.

No part or component of the NSHEV shall fall from the NSHEV during the first 6 min of the test.

Devices having influence on the aerodynamic performance are integral parts of the NSHEV and shall be installed in accordance with the manufacturer's instructions and shall be tested in accordance with Annex G whether they are fixed to the NSHEV itself or to the surrounding construction.

4.5.3 Reaction to fire

The reaction to fire shall be classified in accordance with A.5 and tested in accordance with Annex H.

4.6 Performance under environmental conditions

4.6.1 Opening under load

To simulate the side wind influence roof mounted NSHEV shall be subjected, in the most unfavourable wind direction, to a side wind of 10 m/s velocity when tested in accordance with Annex D.

Roof mounted NSHEV shall open, reach its fire open position within not more than 60 s after actuation and remain in position without an external energy supply (until reset), when tested under the snow load appropriate to its classification and under the specified side wind in accordance with Annex D.

For NSHEV fitted with wind deflectors, the deflectors shall not be fitted in such a way to encourage snow or ice to collect to the detriment of the operation of the NSHEV.

4.6.2 Low ambient temperature

When tested in accordance with Annex E the NSHEV shall open into to the fire open position within 60 s after actuation. No such test is necessary for NSHEV classified T(05), see A.6.

Tests shall be conducted with simulated snow load with the classification in accordance with A.6.

4.6.3 Stability under wind load

The NSHEV shall not open at the opening side(s) more than 50 mm (measured at the location of the actuator) under the wind load appropriate to its classification, see A.6, and shall not suffer permanent deformation when tested in accordance with Annex F and following this test shall open into the fire open position within 60 s after actuation.

4.6.4 Resistance to wind-induced vibration

If wind deflectors form an integral part of the NSHEV, their natural frequency of vibration shall be higher than 10 Hz with a logarithmic decrement of damping greater than 0,1 when tested in accordance with F.5.2.

4.6.5 Resistance to heat

The NSHEV shall open within 60 s under exposure to heat and remain in the fire open position with not more than 10 % reduction of the throat area when tested in accordance with Annex G.

If the NSHEV shall be installed in a building it shall have – according to national requirements – a minimum class $B_{300}30$.

4.7 Durability

4.7.1 Response delay (response time)

The durability of NSHEV considering response delay is fulfilled if the fire open position is reached within 60 s after being tested at least 49 times in accordance with Annex C.

4.7.2 Operational reliability

The durability of NSHEV considering operational reliability is fulfilled if the fire open position is reached after being tested at least 49 times in accordance with Annex C.

4.7.3 Performance parameters under fire conditions

The NSHEV is regarded to be durable if after the test in accordance with Annex G the throat area is not reduced by more than 10 % and all parts relevant for the aerodynamic performance of the NSHEV, e. g filling, wind deflectors and flaps and all structural parts remain in place.

5 Testing, assessment and sampling methods

Test of NSHEV shall be carried out in accordance with Annexes B, C, D, E, F, G and H.

For each test, a test report shall be prepared.

The methods for testing, assessing and sampling for the essential requirements of Clause 4 are:

— For the "nominal activation condition/sensitivity" the presence of the initiation device according to 4.1.1, the "opening mechanism" according to 4.1.2 and "inputs and outputs" according to 4.1.3 shall be checked as present.

— The "response delay (response time)" to be ≤ 60 s shall be tested for reliability according to Annex C, for opening under (snow/wind) load according to Annex D and F, for low ambient temperature according to Annex E and for opening under heat according to Annex G and assessed in accordance with Annex A. The sampling methods are given in the Annexes C, D, E, F, and G.

— The operational reliability shall be tested in accordance with Annex C and assessed in accordance with Annex A. The sampling method is given in Annex C.

Table 1

Reliability classes	No. of Openings into the fire open position
Re 50	50
Re 500	500
Re 1000	1 000
Re A	A

— The effectiveness of smoke/heat gas extraction – aerodynamic free area shall be tested and assessed in accordance with Annex B. The aerodynamic free area A_a shall be larger than 0 m^2. The sampling method is given in Annex B.

— The performance parameters under fire conditions, resistance to heat and mechanical stability shall be tested and assessed in accordance with Annexes G and A as:

B_{300} 30,

$B_{600}30$,

B_A30.

and reaction to fire in accordance with Annexes H and A as:

class

The sampling methods are given in Annexes G and H.

— The performance under environmental conditions shall be tested and assessed for the performance under load in accordance with Annexes D and A as:

Table 2

Snow load	Load [Pa]
SL 500	500
SL 1000	1 000
SL 1500	1 500
SL A	A

for the stability under wind load in accordance with Annexes F and A as:

Table 3

Wind load	Load [Pa]
WL 1500	1 500
WL 3000	3 000
WL A	A

for the low ambient temperature in accordance with Annexes E and A as:

T(−25),

T(−15),

T(−05),

T(05),

T A.

and for the resistance to wind induced vibrations in accordance with Annexes F and A as:

natural frequency of vibration ω_0: > 10 Hz

logarithmic decrement of damping δ: > 0,1

The sampling methods are given in Annexes D, E, and F.

Tests for reliability conducted in accordance to Annex C and for resistance to heat in accordance to Annex G are considered to satisfy the requirements of durability as specified in 4.7.1, 4.7.2 and 4.7.3.

6 Assessment and verification of constancy of performance - AVCP

6.1 General

The compliance of the natural smoke and heat exhaust ventilators (NSHEV) with the requirements of this standard and with the performances declared by the manufacturer in the DoP shall be demonstrated by:

— determination of the product type;

— factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

6.2 Type Testing

6.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions (e.g. use of previously existing data, CWFT and conventionally accepted performance) for declaring them without performing tests.

Assessment previously performed in accordance with the provision of this standard may be taken into account providing that they were made to the same or a more rigorous test method under the same AVCP system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

NOTE Same AVCP system means testing by an independent third party under the responsibility of a product certification body.

For the purpose of assessment the manufacturer's products may be grouped into families where it is considered that the results for one or more characteristics from any one NSHEV within the family are representative for that same characteristics for all the NSHEV within that family.

Products may be in different families for different characteristics.

Reference to the assessment method standards should be made to allow the selection of a suitable representative sample.

In addition, the determination of the product shall be performed for all characteristics included in the standard for which the manufacturer declares performances:

— at the beginning of the production of a new or modified natural smoke and heat exhaust ventilator (NSHEV) (unless a member of the same family), or

— at the beginning of a new or modified method of production (where this may affect the stated properties); or

they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the natural smoke and heat exhaust ventilator (NSHEV) design, in the raw material or in the supplier of the components, or in the production process (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined by the component manufacturer on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the DoP, although this does not replace the responsibility on the NSHEV manufacturer to ensure that the NSHEV is correctly manufactured and its component products have the declared performance values.

6.2.2 Test samples, testing and compliance criteria

The number of samples of NSHEV to be tested / assessed shall be in accordance with Table 4.

Table 4 —Number of samples to be tested and compliance criteria

Characteristic	Requirement	Assessment method	No. of samples	Compliance criteria
Nominal activation conditions/sensitivity, as:				
- Initiation device	4.1.1			4.1.1
- Opening mechanism	4.1.2			4.1.2
- Inputs and outputs	4.1.3			4.1.3
Response delay (response time), as:				
- Reliability	4.2.1	Annex C	cf. Annex C	4.2.1
- Opening under (snow, wind) load	4.2.2	Annex D	cf. Annex D	4.2.2
- Low ambient temperature	4.2.3	Annex E	cf. Annex E	4.2.3
- Opening under heat	4.2.4	Annex G	cf. Annex G	4.2.4
Operational reliability	4.3	Annex C	cf. Annex C	4.3
Effectiveness of smoke/hot gas extraction – aerodynamic free area	4.4	Annex B	cf. Annex B	4.4
Performance parameters under fire conditions, as:				
- Resistance to heat	4.5.1	Annex G	cf. Annex G	4.5.1
- Mechanical stability	4.5.2	Annex G	cf. Annex G	4.5.2
- Reaction to fire	4.5.3	Annex H	cf. Annex H	4.5.3
Performance under environmental conditions, as**:**				
- Performance under load	4.6.1	Annex D	cf. Annex D	4.6.1
- Low ambient temperature	4.6.2	Annex E	cf. Annex E	4.6.2
- Stability under wind load	4.6.3	Annex F	cf. Annex F	4.6.3
- Resistance to wind-induced vibration	4.6.4	Annex F	cf. Annex F	4.6.4
- Resistance to heat	4.6.5	Annex G	cf. Annex G	4.6.5
Durability, as:				
- Response delay (response time)	4.7.1	Annex C		4.7.1
- Operational reliability	4.7.2	Annex C		4.7.2
- Performance parameters under fire conditions	4.7.3	Annex G		4.7.3

6.2.3 Test sequence

For type testing the sequence of the tests is free except for tests in accordance with Annexes C and D which shall be conducted with the same test specimen in the sequence first C then D.

6.2.4 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the NSHEV to which they relate.

6.2.5 Cascading determination of the product type results

For some construction products, there are companies (often called “system houses”) which supply or ensure the supply of, on the basis of an agreement[1)], some or all of the components (e.g. in case of windows: profiles, gaskets, weather strips)[2)] to an assembler who then manufactures the finished product (referred to below as the “assembler”) in his factory.

Provided that the activities for which such a system house is legally established include manufacturing/assembling of products as the assembled one, the system house may take the responsibility for the determination of the product type regarding one or several essential characteristics of an end product which is subsequently manufactured and/or assembled by other firms in their own factory.

When doing so, the system house shall submit an “assembled product” using components manufactured by it or by others, to the determination of the product type and then make the determination of the product type report available to the assemblers, i.e. the actual manufacturer of the product placed on the market.

To take into account such a situation, the concept of cascading determination of the product type might be taken into consideration in the technical specification, provided that this concerns characteristics for which either a notified product certification body or a notified test laboratory intervene, as presented below.

The determination of the product type report that the system house has obtained with regard to tests carried out by a notified body, and which is supplied to the assemblers, may be used for the regulatory marking purposes without the assembler having to involve again a notified body to undertake the determination of the product type of the essential characteristic(s) that were already tested, provided that:

— the assembler manufactures a product which uses the same combination of components (components with the same characteristics), and in the same way, as that for which the system house has obtained the determination of the product type report. If this report is based on a combination of components not representing the final product as to be placed on the market, and/or is not assembled in accordance with the system house’s instruction for assembling the components, the assembler needs to submit his finished product to the determination of the product type;

— the system house has notified to the manufacturer the instructions for manufacturing/assembling the product and installation guidance;

— the assembler (manufacturer) assumes the responsibility for the correct assembly of the product in accordance with the instructions for manufacturing/assembling the product and installation guidance notified to him by the system house;

1) This can be, for instance, a contract, license or whatever kind of written agreement, which should also contain clear provisions with regard to responsibility and liability of the component producer (system house, on the one hand, and the assembler of the finished product, on the other hand.

2) These companies may produce components but they are not required to do so.

— the instructions for manufacturing/assembling the product and installation guidance notified to the assembler (manufacturer) by the system house are an integral part of the assembler's Factory Production Control system and are referred to in the determination of the product type report;

— the assembler is able to provide documented evidence that the combination of components he is using, and his way of manufacturing, correspond to the one for which the system house has obtained the determination of the product type report (he needs to keep a copy of the system house's determination of the product type report);

— regardless the possibility of referring, on the basis of the agreement signed with the system house, to the latter's responsibility and liability under private law, the assembler remains responsible for the product being in compliance with the declared performances, including both the design and the manufacture of the product, which is given when he affixes the regulatory marking on his product.

6.3 Factory production control

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the NSHEV placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This factory production control system documentation shall ensure a common understanding of evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked.

Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

In case the manufacturer has used cascading product type results, the FPC shall also include the appropriate documentation as foreseen in 6.2.5.

6.3.2 Requirements

6.3.2.1 General

The manufacturer is responsible for organizing the effective implementation of the factory production control system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product constancy, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-conformities from occurring, actions in case of non-conformities and to identify and register product constancy problems. Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate conformity of the product at appropriate stages;

— identify and record any instance of non-conformity;

— identify procedures to correct instances of non-conformity.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. All FPC systems should achieve an appropriate level of confidence in the constancy of the product. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;

b) the effective implementation of these procedures and instructions;

c) the recording of these operations and their results;

d) the use of these results to correct any deviations, to repair the effects of such deviations, to treat any resulting instances of non-conformity and, if necessary, to revise the FPC to rectify the cause of non-constancy of performance.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities in accordance with this European Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question. The manufacturer who subcontracts all of his activities may in no circumstances pass these responsibilities on to a subcontractor.

NOTE Manufacturers having a FPC system, which complies with EN ISO 9001 and which addresses the provisions of this European standard are recognized as satisfying the FPC requirements of Regulation (EU) No 305/201.

6.3.2.2 Equipment

6.3.2.2.1 Testing

All weighing, measuring, and testing equipment shall be calibrated and regularly inspected in accordance with documented procedures, frequencies and criteria.

6.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear, or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.2.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the constancy of performance system of the component shall be that given in the appropriate harmonized technical specification for that component.

6.3.2.4 Traceability and marking

The NSHEV shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

6.3.2.5 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

The factory production control system shall document the various stages in the production of products; identify the checking procedure and those individuals responsible for all stages of production.

During the production process itself, a record shall be kept of all checks, their results, and any corrective actions taken. This record shall be sufficiently detailed and accurate to demonstrate that all stages of the production phase, and all checks, have been carried out satisfactorily.

6.3.2.6 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics he declares are maintained.

6.3.2.7 Non-complying products

The manufacturer shall have written procedures which specify how non-complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

6.3.2.8 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

6.3.2.9 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

6.3.3 NSHEV specific requirements

The FPC system shall address this European Standard and ensure that the NSHEV placed on the market comply with the declaration of performance.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the NSHEV at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan, and/or

b) the verifications and tests to be carried out on finished NSHEV according to a frequency laid down in the FPC test plan.

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

NOTE Depending on the specific case, it can be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) refer to the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment, etc. These controls and tests and their frequency shall be chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters, etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

6.3.4 Initial inspection of factory and FPC

Initial inspection of factory and of FPC shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of 6.3.2 and 6.3.3 are fulfilled.

In the inspection it shall be verified:

a) that all resources necessary for the achievement of the NSHEV characteristics included in this European Standard are in place and correctly implemented, and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice, and

c) that the NSHEV complies with the product type samples, for which compliance of the performance to the DoP has been verified.

All locations where final assembly or at least final testing of the relevant product is performed shall be assessed to verify that the above conditions a) to c) are in place and implemented. One visit may cover one or more NSHEV, production lines and/or production processes.

If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

6.3.5 Continuous surveillance of FPC

Surveillance of the FPC shall be undertaken once a year.

The surveillance of the FPC shall include a review of the test plan(s) and production processes for each product to determine if any changes have been made since the last assessment or surveillance and the significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated at appropriate time intervals.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to the determination of the products type and that the correct actions have been taken for non-compliant products.

6.3.6 Procedure for modifications

If modifications are made to the NSHEV which do not comply with the definition of minor changes given in Annex I, modifications made to the production process or FPC system that could affect any of the product characteristics according to this standard, then all characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type as described in 6.2.1. All assessments and their results shall be documented in a report.

6.3.7 Pre-production prototypes

NSHEV produced as prototypes assessed before full production is established shall be assessed as follows.

For type assessment, the provisions of 6.2.1, 3rd paragraph, apply, together with the following additional provisions:

— in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

— on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

— the FPC-documentation; and

— the factory.

In the initial assessment of the factory and FPC it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European standard will be available, and

b) that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and

c) that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this European standard and that the product will be the same as the samples used for the determination of the product type, for which compliance with this European standard has been verified.

Once series production is fully established, the provisions of 6.3 shall apply.

7 Marking, labelling and packaging

The manufacturer shall give on each NSHEV the information in accordance with List Entries a) to k):

a) the name or trade mark of the manufacturer; and

b) the type and model; and

c) the year of manufacture (this may be in coded form); and

d) technical characteristics of the external energy supply (e.g. power, current, voltage, pressure), type of opening (see 4.1.2); if integral gas containers are used they shall be marked with at least the following: mass and type of gas, fill ratio, nominal temperature; and

e) temperature of the thermal initiation device (if fitted); and

f) the aerodynamic free area (see B.3.5) in square metres and limitations to application if relevant (e.g. wind direction dependent opening, with or without wind deflector, additional aerodynamic device); and

g) the classes for wind load, snow-load, low ambient temperature, reliability, heat exposure temperature and reaction to fire; and

h) the number of this European Standard and the year of publication, i.e. EN 12101-2:2017; and

i) suitable for wall mounting with wind sensitive control system only (if tested in accordance with B.3.4.2); and

j) range of installation angle relative to the horizontal; and

k) dual purpose NSHEV, if relevant.

Where regulatory marking provisions require information on some or all items listed in this clause, the provisions of this clause concerning those common items are deemed to be met.

NSHEV delivered to site in a form of components shall be reassembled under the responsibility of the manufacturer. No cutting, drilling, milling or welding of these components are allowed for reassembling.

The manufacturer shall take into account that packaging, handling and storage conditions do not have any negative influences on the declared performances of the NSHEV.

Packaging should be done in such a way that the NSHEV has its declared performance after delivery.

Annex A
(normative)

Classification

NOTE See Clause 4.

A.1 Nominal activation condition/sensitivity

For the "nominal activation condition/sensitivity" the presence of the initiation device according to 4.1.1, the "opening mechanism" according to 4.1.2 and "inputs and outputs" according to 4.1.3 shall be visually checked and described as present.

A.2 Response delay

The "response delay (response time)" to be ≤ 60 s shall be tested for reliability according to Annex C, for opening under (snow/wind) load according to Annex D and F, for low ambient temperature according to Annex E and for opening under heat according to Annex G and assessed in accordance with Annex A. and described as ≤ 60 s.

A.3 Operational Reliability

The NSHEV shall be classified as one of the following classes:

— Re 50,

— Re 1000,

— Re A.

The designation 50, 1000 and A in the above mentioned classes represent the number of openings into the fire open position and closing under no applied load in accordance with Annex C.

A.4 Effectiveness of smoke/hot gas extraction (aerodynamic free area)

The effectiveness of smoke/heat gas extraction – aerodynamic free area shall be tested and assessed in accordance with Annex B. The aerodynamic free area A_a shall be larger than 0 m^2.

A.5 Performance parameters under fire conditions

The resistance to heat and the mechanical stability in accordance with Annex G shall be classified as:

— B_{300} 30,

— B_{600}30,

— B_A30;

and reaction to fire in accordance with Annexes H as:

— class

The designations 300, 600 and A in the above mentioned classes represent the temperature (in °C) at which the NSHEV is tested in accordance with Annex G.

A.6 Performance under environmental conditions

The performance under load in accordance with Annex D shall be classified as:

— SL 500;

— SL 1000;

— SL 1500;

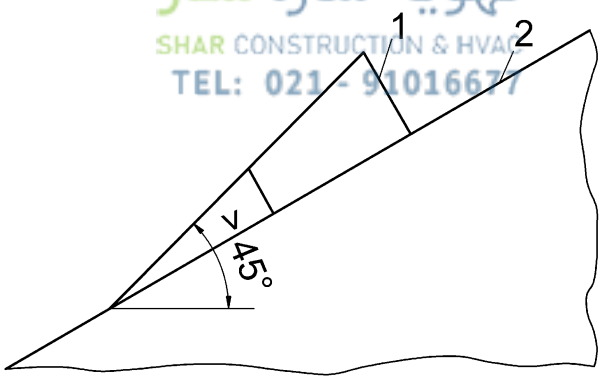
— SL A.

The designations 500, 1000, 1500 and A in the above mentioned classes represent the test snow load in Pa acting on the projection surface of the opening element(s) normal to the exit plane of the NSHEV, applied when the NSHEV is tested in accordance with Annex D.

NOTE 1 A NSHEV classified SL 0 can be installed in accordance with the manufacturer's instructions with a minimum angle of installation > 45° (combining roof pitch and vent pitch, see Figure A.1, except where the snow will be prevented from slipping from the NSHEV, e.g. by wind deflectors).

Except for SL 0 for NSHEV fitted with three or four sided deflectors, the snow load classification should not be less than SL = 2 000 x ***d*** where *d* is the depth of snow, in metres, which can be contained within the confines of the deflectors.

It is recommended that louvre-type NSHEV are classified not less than SL 500 when used in sub-zero temperature conditions.



Key

1 NSHEV

2 roof

Figure A.1 — Combined roof pitch and NSHEV pitch angle > 45°

The stability under wind load in accordance with Annex F shall be classified as:

— WL 1500;

— WL 3000;

— WL A.

The designations 1500, 3000 and A in the above mentioned classes represent the test wind suction load in Pa for NSHEV opening outwards or the test wind pressure load in Pa for NSHEV opening inwards acting on the area given as the product of the external dimensions of the opening element(s) when the NSHEV is tested in accordance with Annex F.

The low ambient temperature in accordance with Annex E shall be classified as:

— T(−25),

— T(−15),

— T(−05),

— T(05),

— T A.

The designations −25, −15, −05, 05 and A in the above mentioned classes represent the number of °C at which the NSHEV is tested in accordance with Annex E.

NOTE 2 Class T(05) NSHEV are only regarded as suitable for use in construction works where the room temperature in the room underneath the NSHEV is 5 °C or above.

The resistance to wind induced vibrations of the wind deflectors tested in accordance with Annexes F shall be given as:

— natural frequency of vibration ω_0: > 10 Hz;

— logarithmic decrement of damping δ: > 0,1.

A.7 Durability

A.7.1 Response delay (response time)

The durability regarding response delay shall be given as ≤ 60 s after being tested at least 49 times in accordance with Annex C.

A.7.2 Operational reliability

The durability regarding operational reliability shall be given as number of opening into the fire open position tested at least 49 times in accordance with Annex C.

A.7.3 Performance parameters under fire conditions

The durability regarding the performance parameters under fire conditions after being tested in accordance with Annex G shall be given as $\Delta A_{throat} < 10$ %.

Annex B
(normative)

Effectiveness of smoke/hot gas extraction (aerodynamic free area)

NOTE See 4.4 and G.1.

B.1 Determination of the aerodynamic free area

The determination of the aerodynamic free area shall be determined according to the simple assessment procedure or according to the experimental procedure.

B.2 Simple assessment procedure

B.2.1 General

The aerodynamic free area in accordance with the simple assessment procedure shall be determined only by a notified testing laboratory.

B.2.2 Roof mounted NSHEV

For the types of NSHEV shown in Figure B.1 a) and with dimensions in accordance with 4.4, the discharge coefficient may be taken as C_v = 0,4 for installation situations with an upstand height of at least 300 mm and for the opening angle specified in Figure B.1 a). An inflow of air into the fire room instead of a discharge of smoke from the fire room shall be avoided.

Small opening angles and/or other installation situations, e.g. see Figure B.2, may lead to negative discharge coefficients.

This may necessitate a wind direction dependent opening of the NSHEV.

B.2.3 Wall mounted NSHEV

For the types of NSHEV shown in Figure B.1 b) and the dimensions of which are in accordance with 4.4 the discharge coefficient in the no-wind condition given in Table B.1 may be taken for the opening angles specified in Table B.1. An inflow of air into the fire room instead of a discharge of smoke from the fire room shall be avoided.

This may necessitate a wind direction dependent opening of the NSHEV.

Table B.1 – Discharge coefficients for wall mounted NSHEV using the simple assessment procedure for various opening angles α

α	NSHEV opening to the outside	NSHEV opening to the inside
30°	0,25	0,20
45°	0,30	0,25
60°	0,40	0,30
90°	0,50	0,40

B.3 Experimental procedure

B.3.1 General

Unless a simple assessment procedure of B.1 is used, A_a shall be determined directly from measurements, or indirectly in accordance with B.3.6 on a number of NSHEV or scaled down models of different sizes. The geometric area of typical roof mounted NSHEV, e.g. light dome NSHEV, is defined in Figure B.4 a). For NSHEV in continuous roof lights the geometric area is defined as the product of the free opening length parallel and the shortest free length normal to the roof light axis. The geometric area of wall mounted NSHEV is the smallest area enclosed by the fixed frame, see Figure B.7.

When testing wall mounted NSHEV opening to the outside the installation described in Figure B.4 a) shall be used. When testing wall mounted NSHEV opening to the inside the installation described in Figure B.4 b) shall be used. The test arrangement as shown in Figure B.4 b) may be used in horizontal position.

The test installation described above is the standard test arrangement. The aerodynamic free area determined using this standard test arrangement shall be valid for other NSHEV installations. If other test installations, e.g. with special inlet configurations, are used the results shall be valid only for the particular application. The installation shall be clearly documented in the test report and the manufacturer's installation documentation.

B.3.2 Test apparatus

A test apparatus with an open jet or a closed test section facility as shown in Figure B.3 shall be used.

This consists of a settling chamber onto which the NSHEV can be mounted in accordance with Figure B.4 so that the mass flow through the NSHEV can be determined, and a side wind simulator by means of which the NSHEV may be subjected to a side wind. The flow in the settling chamber approaching the NSHEV shall be steady-state and uniform.

This will be achieved if the ratio of the geometric area of the NSHEV to the horizontal cross sectional area of the settling chamber $A_v/A_{sc} \leq 0{,}15$ and the velocity (V_{sc}) distribution measured in the open hole (without NSHEV) at the points specified in Figure B.6 varies by no more than ± 10 % of the mean velocity $V_{m,\,sc}$ in the plane of measurement of the velocity. The measurement shall be taken in an opening with an area of $0{,}15 \times A_{sc}$, the ratio of the sides being 2:1 and the opening being located in the centre of the cross-sectional area of the settling chamber. If testing NSHEV in a continuous roof light the cross section of the opening in the settling chamber shall be at least 1,5 times the geometric opening area of the NSHEV.

To obtain a uniform side wind condition, when the NSHEV is subjected to side wind, the tests shall be carried out in side wind simulation facilities. The following conditions shall be satisfied:

Open jet facilities	**Closed test section facilities**
— $A_{pr}/A_n \leq 0,3$	— $A_{pr}/A_n \leq 0,08$
— $H_n/H_v \geq 1,3$	— $H_n/H_v \geq 3$
— $B_n/B_v \geq 1,5$	— $B_n/B_v \geq 2$
— $V_n \geq 10$ m/s	— $V_n \geq 10$ m/s
— velocity at mid height of the up stand $h_{US}/2$ above the test section floor:	
$0,85 \times V < V\left(\frac{h_{US}}{2}\right) < 1,05 \times V$ with $V = \frac{V\left(\frac{H_v}{2}\right) + V\left(\frac{3H_v}{4}\right) + V(H_v) + V\left(\frac{5H_v}{4}\right)}{4}$	
where H_V = maximum height of the NSHEV in the fire open position	

All relative velocities V_l/V_n obtained at the indicated relevant measuring points of lines a1 to a6 in Figure B.5 a) in the entrance area to and at the middle of the test section, for open jet and closed test section facilities, shall lay within the range shown in Figure B.5 b).

All of the turbulence intensities $I_{u,\ hUS}$ measured at the indicated relevant measuring points of lines a1 to a6 in Figure B.5 a) shall lay within the range shown in Figure B.5 c).

NOTE Using larger side wind velocities will increase the accuracy of the measurements.

B.3.3 Test specimen

Tests shall be carried out on full size NSHEV as supplied by the manufacturer and/or supplier, or on accurately scaled-down models. For testing scaled down models flow similarity shall be established. This is always achieved if the Reynolds Numbers of the scaled down model and the full scale NSHEV are identical. The Reynolds Number similarity usually requires model scales of 1:6 or larger. Smaller scales (down to 1/10) may be used if justification is given for the flow similarity.

When testing scaled-down models, all features of the NSHEV in contact with the airflow (e.g. opening elements or details of flaps) shall be included and shall satisfy the similarity requirement.

NOTE Experience has shown that it is difficult to model ridge vents and louvre type NSHEV.

It is not considered necessary to test all sizes of a range of similar NSHEV belonging to the same family, provided tests are carried out on a representative selection of sizes. The sizes for larger ranges (at least 8 sizes) to be investigated shall be chosen in such a way that the relative up stand height (= up stand height h_{US}/hydraulic diameter of the geometric opening $d_{h,g}$) and length to width ratio covers the whole range of possible NSHEV evenly. For small ranges (less than 8 sizes) at least two sizes, the smallest and the largest NSHEV and, if necessary, the NSHEV with the most critical aspect ratio shall be investigated. For testing NSHEV differing in dimensions but belonging to the same range, A_a may be calculated for other sizes. The method of calculation is given in B.3.6.

For NSHEV designed as part of a continuous roof-light the test specimen shall be mounted on the rig with parts of the roof-lights to ensure the correct flow field. Those parts shall have a minimum width of half the external dimension of the NSHEV parallel to the line of the roof-light. For NSHEV intended for

use in continuous roof lights the gable ends of the roof light ends shall be streamlined or fitted with a deflection device as shown in Figure B.8.

For roof mounted NSHEV not intended to be suitable for equal wind conditions from all directions (i.e. single flap NSHEV designed for installation on a sloping roof and relying on the interaction with the roof or other NSHEV to aid aerodynamic performance) the mounting and test conditions in the general test procedure can be replaced by specific mounting and test conditions that replicate the intended application of the NSHEV. The NSHEV shall be tested without and with side wind to determine the limits of the NSHEV's application, i.e. negative C_V which shall be clearly stated in the test report and in the manufacturer's installation documentation. The test arrangement shall be clearly documented in the test report.

B.3.4 Test procedure

B.3.4.1 Roof mounted NSHEV

The outside ambient static pressure shall be quantified with and without wind using the following procedure. Make sure the settling chamber is airproof. Fit into the exit opening of the settling chamber and flush with the exterior of the settling chamber ceiling a thin plate with evenly spaced holes (diameter 50 mm) in order to get a geometric porosity (hole area/exit area of settling chamber) equal to (5 ± 1) %. Measure the static pressure in the settling chamber without wind $p_{int,v0}$ and with wind $p_{int,vw}$ in accordance with the side wind conditions specified below with reference to the atmospheric pressure $p_{amb\,1}$.

$$p_{int,\,v0} = p_{amb\,1} + \Delta p_{v0} \quad \text{(B.1)}$$

$$p_{int,\,vw} = p_{amb\,1} + \Delta p_{vw} \quad \text{(B.2)}$$

Record the Δp_{v0} and Δp_{vw} values, remove the drilled plate, and fit the NSHEV on the settling chamber. Carry out the tests with and without wind.

For the no-side wind case set the full-scale NSHEV onto the settling chamber to get the internal static pressure

$$p_{int} = p_{amb\,2} + \Delta p_{v0} + \Delta p_{int} \quad \text{(B.3)}$$

where

Δp_{int} over the range Δp_{int} = (3 to 12) Pa with an accuracy of at least ± 5 % and

$p_{amb\,2}$ = atmospheric pressure at the time of the measurement.

Measure the ambient atmospheric pressure and temperature, the static pressure of the air in the settling chamber and the volume flow entering the settling chamber. Determine for each value of Δp_{int} the corresponding mass flow $\dot{m}_{ing}$.

Take not less than six readings of Δp_{int} and $\dot{m}_{ing}$ for testing without side wind.

When testing scaled-down models at an increased pressure difference Δp_{int}, due to the Reynolds similarity requirement, the accuracy required of measurement shall be ± 3 % of the reading. The required accuracy of the mass flow measurement is ± 2,5 % of the reading. Measure the temperature and the pressure of the ambient air with an accuracy of ± 0,5 K and ± 0,5 %, respectively.

$$p_{int} = p_{amb\,3} + \Delta p_{vw} + \Delta p_{int} \quad \text{(B.4)}$$

where

Δp_{int} is over the range of Δp_{int} = 0,005 p_d to 0,15 p_d with p_d calculated using the formula:

$$p_d = \frac{1}{2} \rho_{air} V_n^2 \text{; and}$$

p_{amb} = atmospheric pressure at the time of the measurement.

3

Testing full scale NSHEV at larger side wind velocities (V_n > 10 m/s) the pressure difference Δp_{int} shall be increased according $\Delta p_{int}/p_d$ = 0,082, e.g. if V_n = 14 m/s, Δp_{int} is close to 10 Pa.

NOTE The larger Δp_{int} the better the accuracy of the pressure measurement.

Where fluctuations of the ambient pressure field due to the atmospheric wind may influence the test results the mass flow rate, the wind velocity and the static pressure measurements shall be carried out over a period of at least 10 min.

Measure $\dot{m}_{ing}$, take the average of two readings of Δp_{int} and $\dot{m}_{ing}$ for testing with side wind. Determine the discharge coefficient with side wind C_{vw} from the regression line of the readings at $\Delta p_{int}/p_d$ = 0,082. To determine β_{crit}, measure the C_{vw} value for various angles β. β_{crit} is obtained when measurements for angles $\beta = \beta_{crit} \pm 5°$ will lead to higher C_{vw}-values than determined for β_{crit} . In order to increase the accuracy of C_{vw} at β_{crit}, take no less than six readings of Δpi_{nt} and m_{ing} with Δp_{int} over the range 0,07 p_d to 0,10 p_d. Determine the discharge coefficient with side wind C_{vw} from the regression line of the readings at $\Delta P_{int}/p_d$ = 0,082.

Use the same procedure when measuring the discharge coefficient with side wind for scaled-down models. However, to ensure the similarity of the flow around the NSHEV for full size and model, Δp_{int} shall be increased, see above. This leads to an increase in the wind stagnation pressure in accordance with $\Delta p_{int}/p_d$ = 0,082 and thus to an increase in nozzle exit velocity as compared to full size testing. To avoid compressibility effects, do not test at a side wind velocity greater than 100 m/s.

The measurement signals usually fluctuate. They shall be averaged over a time period long enough for the pressure and air volume flow values to be respectively in the range of ± 2,5 % and ± 5 % for. The averaging technique shall be given in the test report.

B.3.4.2 Wall mounted NSHEV

For wall mounted NSHEV the test procedure of B.3.4.1 shall be followed in the “without wind” condition only.

B.3.5 Evaluation of test results

Calculate the discharge coefficient using the formula:

$$C_v = \frac{\dot{m}_{ing}}{A_v \times \sqrt{2 \times \rho_{air} \times \Delta p_{int}}} \quad \text{(B.5)}$$

From the C_v-values thus determined, calculate the mean discharge coefficients C_{v0} (without side wind) and C_{vw} (with side wind). Calculate the aerodynamic free area using the lower value of the C_{v0}- and C_{vw}-values rounded to two digits:

$$A_a = A_v \times C_v \quad \text{(B.6)}$$

Wall mounted NSHEV have a value C_{v0} only.

B.3.6 Calculation of the coefficient of discharge for a family of NSHEV

B.3.6.1 Discharge coefficient without wind

B.3.6.1.1 Basic considerations

The discharge coefficient without wind depends exclusively on the flow through the NSHEV. The flow situation is one of internal aerodynamics. It is common in the field of aerodynamics to calculate the aerodynamic free area A_a of the flow through an orifice using the contraction coefficient μ which is given as:

$$\mu = A_a/A_{ex}, \tag{B.7}$$

where

A_{ex} = area of the exit plane = smallest cross-section area of NSHEV; using the geometric ratio $m = A_{ex}/A_v$ the discharge coefficient can be written as follows:

$C_{v0} = A_a/A_v = m \times \mu$.

For a sharp edged orifice μ depends only on the relative wall thickness of the orifice and – mildly – on the Reynolds-number. The relative wall thickness δ is defined as the wall thickness (i.e. up stand height of a NSHEV h_{us}) divided by the hydraulic diameter d_h of the orifice:

$\delta = h_{us}/d_h$.

B.3.6.1.2 NSHEV with flap opening angles larger than 60°

These NSHEV include single and double flap NSHEV as used for roof mounting and louvre type NSHEV. The calculation procedure is as follows:

— determine C_{v0} for at least 4 sizes of a family of NSHEV in accordance with this annex,

— calculate μ for these sizes and plot μ vs. h_{us}/d_h,

— from this plot determine μ for the other sizes depending on their value of h_{us}/d_h,

— calculate $C_{v0} = m \times \mu$ and A_a for the other sizes.

B.3.6.1.3 NSHEV with flap opening angles 60° and less

Small opening angles are typical for wall mounted ventilators of the window type with horizontal hinges. Here one shall distinguish between the exit area between the parallel lines of the fixed and movable frames and the two triangular areas at the sides of the open NSHEV that are perpendicular to the axis of rotation. The discharge coefficient C_{v0} depends not only on the opening angle α and the aspect ratio of the NSHEV (length to width ratio (l/b)) but also on the relative thickness of the profile δ_P, which is obtained here using the profile height h_p i.e. $\delta_P = h_p/d_h$ where d_h is calculated using the formula $d_h = (4 \times A_v)/U_v$ with U_v = boundary of the geometric area. The discharge coefficients can be calculated in the following way:

— determine C_{v0} for at least 4 sizes of a range of NSHEV in accordance with Annex B;

— C_{v0} is plotted as a function of the dimensionless ratio $(l/b)/\delta_P$;

— if the opening angle α varies, C_{v0} is plotted three-dimensionally as a function of the dimensionless ratio $(l/b)/\delta_P$ and as a function of α.

For other dimensions within a range, C_{v0} is calculated from a three-dimensional interpolation (e.g. triangular interpolation in the space).

B.3.6.2 Discharge coefficient with wind

B.3.6.2.1 Hinged single flap NSHEV

The discharge coefficient with wind depends mainly on the flow around the NSHEV. Hence its determination is a problem of external aerodynamics. For usual NSHEV the discharge coefficient depends mainly on the ratio of the height to the upper edge of the wind deflector h_{uwd} and the upper edge of the opened flap H_v, both above the roof, and – mildly - on the aspect ratio of the NSHEV.

If $C_{vw} \geq C_{v0}$ for all NSHEV tested to calculate the necessary height of the wind deflectors proceed as follows:

— determine the height ratio h_{uwd}/H_v from the measurements of this annex

— plot C_{vw} vs. h_{uwd}/H_V for aspect ratios ≤ 1,5 and > 1,5

— determine the necessary h_{uwd}/H_v for the other sizes to obtain $C_{vw} = C_{v0}$

If no wind deflectors are used the height ratio h_{us}/H_v shall be used.

If $C_{vw} < C_{v0}$ for one or more of the NSHEV tested the calculation procedure shall use the two parameters h_{uwd}/H_V (or h_{us}/H_v if no wind deflectors are used) and the aspect ratio. Triangular interpolation in the space h_{uwd}/H_v (or h_{us}/H_v), aspect ratio, and C_{vw} or a similar calculation method shall be used.

B.3.6.2.2 Hinged double flap NSHEV, louvre type NSHEV and other NSHEV

The discharge coefficient depends mainly on the ratio of the height of the upper edge of the wind deflector h_{uwd} to the hydraulic diameter of the geometric area of the NSHEV $d_{h,g}$ and - mildly - on the aspect ratio of the NSHEV.

If $C_{vw} \geq C_{v0}$ for all NSHEV tested to calculate the necessary height of the wind deflectors proceed as follows:

— determine the height ratio $h_{uwd}/d_{h,g}$ from the measurements of this Annex B,

— plot C_{vw} vs. $h_{uwd}/d_{h,g}$ for aspect ratios ≤ 1,5 and > 1,5,

— determine the necessary $h_{uwd}/d_{h,g}$ for the other sizes to obtain $C_{vw} = C_{v0}$.

If no wind deflectors are used the height ratio $h_u/d_{h,g}$ shall be used.

If $C_{vw} < C_{v0}$ for one or more of the NSHEV tested the calculation procedure shall use the two parameters $h_{uwd}/d_{h,g}$ (or $h_{us}/d_{h,g}$ if no wind deflectors are used) and the aspect ratio. Triangular interpolation in the space $h_{uwd}/d_{h,g}$ (or $h_{us}/d_{h,g}$), aspect ratio, and C_{vw} or a similar calculation method shall be used.

B.4 Test to check the aerodynamic test installations

B.4.1 General

In order to check and validate each test installation, four reference tests shall be carried out.

The tests should be conducted once a year or after any changes that are made to the test facility. The results of the most recent reference tests should be part of each test report.

B.4.2 Reference test without side wind

The coefficient of discharge without side wind (C_{v0}) shall be measured for the installation shown in Figure B.10. The C_{v0}-value obtained shall be:

C_{v0} = 0,62 ± 0,01 for Δp_{int} = 5, 10, 15, 20 Pa

B.4.3 Reference tests with side wind

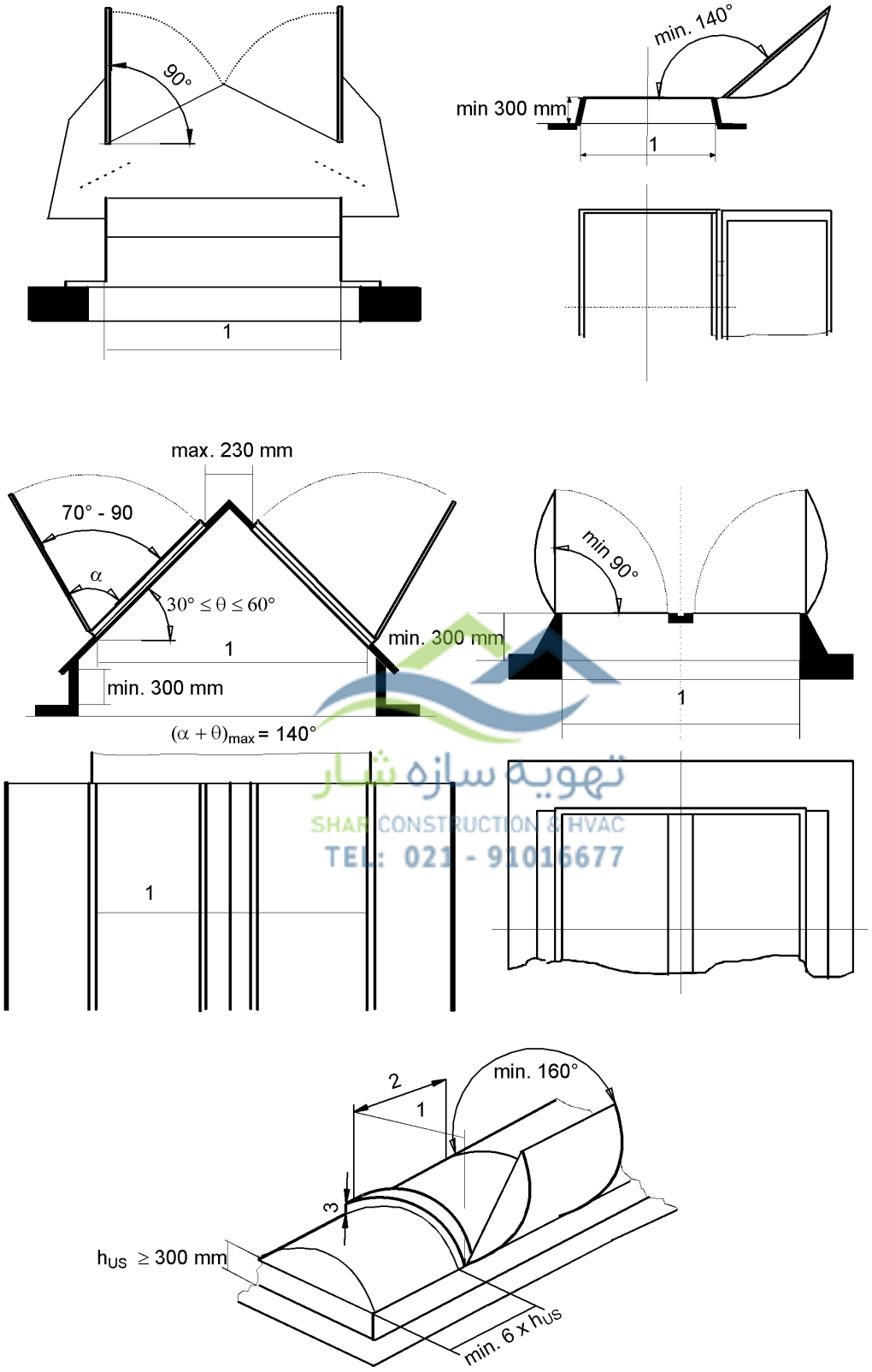
The coefficients of discharge with side wind (C_{vw}) shall be measured for the NSHEV specified in Table B.2.

Table B.2 — Characteristics of the reference NSHEV (full scale size), see Figure B.9

Parameters	Single flap Opening 1,4 × 1,4	Single flap Opening 1,8 × 1,8	simplified NSHEV
Length	1,4 m	1,8 m	1,4 m
Width	1,4 m	1,8 m	1,4 m
Upstand height	0,32 m	0,32 m	0,32 m
Opening design	Flap	Flap	none
Opening angle	140°	140°	none
Upstand	Vertical	Vertical	Vertical

B.4.4 Evaluation of test results

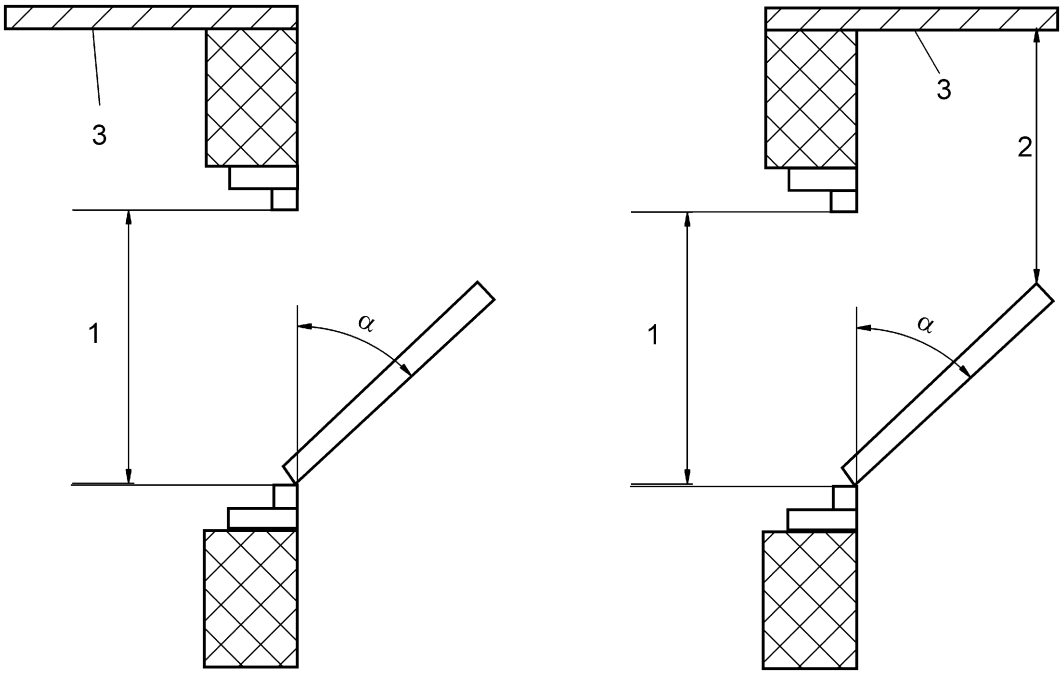
The discharge coefficient for the 4 tests shall be determined in accordance with the test procedure given in B.3.4. The discharge coefficients obtained shall be within the limits specified in B.4.2 and in Figure B.9.



Key

1 length of geometric area 3 frame height (min. 70 mm)
2 width of geometric area

Figure B.1 a) — Types of NSHEV for the simple assessment procedure



opening to the outside opening to the inside

Key

1 length of geometric area

2 distance between upper edges of open flap and ceiling (min. 500 mm)

3 ceiling

α opening angle

Figure B.1 b) —Types of wall mounted NSHEV for the simple assessment procedure

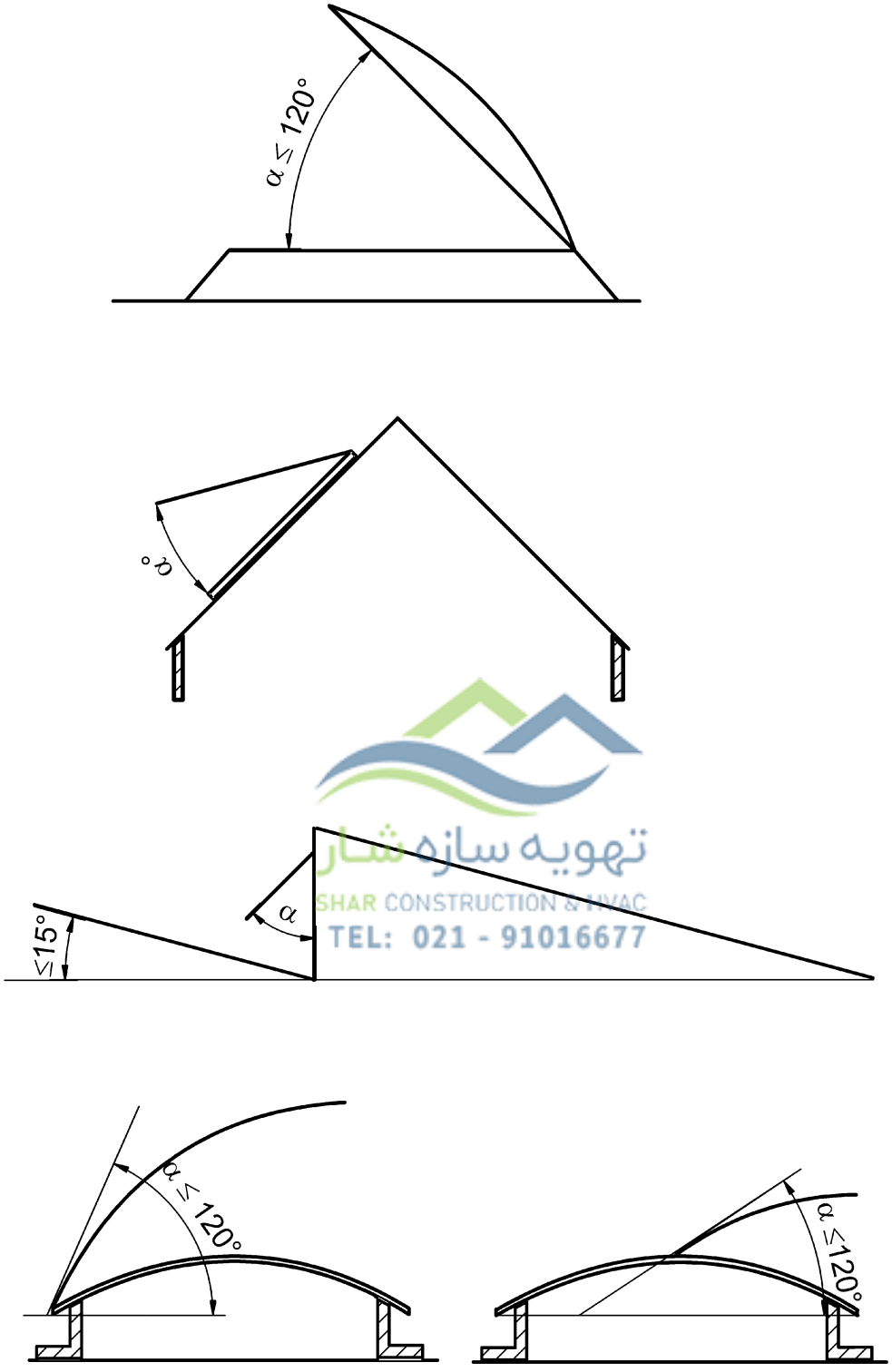
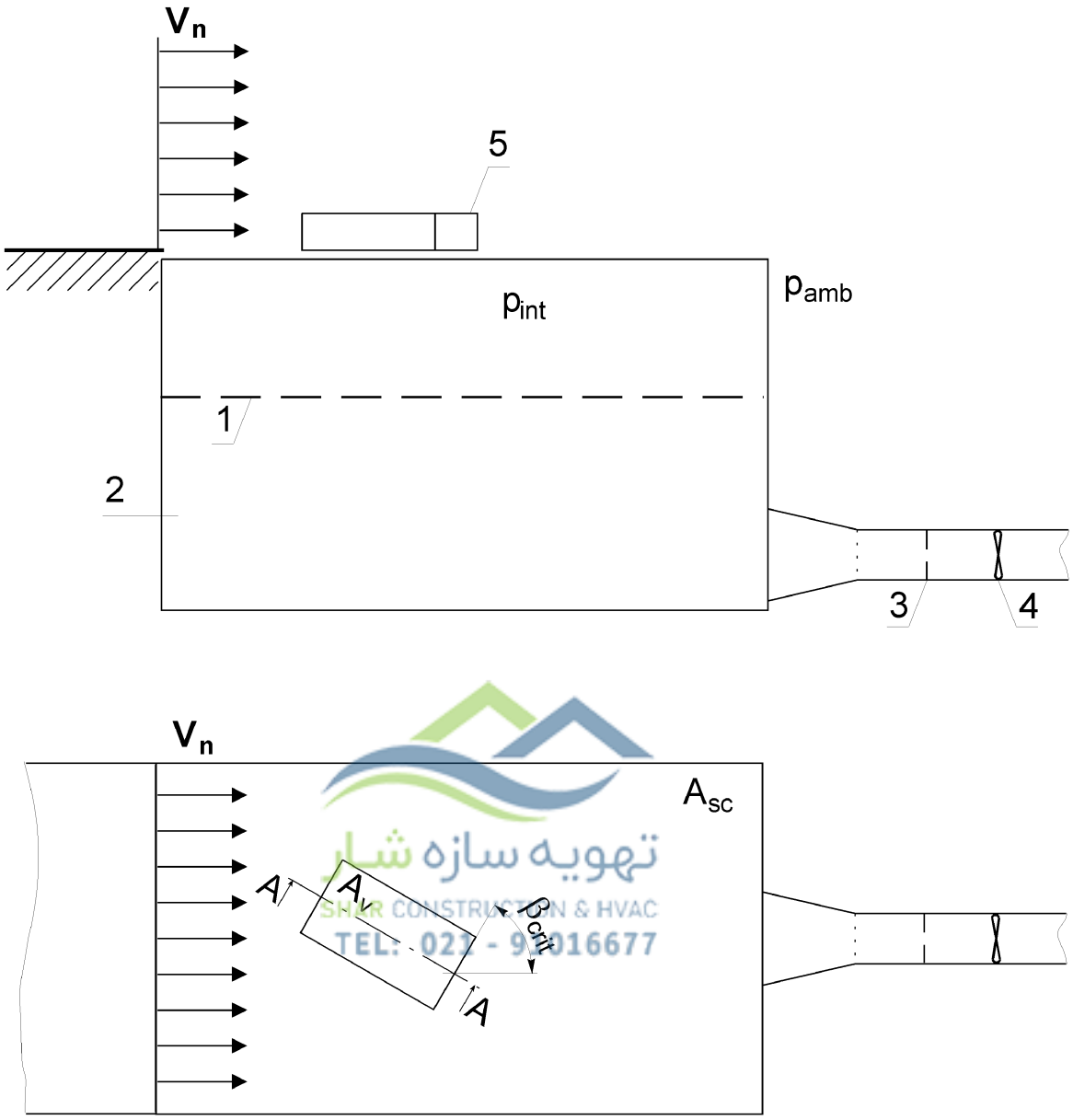


Figure B.2 — Examples of types of NSHEV probably leading to negative discharge



Key

1 screen

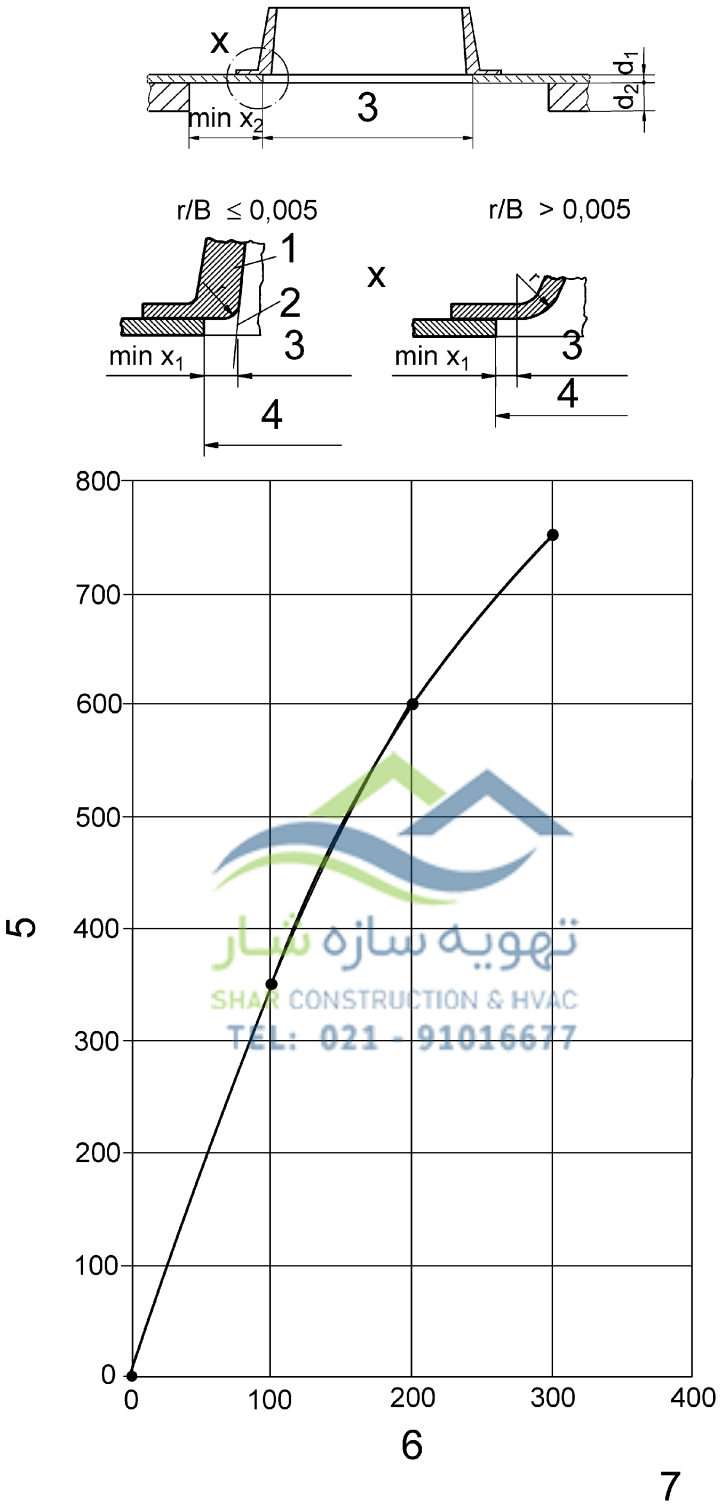
2 settling chamber

3 volume flow measurement

4 fan

5 NSHEV

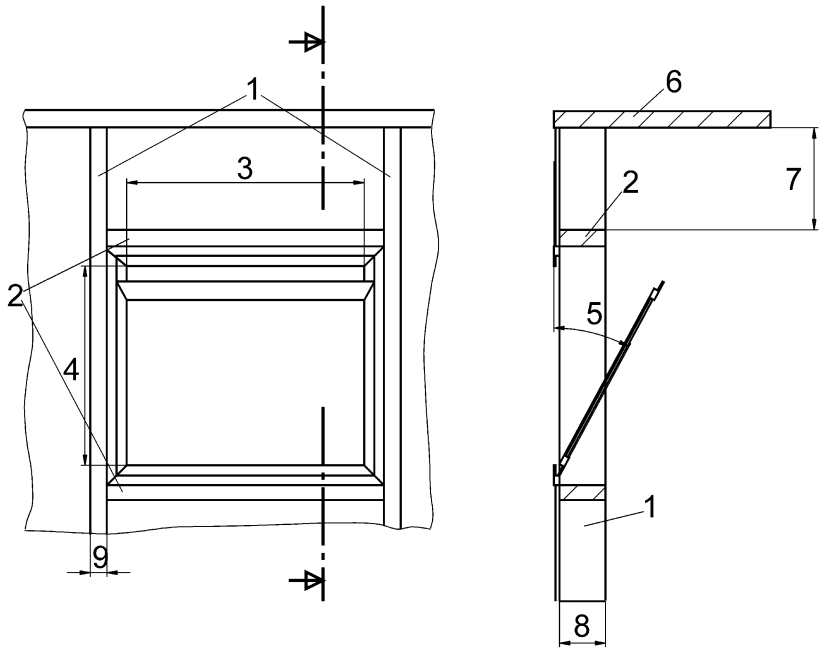
Figure B.3 — Schematic drawing of test set up for the determination of A_a



Key

1 NSHEV
2 tangent
3 geometric dimension of NSHEV
4 ceiling dimension
5 distance measure x_1 min and x_2 min, in mm
6 ceiling thickness d_1 and d_2, in mm
7 diagram to determine the distance for mounting the NSHEV on the ceiling of the settling chamber

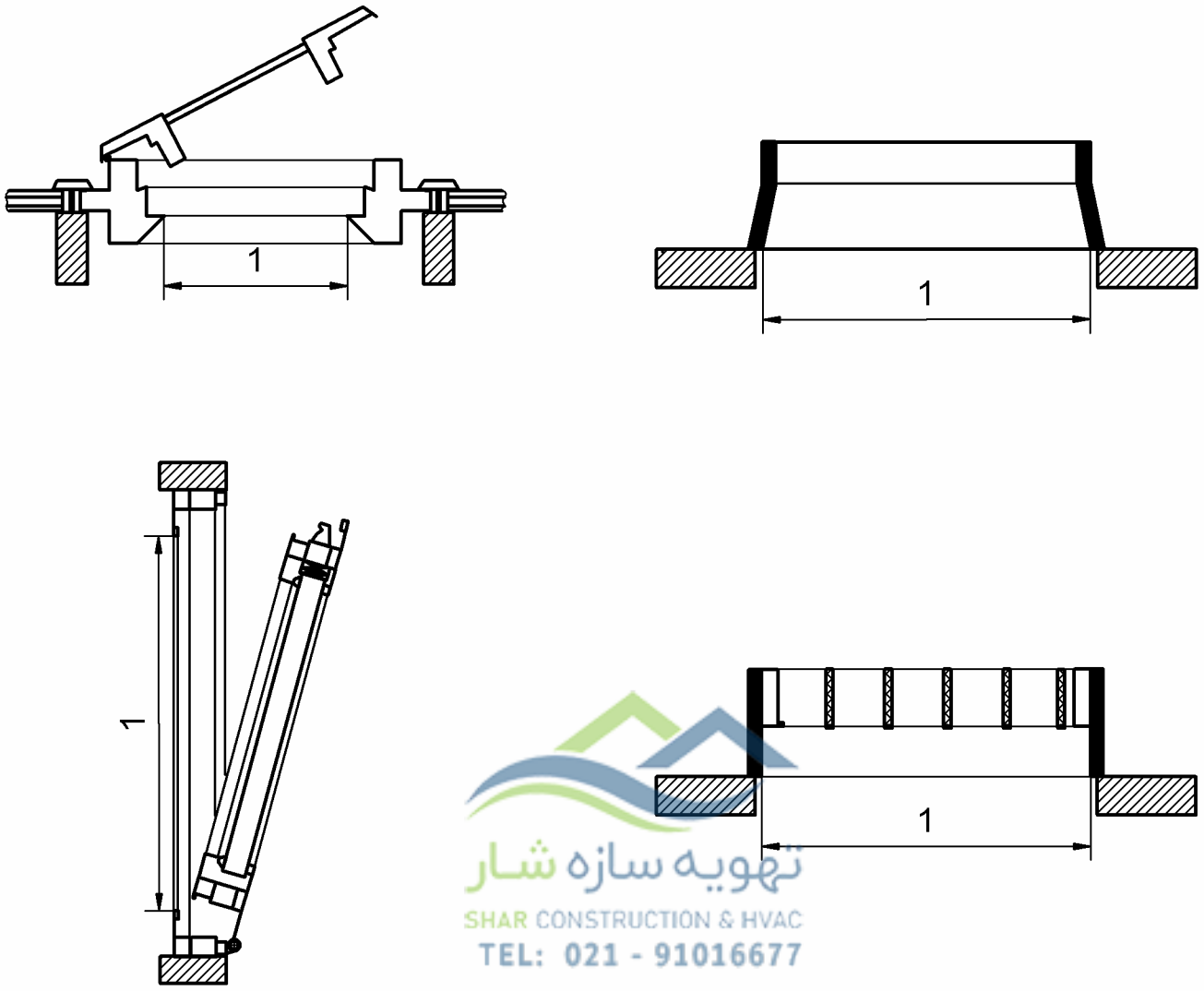
Figure B.4 a) — Data for the mounting of roof mounted and wall mounted NSHEV opening to the outside onto the settling chamber



Key

1 mullion
2 transom
3 width
4 height
5 opening angle α
6 ceiling
7 distance between upper transom and ceiling = 500 mm ± 50 mm
8 depth of mullion and transom = 150 mm ± 15 mm
9 width of mullion and transom = 50 mm ± 5 mm

Figure B.4 b) — Standard test arrangement for the mounting of wall mounted NSHEV opening to the inside onto the settling chamber

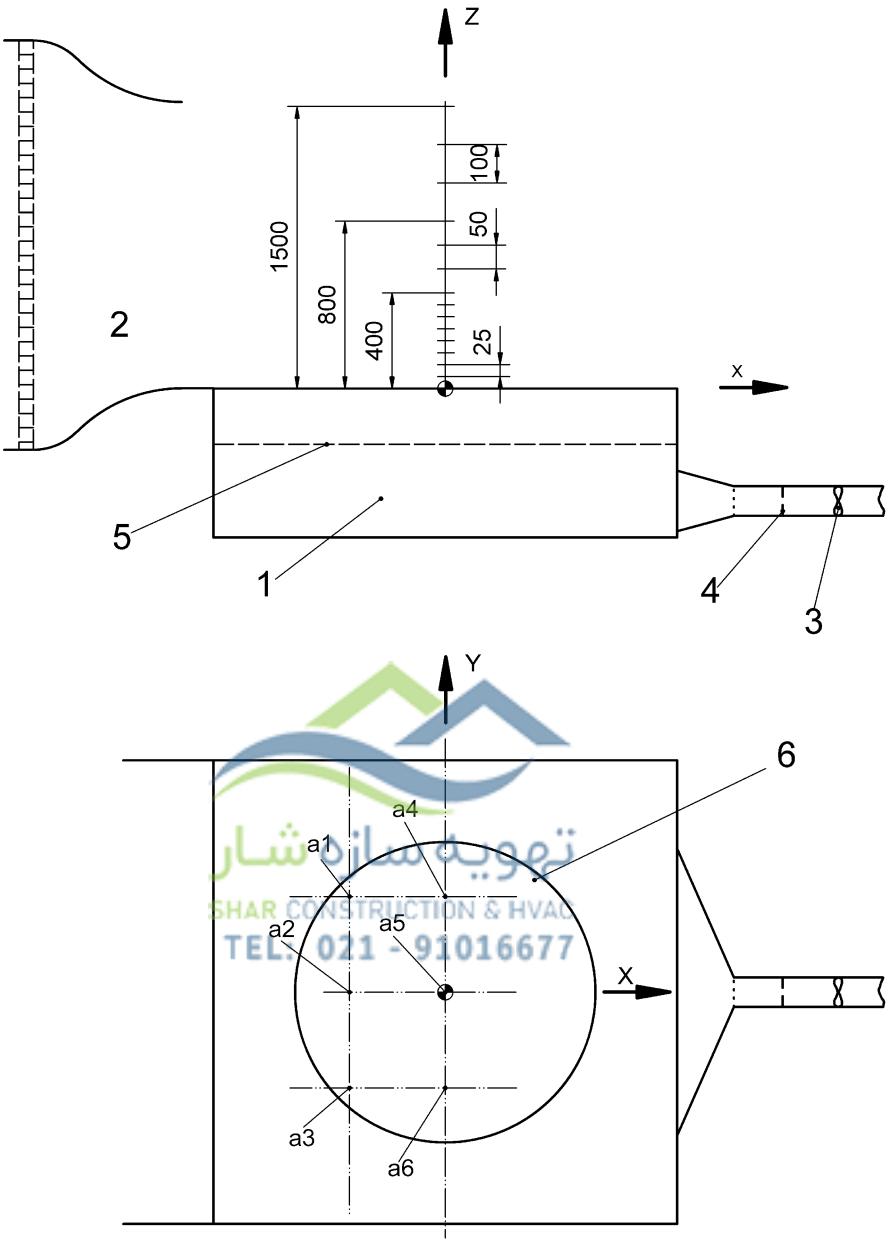


Key

1 length/height of geometric area (A_v = length/height x width)

Figure B.4 c) — Definition of geometric area

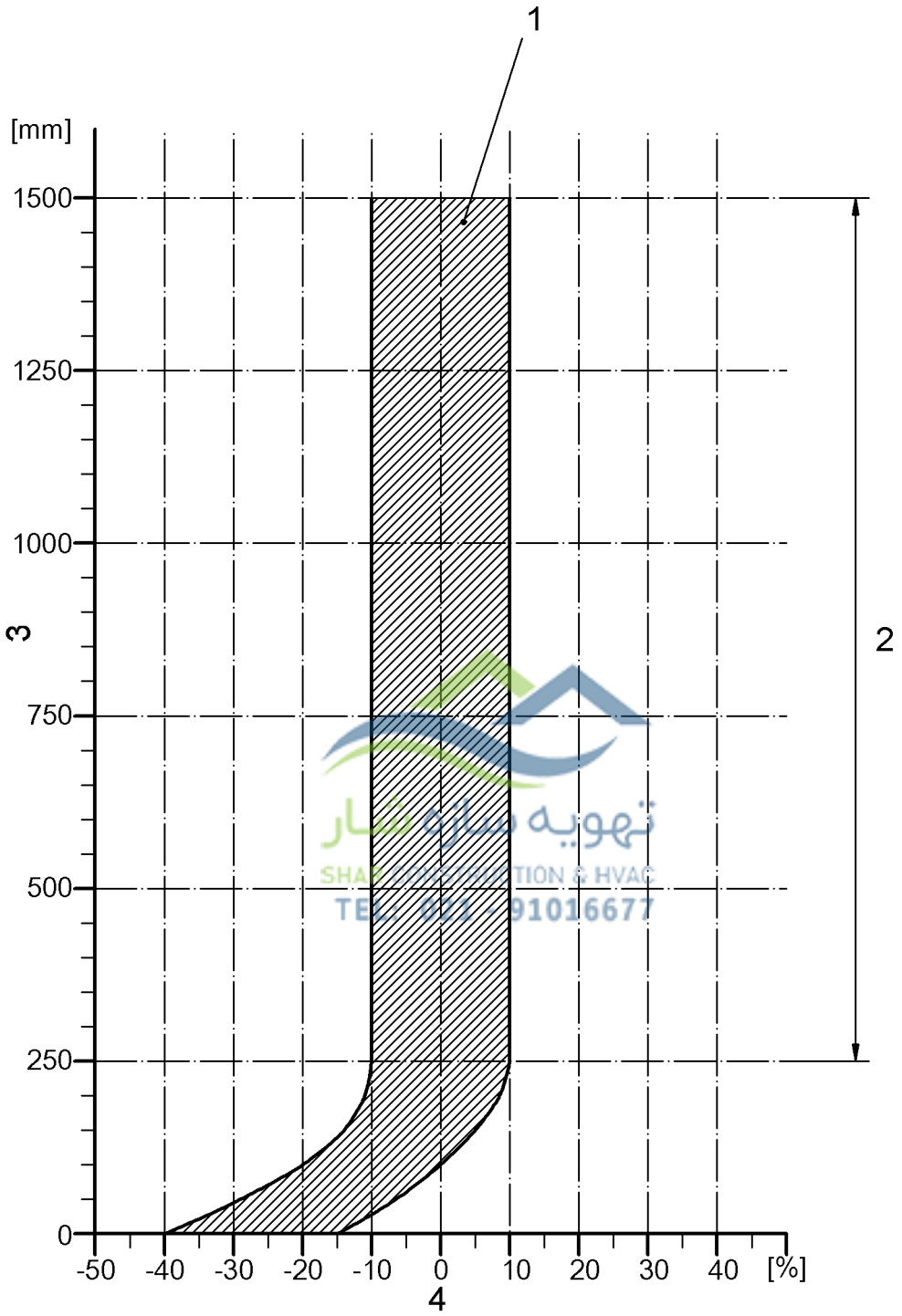
Dimensions in mm



Key

1 settling chamber
2 wind tunnel
3 fan
4 volume flow measurement
5 screen
6 turntable

Figure B.5 a) — Measuring positions for the side wind velocity and turbulence



Key

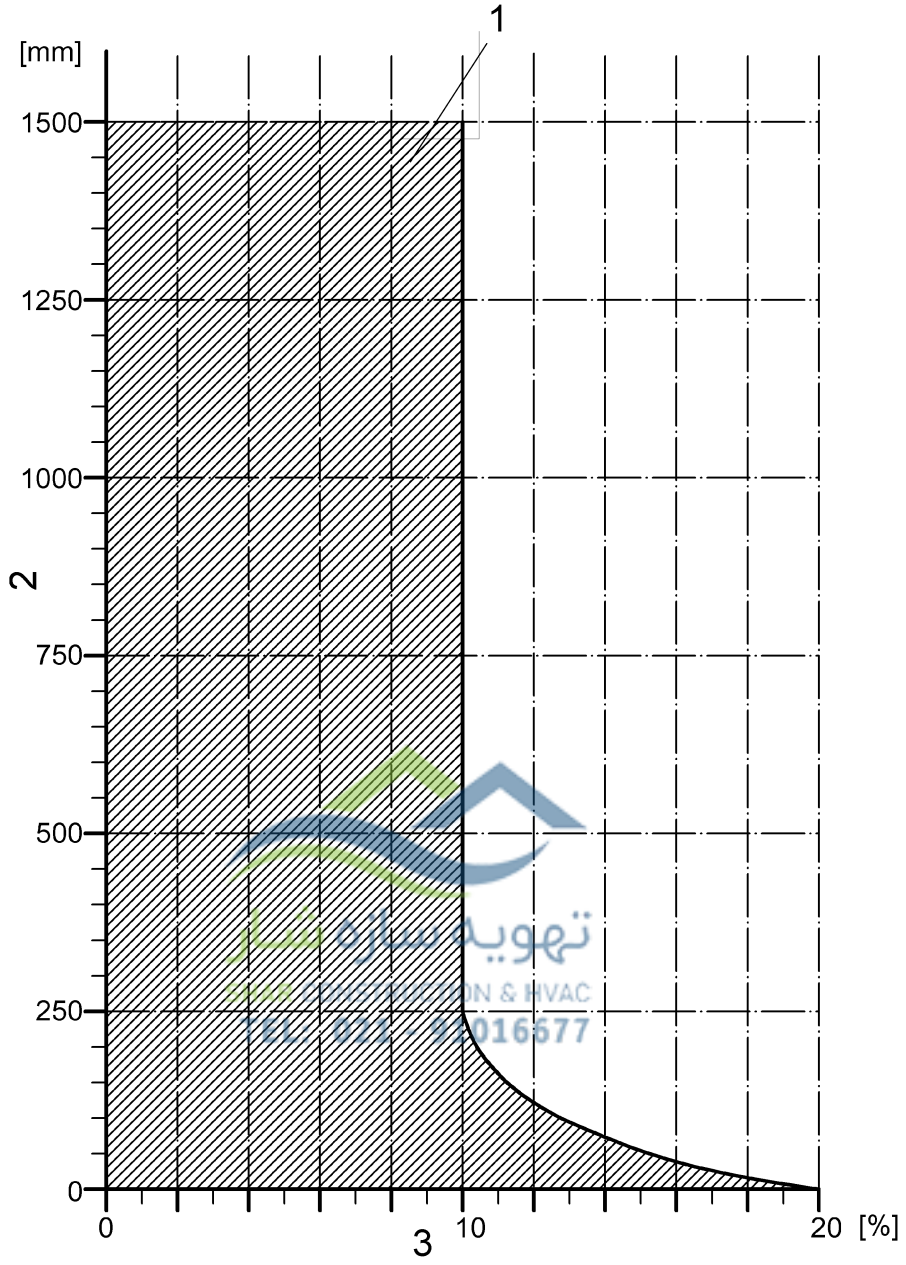
1 permissible relative local air speed (V_l/V_n)-*1*

2 area used to obtain the nozzle velocity V_n

3 height in mm

4 relative local air speed (V_l/V_n)-*1 in %*

Figure B.5 b) — Range of permissible relative local air speed



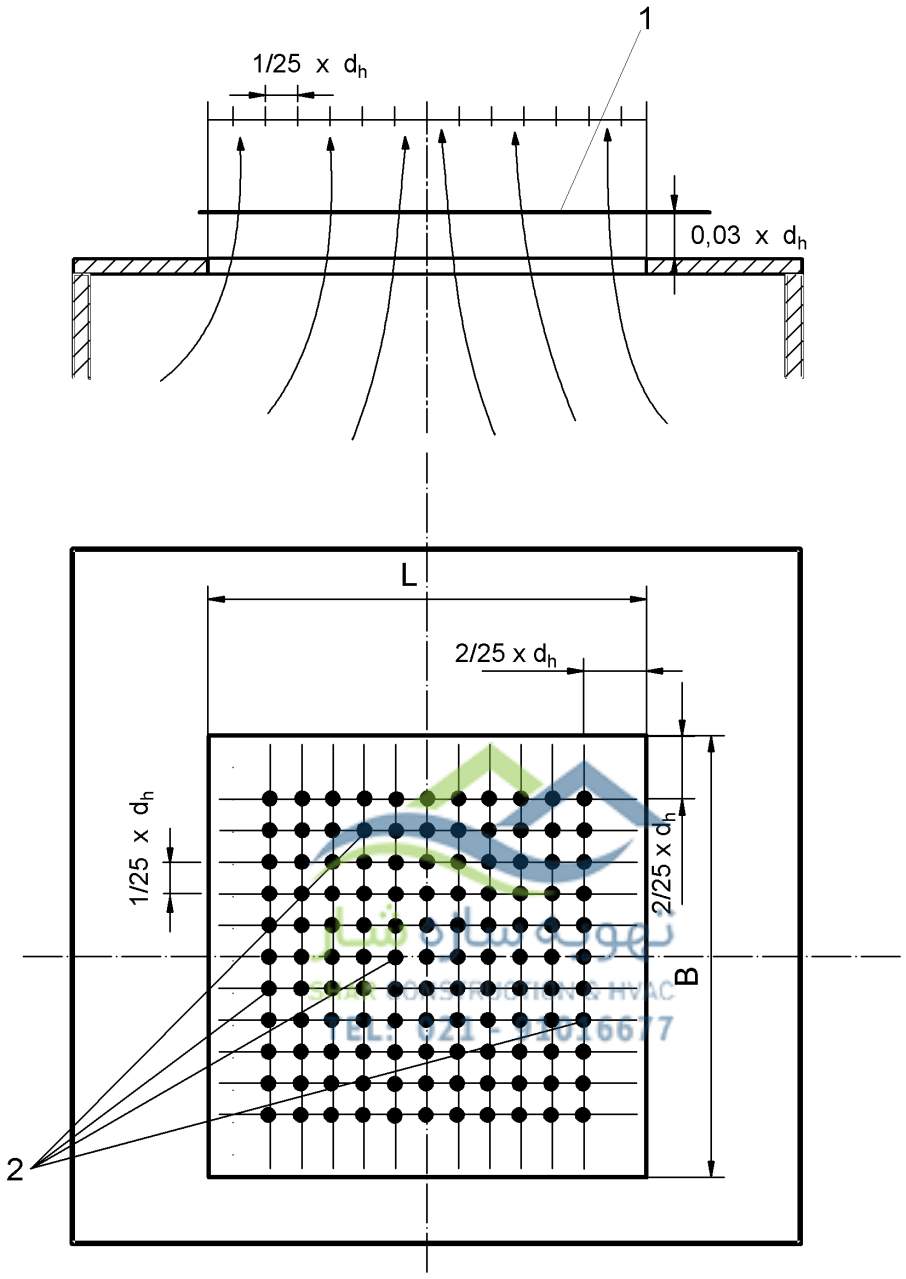
Key

1 permissible local turbulence in %

2 height in mm

3 local turbulence *in %*

Figure B.5 c) — Range of permissible local turbulence

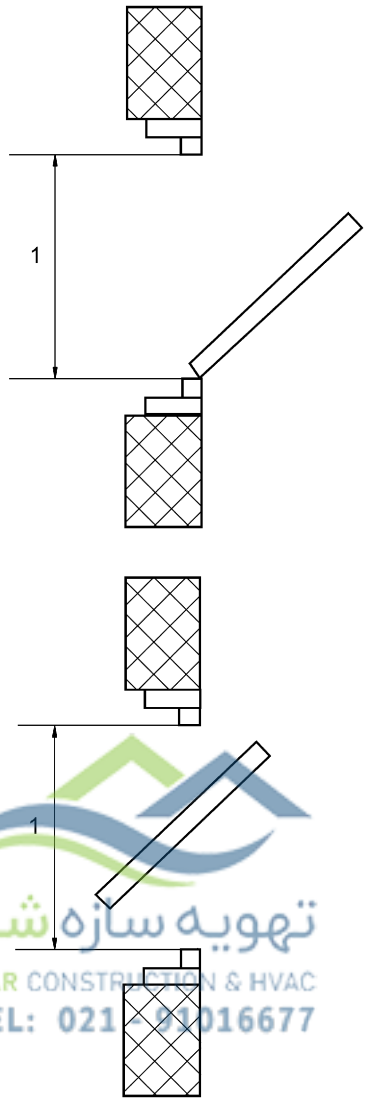


Key

1 plane of measurement

2 measuring points to determine V_{sc}

Figure B.6 — Measuring positions for the flow velocity in the exit opening of the settling chamber



Key

1 length

Figure B.7 — Geometric dimension of wall mounted NSHEV

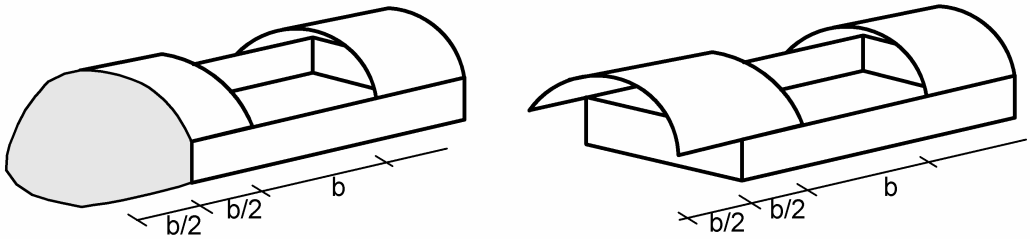
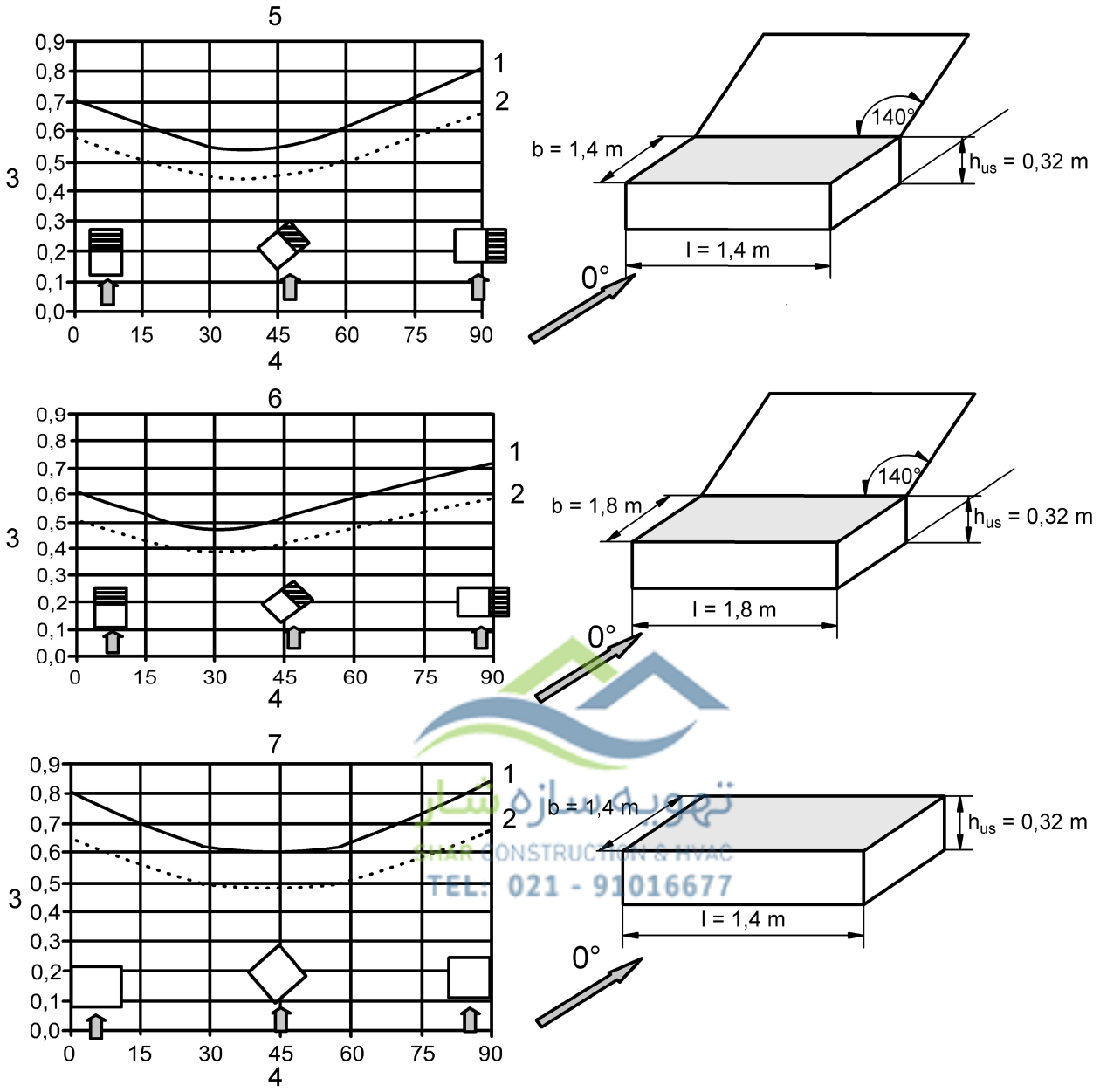


Figure B.8 — Aerodynamic boundary conditions and devices when testing SHEV for use in continuous roof-lights



Key

1 maximum C_V

2 minimum C_V

3 discharge coefficient C_V

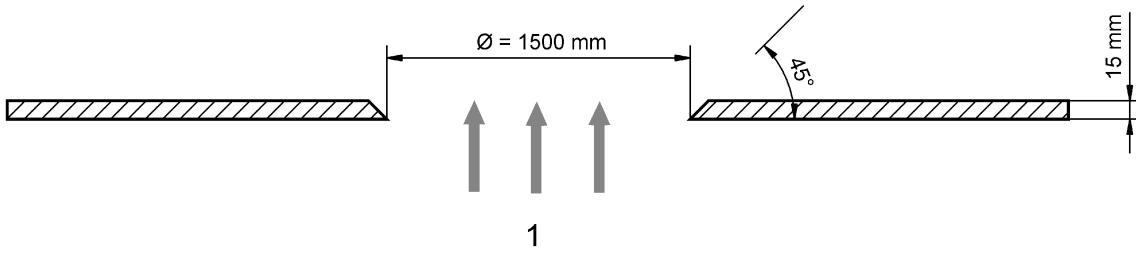
4 wind incidence angle (°)

5 ventilator with a single plate opening (A_V = 1,4 m x 1,4 m)

6 ventilator with a single plate opening (A_V = 1,8 m x 1,8 m)

7 simplified Ventilator (A_V = 1,4 m x 1,4 m)

Figure B.9 — Discharge coefficients for the reference tests with wind



Key

1 flow

Figure B.10 — Geometric details for full-scale installation for the reference test without side wind

Annex C
(normative)

Test method for operational reliability and response time

NOTE See 4.2.1, 4.3, 4.7.1 and 4.7.2.

C.1 Objective of test

The objective of this test is to determine the ability of the installed NSHEV to open and close for the number of cycles specified in A.3.

C.2 Test conditions

If tests are conducted outdoors and if no other atmospheric conditions are specified, e.g. for the low temperature test, the following environmental conditions shall be applied:

— Temperature: (15 ÷ 35) °C;

— Relative humidity: (25 ÷ 75) %;

— Air pressure (86 ÷ 106) kPa;

— max. permitted wind velocity 1 m/s.

For indoor testing in accordance with Annexes C, D and F the room temperature should be in the range of 15 °C to 35 °C.

C.3 Test apparatus

The NSHEV shall be mounted onto a test rig having an energy source to activate the opening and closing mechanism, and a device to automatically count the number of cycles.

C.4 Test specimen

A test on the NSHEV with the largest geometric area and a test on the NSHEV with the largest side length (both achieving the objective of the test) may be considered representative of all NSHEV in a particular range (where a NSHEV has both the largest area and the largest side length, only one test is necessary).

C.5 Test procedure

During the test, do not maintain, repair or replace any part involved in the opening or closing of the NSHEV. Mount the specimen NSHEV securely onto the test rig at the angle within the range of angles specified by the supplier and/or manufacturer which imposes the highest stresses on the NSHEV during use. Do not apply any external load to the NSHEV.

Using the NSHEV's energy source, or using an external energy source to simulate the effect of the NSHEV's energy source, open the NSHEV to the fire open position through the number of cycles in accordance with the reliability classification in A.3. Following this, open the NSHEV to the fire open position through three cycles using the NSHEV's energy source. The fire open position shall be reached in no more than 60 s.

There are two types of NSHEV:

— type A, which shall be opened into their fire open position;

— type B, which shall be opened into their fire open position and shall be closed remotely.

If the NSHEV is designed to be remotely opened and closed for on-site testing purposes, the NSHEV shall be closed in the test remotely using the NSHEV's closing mechanism during each cycle.

If the NSHEV is a dual purpose NSHEV carry out 10 000 cycles to the normal comfort ventilation position prior to the above test.

If more than one energy source may be used, the most critical energy source shall be chosen for the test.

Report any maintenance, repair or replacement of any part not involved in the opening or closing. Such maintenance, repair or replacement shall not constitute a failure of the test.

Annex D
(normative)

Test method for opening under load

NOTE See 4.2.2 and 4.6.1.

D.1 Objective of test

The objective of this test is to establish the ability of the NSHEV to open and remain open against an applied wind and snow load.

D.2 Test conditions

If tests are conducted outdoors and if no other atmospheric conditions are specified, e.g. for the low temperature test, the following environmental conditions shall be applied:

— Temperature: (15 ÷ 35) °C;

— Relative humidity: (25 ÷ 75) %;

— Air pressure (86 ÷ 106) kPa;

— max. permitted wind velocity 1 m/s.

For indoor testing in accordance with Annexes C, D and F the room temperature should be in the range of 15 °C to 35 °C.

D.3 Test apparatus

Use a test rig onto which the NSHEV can be mounted and subjected to a test snow load applied by one of the following methods:

— plates (one or more per louvre blade/flap when testing louvre-type NSHEV);

— bags containing up to 5 kg each of solid particles or liquid;

— or, for NSHEV with pivoting flaps, both the test snow load and the wind load may be replaced by equivalent torque leading to the same torque/opening angle relation. If the wind load is replaced by an equivalent torque the method to obtain the correct torque/opening angle relation shall be clearly documented in the test report.

Spread the loads evenly over the whole of the external surface of the individual elements of the opening parts of the NSHEV, to produce a uniformly distributed load equal to the appropriate load specified in A.6.

For NSHEV in which, under practical conditions involving wind, flaps are opened into the wind flow, carry out the test with a side wind with a distribution of side wind speed (10 ± 1) m/s taken over the projection area of the NSHEV, in the direction critical for opening, i.e. leading to the largest wind resistance against opening, in addition to the test snow load.

NOTE The torque/opening angle relation is usually obtained in a wind tunnel test by measuring the pressure distribution around the NSHEV flap for various opening angles.

D.4 Test specimen

A test on the NSHEV with the largest geometric area and a test on the NSHEV with the largest side length (both achieving the objective of the test) may be considered representative of all NSHEV in a particular range (where a NSHEV has both the largest area and the largest side length, only one test is necessary).

If a range of NSHEV includes different types of flaps, e.g. flaps of different weight, the NSHEV with the most critical type of flap shall be tested.

D.5 Test procedure

Mount the NSHEV onto the test rig at the most critical installation angle taking into account the range of installation angles specified by the manufacturer. Apply the appropriate load. Actuate the NSHEV and check that it opens, reaches the fire open position within 60 s and remains in the fire open position without an external energy supply, without damage, using the primary energy source. Reset the NSHEV and repeat the actuation test a further two times, applying the same opening requirement.

Annex E
(normative)

Test method for low ambient temperature

NOTE See 4.2.3 and 4.6.2.

E.1 Objective of test

The objective of this test is to establish the ability of the NSHEV to operate at low ambient temperature.

E.2 Test apparatus

Use the test apparatus described in D.3.

E.3 Test specimen

A test on the most critical NSHEV tested in accordance with Annex D may be considered representative of all NSHEV in a particular range, for the purpose of the ambient temperature test.

E.4 Test procedure

A test with a complete NSHEV shall be conducted.

Mount the NSHEV in a climatic chamber at the most critical installation angle within the manufacturer's recommended range of installation angles. Reduce the temperature in the climatic chamber to the appropriate value specified in A.6. The NSHEV shall be cooled down to the temperature specified in A.6 prior to testing. It shall be ensured that the deviation of the sample temperature during the performance of the test is not greater than $^{+2}_{-5}$ °C of the appropriate value specified in A.6. Open the NSHEV three times into its fire open position using the NSHEV's primary energy source. Roof-mounted NSEV shall be loaded with snow load in accordance with the snow load classification of the NSHEV in accordance with Annex D.

Annex F
(normative)

Test method for stability under wind load

NOTE See 4.6.3 and 4.6.4.

F.1 Objective of test

The objectives of this test are to establish the integrity of the NSHEV under loads imposed by the wind and that the NSHEV remains closed and that it will open into its fire open position within 60 s after being subjected to the wind load.

F.2 Test conditions

If tests are conducted outdoors and if no other atmospheric conditions are specified, e.g. for the low temperature test, the following environmental conditions shall be applied:

— Temperature: (15 ÷ 35) °C;

— Relative humidity: (25 ÷ 75) %;

— Air pressure (86 ÷ 106) kPa;

— max. permitted wind velocity 1 m/s.

For indoor testing in accordance with Annexes C, D and F the room temperature should be in the range of 15 °C to 35 °C.

F.3 Test apparatus

Use a test rig onto which the NSHEV can be mounted and subjected to a uniformly distributed load applied by one of the following methods:

a) air pressure;

b) air pressure bags;

c) plates or bags containing not more than 10 kg of solid particles or liquids.

F.4 Test specimen

A test on the NSHEV with the largest geometric area and a test on the NSHEV with the largest side length (both achieving the objective of the test) may be considered representative of all NSHEV in a particular range (where a NSHEV has both the largest area and the largest side length, only one test is necessary).

F.5Test procedure

F.5.1 Wind load

Mount the NSHEV on the test rig in accordance with the supplier's and/or manufacturer's recommendations. Apply a load using one of the methods given in F.3, increasing the load from zero to the appropriate upper limit specified in A.6, and maintain this load for (10 ± 1) min. For multi-layer flaps apply this load to the outer layer to simulate the wind load correctly. Remove the load.

Roof mounted NSHEV and wall mounted NSHEV opening to the outside shall be subjected to a suction load wall mounted NSHEV opening to the inside shall be subjected to a pressure load.

On completion of the test, the NSHEV, in its normal operating position, shall be opened without the applied load and remain in the fire open position without an external energy supply.

F.5.2 Vibration

The vibrational behaviour of wind deflectors concerning wind induced vibration shall be characterized by the structure's lowest natural frequency and the logarithmic decrement of damping of free oscillation. The natural frequency and the logarithmic decrement of damping can be determined e.g. with an accelerometer fixed to the wind deflector.

For vibration measurements, the NSHEV shall be fixed and secured firmly to:

— the concrete floor or

— a steel floor or

— a wood frame fitted on the floor or

— a steel frame fitted on the floor.

The obtained acceleration versus time trace shall be evaluated to give the natural frequency and logarithmic decrement.

Annex G
(normative)

Test method for resistance to heat

NOTE See 4.2.4 and 4.6.4.

G.1 Objective of the test

The objective of this test is to establish the ability of the installed NSHEV to open within 60 s under exposure to heat and to remain in the fire open position with not more than 10 % reduction of the throat area.

The resistance to heat and the mechanical stability are given if all parts relevant for the aerodynamic performance of the NSHEV, e.g. wind deflectors and flaps, and all structural parts remain in place.

NOTE The aerodynamic performance is influenced even if a part of the flap or the whole flap is destroyed or falls down before the end of the test.

G.2 Test apparatus

G.2.1 Test furnace

Use a furnace to which the NSHEV is connected directly.

The furnace may be heated by any convenient means. The test apparatus shall not allow the combustion zone of flames to contact the NSHEV.

Suitable test furnaces are specified in EN 1363-1.

G.2.2 Temperature measurement

Measure the furnace temperature using four thermocouples located in accordance with Figures G.1 to G.3. The thermocouple No 3 is used for information only for the working group to continue the work on a future revision of the standard. The thermocouples shall have measuring junctions of nickel chromium/nickel aluminium (type K) wire as defined in EN 60584-1 contained within mineral insulation in a heat resisting alloy sheath of diameter (3 ± 0,2) mm, the hot junctions being electrically insulated from the sheath. The thermocouple hot junction shall project at least 25 mm from any given support tube if used. An example of a thermocouple is given in Figure G.4.

G.2.3 NSHEV mount

G.2.3.1 Roof mounted NSHEV

Use a mount constructed from materials which do not distort when subjected to the test temperature, with an opening area equal in size to the geometric area of the NSHEV (including rooflight parts or glazed partition constructions, when existing, so that these parts are also exposed, see G.3.2 and G.3.3), and with the mount surface pitched at the minimum recommended installation angle for the NSHEV. An example of roof-mounted NSHEV is given in the Figures G.1 and G.2.

G.2.3.2 Wall mounted NSHEV

Wall mounted NSHEV may be tested in a vertical furnace or a horizontal furnace. When using a vertical furnace, cf. Figure G.3 b), mount the NSHEV in a vertical wall. When using a horizontal furnace, cf. Figure G.3 a), mount the test specimen in a holding device which is fixed on the top of the furnace

with a horizontal opening from materials which do not distort when subjected to the test temperature, with openings on no more than two opposite sides each equal in size to the geometric area of the NSHEV (including the area of continuous partition construction, when existing, so that these parts are also exposed, see G.3.2), and with the mounting surface pitched at the installation angle for the NSHEV. An example of wall mounted NSHEV is given in Figures G.3 a) and b).

NOTE It is possible to test up to two NSHEV in opposite sides in the same test. Then it is possible that one NSHEV fails and the other one passes the test, provided the two NSHEV do not influence each other and no part of the failed NSHEV drops down on the other NSHEV.

G.3 Test specimen

G.3.1 General

A test on the widest worst case NSHEV and a test on the longest worst case NSHEV (both with its largest geometric area achieving the objective of the test) may be considered representative of all NSHEV in a particular range given in Tables G.1 and G.2 (where a NSHEV is the widest and the longest, only one test is necessary). The NSHEV with the most critical material and most critical parts (e.g. with regard to high temperature and distortion under heat, weight etc.) shall be selected for the test. Where a most critical combination cannot be identified more than one test specimen might be necessary. If the same NSHEV can be equipped with the opening mechanism exposed to the furnace atmosphere or at the unexposed side, the NSHEV with the opening mechanism exposed to the furnace atmosphere shall be selected. The NSHEV with the opening mechanism at the unexposed side can be covered by the NSHEV with the opening mechanism exposed to the furnace atmosphere, if the fixation of the opening mechanism is equivalent.

The results of previous tests to this standard on similar ranges of products from the same manufacturer may be taken into account when selecting the test specimens for a product range.

G.3.2 NSHEV mounted to a glazed partition construction

For wall and roof mounted NSHEV designed as part of a continuous glazed partition construction, the test specimen shall be tested as a part of the continuous glazed partition construction having a minimum width of 250 mm on all sides surrounding the NSHEV, including transoms/mullions and/or glazing profiles as representative.

The continuous glazed partition construction can be omitted if the NSHEV is a structurally self-supporting system and is independent of the continuous glazed partition construction, i.e. that static and dynamic forces will not be transferred to the continuous glazed partition construction, but directly to the load bearing structure. The materials of the filling of the continuous glazed partition construction shall be classified as Class A1 or A2 in accordance with EN 13501-1 and the melting point of this material shall be higher than the heat exposure classification temperature, otherwise the test shall include the continuous glazed partition construction.

NOTE These tests with additional parts of the continuous glazed partition construction give information about warping of the extrusions used under heat exposure.

G.3.3 Roof mounted NSHEV as part of a continuous rooflight

For roof mounted NSHEV designed as part of a continuous rooflight the test specimen shall be tested with parts of the rooflight with a minimum width of 250 mm on either side of the NSHEV parallel to the line of the rooflight.

The continuous rooflight may be omitted if the NSHEV is a structurally self-supporting system and is independent of the continuous rooflight, i.e. that static and dynamic forces will not be transferred to the continuous rooflight, but directly to the load bearing structure of the roof. The materials of the filling of the continuous rooflight shall be classified as Class A1 or A2 in accordance with EN 13501-1 and the

melting point of this material shall be higher than the heat exposure classification temperature, otherwise the test shall include the continuous rooflight.

NOTE The tests with additional parts of the rooflight give information about warping of the extrusions under heat exposure.

G.3.4 Wall mounted NSHEV

Select the worst case of the wall mounted NSHEV in accordance with Tables G 1 and G.2 for testing. All other opening types are covered by testing the worst case opening type.

G.3.5 Roof mounted NSHEV

Select the worst case of the NSHEV in accordance with Table G.1 for testing. All other opening types are covered by testing the worst case opening type.

Table G.1 — Top hung NSHEV, bottom hung NSHEV and side hung NSHEV

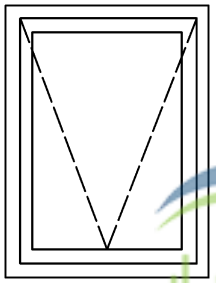
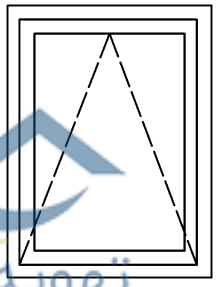
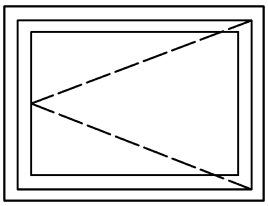
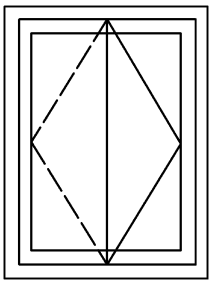
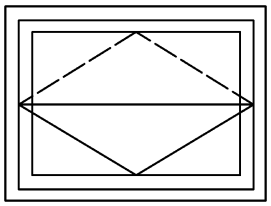
Range of NSHEV	Top hung NSHEV with the hinges at the top	Bottom hung NSHEV with hinges at the bottom	Side hung NSHEV with the hinges at the side
			
	a **b**	**a** **b**	**a** **a**
opening to the outside	Case 1: Worst case	Case 2: Covered by case 1	Case 3: Covered by case 6
opening to the inside	Case 4: Covered by case 5	Case 5: Worst case	Case 6: Worst case
Key a width / height b length			

Table G.2 — NSHEV with horizontal or vertical middle axis

Range of NSHEV	NSHEV with hinges in the middle of the top and the bottom	NSHEV with hinges in the middle at the sides
	a  **b**	**a**  **b**
opening to the outside and the inside	Case 8: Covered by case 7	Case 7: Worst case
Key a width / height b length		

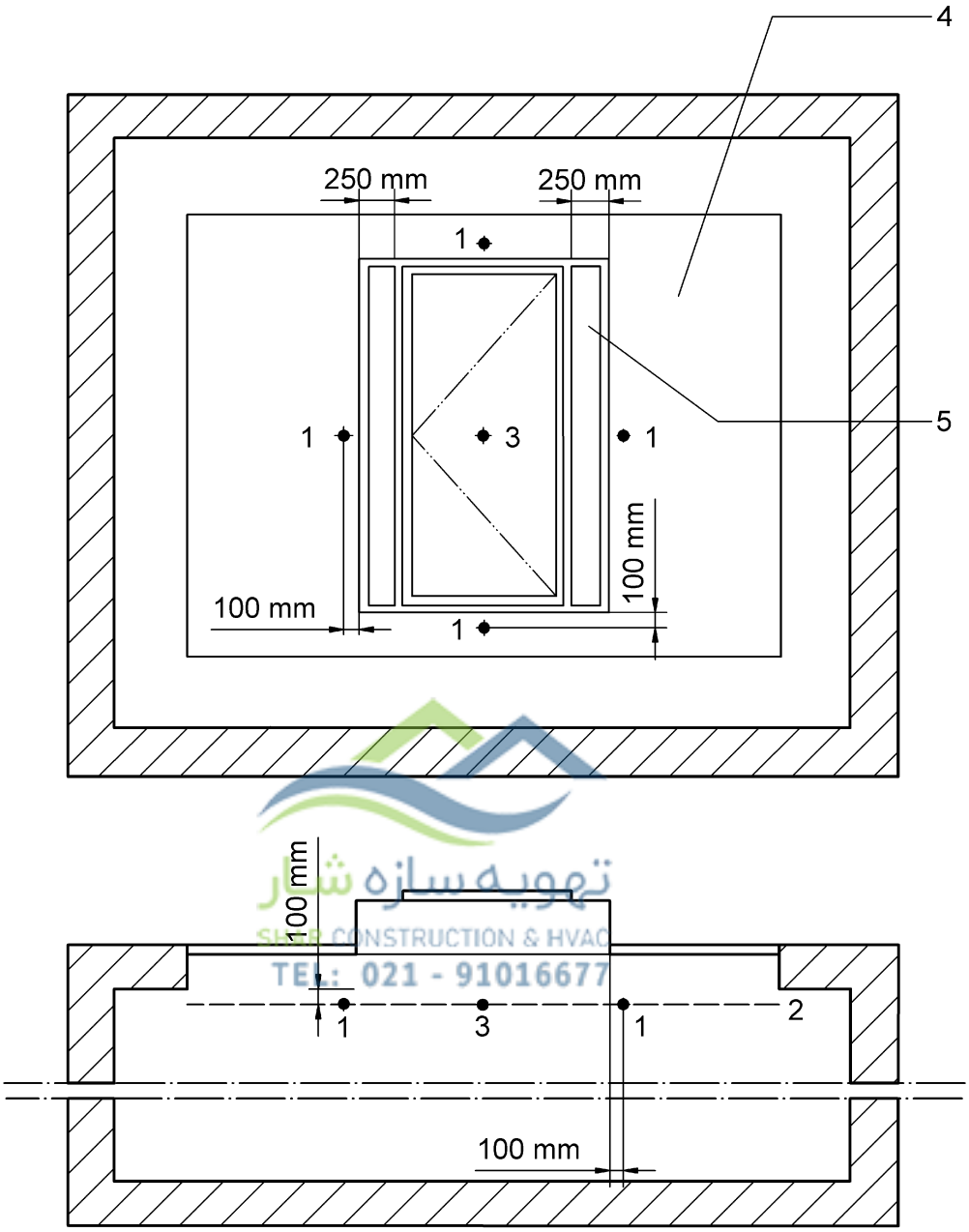
G.4 Test procedure

Fix the NSHEV securely to the furnace and ensure that the mounting opening lines up with the geometric area of the NSHEV.

Increase the furnace temperature from $20 \pm^{10}_{10}$ °C following a gradient between limits defined by 0,8 K/s and 1,2 K/s to reach a mean temperature in the plane of measurement of $(300 \pm^{60}_{0})$°C within 5 min or $(600 \pm^{60}_{0})$°C within 10 min (all from the start of the test) as appropriate (see A.6). This temperature shall be maintained for the remaining test time (except for the 5 min following the NSHEV actuation). The total test time shall be 30 min. For the first 2 min after starting the burners no temperature tolerance is defined. For the first 5 min the NSHEV shall remain closed. The NSHEV shall be initiated manually into its fire open position within 60 s, 5 min after the furnace temperature starts to rise. If the NSHEV is fitted with a thermal device neutralize the thermal device from the opening mechanism which then will be operated manually.

For a period of 5 min after actuating the NSHEV, the tolerances applying to the furnace temperature are enlarged to ± 100 °C. The temperature/time-curve of the whole test procedure is shown in Figure G.5.

Check, at least by observation, that the throat area, see Figure G.6, has not been reduced by more than 10 % during the test and measure the opening at the end of the test.



Key

1 thermocouple

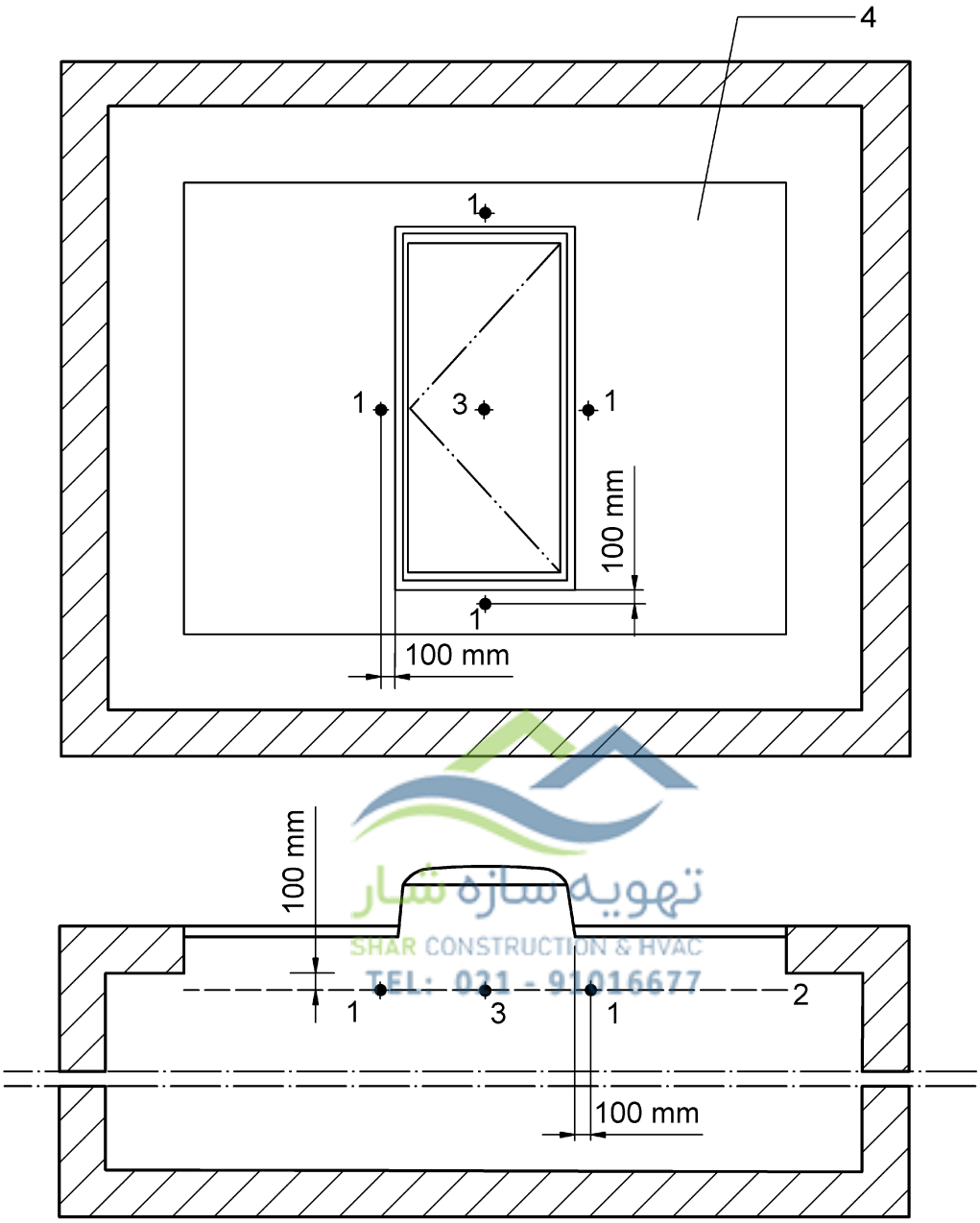
2 plane of measurement

3 thermocouple for information only (position: In the plane of measurement central under the NSHEV)

4 mount constructed above the furnace opening

5 rooflight parts

Figure G.1 — Position of thermocouples for roof-mounted NSHEV with rooflight parts



Key

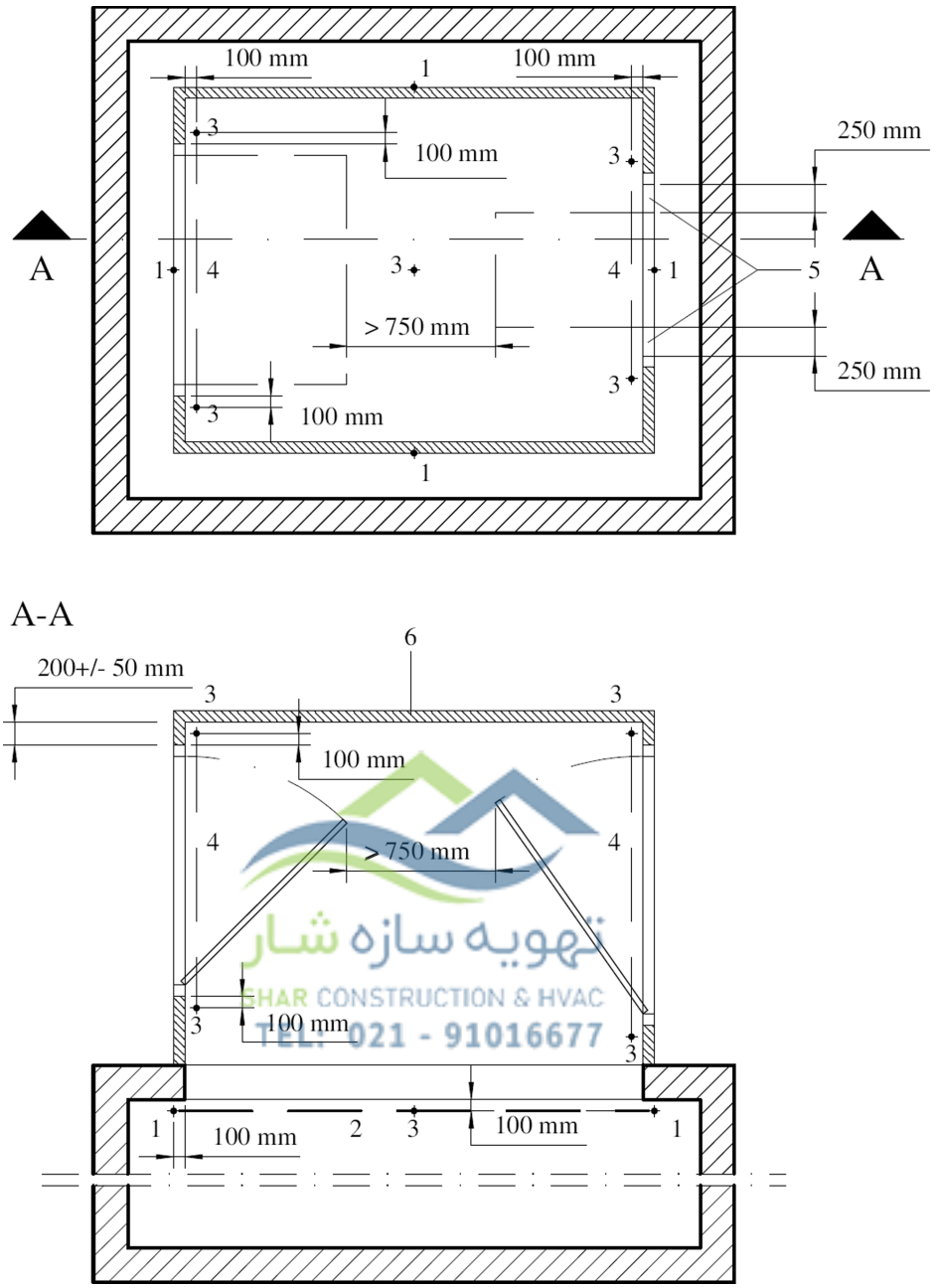
1 thermocouple

2 plane of measurement

3 for information only (position: In the plane of measurement central under the NSHEV)

4 mount constructed above the furnace opening

Figure G.2 — Position of thermocouples for roof-mounted NSHEV without rooflight parts



Key

1 thermocouple

2 plane of measurement

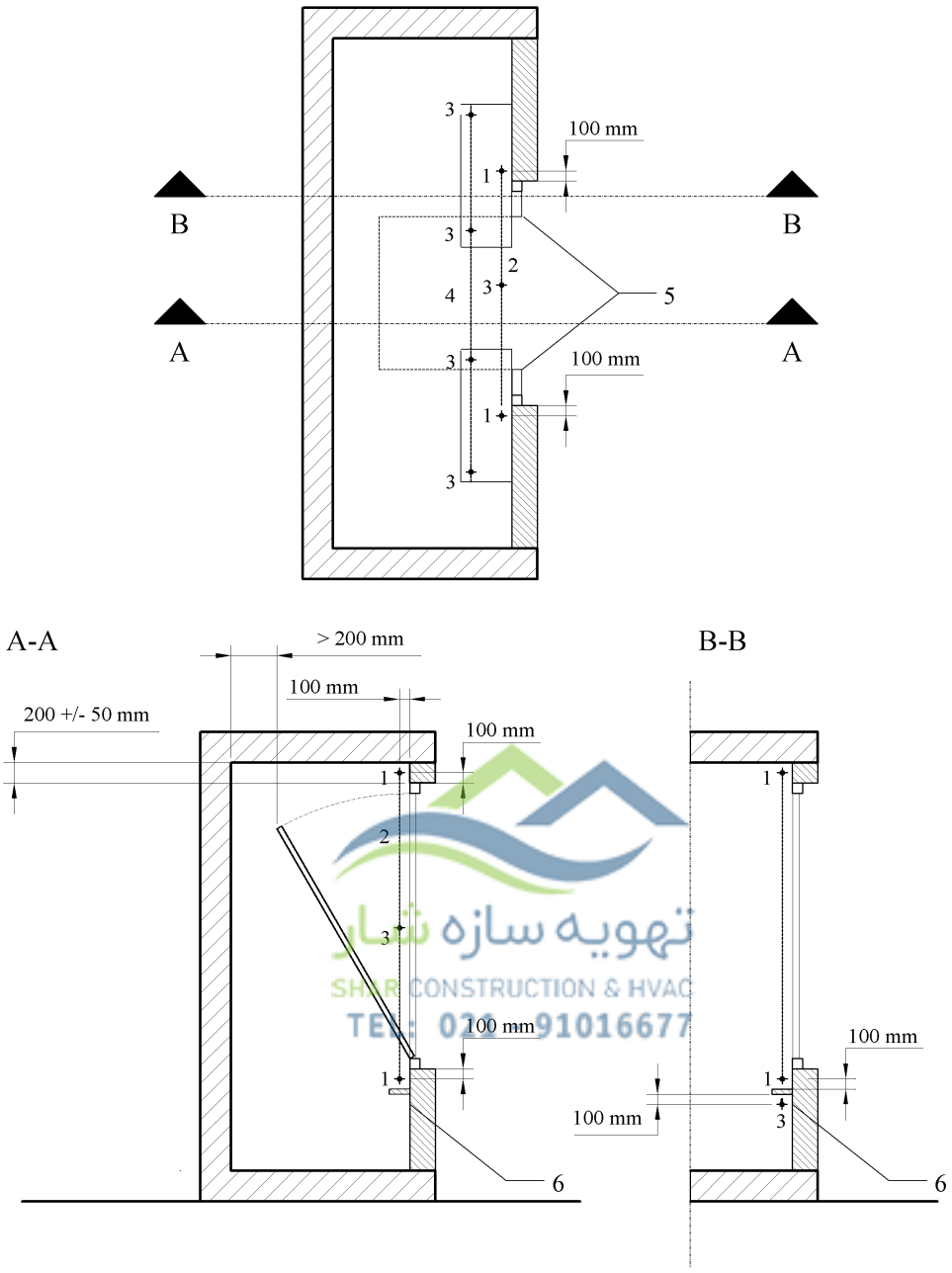
3 for information only (position: one thermocouple in the plane of measurement central under the opening of the specimen holding device and 4 thermocouples around each test specimen in the middle of each side 100 mm towards inside and 100 mm distance to the test specimen)

4 for information only (plane of the thermocouples 3)

5 parts of the glazing facades if required (see G.3.3)

6 specimen holding device fixed on the top of the furnace

Figure G.3a — Position of thermocouples for wall-mounted NSHEV



Key

1 thermocouples

2 plane of measurement

3 for information only (position: One thermocouple in the plane of measurement central under the opening of the specimen holding device and 4 thermocouples around each test specimen in the middle of each side 100 mm towards inside and 100 mm distance to the test specimen)

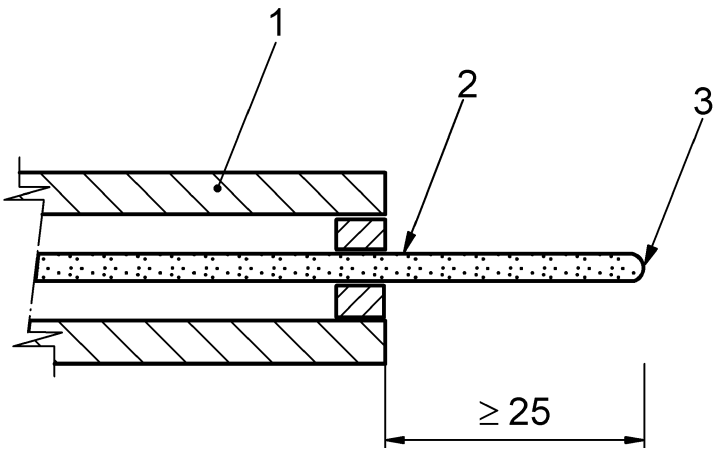
4 for information only (plane of the thermocouples 3)

5 parts of the glazing facades if required (see G.3.3)

6 furnace wall with implemented horizontal board covering the for information only thermocouples in the plane 4, 200 mm underneath the test specimen with a width of 200 mm

Figure G.3b — Position of thermocouples for wall-mounted NSHEV

Dimensions in millimetres



Key

1 heat resisting alloy steel tube

2 (3 ± 0,2) mm diameter sheathed thermocouple

3 hot junction

Figure G.4 — Example of thermocouple assembly in support tube

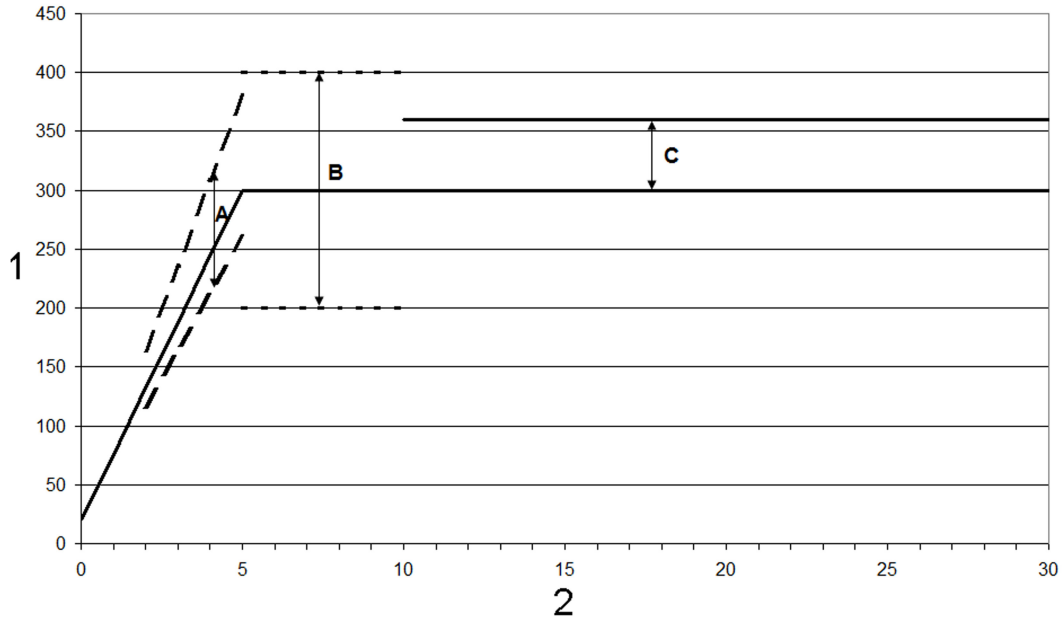


Figure G.5a

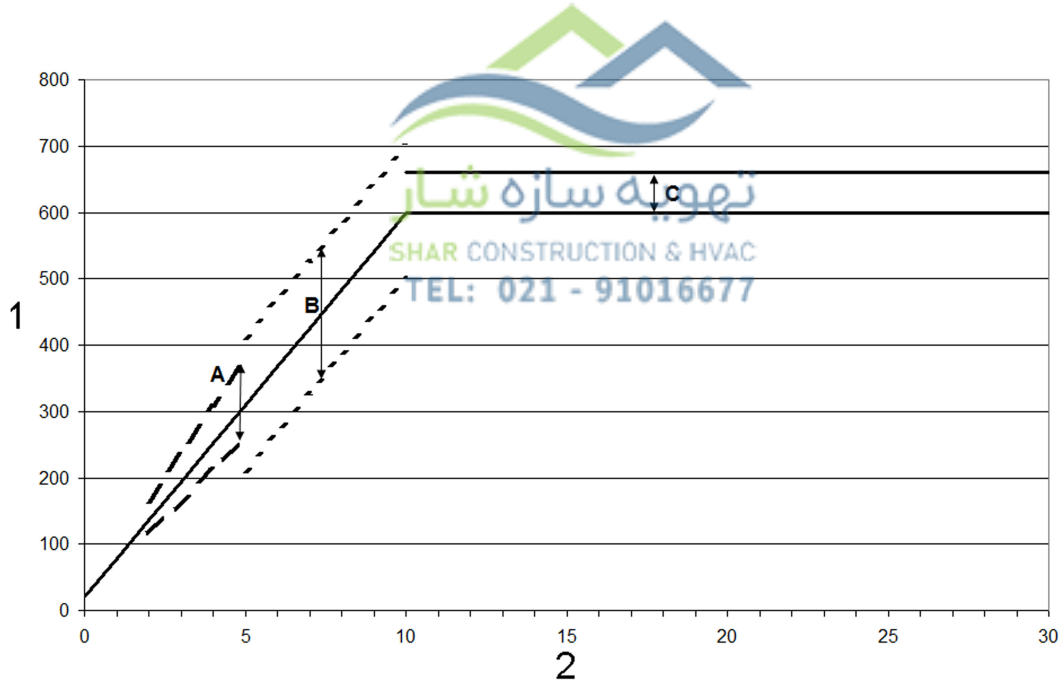
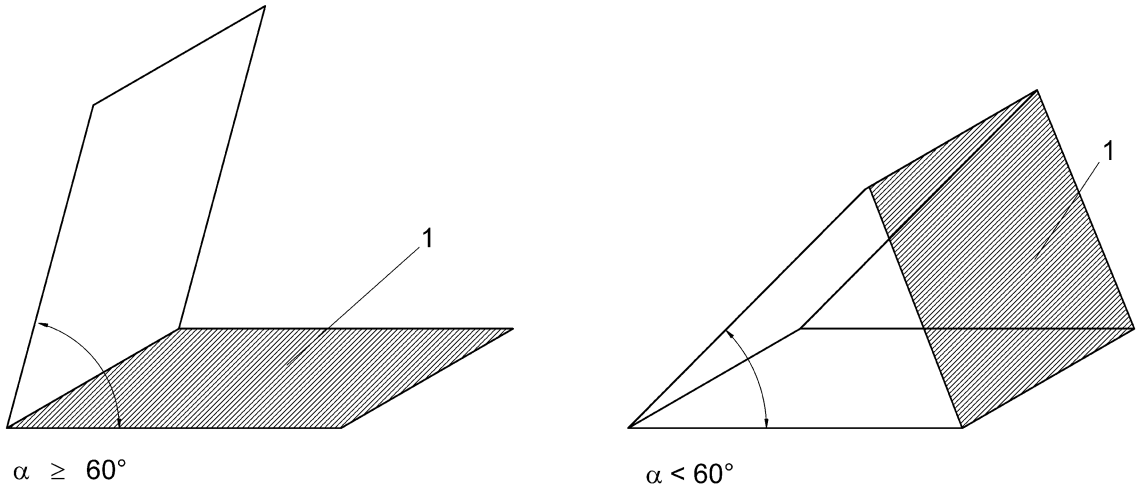


Figure G.5b

Key

1 temperature in °C
2 time in minutes
A tolerances during the heat up period:
temperature rises between 0,8 K/s and 1,2 K/s except for the first 2 min when no tolerance is defined
B tolerance during the 5 min period following the NSHEV actuation: reference value $^{+100}_{-100}$ °C
C tolerance during the final period: 300^{+60}_{-0} °C and 600^{+60}_{-0} respectively

Figure G.5 — Temperature/time curve of the test procedure



Key

1 throat area

Figure G.6 — Throat area depending on the opening angle α of the NSHEV

Annex H
(normative)

Mounting and fixing conditions for the SBI or small flame tests

NOTE See 4.5.3.

H.1 General

Products will need to be evaluated under “end use conditions” in the pre-flashover period of a fire. This generally implies that it is not possible to judge the performance of a product made up of many components (like rubber seals, aluminium frame, PE ventilator) by assessing the materials individually. The products shall be classified in accordance with EN 13501-1.

The NSHEV shall be classified with the least favourable classification of any of the materials it is made of, if it can be clearly shown that the reaction to fire properties of the complete NSHEV is likely not to perform worse than the worst material in terms of its reaction to fire performance. In this case tests for the purpose of classification where mounting and fixing of a material can influence the performance of a material (SBI test EN 13823 and the test with the small flame EN ISO 11925-2) shall be performed on the materials in accordance with the appropriate test method. Requirements to mounting and fixing are given in this annex dealing with the test methods.

The product and/or individual component is considered to satisfy the requirements for performance class of the characteristic reaction to fire in accordance with the relevant EC Decision on Classified Without Further Testing (CWFT) without the need for testing on the basis of its conformity with the specification of the product detailed in that decision and its intended end use application being covered by that decision.

The relevant individual components to be tested are e.g.:

— profile including thermal separation elements of thermally isolated frames (for example frame, sash, upstand);

— infill (for example glazing, panels);

— gasket between infill and profile;

— gasket between frame/upstand and sash;

— additional gasket;

— organic coating (if relevant and not part of the profile testing);

— opening mechanism inclusive brackets.

Small components with dimensions of not more than 50 mm x 50 mm and a weight of not more than 50 g may not need to be considered for final assessment of a classification.

Gaskets shall not be considered as products having small areas and/or small surfaces.

In accordance with EN 13501-1 class F is the classification used for products which are not tested at all or where the product has failed the performance criteria required for class E.

Class F classification may be sufficient for many member countries in the EC. At the moment there are only some member countries which have a requirement for at least class E. Generally it is therefore not

necessary to claim a higher classification other than class E to cover the requirement within the member countries in the EC unless for particular circumstances a better classification is required.

Components with their own product standard (e.g. glass products or parts of windows) do not need to be tested again. The class for those components shall to be taken from that product standard in question.

H.2 Class E

H.2.1 General

For class E the small flame test in accordance with EN ISO 11925-2 is the test procedure for the purpose of classification in accordance with EN 13501-1. For the single flame test in accordance with EN ISO 11925-2 only those components shall be considered which are visible when the NSHEV is opened and/or closed.

H.2.2 Small flame test in accordance to EN ISO 11925-2

In accordance with EN ISO 11925-2 any material which is not a small component in accordance with the definition in H.1 shall be tested in the sizes specified in EN ISO 11925-2.

If materials are available as flat products the test specimen shall be in the design in end use application in the NSHEV, e.g. fillings. Mounting and fixing shall be done as specified in EN ISO 11925-2. The test on flat products may be performed with surface flame attack only.

Products which are not flat in the end use application e.g. profiles and gaskets shall be tested in their original design in the end use application. That implies that e.g. gasket or thermal separation elements of thermally isolated profiles shall be tested fitted into the appropriate profile. An adjacent glazing element may be simulated by a non-combustible plate, e.g. a steel board. The tests, except for corner tests as described in the next paragraph, shall be performed with surface flame attack from the most critical fire-exposed side only. The test laboratory may select the most critical fire-exposed side of the product.

If products are bent around a corner, e.g. gasket, this corner part shall be tested in its original composition and the test shall be performed with edges and surface flame attack at the corner.

If products have different top layers, e.g. profiles or fillings, both surfaces (interior and exterior surface) shall be tested.

The test specimen including those for corner tests shall have a maximum length of 250 mm and a maximum width of 90 mm. The maximum depth of test specimen is 60 mm.

If a product has different kinds of gasket, etc., of the same material the test laboratory may select the most critical gasket subject to the assembly area, the cross section of the gasket and the exposed width.

The test results for profiles are valid for profiles of the same material and a greater thickness of the visible surface.

The test results for coatings are valid for substrates with the same or greater thickness and for coatings with the same or lower thickness and with an equal or lower PCS value.

H.3 Class A2 to class D

H.3.1 General

For class A2 to class D the SBI test in accordance with EN 13823 is the main test procedure for the purpose of classification in accordance with EN 13501-1. The small flame test in accordance with EN ISO 11925-2 (see H.2.2) applies also for class D, C and B. The non-combustible test in accordance

with EN ISO 1182 or the determination of the heat of combustion in accordance with EN ISO 1716 applies also for class A2.

H.3.2 Single Burning Item test (SBI)

In accordance with EN 13823 materials of the NSHEV which are not small components in accordance with H.1 shall be tested in the sizes specified in EN 13823.

H.4 Non-combustible test and determination of the heat combustion

For class A1 the non-combustible test in accordance with EN ISO 1182 and the determination of the heat of combustion in accordance with EN ISO 1716 are the main test procedures for the purpose of classification in accordance with EN 13501-1.

NSHEV which are made of materials belonging to class A1 without the need of testing are given in the Commission Decision 96/603/EEC as amended.

NOTE The class A1 classification relates to the post-flashover period of a fire and relates to a material test (that is not under “end use conditions”).

Annex I
(normative)

Handling changes affecting declared performances for NSHEV

NOTE See 6.3.6.

I.1 General

Modification of NSHEV shall only be made by the manufacturer and shall be documented in the FPC.

If the modifications do not affect the listed relevant parameters under I.2, I.3, I.4, I.5, I.6 and I.7 and modification not having a negative influences on the declared characteristics they are defined as minor changes.

I.2 Effectiveness of smoke/hot gas extraction

NOTE See 4.4 and G.1.

The effectiveness of smoke/hot gas extraction, i.e. the aerodynamic free area, determined in accordance with B.2 (experimental procedure) is predominantly affected by the following relevant parameters:

— design and arrangement of flow modification devices (e.g. wind deflector);

— shape, position and size of actuating mechanism;

— height and design of the upstand;

— opening angle.

I.3 Reliability

NOTE See 4.2.1, 4.3, 4.7.1 and 4.7.2.

For reliability, assessed in accordance with Annex C, relevant parameters are:

— material and arrangement of hinges

— material and arrangement of centres of rotation or relevant sliding parts,

— material, thickness or geometry of parts which are fixed to hinges and connected to centre of rotation

— material and arrangement of applied connections (e.g. screws, bolts)

— the installed opening system including the release element

— type, amount and form of applied energy

— weight of opening elements.

I.4 Opening under load

NOTE See 4.2.2 and 4.6.1.

For the ability of the NSHEV to open against an applied wind and snow load, assessed in accordance with Annex D, relevant parameters are e.g.:

— material and arrangement of hinges,

— material and arrangement of centres of rotation or relevant sliding parts,

— material, thickness or geometry of parts which are fixed to hinges and connected to centre of rotation,

— material and arrangement of applied connections (e.g. screws, bolts),

— the installed opening system including the release element,

— material and thickness of load bearing surface,

— geometric area,

— type, amount and form of applied energy,

— weight of opening elements (e.g. flap or filling).

I.5 Opening at low ambient temperatures

NOTE See 4.2.3 and 4.6.3.

For the ability of the NSHEV to open at low temperature, assessed in accordance with Annex E, relevant parameters are e.g.:

— material and arrangement of hinges,

— material and arrangement of centres of rotation or relevant sliding parts,

— material, thickness or geometry of parts which are fixed to hinges and connected to centre of rotation,

— material and arrangement of applied connections,

— the installed opening system including the release element,

— material and thickness of load bearing surface,

— geometric area,

— type, amount and form of applied energy,

— weight of opening elements.

I.6 Wind load

NOTE See 4.6.3 and 4.6.4.

For the integrity of the NSHEV under wind load, assessed in accordance with Annex F, relevant parameters are e.g.:

— material and arrangement of hinges,

— material and arrangement of centres of rotation or relevant sliding parts,

— material, thickness or geometry of parts, which are fixed to hinges and connected to centre of rotation,

— material and arrangement of applied connections (e.g. screws, bolts),

— the installed opening system including the release element,

— material and thickness of load bearing surface,

— geometric area,

— weight of opening elements.

I.7 Resistance to heat

NOTE See 4.2.4 and 4.6.4.

For the ability of the NSHEV to open within 60 s under exposure to heat, assessed in accordance with Annex G, the relevant parameters are e.g.:

— the installed opening system including the release element

— materials and thickness.

Annex J
(informative)

Installation and maintenance information

J.1 Installation information

Installation information shall be provided including the following:

— fixing information;

— connection information to external services (e.g. electric and pneumatic installation).

J.2 Maintenance information

Maintenance information for the NSHEV shall be provided, which shall include the following:

— maintenance procedures;

— recommended frequency of operational checks;

— recommended checks for the effects of corrosion.

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/109, “Fire alarm/detection, fixed fire fighting, fire and smoke control and explosion suppression products”, as amended by Mandate M/139, given to CEN by the European Commission and the European Free Trade Association. If this European standard is cited in the Official Journal of the European Union (OJEU), the clauses of this standard, shown in this annex, are considered to meet the provisions of the relevant mandate, under the Regulation (EU) No. 305/2011.

This annex deals with CE marking of the Natural Smoke and Heat Exhaust Ventilator intended for the use indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as the relevant part in Clause 1 of this standard related to the aspect covered by the mandate and is defined by Table ZA.1.

Table ZA.1 — Relevant clauses for natural smoke and heat exhaust ventilators to be installed in smoke and heat control systems in buildings

Products:	Natural smoke and heat exhaust ventilators (NSHEV)		
Intended use**:**	to be installed in smoke and heat control systems in buildings		
Essential characteristic	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
NOMINAL ACTIVATION CONDITIONS/SENSITIVITY, as:			
- Initiation device	4.1.1	-	description
- Opening mechanism	4.1.2	-	description
- Inputs and outputs	4.1.3	-	description
RESPONSE DELAY (RESPONSE TIME), as:			
- Reliability	4.2.1	-	s
- Opening under (snow, wind) load	4.2.2	-	s
- Low ambient temperature	4.2.3	-	s
- Opening under heat	4.2.4	-	s
OPERATIONAL RELIABILITY, as:			
- Reliability	4.3		class
EFFECTIVENESS OF SMOKE/HOT GAS EXTRACTION, as:			
- Aerodynamic free area	4.4	-	m^2
PERFORMANCE PARAMETERS UNDER FIRE CONDITIONS, as:			
- Resistance to heat	4.5.1		class
- Mechanical stability	4.5.2	-	description
- Reaction to fire	4.5.3		class
PERFORMANCE UNDER ENVIRONMENTAL CONDITIONS, as:			
- Performance under load	4.6.1		class
- Low ambient temperature	4.6.2		class
- Stability under wind load	4.6.3		class
- Resistance to wind induced vibration	4.6.4	-	Hz
- Resistance to heat	4.6.5		class
DURABILITY, as:			
- Response delay (response time)	4.7.1	-	s
- Operational reliability	4.7.2		class
- Performance parameters under fire conditions	4.7.3		class

The declaration of the product performance related to certain essential characteristics is not required in those Member States (MS) where there are no regulatory requirements on these essential characteristics for the intended use of the product.

In this case, manufacturers placing their products on the market of these MS are not obliged to determine nor declare the performance of their products with regard to these essential characteristics and the option "No performance determined" (NPD) in the information accompanying the CE marking and in the declaration of performance (see ZA.3) may be used for those essential characteristics.

ZA.2 Procedure of AVCP of natural smoke and heat exhaust ventilators

ZA.2.1 System of AVCP

The AVCP system of natural smoke and heat exhaust ventilators indicated in Table ZA.1 established by EC Decision 1996/577/EC (*OJEU L254 of 1996-10-08*), as amended by EC Decision 2002/592/EC (*OJEU L192 of 2002-07-20*), as given in Annex III of the Mandate for Fire alarm/detection, fixed fire-fighting, fire and smoke control and explosion suppression products, is shown in Table ZA.2 for the indicated intended use and relevant level or class of performance.

Table ZA.2 — Attestation of conformity system

Product	Intended use	Level(s) or class(es)	Attestation of conformity system
Natural smoke and heat exhaust ventilators	Fire safety	-	1
System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2.			

The AVCP of natural smoke and heat exhaust ventilators in Table ZA.1 shall be in accordance to the AVCP procedures indicated in Table ZA.3 resulting from application of the clauses of this or other European Standards indicated therein. The content of tasks of the notified body shall be limited to those essential characteristics as provided for, if any, in Annex III of the relevant mandate and to those that the manufacturer intends to declare.

Table ZA.3 — Assignment of AVCP tasks for natural smoke and heat exhaust ventilators under system 1

Tasks		Content of the task	AVCP clauses to apply
Tasks of the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3
	Further testing of samples taken at the factory in accordance with the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3.2.6
Tasks of the notified product certification body	determination of the product type on the basis of type testing type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended	6.2
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use. Documentation of the FPC	6.3.4 6.3.2 6.3.3
	Continuous surveillance, assessment and approval of FPC	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared. Documentation of the FPC	6.3.5

ZA.2.2 Declaration of performance (DoP)

ZA.2.2.1 General

The manufacturer draws up the DoP and affixes the CE marking on the basis of:

- the factory production control and further testing of samples taken at the factory according to the prescribed test plan; and
- the certificate of constancy of performance issued by the notified product certification body on the basis of determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control.

ZA.2.2.2 Content

The model of the DoP is provided in Annex III of the Regulation (EU) No 305/2011.

According to this Regulation, the DoP shall contain, in particular, the following information:

- the reference of the product-type for which the declaration of performance has been drawn up;
- the AVCP system or systems of the construction product, as set out in Annex V of the CPR;

- the reference number and date of issue of the harmonized standard which has been used for the assessment of each essential characteristic;

- where applicable, the reference number of the Specific Technical Documentation used and the requirements with which the manufacturer claims the product complies.

The DoP shall in addition contain:

a) the intended use or uses for the construction product, in accordance with the applicable harmonized technical specification;

b) the list of essential characteristics, as determined in the harmonized technical specification for the declared intended use;

c) the performance of at least one of the essential characteristics of the construction product, relevant for the declared intended use;

d) where applicable, the performance of the construction product, by levels or classes, or in a description, if necessary based on a calculation in relation to its essential characteristics determined in accordance with the Commission determination regarding those essential characteristics for which the manufacturer shall declare the performance of the product when it is placed on the market or the Commission determination regarding threshold levels for the performance in relation to the essential characteristics to be declared.

e) the performance of those essential characteristics of the construction product which are related to the intended use or uses, taking into consideration the provisions in relation to the intended use or uses where the manufacturer intends the product to be made available on the market;

f) for the listed essential characteristics for which no performance is declared, the letters “NPD” (No Performance Determined);

Regarding the supply of the DoP, Article 7 of the Regulation (EU) No 305/2011 applies.

The information referred to in Article 31 or, as the case may be, in Article 33 of Regulation (EC) No 1907/2006, (REACH) shall be provided together with the DoP.

ZA.2.2.3 Example of DoP

The following gives an example of a filled-in DoP for NSHEV:

DECLARATION OF PERFORMANCE

No. *to be given by the manufacturer*

1. Unique identification code of the product-type:

to be given by the manufacturer

2 Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):

to be given by the manufacturer

3. Intended use or uses of the construction product, in accordance with the applicable harmonized technical specification, as foreseen by the manufacturer:

smoke and heat control systems in buildings

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5):

AnyCo SA,

PO Box 21

B-1050 Brussels, Belgium

Tel. +32987654321

Fax: +32123456789

Email: anyco.sa@provider.be

5. Where applicable, name and contact address of the authorized representative whose mandate covers the tasks specified in Article 12(2):

Anyone Ltd

Flower Str. 24

West Hamfordshire

UK-589645 United Kingdom

Tel. +44987654321

Fax: +44123456789

e-mail: anyone.ltd@provider.uk

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 1

7. The notified certification body No. 1234 performed the determination of the product type on the basis of type testing (including sampling); type calculation of the product; the initial inspection of the manufacturing plant and the factory production control and the continuous surveillance, assessment and evaluation of the factory production control under system 1 and issued the Certificate of Constancy of Performance No. .....

8. Declared performance

Essential characteristics	Performance	Harmonized technical specification
Nominal activation conditions/sensitivity, as: - Initiation device - Opening mechanism - Inputs and outputs	present present present	EN 12101–2:2017
Response delay (response time), as: - Reliability - Opening under (snow, wind) load - Low ambient temperature - Fire Performance	≤ 60 s	
Operational reliability, as: - Reliability	Re 1000, Type B	
Effectiveness of smoke/hot gas extraction, as: - Aerodynamic free area	A_a = 2,67 m²	
Performance parameters under fire conditions, as: - Resistance to heat - Mechanical stability - Reaction to fire	$B_{300}30$ ΔA_{throat} < 10 % E	
Performance under environmental conditions, as: - Opening under load - Low ambient temperature - Stability under wind load - Resistance to wind-induced vibration (where included) - Resistance to heat	 SL 500 T(−15) WL 1500 ω_0: > 10 Hz, δ: > 0,1 $B_{300}30$	
Durability, as - Response delay (response time) - Operational reliability - Performance parameters under fire conditions	 ≤ 60 s Re 1000 ≤ 60 s; ΔA_{throat} < 10 %	

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

……

(name and function)

……

(place and date of issue) (signature)

ZA.3 CE marking and labelling

The CE marking symbol shall be in accordance with the general principles set out in Article 30 of Regulation (EC) No 765/2008 and shall be affixed visibly, legibly and indelibly:

- to the natural smoke and heat exhaust ventilator together with, cf. Figure ZA.1.

The above information together with the following shall be given in the accompanying documents:

- the last two digits of the year in which it was first affixed,
- the level or class of the performance declared and
- the dated reference to the harmonized technical specification applied.

The CE marking shall be affixed before the construction product is placed on the market. It may be followed by a pictogram or any other mark notably indicating a special risk or use.

Figures ZA.1 and ZA.2 give examples of the information related to the NSHEV subject to AVCP under System 1 to be given on the NSHEV (ZA.1) and on the accompanying paper (ZA.2).

CE

0123

CE marking, consisting of the "CE"-symbol given in Directive 93/68/EEC

Identification number of the certification body

ref. no. to be given by the manufacturer

Name and registered address of manufacturer

code to be given by the manufacturer

NSHEV intended to be installed in smoke and heat control systems in buildings.

Re 1000, A_a = 2,67 m², SL750, WL1500, T(−15), B_{300}30 E

Reference number of the DoP

Name and registered address of manufacturer "c.f. no. 4 DoP"

Unique identification code of the product-type

Intended use of the product as laid down in the European standard applied

classes of declared performance (CPR Article 9 (2))

Figure ZA.1 — Example of the CE marking to be shown on NSHEV

CE	*CE marking, consisting of the "CE"-symbol given in Directive 93/68/EEC*
0123	*Identification number of the certification body*
Name or trademark of manufacturer	*Name or trademark of manufacturer*
15	*Last two digits of the year in which the marking was first affixed*
ref. no to be given by the manufacturer	*Reference number of the DoP*
EN 12101-2:2017	*No. of European standard applied, as referenced in OJEU*
code to be given by the manufacturer	*Unique identification code of the product-type*
NSHEV which are intended to be installed in smoke and heat control systems in buildings	*Intended use of the product as laid down in the European standard applied*
NOMINAL ACTIVATION CONDITIONS/SENSITIVITY, as:	*All essential characteristics given in Table ZA.1*
- Initiation device — present	
- Opening mechanism — present	
- Inputs and outputs — present	
RESPONSE DELAY (RESPONSE TIME), as:	
- Reliability — ≤ 60 s	
- Opening under (snow, wind) load — ≤ 60 s	
- Low ambient temperature — ≤ 60 s	
- Opening under heat — ≤ 60 s	
OPERATIONAL RELIABILITY — Re 1000	
EFFECTIVENESS OF SMOKE/HOT GAS EXTRACTION (AERODYNAMIC FREE AREA) — A_a = 2,67 m²	
PERFORMANCE PARAMETERS UNDER FIRE CONDITIONS, as:	
- Resistance to heat — $B_{300}30$	
- Mechanical stability — ΔA_{throat} < 10 %	
- Reaction to fire — E	
PERFORMANCE UNDER ENVIRONMENTAL CONDITIONS, as:	
- Performance under load — SL 750	
- Stability under wind load — WL 1500	
- Low ambient temperature — T(−15)	
- Resistance to wind-induced vibration — ω_0: > 10 *Hz*, δ: > 0,1	
- Resistance to heat — $B_{300}30$	
DURABILITY, as:	
- Response delay (response time) — < 60 s	
- Operational reliability — Re 1000	
- Performance parameters under fire conditions — ≤ 60s, ΔA_{throat} < 10 %	

Figure ZA.2 — Example of the CE marking to be shown on the commercial documents

Bibliography

[1] EN 13501-4, *Fire classification of construction products and building elements — Part 4: Classification using data from fire resistance tests on components of smoke control systems*

[2] EN ISO 9001, *Quality management systems - Requirements (ISO 9001)*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.
- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services
Tel: +44 345 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 345 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.