BS EN 14471:2013

BSI Standards Publication

Chimneys — System chimneys with plastic flue liners — Requirements and test methods

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National foreword

This British Standard is the UK implementation of EN 14471:2013. It supersedes BS EN 14471:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/506/2, Chimneys and their components having inner linings of plastic.

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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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

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Foreword

This document (EN 14471:2013) has been prepared by Technical Committee CEN/TC 166 “Chimneys”, the secretariat of which is held by ASI.

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of an identical text or by endorsement, at the latest by May 2014, and conflicting national standards shall be withdrawn at the latest by May 2014.

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 14471:2005.

The main modifications compared to EN 14471:2005 are the following:

— the Normative References were updated;

— additions were made in Clause 3 (Terms and definitions);

— Clause 4 was revised;

— the requirements in Clause 5 were completely revised;

— all annexes were revised and some annexes were added.

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 document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The objective of this European Standard is to evaluate the behaviour of system chimneys with plastic flue liners.

A system chimney with a plastic flue liner may be a single wall chimney (only the plastic flue liner) or may be a double wall chimney or a flue liner with enclosure or with outer wall. The system chimney according to this standard can consist of a plastic liner only (e.g. single wall) or a system with plastic inner liner (e.g. concentric or with outer wall). The system chimney is defined by the manufacturer, whereas the requirements for the installation are defined by the national regulations of the member states.

1 Scope

This European Standard specifies the performance requirements and test methods for system chimneys with plastic flue liners used to convey the products of combustion from appliances to the outside atmosphere under dry and wet conditions. It also specifies the requirements for marking, manufacturer's instructions and evaluation of conformity.

This European Standard describes chimney components from which system chimneys can be assembled.

This European Standard is not applicable to chimneys with sootfire resistance classification class G.

This European Standard is not applicable for chimneys with the following classification:

— corrosion resistance class 2 concerning natural wood[1)];

— corrosion resistance class 3;

— pressure class N2.

This European Standard is applicable to chimneys designed so that no condensate accumulation can occur, e.g. with a minimum inclination of 3° to the horizontal.

This European Standard is not applicable

— for system chimneys with plastic coated flue liners;

— to structurally independent (free-standing or self-supporting) chimneys.

Chimneys with components which need further processing during the installation to reach the final material properties are no system chimneys and therefore also not covered by this standard.

This European Standard does not cover the requirements for horizontal terminals (as defined for C1 installation types in CEN/TR 1749) regarding aerodynamic behaviour, rainwater ingress and icing behaviour.

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 1443:2003, *Chimneys — General requirements*

EN 13216-1:2004, *Chimneys — Test methods for system chimneys — Part 1: General test methods*

EN 13384-1:2002+A2:2008, *Chimneys — Thermal and fluid dynamic calculation methods — Part 1: Chimneys serving one appliance*

EN 13501-1:2007+A1:2009, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

EN 13501-2, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

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

1) There is no sufficient knowledge on data for flue gas condensate from appliances fired with natural wood.

EN 14241-1, *Chimneys — Elastomeric seals and elastomeric sealants — Material requirements and test methods — Part 1: Seals in flue liners*

EN 14297, *Chimneys — Freeze-thaw resistance test method for chimney products*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529)*

EN ISO 75-1, *Plastics — Determination of temperature of deflection under load — Part 1: General test method (ISO 75-1)*

EN ISO 178, *Plastics — Determination of flexural properties (ISO 178)*

EN ISO 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test (ISO 179-1)*

EN ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST) (ISO 306)*

EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1)*

EN ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2)*

EN ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics (ISO 1043-1)*

EN ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method (ISO 1133-1)*

EN ISO 1133-2, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 2: Method for materials sensitive to time-temperature history and/or moisture (ISO 1133-2)*

EN ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1)*

EN ISO 8256, *Plastics — Determination of tensile-impact strength (ISO 8256)*

EN ISO 9969, *Thermoplastics pipes — Determination of ring stiffness (ISO 9969)*

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)*

EN ISO 11357-3, *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization (ISO 11357-3)*

EN ISO 14021, *Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling) (ISO 14021)*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1443:2003, EN 13216-1:2004 and the following apply.

3.1
characterization
identification (finger print) of the material by determining a combination of properties covering the thermal, mechanical and physicochemical behaviour

3.2
material
material composition of which an individual component is made, being the result of a manufacturing process in which the raw material(s) is transformed by extrusion, moulding, welding, etc. in its intended shape

3.3
material test
test in which specific properties of a material as defined in 3.2 are tested

Note 1 to entry: The material test does not include the effects of the performance of the chimney system resulting in stress etc. on the individual components.

3.4
flue
passage for conveying the products of combustion to the outside atmosphere

3.5
flue gas
gaseous portion of the products of combustion conveyed in a flue

3.6
products of combustion
products resulting from the combustion of fuel (gaseous, liquid and solid constituents)

3.7
flue liner
wall of a chimney consisting of components the surface of which is in contact with products of combustion

[SOURCE: EN 1443:2003, 3.5]

3.8
coated flue liner
flue liner where material is applied to the inner surface of the flue liner to change the surface properties

3.9
chimney
structure consisting of a wall or walls enclosing a flue or flues

3.10
chimney component
any part of a chimney

[SOURCE: EN 1443:2003, 3.7]

3.11
chimney fitting
chimney component conveying products of combustion except a chimney section

3.12
chimney section
straight chimney component conveying products of combustion

3.13
single wall chimney
chimney where the flue liner is the chimney

3.14
multi-wall chimney
chimney consisting of a flue liner and at least one additional wall

3.15
outer wall
external wall of a chimney the surface of which comes in contact with ambient or external environment, or is within cladding or enclosure

3.16
cladding
additional non-structural outer wall around a chimney for protection against heat transfer or weathering, or for decorative purposes

3.17
external installation
part of a chimney which is located outside the building

3.18
internal installation
part of a chimney which is located inside a building

3.19
joint
connection between two components

3.20
support
chimney accessory used to fix (or transfer the load of) chimney components to structural elements (building, mast, etc.)

3.21
connecting flue pipe
component or components connecting the heating appliance outlet and the chimney

3.22
terminal
fitting installed at the outlet of a chimney

3.23
system chimney
chimney that is installed using a combination of compatible chimney components, obtained or specified from one manufacturing source with product responsibility for the whole chimney

3.24
enclosure
barrier that when built around a chimney will give additional safety in case of fire and may provide additional heat transfer resistance

3.25
dry operating condition
condition when a chimney is designed to operate normally with the temperature of the inner surface of the flue liner above the water dew point

3.26
wet operating condition
condition when the chimney is designed to operate normally with the temperature of the inner surface of the flue liner at or below the water dew point

3.27
condensate
liquid products formed when the flue gas is at or below the water dew point

3.28
negative pressure chimney
chimney designed to operate with the pressure inside the flue less than the pressure outside the flue

3.29
positive pressure chimney
chimney designed to operate with the pressure inside the flue greater than the pressure outside the flue

3.30
sootfire
combustion of the flammable residue deposited on the flue liner

3.31
sootfire resistant chimney
chimney that is capable of withstanding a specified thermal shock

3.32
thermal resistance of a chimney
resistance to heat transfer through the wall or walls of the chimney

3.33
reaction to fire
response of a product in contributing by its own decomposition to a fire to which it is exposed, under specified conditions

3.34
resistance to fire of a chimney
ability of the chimney to prevent ignition of adjacent combustible materials and to prevent the spread of fire to adjacent areas

3.35
nominal working temperature
average flue gas temperature obtained during the nominal output test for the maximum temperature level

symbol : T_{nom} in °C

3.36
material test temperature
temperature the material is actually exposed to in the oven during long-term resistance to thermal load

symbol *:* T_m in °C

3.37
performance test temperature
temperature of the medium in the flue liner of a system chimney which is exposed to during the test according to 7.2 to 7.6

symbol : T_f in °C

3.38
free-standing chimney
chimney, externally attached to a building, which meets at least one of the following criteria:

— distance between the lateral supports is greater than 4 m;

— free-standing height above the uppermost structural attachment is greater than 3 m;

— horizontal distance between the building and the outer surface of the chimney is greater than 1 m.

A chimney attached to a free-standing mast is considered as a free-standing chimney.

A chimney can also be considered as free-standing if it is guyed or laterally supported or if it stands on another structure.

[SOURCE: EN 13084-1:2007]

3.39
flexible flue liner
flue liner that is designed to change its shape by elastic deformation to accommodate bends in the route of the flue without significantly changing the cross section

3.40
flow resistance of a terminal
pressure loss in a terminal due to the flow in the flue duct and where appropriate in the air duct gas at a given temperature and velocity

Note 1 to entry: For balanced flue applications there is a pressure loss for the flue and also for the air supply. For non-balanced flue applications there is a pressure loss only for the flue.

3.41
coefficient of flow resistance
ratio between the flow resistance of a terminal and the dynamic pressure of the medium due to a directional and/or cross sectional change in the terminal

3.42
wind velocity pressure
pressure generated on the terminal due to wind

3.43
coefficient of wind velocity pressure
ratio between the pressure generated by wind in the flue duct and where appropriate in the air duct and the dynamic pressure of the wind

Note 1 to entry: For balanced flue applications it is the ratio of the differential pressure generated by wind between the flue duct and the air duct and the dynamic pressure of the wind.

3.44
recirculation factor
ratio between the amounts of flue gas returning from the flue gas outlet to the air supply duct and the air flow in the air supply duct

3.45
wind direction characteristics
range of the angles of wind directions in a vertical plane

3.46
rainwater ingress
water which enters the flue duct or the air duct

3.47
icing behaviour
ice sticking to the terminal caused by condensing flue gas under freezing conditions

3.48
room-sealed appliance
appliance, in which the combustion circuit (air supply, combustion chamber, heat exchanger and evacuation of the products of combustion) is sealed with respect to the room in which the appliance is installed

3.49
balanced flue terminal
terminal where the air entry to the combustion air supply duct is adjacent to the discharge of combustion products from the flue

Note 1 to entry: The inlet and outlet being so positioned that wind effects are substantially balanced.

3.50
test sample
assembly of chimney components necessary to enable the system chimney to be assessed as defined for specific performance criteria

4 Classification and designation

4.1 General

The classification system of EN 1443 is followed.

Chimneys shall be classified in accordance with classes of convenience for the following parameters:

— temperature;

— pressure;

— sootfire resistance;

— condensate resistance;

— corrosion resistance;

— thermal resistance;

— distance from combustibles;

— location;

— reaction to fire;

— outer wall.

4.2 Temperature classes

For temperature classes for chimneys, see Table 1.

NOTE Temperature classes up to T600 do not necessarily imply that all of these classes are applicable for system chimneys with plastic flue liners.

Table 1 — Temperature classes

Temperature class	Nominal working temperature in °C	Performance test temperature n ° C
T 080	≤ 80	100
T 100	≤ 100	120
T 120	≤ 120	150
T 140	≤ 140	170
T 160	≤ 160	190
T 200	≤ 200	250
T 250	≤ 250	300
T 300	≤ 300	350
T 400	≤ 400	500
T 450	≤ 450	550
T 600	≤ 600	700

4.3 Pressure classes

Pressure classes in accordance with EN 1443:2003, Table 5 are:

— negative pressure chimneys: N1 and N2; remark: N2 is excluded in the scope of this standard;

— positive pressure chimneys: P1 and P2;

— high positive pressure chimneys: H1 and H2.

4.4 Sootfire resistance classes

Sootfire resistance classes:

— G chimneys with sootfire resistance; remark: G is excluded in the scope of this standard;

— O chimneys without sootfire resistance.

4.5 Condensate resistance classes

Condensate resistance classes:

— W chimneys operating under wet conditions;

— D chimneys operating under dry conditions.

4.6 Corrosion resistance classes

Corrosion resistance classes for chimneys which convey products of combustion from various fuels are given in Table 2.

Table 2 — Corrosion resistance classes

Corrosion resistance class	1 Possible fuel types	2 Possible fuel types	3 Possible fuel types
gas	gas: sulphur-content ≤ 50 mg/m³, natural gas L + H	gas natural gas L + H	gas natural gas L + H
liquid	kerosene: sulphur-content ≤ 50 mg/m³	oil: sulphur-content ≤ 0,2 mass % kerosene: sulphur-content ≥ 50 mg/m³	oil: sulphur-content > 0,2 mass % kerosene: sulphur-content ≥ 50 mg/m³
wood	-	wood in open fire places	wood in open fire places wood in closed stoves
coal	-	-	coal
peat	-	-	peat
NOTE Definition of corrosion resistance class 2 in accordance with EN 1443. In the scope of this European Standard natural wood is excluded, see Clause 1.			

4.7 Thermal resistance

The designation of the thermal resistance is given as Rxx, where xx is the value in m^2 K/W multiplied by 100, rounded to the nearest integer, e.g. R22 is R = 0,22 m^2 K/W.

4.8 Distance to combustible material

The designation of the distance of the outer surface of the chimney to combustible material shall be given as xx, where xx is the value in whole millimetres.

4.9 Location

Classes for location:

— LI internal installation of (components of) chimneys;

— LE both internal and external installation of (components of) chimneys.

4.10 Reaction to fire

Classes for reaction to fire in accordance with EN 13501-1:

— A1 No contribution to a fire / non-combustible;

— A2 No contribution to a fire / non-combustible;

— B Very limited contribution to a fire;

— C Limited – but some – contribution to a fire;

— D Not negligible contribution to a fire;

— E Poor fire reaction properties;

— F No performance criteria.

For further information and additional classifications, see EN 13501-1.

4.11 Outer wall classes

Classes for outer walls:

— U chimney which is designed and tested to be assembled only without outer wall;

— U0 chimney which is designed and tested to be assembled within non-combustible outer wall;

— U1 chimney which is designed and tested to be assembled within combustible outer wall.

4.12 Designation

The designation of a chimney shall consist of:

— the number of the corresponding European Standard;

— temperature class (see Table 1), related to thermal performance and long term resistance to thermal load;

— pressure class; (see 4.3), related to gas tightness;

— condensate resistance class; (see 4.5), related to durability against condensing flue gas;

— corrosion resistance class; (see 4.6), related to durability against condensate;

— sootfire resistance; in this standard only class O (see 4.4);

— distance to combustible material (see 4.8), related to thermal performance;

— location (see 4.9), related to durability against weathering;

— reaction to fire (see 4.10);

— outer walls (see 4.11), related to protection against environmental influences and related to thermal performance.

EXAMPLE EN 14471 - T120 P1 W 1 O50 LI E U0

5 Dimensions and tolerances

The following requirements apply:

— Thickness of the component shall not be less than the minimum thickness declared by the manufacturer.

— The measured internal diameter of the fitting or section shall not be less than the minimum internal diameter declared by the manufacturer.

— External circumference of the fitting or section shall be within $^{+5}_{-0}$ mm up to 600 mm internal diameter and within $^{+13}_{-0}$ mm over 600 mm internal diameter, of that declared by the manufacturer;

— Installed length of a fitting or section (measured on an assembly including at least one joint) shall be within ± 5 mm of the installed length declared by the manufacturer;

— Density of insulation in a fitting or a section shall be within $^{+30}_{-0}$ % of that declared by the manufacturer.

Diameters are classified in accordance with Table 3.

Table 3 — Classification of diameters

Size group	Declared internal diameter mm
1	$d \leq 100$
2	$100 < d \leq 160$
3	$160 < d \leq 400$
4	$d > 400$

6 Performance requirements

6.1 General

All components shall be made in such a way that they are appropriate for the intended purpose.

Unless otherwise stated, performance requirements on fittings shall be the same as those for chimney sections.

6.2 Resistance to the combination of mechanical and thermal load

6.2.1 General

The thermal performance of the system chimney shall be performed in accordance with the thermal test of EN 13216-1 and shall also be performed with a second test in accordance with 7.2.

In case of

— nominal working temperature is lower than or equal to 120 °C, or

— nominal working temperature is lower than or equal to 200 °C and the flue liner is ventilated outside (ventilated circular gap between flue liner and outer wall),

the test of 7.2 shall be performed and is sufficient.

For each size group, one size shall be tested. After this test, the requirements of 6.2.2 shall be fulfilled.

The system chimney shall be guided at least at the bottom (support) of the vertical section and at the top (outlet) of the vertical section.

The heating appliance or the adapter of the heating appliance is no support of the system chimney.

6.2.2 Mechanical behaviour and stability

6.2.2.1 Vertical installation

The chimney sections, fittings and other components like supports shall not show any physical damage (e.g. cracks) on visual examination.

For rigid pipes and fittings the change of diameter or length of sections and fittings shall not exceed 2 %, the change of angles (e.g. elbows) shall not exceed 2°.

Flexible flue liners are normally used with length more than 1,5 m and for that reason they can be tested with length more than 1,5 m. For flexible liners which are mounted in segments the joints have to be included in the test.

Flexible flue systems are mostly fixed at the top and at the bottom. In this case the additional weight for the mechanical load has to be mounted in a way that it is possible for the flexible liner to be compressed in the lower area and elongated in the upper area. The additional weight for the mechanical load has to be calculated according to the difference of the maximum height declared by the manufacturer and the real installed height of the test chimney.

The requirement of the change in length (maximum 2 %) according to the text in the standard is for sections up to 1,5 m. In the upper part flexible pipes elongate and in the lower part they got compressed if the liner is fixed at the bottom. According to the standard the requirement of length change not more than 2 % is equal for both, elongation and compressing.

The change in length of flexible liners is affected by the way of installation. Especially the duct is important. E.g.: If the flexible liner is mounted inside an enclosure or with outer wall which is not much wider than the flexible liner, the test results could be different from the test inside a bigger enclosure or outer wall. The reason is the offsetting of the flexible liner in a bigger enclosure or outer wall, and thus the reaction forces of compressing and elongation cannot interact.

The requirement of the limit of the change in length for the compressed and elongated segments can be substituted by reference to the whole length of the test chimney if the offsetting of the flexible liner is prevented by mounting it inside an enclosure or outer wall with an inner diameter not more than 2x outer diameter of the flexible liner according to the manufacturer declaration also for the test. If the manufacturer declares a bigger enclosure or outer wall, the type test has to consider the declared diameters. The possibility of offsetting also has to be checked.

6.2.2.2 Non-vertical installation with supports not more than 1,5 m apart

The chimney sections, fittings and other components like supports shall not show any physical damage (e.g cracks) on visual examination.

The change of diameter or length of sections and fittings shall not exceed 2 %, the change of angles (e.g. elbows) shall not exceed 2°.

The vertical deviation from the original position of the segment shall not be more than 2 mm per metre between supports.

These requirements are fulfilled without test if every section is supported separately.

6.2.2.3 Non-vertical installation with supports more than 1,5 m apart

The chimney sections, fittings and other components like supports shall not show any physical damage (e.g. cracks) on visual examination.

The change of diameter or length of sections and fittings shall not exceed 2 %, the change of angles (e.g. elbows) shall not exceed 2°.

The inclination to the horizontal of the segment shall always be greater than 3° at any point between the supports and shall not have changed by more than 5°.

These requirements are fulfilled without test if every section is supported separately.

6.3 Components subject to wind load

When tested in accordance with 7.3, chimney components designated suitable for external installation with a length of the external unsupported part more than 10 times the diameter or more than 1 m, shall not show any physical damage on visual examination.

6.4 Fire resistance

The sootfire resistance for all plastic system chimney products shall be declared zero.

For the fire resistance from external to external the performance criteria of integrity and insulation shall be declared in accordance with EN 13501-2 in relation to the outer wall. For single wall system chimney products the fire resistance from external to external shall be declared zero.

6.5 Hygiene, health and environment

6.5.1 Gas tightness

The leakage rate, determined in accordance with 7.5.1, shall not be greater than that given in Table 4.

Table 4 — Leakage rate

Class	Leakage rate $l \cdot s^{-1} \cdot m^{-2}$	Test pressure Pa
N 1	2,0	40 for negative pressure chimneys
N 2	3,0	20 for negative pressure chimneys
P 1	0,006	200 for positive pressure chimneys
P 2	0,120	200 for positive pressure chimneys
H 1	0,006	5 000 for high positive pressure chimneys
H 2	0,120	5 000 for high positive pressure chimneys

6.5.2 Recycling

All products shall be marked in accordance with EN ISO 14021. The abbreviations of EN ISO 1043-1 shall be used.

6.6 Safety in use

6.6.1 Thermal performance

6.6.1.1 General

The appropriate test as defined in 6.2.1 shall be performed. After this test the requirements of 6.6.1.2 and 6.6.1.3 shall be fulfilled. The requirements of 6.6.1.4 shall be fulfilled also.

6.6.1.2 Accidental human contact

Where the system chimney is not protected from human contact, the temperature of the outer wall of the test assembly shall not be greater than 93 °C, when tested in accordance with 7.6.1.2.

If the temperature is higher than 93 °C, the manufacturer shall declare how to prevent accidental human contact.

6.6.1.3 Adjacent combustible materials

When tested in accordance with 7.6.1.2, the maximum surface temperature of combustible materials adjacent to the test chimney shall not be greater than 85 °C.

In case of:

— chimneys of temperature classes lower than or equal to T120; or

— chimneys of temperature classes lower than or equal to T200 and outside ventilation of the flue liner (ventilated circular gap between flue liner and outer wall/enclosure),

this requirement is fulfilled when the outer surface temperature of the system chimney is not higher than 85 °C.

6.6.1.4 Gas tightness

Before and after the test, the requirements of 6.5.1 shall be fulfilled.

6.6.2 Thermal resistance

If the thermal resistance is not declared to be zero, the thermal resistance value of the chimney section declared by the manufacturer shall be verified in accordance with 7.6.2.

6.6.3 Resistance against condensate

To proof the resistance against condensate the tightness against moisture and condensate has to be evaluated.

— Positive pressure chimneys (class P1 and H1) deemed to be sufficient tight against moisture and condensate without further tests.

— For single wall chimneys with negative pressure (N1) or positive pressure (P2 and H2) no condensate shall appear at the outer surface of sections or fittings including joints during the test in accordance with 7.6.3.

— For insulated double wall chimneys with negative pressure (N1) or positive pressure (P2 and H2) the mass increase of the insulation of sections or fittings shall not exceed 1,0 % during the test in accordance with 7.6.3.

6.6.4 Rainwater penetration resistance for insulated chimneys for external installation

For insulated double wall chimneys designated for external installation the mass increase of the insulation of sections or fittings shall not exceed 1,0 % during the test in accordance with 7.6.4.

6.6.5 Flow resistance

The manufacturer shall declare the flow resistance values for all components except terminals in accordance with 7.6.5. For requirements for terminals, see 6.6.6.

6.6.6 Terminals

6.6.6.1 Characteristics of a terminal

The manufacturer shall characterize the terminal by the type and the wind direction as described in Annex G.

6.6.6.2 Performance requirements

The terminal shall meet the requirements for the declared type of terminal as given in Annex G.

6.7 Materials, durability

6.7.1 General

The material shall be resistant against the mechanical, chemical and thermal attack.

The effects of combustion products and condensate as well as the effects of impact strength, sunlight (especially UV radiation) and low temperatures shall also be taken into account.

6.7.2 Characterization

The material shall be identified by the thermal, mechanical and physicochemical behaviour.

The characterization shall include the density and at least 5 more properties. At least one property has to be taken of each of the three groups of methods in Annex A.

The characterization methods shall be chosen in such a way that the characterization includes the relevant properties of the material. Examples are given in Annex B.

The material shall be characterized as described in 7.7.2. Tolerances for material properties are given in Table 5.

Table 5 — Criteria for characterization

Property	Value
impact strength	+ 20 %
yield stress	+ 20 %
density	± 0,05 g/cm³
melting temperature	± 5 K
melting enthalpy	± 20 %
ring stiffness	± 20 %

6.7.3 Long-term resistance to thermal load

The material shall be capable of withstanding exposure to the nominal working temperature as described in 7.7.3.

The tensile modulus and the yield stress shall be measured in all cases of rigid pipes and fittings.

In case of thermosetting plastics the flexural modulus and flexural strength shall also be determined.

In case of flexible tubes the ring stiffness shall be determined.

Other relevant properties like the density or the impact strength shall be measured before and after the period of exposure, if they are relevant to evaluate the deterioration of the material.

The properties shall be determined in accordance with the methods as listed in Annex C.

The properties shall not change more than the values as listed in Table 6.

Table 6 — Criteria for testing long-term resistance to thermal load

Property	Value
impact strength	≤ 50 %
tensile modulus	≤ 50 %
yield stress	≤ 50 %
density	≤ 2 %
flexural modulus	≤ 50 %
flexural strength	≤ 50 %
ring stiffness	≤ 50 %
NOTE If these values are not met, it is allowed to take new reference values obtained after 24 h exposure in air at nominal working temperature (conditioning) to release processing pressures/effects. These effects are covered by the requirements for the mechanical stability of chimneys in accordance with 6.2 and 6.3.	

6.7.4 Long-term resistance to condensate exposure

The material shall be capable of withstanding exposure to condensate as described in 7.7.4.

The tensile modulus and the yield stress shall be measured in all cases of rigid pipes and fittings.

In case of thermosetting plastics the flexural modulus and flexural strength shall also be determined.

In case of flexible tubes the ring stiffness shall be determined.

Other relevant properties like the density or the impact strength shall be measured before and after the period of exposure, if they are relevant to evaluate the deterioration of the material.

The properties shall be determined in accordance with the methods as listed in Annex C.

The properties shall not change more than the values as listed in Table 7.

Table 7 — Criteria for long-term resistance to condensate exposure

Property	Value
impact strength	≤ 50 %
tensile modulus	≤ 50 %
yield stress	≤ 50 %
density	≤ 2 %
flexural modulus	≤ 50 %
flexural strength	≤ 50 %
ring stiffness	≤ 50 %
NOTE If these values are not met, it is allowed to take new reference values obtained after 24 h exposure in air at nominal working temperature (conditioning) to release processing pressures/effects. These effects are covered by the requirements for the mechanical stability of chimneys in accordance with 6.2 and 6.3.	

6.7.5 Resistance to wet/dry cycling

After exposure in accordance with 7.7.5 the flue liner is disassembled and visual examined. It shall not show damages like cracks and pinholes.

The dimensions of the sections and fittings shall not change more than 2 %. The maximum deviations of the dimensions may not exceed the required values given in 6.2.2.

The tensile modulus and the yield stress shall be measured for rigid pipes and fittings in all cases.

In case of thermosetting plastics the flexural modulus and flexural strength shall also be determined.

In case of flexible tubes the ring stiffness shall be determined.

Other relevant properties like the density or the impact strength shall be measured additional before and after the period of exposure, if they are relevant to evaluate the deterioration of the material.

The properties shall be determined in accordance with the methods as listed in Annex C.

The properties shall not change more than the values as listed in Table 8.

Table 8 — Criteria for testing resistance to wet/dry cycling

property	Value
impact strength	≤ 30 %
tensile modulus	≤ 30 %
yield stress	≤ 30 %
density	≤ 2 %
flexural modulus	≤ 30 %
flexural strength	≤ 30 %
ring stiffness	≤ 30 %
NOTE If these values are not met, it is allowed to take new reference values obtained after 24 h exposure in air at nominal working temperature (conditioning) to release processing pressure/effects.	

6.7.6 Resistance against weathering

The material of the components for conveying flue gas or combustion air intake that is exposed to UV and is made of plastic (e.g. outside installation, where location class conforms to 4.9 or terminals), shall be tested in accordance with 7.7.6.

After the exposure test the following requirements shall be met:

— Tensile-impact strength, as mentioned in Annex C, shall not change more than +100 % or -50 % (based on new material, where the tensile-impact strength was measured without exposure); all measured values after exposure have to be done after the exposure times of: 500 h, 1 000 h, 2 000 h and 4 000 h.

— In case of thermosetting plastics the flexural modulus and flexural strength, as mentioned in Annex C, shall not change more than 50 % (based on new material, where the tensile-impact strength was measured without exposure); all measured values after exposure have to be done after the exposure times of: 500 h, 1 000 h, 2 000 h and 4 000 h.

The exposure shall be done from the same side to the test pieces like the test pieces are planned to get in contact with weathering.

6.7.7 Geometrical stability

After exposure in accordance with 7.7.7, the change in internal diameter/length of the pipe shall not exceed 2 %.

For each size group of diameters one size shall be tested.

6.7.8 Reaction to fire

The manufacturer shall declare the class of reaction to fire as defined in 4.10 and test it in accordance with 7.7.8.

6.7.9 Freeze-thaw resistance

System chimney components made of plastic without fibre stabilization are considered to satisfy the requirement on freeze-thaw resistance. Others have to meet the requirements of 7.7.9.

6.7.10 Seals and sealants

Seals shall comply with the requirements and test methods defined in 7.7.10.

If sealants are used they shall comply following the requirements and test methods as defined in 7.7.10.

7 Test methods

7.1 General

Unless otherwise stated, a test chimney shall be installed in accordance with the manufacturer's installation instructions.

Unless otherwise stated, the accuracy of measurements shall be established to ensure that maximum or minimum specifications are not exceeded.

7.2 Resistance to the combination of mechanical and thermal load

7.2.1 Test sample

The test configuration as shown in Figure 1 shall be used.

The test chimney includes all relevant components, e.g. sections, fittings, fasteners, space holders, supports and terminals. The height of the chimney from the inlet of the flue gas to the terminal shall be equal to or higher than 4,5 m.

The vertical segment of the test chimney:

— shall comprise sections with a length no longer than 1,5 m each;

— shall be loaded with an extra weight corresponding to the weight of a chimney with the maximum height, as declared by the manufacturer. In case the vertical segment is supported at the top, the mechanical load shall be upended on the bottom of the vertical segment. In case the vertical segment is supported at the bottom, the mechanical load shall be put on top of the vertical segment;

— shall be installed without outer wall, only when the manufacturer declares suitability for installation without outer wall or without non-ventilated enclosure;

— shall be installed with outer wall with a thermal resistance of about 0,07 m^2K/W (for example concrete elements with a wall thickness of 0,05 m), unless the manufacturer declares suitability for installation with a non-ventilated enclosure; or

— shall be installed with outer wall with the maximum thermal resistance declared by the manufacturer, when the manufacturer declares suitability for installation with a non-ventilated outer wall.

If the system chimney is tested with outer wall, the test is valid for test without outer wall as well.

The installation with a non-ventilated outer wall covers also the installation with a ventilated outer wall. The non-vertical segment of the test chimney:

— shall be an assembly of all components to be tested, like fittings for inspection, measurement of temperature or flue gas composition, condensate drain, variable length, variable elbow, etc;

— shall not have a total length greater than 2 m[2)]. If the assembly of all fittings to be tested would result in a non-vertical segment with a length of more than 2 m, the fittings shall be tested in two or more test series;

— is connected to the vertical segment preferably by an elbow.

For vertical installation and for non-vertical installation with supports not more than 1,5 m apart, the distance between supports shall meet the maximum value in accordance with the manufacturer's declaration.

For non-vertical installation with supports more than 1,5 m apart the test chimney shall:

— be assembled consisting of at least 2 sections with a joint in the middle between the supports;

— be built in such a way that the maximum angle to the vertical in accordance with the manufacturer's declaration is reached;

— be chosen so that the diameter meets the lowest inertia of the cross section (function of diameter and wall thickness); and

— be assembled so that it is quite straight before load.

In the case of testing flexible liners with a length more than 1,5 m the weight for the mechanical load may be mounted as a single weight in the middle of the test length of the flexible liner. It may also be split into single weights and to be mounted evenly distributed to the whole length of the test chimney. The vertical section of the test chimney shall have a minimum length of 4,5 m. It is permissible to extend this length for the test.

7.2.2 Test performance

The test chimney is exposed to a cyclic load, consisting of a flue gas flow for 3 h, followed by a period without flow of 2 h. This cycle shall be repeated 8 times. Flue gas temperatures of Table 1 shall be used.

The flue gas velocity for the test has to be adjusted in compliance with Table 1 of EN 13216-1:2004.
For diameters smaller than 100 mm the velocity for 100 mm has to be applied. For diameters bigger than 200 mm the velocity for 200 mm has to be applied.

For flue gas temperatures up to 300 °C, it is allowed to use hot air instead of flue gas.

The flue gas temperature or hot air temperature shall be measured at a distance equal to or greater than 5 times the diameter above the inlet of the chimney and at 0,5 m below the terminal with an accuracy of ± 3 K.

7.2.3 Test environment

The test room shall consist of a ventilated space not subject to draughts greater than 0,5 m/s measured at a position (300 ± 5) mm below the ceiling and (300 ± 5) mm above the floor.

Ambient temperature within the test room shall be maintained within the limit of 20 °C ± 15 K, measured at a position (300 ± 5) mm below the ceiling and (300 ± 5) mm above the floor with an accuracy of 1,5 °C.

The humidity shall be controlled between 30 % RH and 70 % RH.

Ambient air shall be able to circulate freely between all parts of the test room.

The distance between the test assembly and other structures (e.g. test room walls) shall be at least 1,0 m.

2) The restriction in length of the non-vertical part is to minimize heat loss during testing.

7.3 Components subject to wind load

The test assembly shall consist of the manufacturer's declared free-standing components and further chimney sections up to the manufacturer's maximum declared lateral support separation distance between the supports, and once again the same distance up to an anchor point (see Figure 2).

An evenly distributed test load is applied and increased uniformly up to 1,5 kN/m^2 ± 2,5 % of projected outer surface area.

NOTE A method for applying an evenly distributed load is described in informative Annex E. Other methods using a vertical assembly can also be used.

The test load is applied to those components declared by the manufacturer for external use, except 50 % of the last laterally supported section of the test assembly.

The test load is applied by a number of individual evenly distributed loads equally spaced from the free-standing end at not more than (0,2 ± 0,01) m intervals. The individual loads shall not vary by more than 1 %.

7.4 Fire resistance

The sootfire resistance for all plastic chimney products is declared zero, so no test is required.

The resistance to fire external to external shall be tested according to the relevant test standards for shafts and ducts.

7.5 Hygiene, health and environment

7.5.1 Gas tightness

The flue outlet of the test chimney, as described in 7.2, see also Figure 3, is sealed with an airtight seal. If additional components (e.g. siphon, revision openings, measuring openings, variable lengths) will be supplied by the manufacturer, they have to be added to the test installation. A positive pressure air supply and flow meter are connected to the test chimney flue inlet with appropriate air-tight seals. A manometer is connected to the flue of the test assembly.

The test is undertaken at ambient temperature.

Air from the air supply is delivered to the flue at a rate necessary to achieve and maintain the required test pressure given in the leakage rate for at least 5 min.

The test pressure and the airflow rate are measured, both to an accuracy of ± 2,0 %.

7.5.2 Recycling

The marking has to be checked by visual inspection.

7.6 Safety in use

7.6.1 Thermal performance

7.6.1.1 General

The test for thermal performance and the test for mechanical stability are combined, see also 7.2.

7.6.1.2 Accidental human contact

The appropriate test according to 6.2.1 shall be performed.

The outer wall temperature shall be measured at the inlet, at distances of 1,0 m and 2,5 m above the inlet and at the outlet.

7.6.1.3 Adjacent combustible materials

The appropriate test according to 6.2.1 shall be performed.

If the test is performed according to 7.2 the outer wall temperature shall be measured at the inlet, at distances of 1,0 m and 2,5 m above the inlet and at the outlet.

7.6.2 Thermal resistance

The verification of the thermal resistance value shall be performed by testing in accordance with EN 13216-1:2004, 5.10. Alternatively, the verification can be made on basis of calculation in accordance with Annex D.

When the value for the thermal resistance is calculated, the thermal conductivity value shall be based on the mean temperature of the insulation depending on the performance test temperature of Table 1.

7.6.3 Resistance against condensate

The tightness against moisture and condensate is tested for negative pressure chimneys (N1) or positive pressure chimneys (P2 and H2) with:

— single wall system chimney products in accordance with EN 13216-1:2004, 5.6;

— insulated double wall system chimney products in accordance with EN 13216-1:2004, 5.7.

7.6.4 Rainwater penetration resistance for insulated chimneys for external installation

The chimney sections, which have been subjected to the appropriate test according to 6.2.1, shall be conditioned in the test environment of this test. In case the test of EN 13216-1:2004, Clause 5, is used, the chimney sections located in zone C shall be selected. The chimney sections, which include at least one joint between the sections, shall be removed in their assembled state so that any joint between the sections shall have been left undisturbed.

The section is weighed to an accuracy of 0,5 g.

The test structure shall consist of a rotating free draining plinth. The spray tube shall be perforated to direct jets of water towards the centre of the circle. The sections are installed onto the centre of the plinth of the test structure so that the centre of the spray arc is approximately at the centre of the flue below a level with the joint (see Figure 4). To prevent ingress of water into open end of section, this end shall be sealed.

The spray tube shall be constructed and dimensioned to allow the flow conditions of EN 60529 to be achieved and maintained.

Water is sprayed for 60 min $\pm$ 1 min while oscillating spray arc through an angle of 120º $\pm$ 5º (60º either side of the vertical) and rotating the plinth. The time for one complete oscillation (two oscillations of 120º) shall be (6 $\pm$ 1) min and the time for one revolution of the plinth shall be (5 $\pm$ 1) min. Any surface moisture is removed from the surfaces of the chimney sections and the sections are conditioned for at least 12 h, and not more than 24 h, in the test environment. The sections may be separated to facilitate removal of surface moisture.

The test sections are re-weighted.

7.6.5 Flow resistance

The flow resistance characteristics of the components shall be determined in accordance with EN 13216-1.

Alternatively, values for flow resistance for often used forms are given in EN 13384-1.

7.6.6 Terminals

Test procedures for all types of terminals are given in:

— for flow resistance in Annex H;

— for wind effects on pressure in Annex I;

— for wind effects on recirculation in Annex J;

— for rain water ingress in Annex K;

— for icing behaviour in Annex L.

7.7 Materials

7.7.1 General

Preferably test pieces should be taken out of the product. In case of several size groups of diameters, the size group with the smallest wall thickness shall be used. If this is not possible for practical reasons, test pieces could be produced with the same manufacturing process and with the same thickness as the product.

7.7.2 Characterization

The density shall be determined in accordance with EN ISO 1183-1.

For further characterization of the material a selection can be made from the methods as listed in Annex A.

Properties, which are mentioned in Annex A, shall be tested in accordance with the standards in Annex A.

Prior to the characterizations the test pieces shall be conditioned at least for 24 h in air with a relative humidity of 50 % and a temperature of 23 °C

7.7.3 Long-term resistance to thermal load

To determine the long-term resistance to thermal load the test pieces are exposed to hot air in a forced air circulation oven - that meets the following conditions:

— exhaust rate is at least one oven chamber volume in 10 min;

— temperature varies no more than the values as listed in Table 9:

Table 9 — Values for temperature variation for determination of long-term resistance to thermal load

Temperature ° C	**Variation** ° C	
	in space	in time
≤ 200	1,5	1
> 200	2	1

— metal parts that come into contact with test pieces are lined with fluorocarbon film or other materials that have no effect on the oxidative stability of the material to be tested.

The material test temperature T_m is equal to or higher than the nominal working temperature.

For a temperature class T the exposure time t_{exp} at a given material test temperature T_m is calculated relating to an expected heat load during a reasonable lifetime. The results of these calculations are given in Table 10.

Table 10 — Exposure time at raised temperatures

	t_{exp} in weeks					
T	T80	T100	T120	T140	T160	T200
T_m ° C						
80 °C	21,9					
85 °C	13,0					
88 °C	10,0					
100 °C		17,2				
105 °C		10,8				
106 °C		10,0				
120 °C			14,4			
124 °C			10,0			
140 °C				12,6		
143 °C				10,0		
160 °C					11,4	
162 °C					10,0	
200 °C						10,0
T_m should be at least equal to T_{nom}. t_{exp} should not be shorter than 10 weeks.						

Prior to the determination of properties the test pieces are conditioned at least for 24 h in air with a relative humidity of 50 % and a temperature of 23 °C.

7.7.4 Long-term resistance to condensate exposure

To determine the long-term resistance to condensate exposure the test pieces are fully immersed in test condensate.

The composition of test condensate is in accordance with the corrosion class as listed in Table 11 and Table 12.

Table 11 — Composition of test condensate for corrosion class 1

component	**concentration** mg/l
chloride	30
nitrate	200
sulphate	50

Table 12 — Composition of test condensate for corrosion class 2

component	concentration mg/l
chloride	30
nitrate	200
sulphate	400

The test condensate shall be prepared using hydrochloric acid (HCl), nitric acid (HNO_3) and sulphuric acid ($H_2 SO_4$).

Except for temperature class T80 the test pieces are exposed to the condensate at 90 °C. For T80 the test pieces are immersed at 80 °C. The duration of the exposure to condensate is 10 weeks for all temperature classes.

7.7.5 Resistance to wet/dry cycling

The test chimney shall consist of sections and fittings (see Figure 1). Chimneys for installation with enclosure shall be built with an enclosure, test chimneys with insulation shall be built partly with the maximum insulation. The height of the test chimney shall be 4,5 m at least.

At the top the test chimney shall have a vertical load in accordance with the maximum height (manufacturer declared).

The test chimney shall be connected to an appliance fired with the designed fuel (gas or oil of the intended corrosion class). The quality of the test fuel has to be fixed to a specific content of sulphur and chlorine of respectively 3 g/kg s and 50 mg/kg Cl for oil and 60 mg/m^3 s and 25 ppm Cl for natural gas. There shall be the possibility to change the flue gas temperature of the appliance from 60 °C to the performance test temperature T_f.

The appliance shall operate during 4 d at 60 °C (condensing conditions) and during 3 d at the performance test temperature T_f as mentioned in Table 1 (drying conditions). The CO_2 content of the flue gas shall be fixed at (12,5 ± 0,5) % for oil and (10,0 ± 0,5) % for natural gas. The velocity of the flue gas is (2,0 ± 0,5) m/s. This cycle of 7 d shall be performed 12 times.

Test pieces are taken from the section immediately downstream of the flue gas entrance.

7.7.6 Resistance against weathering

The artificial weathering test is carried out in accordance with EN 513, see also Annex F.

The apparatus shall be adjusted as follows:

— intensity of light: (60 ± 2) W/m² (300 – 400) nm;

— exposure times: 500 h, 1 000 h, 2 000 h and 4 000 h;

— black standard temperature: (65 ± 3) °C (method 2);

— spray cycles: 6 min spraying, 114 min drying;

— no rotation of test pieces.

7.7.7 Geometrical stability

To determine the geometrical stability 3 chimney section segments with a length of 20 cm coupled together with each other by the system specific joints or three samples without coupling are tested in accordance with 7.7.3 beside the duration. The test pieces are placed in a horizontal position. The three sections are conditioned for a period of 48 h at the nominal operating temperature *T*.

7.7.8 Reaction to fire

Test as specified in EN 13501-1:2007+A1:2009, Clause 8 as a function of the classification have to be applied.

The test specimens for all tests shall be sections of the system chimney representing the minimum and maximum wall thickness.

The test specimen for the SBI test in accordance with EN 13823 shall be mounted vertically in a test corner with a distance to the test corner walls of 25 mm with a tolerance of ± 5 mm, using wall brackets according to the specification of the manufacturer. The wall brackets shall fit each section on the top and on the bottom.

If required for the classification of EN 13501-1 the ignitability test in accordance with EN ISO 11925-2 shall be done by flame exposure at the bottom edge and flame exposure on the surface. The test specimens shall be mounted with a distance of 100 to 150 mm to the ground.

7.7.9 Freeze-thaw resistance

The freeze thaw resistance shall be tested in accordance with EN 14297.

7.7.10 Seals and sealants

Test methods for the seals specified in EN 14241-1 have to be applied.

Test methods for sealants shall follow the test methods as defined in EN 14241-1.

8 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: http://ec.europa.eu/enterprise/construction/cpd-ds/

9 Product information

9.1 General

The manufacturer’s instructions shall be available in the language of each country in which the product is placed in the market.

9.2 Minimum information to be included in the manufacturer’s instructions

9.2.1 Information for the installer

The manufacturer's instructions for the installer shall include at least the following:

— manufacturer’s identification;

- product designation with explanation;
- material specification;
- thermal resistance;
- installation drawing typical for the application;
- method of jointing the components;
- method of installing sections or fittings, supports and accessories;
- maximum distances between lateral supports or guides and how to support and/or guide the system chimney;
- minimum distance to combustibles;
- limitations of height, maximum height of the construction with respect to stability aspects;
- location of the chimney (inside or outside the building);
- mass and dimension of chimney components, outside diameter and wall thickness;
- instruction for installation and completion of the data of the chimney plate;
- internal diameter.

9.2.2 Information for the user

The manufacturer's instructions for the user shall include at least the following:

- manufacturer’s identification;
- product designation with explanation;
- minimum distance to combustibles.

9.3 Additional information to be included in the manufacturer’s instructions:

9.3.1 Information for the installer

Where appropriate, the manufacturer's instructions for the installer shall include the following:

- maximum thermal resistance declared by the manufacturer;
- direction of flow;
- storage instructions;
- method of application of any seal or sealant required;
- individual assembly instructions for any components which are supplied in unassembled conditions;
- minimum distance from chimney outer surface to the inner surface of the enclosure or outer wall;
- maximum suspended load from the sections and fittings;

— positions of apertures for cleaning and inspection[3)];

— installation of chimney plate to the system chimney, cladding or enclosure;

— terminal aerodynamic properties, including pressure drop in no wind condition;

— flow resistance factors of fittings and chimney sections;

— need for human contact shielding (based on outer surface temperature test results);

— enclosure and or cladding;

— other material specifications (e.g. seals);

— specific methods or instruments for cleaning;

— recommendation on condensate drainage;

— fuel(s) for which the system chimney can be used.

9.3.2 Information for the user

Where appropriate, the manufacturer's instructions for the user shall include the following:

— specific methods or instruments for cleaning;

— recommendations on condensate drainage.

9.3.3 Additional information for terminals

For each terminal the type and the wind direction characteristic including explanation shall be given.

9.3.3.1 Terminal Type Ia

a) Icing behaviour, where appropriate.

9.3.3.2 Terminal Type Ib

b) Rain water ingress;

c) icing behaviour, where appropriate.

9.3.3.3 Terminal Type II

d) wind direction characteristics;

e) wind effect on pressure;

f) rain water ingress, where appropriate;

g) icing behaviour, where appropriate.

9.3.3.4 Terminal Type III

h) wind direction characteristics;

3) In accordance with national regulations apertures for cleaning and inspection may be required.

i) wind effect on pressure;

j) rain water ingress, where appropriate;

k) icing behaviour, where appropriate.

10 Assessment and Verification of the Constancy of Performance (AVCP)

10.1 General

The compliance of a chimney with the requirements of this European Standard shall be demonstrated by:

— determination of the product type determination;

— factory production control.

10.2 Product type determinations

The following aspects for initial type testing are distinguished:

— material testing;

— performance testing.

The determination of the product type shall be performed on first application of this standard. Tests previously performed in accordance with the provisions of this standard may be taken into account. In addition, the determination of the product type shall be performed at the beginning of the production of a new product type or at the beginning of a new method of production (where these may affect the stated properties).

All requirements of Clause 6 shall be subject to the determination of the product type.

10.3 Further type testing

In cases where the design, the manufacturing process or the material is changed, products are considered as new products. In case the requirements of Clause 6 are affected type test has to be repeated. The repeating of type testing may be limited to items which are affected.

Changing the raw material(s) shall always require new initial type testing.

Changing the manufacturing process shall always be documented by the manufacturer in the system of factory production control.

10.4 Continuous surveillance of FPC

Surveillance of the FPC shall be undertaken annually every 12 months. The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. 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 product type and that the correct actions have been taken for non-compliant products.

10.5 Factory production control (FPC)

10.5.1 General

The manufacturer shall establish, document and maintain a FPC system to ensure that the manufactured products conform to the stated performance characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to, e.g. control raw materials, equipment, the production process and the product.

The manufacturer is responsible for organising the effective implementation of the factory production control system. Tasks and responsibilities in the production control organization should be documented and this documentation should be kept up to-date. In each factory the manufacturer may delegate the action to a person having the necessary authority to:

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

b) identify and record any instance of non-conformity;

c) identify procedures to correct instances of non-conformity.

The manufacturer should draw up and keep up-to-date documents defining the factory production control which he applies. 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 conformity of the product. This involves:

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

e) effective implementation of these procedures and instructions;

f) recording of these operations and their results;

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

The production control operations shall include some or all of the following operations:

h) specification and verification of raw materials;

i) controls and tests to be carried out during manufacture according to a frequency laid down;

j) verifications and tests to be carried out on finished products according to a frequency laid down and adapted to the product and its conditions of manufacture.

Depending on the specific case, it may be necessary to carry out the operations referred to under i) and j), or only the operations under i), or only those under j).

The operations under i) concentrate as much on the intermediate states of the product as on manufacturing machines and their adjustment, and equipment, etc. These controls and tests and their frequency are 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 have or have available the installations, equipment and personnel which enable him to carry out the necessary verifications and tests. He may, as may his agent, meet this requirement by concluding a sub-contracting agreement with one or more organizations or persons having the necessary skills and equipment.

The manufacturer has responsibility to calibrate or verify and maintain the control, measuring or test equipment in good operating condition, whether or not it belongs to him, with a view to demonstrating conformity of the product with its technical specification. The equipment shall be used in conformity with the specification or the test reference system to which the specification refers.

If necessary, monitoring is carried out of the conformity of intermediate states of the product and at the main stages of its production.

This monitoring of conformity focuses where necessary on the product throughout the process of manufacture, so that only products having passed the scheduled intermediate controls and tests are dispatched.

The results of inspections, tests or assessments requiring action shall be recorded, as any action taken. The action to be taken when control values or criteria are not met shall be recorded.

10.5.2 Equipment

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

10.5.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as the inspection scheme for ensuring their conformity. The sampling plan for every delivered lot, acceptable quality level and inspection level shall be selected from ISO 2859-1. Supplier's declaration for material type and properties shall be accepted, provided that the supplier has an appropriate quality assurance system.

NOTE A delivered lot is defined as one kind of material from one batch delivered at one time.

Items to be inspected for evaluation of conformity:

- Raw materials for pipes and fittings:
  - Supplier;
  - Type according to the definition of the supplier;
- Components in contact with flue gas:
  - Supplier;
  - Dimensions;
  - Material (analysis, characterization according to 6.7.2 or characterization according to the relevant product standards);
- Components not in contact with flue gas:
  - Supplier;
  - Dimensions;
  - Material (Confirmation of the manufacturer).

10.5.4 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics are maintained. The sampling plan for every produced lot, acceptable quality level and inspection level shall be selected from ISO 2859-1.

NOTE A produced lot is defined as products from one production process out of one delivered lot of raw material produced in a period of time of not more than one month.

Items to be inspected for evaluation of conformity:

- pipes and fittings (inner liner):
  - dimensions;
  - gastightness;
  - material characterization according to 6.7.2 (for a minimum the density, one characteristic to describe the thermal behaviour, one characteristic to describe the mechanical behaviour and one characteristic to describe the physicochemical behaviour have to be checked and documented);
- outer liners, shafts:
  - dimensions;
  - gas tightness;
  - material characterization;
- insulation, supports and other components:
  - dimensions;
  - material characterization;
- seals:
  - dimensions;
  - material characterization according to EN 14241-1.

11 Marking and labelling

11.1 Marking chimney components

All chimney components shall be marked on the product itself or on the packaging. The text on the component shall be readable during its lifetime.

NOTE For CE-Marking, see Annex ZA.

Chimney sections shall be marked at least every 2 m. Flexible pipes shall be marked continuously (e.g. once or twice during one corrugator turn).The following minimum information shall be stated on the component and/or on a label:

- name or trademark of the manufacturer;
- manufacturing batch or product reference of manufacturer;

— temperature class;

— material (in combination with 6.5.2);

— number of this standard.

11.2 Chimney plate

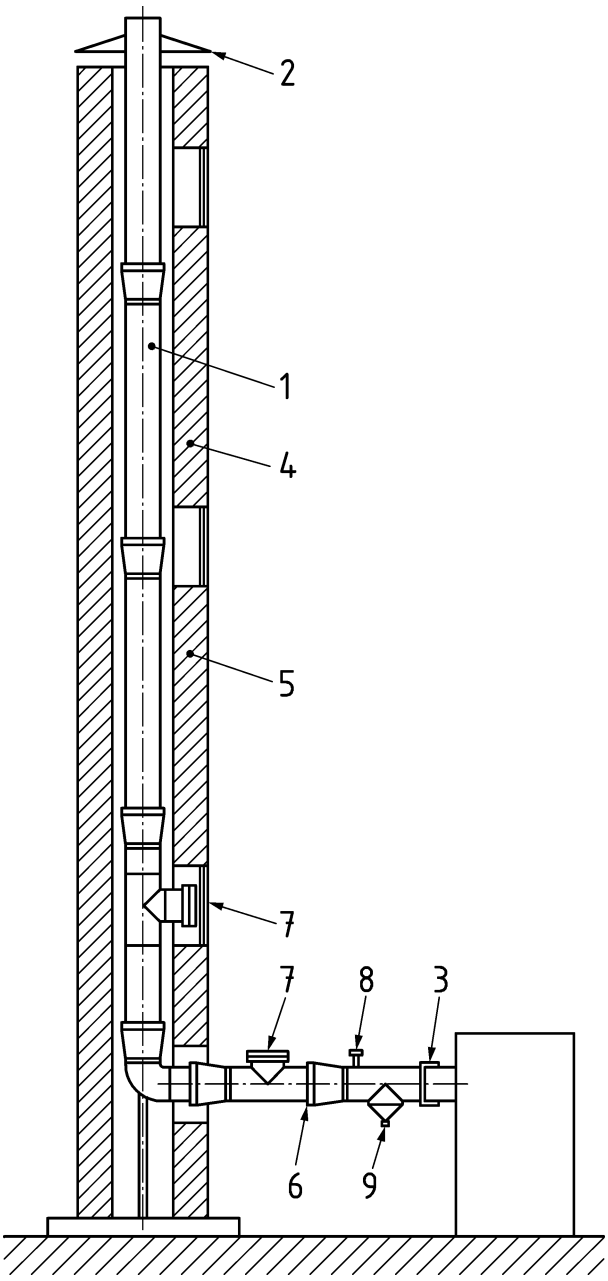
The manufacturer shall provide an indelibly marked chimney plate made of a durable material that shall include the following information:

— name or trademark of the manufacturer;

— designation in accordance with 4.12;

— space for size;

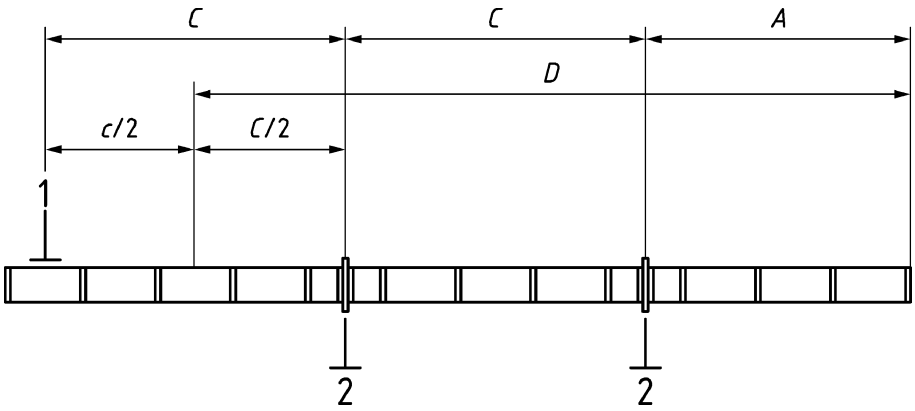
— space for installer data and date of installation.



Key

1	test chimney	6	variable length
2	terminal	7	inspection
3	flue gas inlet	8	measuring opening
4	air gap	9	condensate drain
5	enclosure or outer wall		

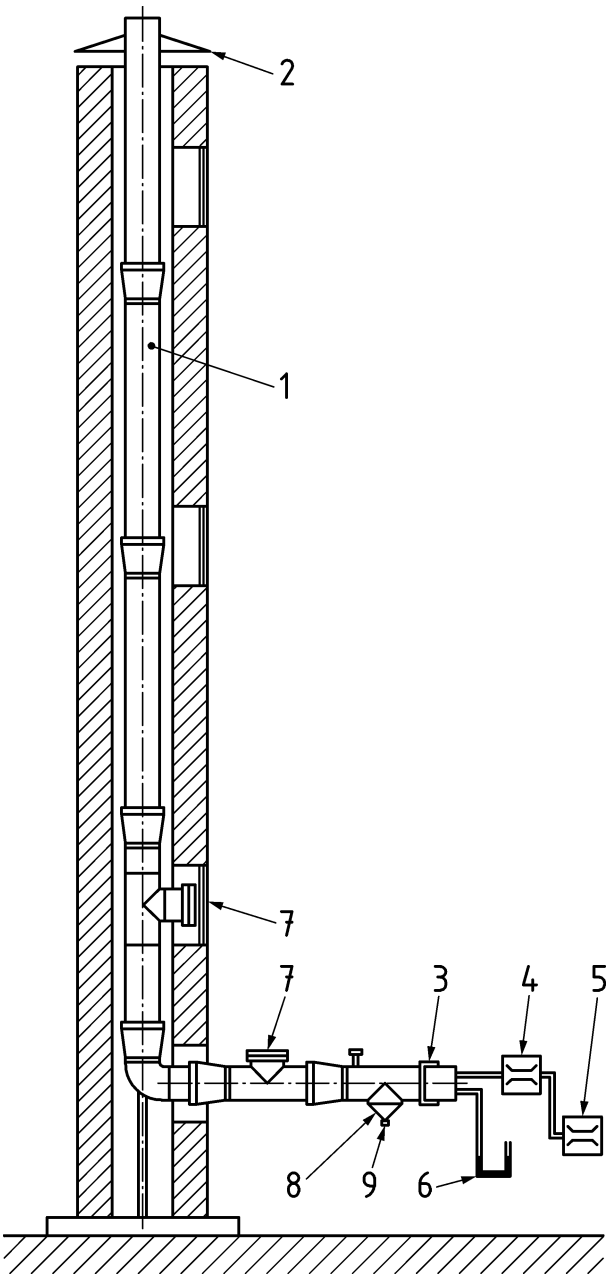
Figure 1 — Test chimney to determine the resistance to the combination of mechanical and thermal load



Key

A manufacturer's declared freestanding length
2 wall bracket
C manufacturer's declared maximum wall bracket separation distance
1 anchor point
D distance over which the load is distributed = A + C + C/2

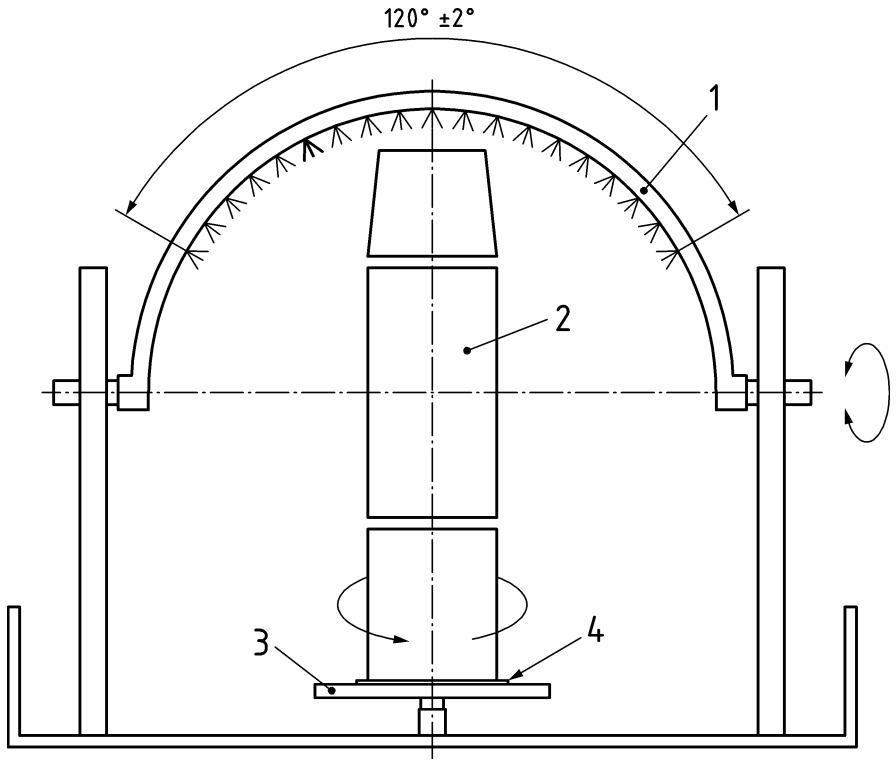
Figure 2 — Test assembly for wind load testing



Key

1 test chimney
2 equipment for closing the outlet (plate or bladder)
3 seal/adapter
4 flowmeter
5 fan (air supply)
6 manometer
7 inspection fitting
8 condensate drain
9 equipment for closing the condensate drain

Figure 3 — Test chimney to determine the gas tightness



Key

1 spray tube
2 sample
3 free draining plinth
4 seal to prevent ingress of water into open end of section

Figure 4 — Spray apparatus to determine rainwater penetration resistance

Annex A
(normative)

Test methods for characterization

Possible methods describing the material are given below.

Groups of methods to determine the thermal behaviour of the material:

— melt temperature in accordance with EN ISO 11357-3;

— Vicat in accordance with EN ISO 306;

— HDT in accordance with EN ISO 75-1.

Groups of methods to determine the mechanical behaviour of the material:

— tensile modulus in accordance with EN ISO 527-1 and EN ISO 527-2;

— tensile strength at yield and/or at break in accordance with EN ISO 527-1 and EN ISO 527-2;

— flexural strength and flexural modulus in accordance with EN ISO 178;

— Charpy impact strength in accordance with EN ISO 179-1 (unnotched test bars);

— tensile-impact strength in accordance with EN ISO 8256 (unnotched test bars);

— for flexible pipes:

  — ring stiffness in accordance with EN ISO 9969.

Groups of methods to determine the physicochemical behaviour of the material:

— FTIR;

— MFR or MVR in accordance with EN ISO 1133-1 and EN ISO 1133-2;

— DSC in accordance with EN ISO 11357-3;

— GPC.

NOTE 1 Vicat:

The Vicat softening temperature is a short-term thermal behaviour index of the material under a point load.

NOTE 2 HDT:

The Heat Deflection Temperature under load is an index of the short-term thermal behaviour of the material under load.

NOTE 3 FTIR:

Fourier Transformed Infrared Spectroscopy yields a fingerprint of the material, including additives.

NOTE 4 MFR/MVR:

The Melt Flow Rate or the Melt Volume Rate give an indication of the molecular weight.

NOTE 5 DSC:

By means of Differential Scanning Calorimetry the material is characterized by the specific heat as a function of temperature.

NOTE 6 GPC:

By Gel Permeation Chromatography the molecular length distribution is determined.

Flexural strength and flexural modulus are important parameters in thermosetting plastics.

Annex B
(informative)

Examples of characterization

The following tables show examples of characterization data for PVDF and PP. Other data from different test methods can be equally valid to characterize the test material's properties.

Table B.1 — Example of characterization data for PVDF

Type of pipe	Characterization data
Rigid pipe	
	Property
	Density
Thermal behaviour	Melt temperature
	Vicat softening temperature
Mechanical behaviour	Tensile modulus
	Tensile stress at yield
	Elongation at yield
Physicochemical behaviour	DSC
	MFI/MFR
Flexible pipe	
	Property
	Density
Thermal behaviour	Melt temperature
Mechanical behaviour	Ring stiffness
	Ring pressure at 3 % deformation
Physicochemical behaviour	DSC
	MFR/MVR

Annex C
(normative)

Test methods to determine the effect to long-term thermal load, long-term condensate exposure, wet/dry cycling and resistance to UV

Possible methods to determine the change in properties before and after exposure:

— impact strength in accordance with EN ISO 179-1 (unnotched test bars, Charpy impact strength);

— if execution meets with problems, the impact strength may be determined in accordance with EN ISO 8256 (unnotched test bars, tensile-impact strength);

— tensile modulus in accordance with EN ISO 527-1 and EN ISO 527-2;

— yield stress in accordance with EN ISO 527-1 and EN ISO 527-2;

— density in accordance with EN ISO 1183-1;

— in the case of thermosetting plastics:

  — flexural modulus and flexural strength in accordance with EN ISO 178;

— in the case of flexible pipes:

  — impact strength, tensile modulus and yield stress shall be carried out on rigid test pieces, manufactured as close as possible to the original manufacturing process;

  — ring stiffness in accordance with EN ISO 9969.

Deterioration of mechanical properties of plastics is often caused by surface attack. Miniature cracks at the surface may result in brittling of the material. This notching effect shows best under a rapid flexural load.

Any changes in tensile modulus and yield stress are relatively easy to determine and give an indication of all kinds of attack.

Any changes in volume (e.g. shrinking) should be minor. In the case of a flexible tube ribs, if any, are essential to its flexibility and ring stiffness. At too high temperatures any residual strains may cause ribs to disappear (shrinking).

Annex D
(normative)

Simplified calculation of thermal resistance for circular flues

The value of thermal resistance shall be computed with:

$$\left(\frac{1}{\Lambda}\right) = \sum\left[\frac{D_h}{2 \cdot \lambda_n} \cdot \ln\left(\frac{D_{n+1}}{D_n}\right)\right] \cdot f \qquad \text{(D.1)}$$

where

$\left(\frac{1}{\Lambda}\right)$ is the thermal resistance in square metre Kelvin per Watt;

D_h is the internal hydraulic diameter of the flue in metres;

λ_n is the thermal conductivity of the wall n in Watt per metre Kelvin;

D_n is the inner diameter of the wall n in metres;

D_{n+1} is the outer diameter of the wall n in metres;

f is the factor = 0,65.

If the thermal conductivity depends on the temperature, it shall be computed iteratively with:

$$t_{m,n} = \frac{t_n + t_{n+1}}{2} \qquad \text{(D.2)}$$

where

$t_{m,n}$ is the mean temperature of the wall n in degrees Celsius;

t_n is the inner surface temperature of the wall n in degrees Celsius;

t_{n+1} is the outer surface temperature of the wall n in degrees Celsius.

$$t_{n+1} = t_n - \frac{q \cdot f}{2 \cdot \pi \cdot \lambda_n} \cdot \ln\left(\frac{D_{n+1}}{D_n}\right) \qquad \text{(D.3)}$$

$$q = \frac{\pi \cdot D_h}{\frac{1}{\alpha_i} + \left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha} \cdot \alpha_a}} \cdot (t_N - t_u) \qquad \text{(D.4)}$$

or

$$q = \frac{\pi \cdot D_h}{\left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha} \cdot \alpha_a}} \cdot (t_i - t_u) \qquad \text{(D.5)}$$

where

$q = \frac{\text{heat flow}}{\text{length}}$ Watts per square meter Kelvin; (D.6)

α_i is the internal film coefficient in Watts per square metre Kelvin;

α_a is the external film coefficient in Watts per square metre Kelvin;

D_{ha} is the external hydraulic diameter of the chimney in metres;

t_N is the nominal flue gas temperature in degrees Celsius;

t_u is the ambient temperature in degrees Celsius;

t_i is the inner surface temperature of the liner in degrees Celsius.

The value of the outer film coefficient for normal condition is:

$$\alpha_a = 8 \frac{W}{m^2 K} \quad \text{(D.7)}$$

For the calculation, the liner surface temperature shall be 20 % below the nominal working temperature, but not over 200 °C for dry chimneys or 70 °C for wet chimneys:

$$t_i = \left\{ \begin{matrix} 0,8 \cdot t_g & for\ t_g < 250\,°C \\ 200\,°C & for\ t_g \geq 250\,°C \end{matrix} \right\} \text{for dry chimneys} \quad \text{(D.8)}$$

$$t_i = \left\{ \begin{matrix} 0,8 \cdot t_g & for\ t_g < 87,5\,°C \\ 70\,°C & for\ t_g \geq 87,5\,°C \end{matrix} \right\} \text{for wet chimneys} \quad \text{(D.9)}$$

If the chimney has only one relevant wall, the thermal resistance can be computed with:

$$\left(\frac{1}{\Lambda}\right) = \frac{D_h}{2 \cdot \lambda_n} \cdot \ln\left(\frac{D_h}{D_{ha}}\right) \cdot f \quad \text{(D.10)}$$

$$\lambda_n = f(t_m, \text{material}) \quad \text{(D.11)}$$

$$t_m = \frac{t_i + t_a}{2} \quad \text{(D.12)}$$

$$t_a = \frac{\frac{D_h}{D_{ha} \cdot \alpha_a}}{\left(\frac{1}{\Lambda}\right) + \frac{D_h}{D_{ha} \cdot \alpha_a}} \cdot \left(t_i - t_u\right) \quad \text{(D.13)}$$

Annex E
(informative)

Method for applying an evenly distributed load (horizontal)

The chimney components are installed in accordance with the manufacturer's installation instructions in a horizontal orientation.

At (0,2 ± 0,01) m intervals from the free-standing end of the test assembly a rope or strap is positioned over the chimney, at each end of which is a free hanging container for water of approximately 10 l capacity.

A tube of approximately 160 mm diameter is mounted above both rows of containers in such a manner that the tubes can be rotated through 180º. Nozzles are fitted with an orifice of approximately 2 mm diameter positioned to coincide with the containers. The tubes are filled and levelled. Both tubes are turned to fill the containers. The container contents are adjusted to an accuracy of half a litre to ensure an even distribution. It is continued to fill the containers evenly until a distributed load of 1,5 kN/m^2 is achieved.

Annex F
(informative)

Resistance to UV

The mean radiation during one year of outdoor exposure in a mild climate is adopted to be 4 GJ/m^2. For the artificial weathering test the spectrum (UV radiation) from 300 nm to 400 nm is representative. This amounts to 6 % of the total spectral energy distribution of the sunlight. It is essential that a second correction factor of 30 % be applied because radiation is not only obtained during summer (high temperatures) but also during winter (low temperatures). In this second correction factor is also taken into account the effect of the temperature difference of the material surface during accelerated artificial weathering and natural weathering. To simulate one year of natural weathering it is essential that the test pieces be exposed to a radiation dose of the apparatus of 4 × 0,06 × 0,3 = 0,072 GJ/m^2 between 300 nm and 400 nm. The exposure time (t) is calculated as follows:

$$t = 0{,}072 \times 10^9/(I_{300\text{-}400} \times 3600) \text{ in hours} \qquad \text{(F.1)}$$

where

$I_{300\text{-}400}$ is the intensity measured between 300 nm and 400 nm.

To simulate one year of natural weathering the exposure time in the apparatus comes to ca. 332,5 h at an intensity of light of 60 W/m^2.

In the test in accordance with 6.7.6, 12 years of natural weathering are simulated.

Normally a black standard temperature of 60 °C or 65 °C is used for testing the influence of weathering for white or light coloured PVC materials. For dark coloured products this 'high' black standard temperature causes a rapid burning of the surface of the test pieces that does not correspond to the weathering in the field. To realize a black standard temperature of 65 °C it is essential that the intensity of light be decreased to 60 W/m^2.

This calculation method represents a rather global way of calculating. Keeping in mind that natural weathering itself is also a variable phenomenon depending on local aspects, protection etc., it is a more or less logical base for the requirements.

Annex G
(normative)

Terminals

G.1 Characteristics of a terminal

G.1.1 General

The flue gas conveying components of the terminal shall meet the same requirements as the flue gas conveying components of the system chimney.

G.1.2 Types of terminals

G.1.2.1 Type I

G.1.2.1.1 General

The terminal may be additional tested for icing behaviour.

G.1.2.1.2 Type Ia

A terminal for non-balanced flue applications, tested for flow resistance but not for wind velocity pressure (wind influence) and not for rainwater ingress.

NOTE The terminal is suitable for non room-sealed and non-balanced flue room-sealed applications.

G.1.2.1.3 Type Ib

A terminal for non-balanced flue applications, tested for flow resistance but not for wind velocity pressure (wind influence). This terminal is additional tested for rainwater ingress.

NOTE The terminal is suitable for non room-sealed and non-balanced flue room-sealed applications.

G.1.2.2 Type II

A terminal for non-balanced flue applications, tested for flow resistance and for wind velocity pressure at least. The terminal may be additional tested for rainwater ingress and icing behaviour.

NOTE The terminal is suitable for non room-sealed and non-balanced flue room-sealed applications when wind influence according to EN 13384-1 is covered.

G.1.2.3 Type III

A terminal for balanced flue applications, tested for flow resistance and for wind velocity pressure at least. The terminal may be additional tested for rainwater ingress and icing behaviour.

NOTE The terminal is suitable for room-sealed applications.

G.1.3 Wind direction characteristics

One of the following ranges of the angles of wind direction in a vertical plane shall be regarded, see Table G1.

Table G.1 — Wind direction characteristics

Wind direction characteristic	A90	A45	A30
Wind direction in a vertical plane	- 45° to + 90°	- 45° to + 45°	- 30° to + 30°

G.2 Requirements

G.2.1 General

The terminal or the fastening of the terminal shall not prohibit the cleaning and inspection of the chimney.

G.2.2 Flow resistance of terminals Type I, II and III

The manufacturer shall declare the flow resistance of the terminal expressed as coefficient of flow resistance, determined in accordance with G.3.1.

G.2.3 Aerodynamic properties of terminals Type II and III

G.2.3.1 Terminal Type II

The manufacturer shall declare the coefficient of wind velocity pressure for wind direction characteristics specified, determined in accordance with G.3.2.1.

The following requirements for the coefficient of wind velocity pressure c_F apply:

— $c_F \geq 0$ for terminals for chimneys operating under negative and positive pressure.

In addition for a terminal Type II the manufacturer shall declare the wind velocity pressure P_F in accordance with G.3.2.1.

A value $c_F < 0$ for chimneys fulfils the criterion also, if the pressure caused by wind effects is taken into account as an additional flow resistance during calculation of the chimney according to EN 13384-1.

G.2.3.2 Terminal Type III

The manufacturer shall declare the coefficient of wind velocity pressure for wind direction characteristics specified, determined in accordance with G.3.2.2.

The following requirements for the coefficient of wind velocity pressure c_{FA} apply:

— $c_{FA} \leq 0{,}6$ for all terminals and wind attack angles; and

— $c_{FA} \geq 0$ for terminals for chimneys operating under negative and positive pressure.

A value $c_{FA} < 0$ for chimneys fulfils the criterion also, if the pressure caused by wind effects is taken into account as an additional flow resistance during calculation of the chimney according to EN 13384-1.

The manufacturer shall declare the recirculation factor, determined in accordance with G.3.2.3.

NOTE The recirculation factor is limited by the appliance the terminal is planned to be used for.

G.2.4 Rain water ingress

If the manufacturer of a terminal declares rain water resistance in the flue duct and/or in the air duct the weight of water in the flue shall be determined in accordance with G.3.3.

For a terminal of Type III the weight of water shall be determined in the flue duct and in the air duct.

G.2.5 Icing behaviour

If the manufacturer of a terminal declares resistance to icing the increase in weight and the dimensions of any ice formation shall be determined in accordance with G.3.4.

G.3 Characteristics of the terminal

G.3.1 Flow resistance

G.3.1.1 Flue duct for terminals Type I, II, III

The coefficient of flow resistance in the flue duct shall be determined in accordance with Annex H and the following formula:

$$\zeta_F = P_F / [(\rho / 2) \times w_F^2] \quad \text{(G1a)}$$

for $P_F > 0$

and

$$\zeta_F = 0 \quad \text{(G1b)}$$

for $P_F \leq 0$

where

ζ_F is the coefficient of flow resistance for the flue duct;

P_F is the pressure loss in the flue duct, in Pa;

ρ is the density of the air, in kg/m³K;

w_F is the velocity of the air in the flue duct, in m/s.

NOTE ζ_F does not take account of the effects of changes in dynamic pressure as it is normally already accounted for in the value of the differential pressure of the heating appliance.

The coefficient of flow resistance for the flue duct of the terminal shall not be higher than the value declared by the manufacturer.

Comparable methods to Annex H are accepted too.

G.3.1.2 Air duct for terminal Type III

The coefficient of flow resistance in the air duct shall be determined in accordance with Annex H and the following formula:

$$\zeta_A = P_A / [(\rho / 2) \times w_A^2] \quad \text{(G2)}$$

where

ζ_A is the coefficient of flow resistance for the air duct;

P_A is the pressure loss in the air duct, in Pa;

ρ is the density of the air, in kg/m³K;

w_A is the velocity of the air in the air duct, in m/s.

NOTE ζ_A does not take account of the effects of changes in dynamic pressure as it is normally already accounted for in the value of the differential pressure of the heating appliance.

The coefficient of flow resistance for the air duct of the terminal shall be not higher than the values declared by the manufacturer.

Comparable methods to Annex H are accepted too.

G.3.2 Aerodynamic properties

G.3.2.1 Wind velocity pressure of a terminal Type II – for non room-sealed and room-sealed appliances

When tested according to Annex I the coefficient of wind velocity pressure shall be determined for each wind direction and wind velocity using the following formula:

$$c_F = - \Delta P_{F0} / [(\rho / 2) \times w_w^2] \quad \text{(G3a)}$$

or

$$c_F = - (P_{FA1} - P_{F01}) / [(\rho / 2) \times w_w^2] \quad \text{(G3b)}$$

where

c_F is the coefficient of wind velocity pressure;

ΔP_{F0} is the difference of static pressure between the flue and the environment ($P_{FA1} - P_{F01}$), in Pa;

P_{FA1} is the static pressure in the flue in Pa;

P_{F01} is the pressure in the environment in Pa;

ρ is the density of the air, in kg/m^{3}K;

w_w is the velocity of the air in the wind tunnel, in m/s.

Comparable methods to Annex I are accepted too.

When the terminal shall be designated for an application in accordance with EN 13384-1:2002+A2:2008, 5.10.4 the wind velocity pressure has to be expressed as follows:

The wind velocity pressure P_L related to EN 13384-1:2002+A2:2008 shall be calculated with:

— for the country side (reference value w_F = 6 m/s)

$$P_L = 25 - c_{Fmin6} \times 20 \quad \text{(G4a)}$$

— for the coast side (reference value wF = 12 m/s)

$$P_L = 40 - c_{Fmin12} \times 80 \quad \text{(G4b)}$$

where

P_L is the wind velocity pressure, in Pa;

c_{Fmin6} is the smallest value of the coefficient of the wind velocity pressure c_F for w_F = 6 m/s;

c_{Fmin12} is the smallest value of the coefficient of the wind velocity pressure c_F for w_F = 12 m/s.

The wind velocity pressure P_L shall be declared 0 if the calculated wind velocity pressure $P_L \leq 0$.

G.3.2.2 Wind velocity pressure of a terminal, Type III – for balanced flue applications

When tested according to Annex I the wind velocity pressure shall be determined for each wind direction using the following formula:

$$c_{FA} = - \Delta P_{FA} / [(\rho / 2) \times w_W^2] \quad \text{(G5a)}$$

or

$$c_{FA} = - (P_{FA1} - P_{FA2}) / [(\rho / 2) \times w_W^2] \quad \text{(G5b)}$$

where

c_{FA} is the coefficient of the wind velocity pressure for a balanced flue terminal;

ΔP_{FA} is the difference of static pressure between the flue and the air duct (P_{FA1}- P_{FA2}), in Pa;

P_{FA1} is the static pressure in the flue in Pa;

P_{FA2} is the static pressure in the air duct in Pa;

ρ is the density of the air, in kg/m³K;

w_W is the velocity of the air in the wind tunnel, in m/s.

Comparable methods to Annex I are accepted too.

G.3.2.3 Recirculation factor of a terminal, Type III, (for room sealed appliances)

When a terminal is tested according to Annex J the gas concentration in the air duct C_A and in the flue duct C_F shall be determined for each wind direction.

The recirculation factor R has to be calculated with the following formula, for a closed circle as shown in Figure H.2.

$$R = [(C_{total} - C_{basis}) / (C_{total} - C_0)] \times 100 \quad \text{(G6)}$$

where

R is the recirculation factor, in %;

C_{total} is the tracer gas concentration at sample point Nr. 6 in Figure H.2, with recirculation, in Vol.%;

C_{basis} is the tracer gas concentration at sample point Nr. 6 in Figure H.2, without recirculation, in Vol.%;

C_0 is the background tracer gas concentration in the room, in Vol.%.

Comparable test methods to Annex J are accepted too.

G.3.3 Rainwater ingress

A terminal declared to be rainwater resistant shall be tested in accordance with K.1 without wind or in accordance with K.2 with wind according to the manufacturer's declaration.

For class D, no more than 0,05 mm^3/s of rainwater per mm of the nominal diameter of the flue shall enter the flue outlet or the air inlet, during each test period.

For class W, no more than 0,05 mm^3/s of rainwater per mm of the nominal diameter of the flue shall enter the air inlet, during each test period.

In an air duct of a terminal Type III the volume of the water collected in the air supply duct shall also not exceed 0,05 mm^3/s related to the declared internal diameter in mm. For variations in the form from a circle the hydraulic internal diameter has to be taken.

G.3.4 Icing behaviour

A terminal declared to be resistant to icing shall be tested in accordance with Annex L.

The test shall satisfy the following requirements:

— the increase in weight of the tested flue terminal shall not exceed 0,5 g for each mm of the declared internal diameter of the flue;

— the dimension of any ice formation, measured in the flue in any direction on or in the terminal, shall not exceed 10 mm.

Annex H
(normative)

Test methods for flow resistance

H.1 For terminal Type I, II and III, test method for flow resistance

H.1.1 Test apparatus

For the test is necessary:

An apparatus for testing flue terminal, which shall have a fan, shall have a range of throughputs variable according to the size of the test sample tested. A suitable method to measure the flow shall be sized accordingly.

The length of straight rigid liners below the flue duct shall be at least six times the nominal internal diameter. Place pitot tubes in the flue liner at a distance of approximately three times the nominal internal diameter from the terminal. At least three pitot tubes 1 mm diameter shall be evenly distributed around the circumference of the flue liner or of the air duct, in a plane perpendicular to the flue liner axis. The pitot tubes shall have smooth openings into the inside of the flue liner. The pitot tubes shall be used to determine the average static pressure within the flue liner or in the air duct.

For more details, for terminal Type I and II see Figure H.1.

For more details, for terminal Type III see Figure H.2.

H.1.2 Test sample

The test shall be done with a terminal:

— as specified in the relevant product standards;

— the size shall be the largest size up to 200 mm flue diameter, in the range produced.

H.1.3 Measurement parameters

The test shall specify the following parameters (see Table H.1):

Table H.1 — Measurement parameters and tolerances

Measurement parameters	Tolerance
ambient air temperature in the test room in °C	± 1 °C
atmospheric pressure values in Pa	± 50 Pa
static pressure in Pa	± 1 Pa
pressure difference in Pa	± 0,2 Pa
velocities for the air flow in the flue duct and where appropriate in the air duct in m/s	± 0,1 m/s
dimensions of the terminal in mm	± 1 mm

H.1.4 Test condition

The following parameters are recommended for an assessment of a flow resistance, individual product standards may prefer additional point assessments:

— ambient air temperatures in the test room shall remain in a range between 20 °C and 30 °C;

— a wind velocity w_w = 0 m/s;

— one air velocity in the flue duct w_F = 2 m/s ± 0,2 m/s and/or in the air duct w_A = 2 m/s ± 0,2 m/s at least.

H.1.5 Test procedure

For a terminal Type I and II connect the flue duct of the terminal to a flue liner with the same nominal internal diameter, see Figure H.1.

For a terminal Type III for a non balanced flue application connect the flue duct and the air duct to two liners with the same nominal diameters. A terminal Type III for a balanced flue applications terminal has to be installed behind a swifel fitting, see Figure H.2.

Deliver air by means of the fan at a nominal velocity in the flue of 2 m/s ± 0,2 m/s.

Measure the pressure difference between the static pressure in the flue liner and the pressure in the test room. The pressure difference shall be recorded.

For a terminal Type III for balanced flue applications the measurement has to be done twice, once without the terminal and once with the terminal. The flow resistance of the terminal is the difference of the two measurements.

The flow resistance factor shall be calculated according to G.3.1.1 and G.3.1.2.

H.1.6 Test result

The results shall be presented for the flue duct and for the air duct where appropriate as:

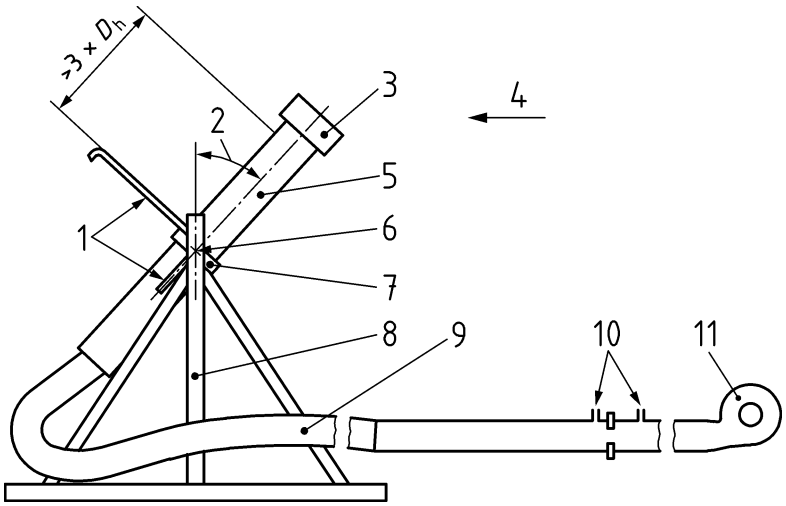
— pressure difference P_F and/or P_A in Pa;

— air velocity in the flue duct w_F in m/s and/or in the air duct w_A in m/s;

— coefficient of flow resistance/friction factor ζ_F and/or ζ_A, according to G.3.1.1 and G.3.1.2;

— geometrical data of the terminal;

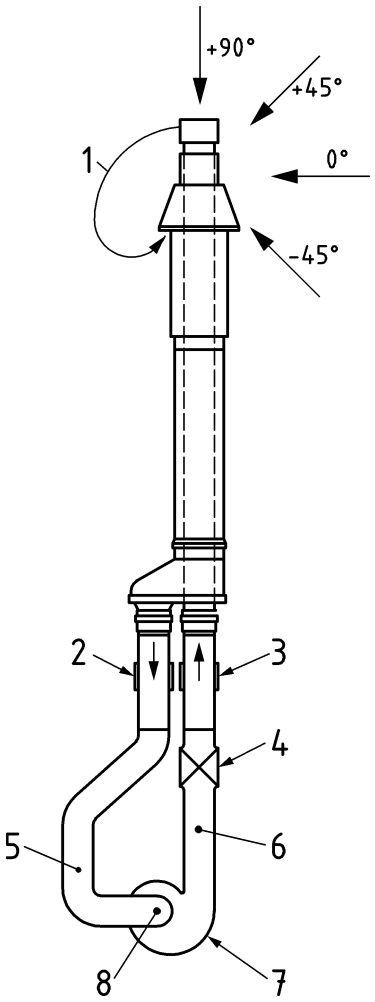
— test room data.



Key

1 pitot static tubes
2 angle of tilt
3 terminal
4 applied wind front
5 125 mm or 150 mm nominal diameter flue pipe
6 pivot
7 pipe clamp
8 height adjustable section
9 flexible tube
10 orifice plate with D and D/2 pressure tappings
11 fan

Figure H.1 — Flow resistance, wind velocity pressure, for terminal Type I and II - test rig



Key

1 external recirculation
2 static pressure air supply duct P_A
3 static pressure flue duct P_F
4 orifice plate measuring arrangement
5 pipe
6 tracer gas sampling
7 fan
8 tracer gas injection

Figure H.2 — Flow resistance, wind velocity pressure, wind effects on recirculation, for terminal Type III - test rig

Annex I
(normative)

Test methods for wind effects on pressure

I.1 For terminal Type II, test method for wind velocity pressure

I.1.1 Test apparatus

For the test is necessary:

An apparatus for testing flue terminal, which shall have a fan, shall have a range of throughputs variable according to the size of the test sample tested. One suitable method for determining the air flow rate is by the use of orifice plates.

A wind generator, capable of delivering a minimum wind front of 5 times the projected cross section of the terminal to be tested but not less than 1 m^2. The overall wind velocity distribution shall be within 0,25 m/s at velocities up to 12 m/s at the terminal test position.

The length of straight rigid flue liner below the flue terminal shall be at least 6 times the nominal internal diameter. Place pitot tubes in the flue liner at a distance of approximately 3 times the nominal internal diameter from the terminal. At least three pitot tubes 1 mm diameter shall be evenly distributed around the circumference of the flue liner, in a plane perpendicular to the flue liner axis. The pitot tubes shall have smooth openings into the inside of the flue liner. The pitot tubes shall be used to determine the average static pressure within the flue liner.

For more details, see Figure H.1.

I.1.2 Test sample

The test shall be done with a terminal:

— as specified in the relevant product standards;

— the size shall be the largest size up to 200 mm flue diameter in the range produced.

I.1.3 Measurement parameters

The test shall specify the following parameters (see Table I.1):

Table I.1 — Measurement parameters and tolerances

Measurement parameter	Tolerance
ambient air temperature in the test room in °C	± 1 °C
atmospheric pressure values in Pa	± 50 Pa
static pressure in Pa	± 1 Pa
pressure difference in Pa	± 0,2 Pa
wind velocity in m/s	± 0,5 m/s
air velocities the flue duct in m/s	± 0,1 m/s
dimensions of the terminal in mm	± 1 mm

I.1.4 Test condition

The following parameters are recommended for an assessment of a maximum pressure difference; individual product standards may prefer additional point assessments:

— ambient air temperatures in the test room shall remain in a range between 20 °C and 30 °C;

— wind velocity w_w = 12 m/s ± 0,5 m/s, in a wind direction round the test sample and with the specified wind direction characteristic A90 or A45 or A30;

— air velocity in the flue duct w_F = 2 m/s ± 0,2 m/s.

I.1.5 Test procedure

The test shall be done as follow:

For a terminal Type II connect the flue duct of the terminal to a flue liner with the same nominal internal diameter.

The test shall be done with flue, deliver air by means of the fan at a nominal velocity in the flue of (1 ± 0,2) m/s for negative pressure terminals and (2 ± 0,2) m/s for positive pressure terminals.

Rotate the flue terminal in front of the wind system in such a way that the wind pressure angles relative to the flue terminal range from downward wind (+ 90°) to an upward wind (- 45°) in maximum steps of 7,5°.

Determine the pressure characteristics through wind influences of the flue terminal.

The product group may decide to run the test without a flow in the flue duct.

I.1.6 Test result

The results shall be presented for the flue duct, for wind direction round the test sample and for the specified wind direction characteristic A90, A45 or A30 as:

— c_F – values according to G.3.2.1;

— air velocity in the wind tunnel w_W;

— air velocity in the flue duct w_A;

— geometrical data of the terminal;

— test room data.

I.2 For a terminal Type III, test method for wind velocity pressure

I.2.1 Test apparatus

For the test is necessary:

An apparatus for testing flue terminal, which shall have a fan, shall have a range of throughputs variable according to the size of the test sample tested.

The apparatus shall be possible to turn the combination of terminal and air supply duct and flue in front of the wind system in such a way that wind pressure angles relative to the terminal ranging from a downward wind (+ 90°) to an upward wind (- 45°) can be set in maximum steps of 7,5°.

Figure H.2 shows the set-up diagram for the wind testing installation.

The wind is generated by a unit which produces an air flow at a constant velocity, adjustable between 0,5 m/s and 12 m/s.

The air flow at the point of measurement of the air/flue terminal (in a plane perpendicular to the wind direction) shall not show a standard deviation greater than 0,25 m/s at all wind speeds set. Both the average wind speed and the standard deviation are determined at the point of measurement in a plane whose dimensions are 90 % of the height and width of the wind tunnel outlet. In this plane there shall be $9 \times 9 = 81$ measurement points, evenly distributed.

The degree of turbulence of the air flow at the point of measurement shall not exceed 5 %.

During the test, the largest projected area of the air/flue terminal in the air flow shall not be more than 20 % of the area of the wind tunnel outlet.

Suspend the terminal horizontally in front of the wind tunnel.

The centre of the air/flue terminal shall be placed in the centre line of the wind tunnel during the test.

If the air/flue terminal is not rotation-symmetric, determine experimentally the most unfavourable position with regard to its aerodynamic behaviour. Undertake the aerodynamic behaviour tests in this position.

Pressure test points are fitted in the air supply duct and flue at a distance of 500 mm ± 20 mm from the connection nozzles of the air/flue terminal.

I.2.2 Test sample

The test shall be done with a terminal:

— as specified in the relevant product standards, connected to a parallel or concentric air supply duct and flue with the same nominal diameter. This air/flue supply duct and flue shall have a straight length of at least 1 000 mm. No bends or other fittings shall be placed between the air/flue terminal and the air supply duct and flue;

— the size shall be the largest size up to 200 mm flue diameter, in the range produced.

I.2.3 Measurement parameters

The test shall specify the following parameters (see Table I.2):

Table I.2 — Measurement parameters and tolerances

Measurement parameters	Tolerance
ambient air temperature in the test room in °C	± 1 °C
atmospheric pressure values in Pa	± 50 Pa
static pressure in Pa	± 1 Pa
pressure difference in Pa	± 0,2 Pa
wind velocity in m/s	± 0,5 m/s
air velocities in the flue duct and in the air duct in m/s	± 0,1 m/s
dimensions of the terminal in mm	± 1 mm

I.2.4 Test condition

The following parameters are recommended for an assessment of a maximum pressure difference between air duct and flue duct, individual product standards may prefer additional point assessments.

— ambient air temperatures in the test room shall remain a range between 20 °C and 30 °C;

— wind velocity w_w = 12 m/s ± 0,5 m/s, in a wind direction round the test sample and with the specified wind direction characteristic A90 or A45 or A30;

— air velocity in the flue duct w_F = 1 m/s ± 0,2 m/s and 2 m/s ± 0,2 m/s.

I.2.5 Test procedure

The test shall be done as follow:

Flow rate is created in the air supply duct and flue by means of a fan.

The air supply duct and flue are connected to each other through the fan.

The test shall be done with flue, the air transport in the air supply duct shall be equal to the air transport in the flue.

The flow rate through the air/flue terminal is measured using for example an orifice plate measuring arrangement.

The pressure differential (flow resistance P_t) between the air supply duct and flue is measured using at least 3 openings with a 1 mm diameter evenly distributed around the circumference of each duct, in a plane perpendicular to the central line. These openings shall be free of burrs on the inside of the duct.

The product group may decide to run the test without a flow in the flue duct.

I.2.6 Test result

The results shall be presented for the flue duct and for the air duct, for wind direction round the test sample and for the specified wind direction characteristic A90 or A45 or A30:

— c_F and c_{FA} – values according to G.3.2;

— air velocity in the wind tunnel w_w;

— air velocity in the flue w_F and in the air duct w_A;

— geometrical data of the terminal;

— test room data.

Annex J
(normative)

Test methods for wind effects on recirculation

J.1 For terminal Type III, test method for recirculation

J.1.1 Test apparatus

For the test is necessary:

— an air flow generator;

— a wind generator;

— a tracer gas generator for CO_2 or CH_4;

— a test rig for the terminal.

Inject the tracer gas in front of the fan which provides the air transport via the air/flue terminal (it is assumed that the tracer gas injected is completely mixed in the fan with the supplied air).

For more details for the air flow generator, the wind generator and the test rig, see Figure H.2 and I.2.1.

J.1.2 Test sample

The test shall be done with a terminal:

— as specified in the relevant product standards;

— the size shall be the largest size up to 200 mm flue diameter, in the range produced.

J.1.3 Measurement parameters

The test shall specify the following parameters (see Table J.1):

Table J.1 — Measurement parameters and tolerances

Measurement parameters	Tolerance
ambient air temperature in the test room in °C	± 1 °C
atmospheric pressure values in Pa	± 50 Pa
tracer gas concentration in the flue duct and in the room in Vol.%	± 0,1 Vol.%
wind velocity in m/s	± 0,2 m/s
velocities for the air flow in the flue duct and in the air duct	± 0,1 m/s
dimensions of the terminal in mm	± 1 mm

J.1.4 Test condition

The following parameters are recommended for an assessment of the recirculation; individual product standards may prefer additional point assessments:

— ambient air temperatures in the test room shall remain in a range between 20 °C and 30 °C;

— wind velocity w_w = 1,0 m/s ± 0,25 m/s and 2,0 m/s ± 0,25 m/s and 3,0 ± 0,25 m/s;

— flue gas velocity w_F = 2,0 m/s ± 0,2 m/s;

— tracer gas injection with the same flow rate for all conditions.

J.1.5 Test procedure

The test shall be done as follows:

— install the terminal in the test rig;

— produce a flow with a tracer gas concentration without wind velocity in the wind tunnel to get the basis values;

— produce a flow with the same flue gas velocity and the same tracer gas flow rate and with a wind velocity in the wind tunnel;

— change the wind direction in the vertical plan also in steps of 7,5°;

— change the wind direction horizontal in steps of 7,5°;

— record the measurement parameters.

In selecting the wind pressure angles step by step, a waiting time shall be applied such that a state of equilibrium is reached each time for C_{total}.

Determine the recirculation factor R for each of the above conditions. The recirculation factor R is defined in G.3.2.3.

The product group may decide to reduce test steps, when a terminal is built up symmetric.

J.1.6 Test result

The results shall be presented for the test conditions:

— tracer gas concentration in the flue duct, without recirculation;

— tracer gas concentration in the flue duct, with recirculation;

— tracer gas concentration in the environment;

— calculated R value according to G.3.2.3 and determine the maximum recirculation value for each tested wind angle.

Annex K
(normative)

Test method for rain water ingress

K.1 For terminal Type Ib, II and III, test method without wind

K.1.1 Test apparatus

For the test is necessary:

The test structure shall consist of a rotating free draining plinth. The spray tube shall be perforated to direct jets of water toward the centre of the circle. Install the terminal with sections onto the centre of the plinth of the test structure so that the centre of the spray arc is approximately at the centre of the flue below or level with the joint (see Figure K.1). Seal the joint where the sections stand on the plinth to prevent ingress of water into open end of sections.

A rain water generator.

A test rig to install the terminal.

The spray tube shall be constructed and dimensioned to allow the flow conditions of EN 60529 to be achieved and maintained.

For more details, see Figure K.1.

K.1.2 Test sample

The test shall be done with a terminal:

— as specified in the relevant product standards;

— the size shall be the largest size up to 200 mm flue diameter, in the range produced.

K.1.3 Measurement parameters

The test shall specify the following parameters (see Table K.1)

Table K.1 — Measurement parameters and tolerances:

Measurement parameters	Tolerance
ambient air temperature in the rest room in °C	± 1 °C
the weight of rain water in g/h	± 1 g
dimensions in mm	± 1 mm

K.1.4 Test condition

The test shall be done under the following conditions:

— ambient air temperature in the test room shall remain in the range between 10 °C and 30 °C;

— wind velocity w_w = 0 m/s;

— air velocity in the flue duct w_F = 0 m/s.

K.1.5 Test procedure

The test shall be done as follows:

— install the terminal in the test rig;

— produce rainwater fitted to a chimney section according to the manufacturer's instructions, onto the centre of the plinth. The time for one complete traverse (two traverses of 120°) shall be (6 ± 1) min and the time for one revolution of the plinth shall be (5 + 1) min and spray water on the test sample without wind;

— wait for steady state conditions;

— collect the water in the flue duct in a given time, for measuring the weight of water collected use a balance;

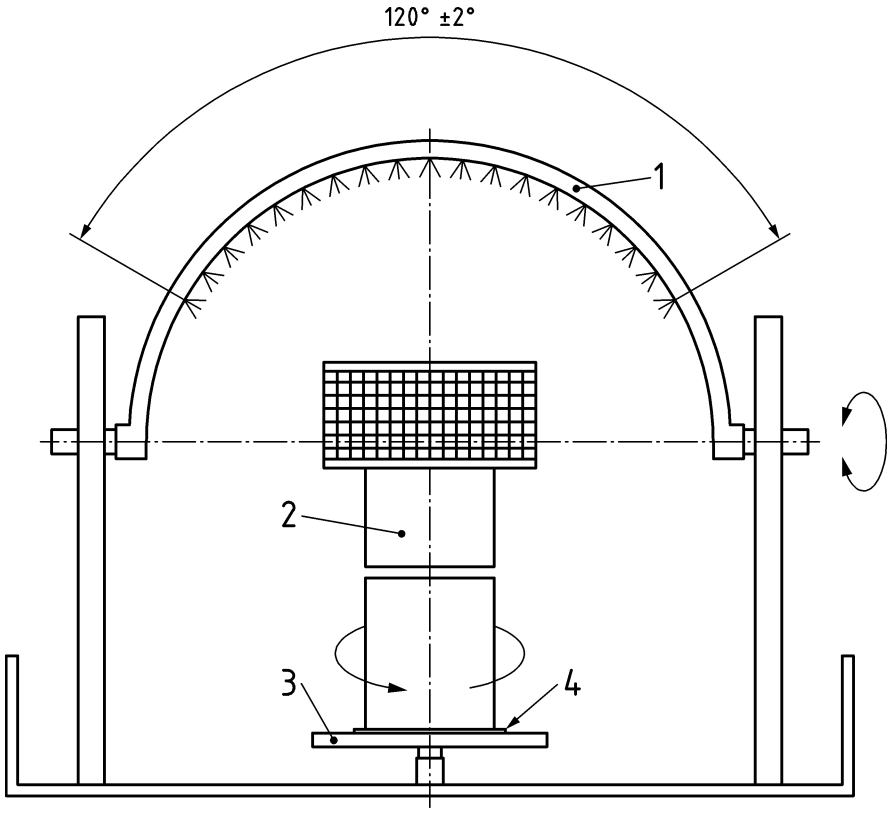
— record the measurement parameters.

K.1.6 Test result

The results shall be presented for the flue duct and for the air duct where appropriate:

Weight of water collected in a given time.

Record the weight of water collected inside the flue.



Key

1 spray tube
2 test sample
3 free draining plinth
4 seal to prevent ingress of water into open end of terminal

Figure K.1 — Rainwater resistance without wind, spray apparatus

K.2 For terminal Type Ib, II and III, test method with wind

K.2.1 Test apparatus

For the test is necessary:

The rainmaking installation is made up of parallel pipes in a horizontal plane. The tubes have small spray holes (placed vertically downwards).

These spray holes are evenly distributed across the area above the wire mesh. The water from the spray holes shall be distributed through a web of fine (1,3 ± 0,1) mm wide wire mesh, after which the water will fall in the form of raindrops. A typical arrangement is shown in Figure K.2.

The rain intensity shall be (1,6 ± 0,2) mm/min and shall be measured. During calibration is found an area in front of the wind generator where with and without wind the rain intensity is (1,6 ± 0,2) mm/min. The largest area of the top of the terminal shall not be more than 20 % of the area found by calibration.

The wind generator supplies a horizontal airflow at a velocity of 12 m/s. The outlet of the wind generator should be square or circular. For a terminal with a length L_1 between the bottom of the air inlet and the roof of more than 300 mm, the minimum dimensions of the height and the width or the diameter can be calculated by L_2 + 300 mm.

For a terminal with a length L_1 between the bottom of the air inlet and the roof of 300 mm or less, the minimum dimensions of the height and the width or the diameter can be calculated by L_1 + L_2 + 150 mm.

Nevertheless the dimensions of the outlet of a square wind generator will be at least 900 mm × 900 mm and the diameter of a round wind generator will be at least 600 mm.

A roof plane is needed if the length $L_1 \leq$ 300 mm. The roof plane shall be a square with a minimum size of the diameter of the terminal + 1 200 mm. The roof plane has to be covered by roofing tiles.

The tolerance of the measurements of the lengths and diameters shall be ± 2 mm.

For more details, see Figure K.2.

K.2.2 Test sample

The test shall be done with a terminal:

— as specified in the relevant product standards;

— the size shall be the largest size up to 200 mm flue diameter, in the range produced.

K.2.3 Measurement parameters

The test shall specify the following parameters (see Table K.2):

Table K.2 — Measurement parameters and tolerances

Measurement parameters	Tolerance
ambient air temperature in the test room in °C	± 1 °C
atmospheric pressure value in Pa	± 50 Pa
wind velocities in m/s	± 0,5 m/s
weight of rain water, collected in the duct in a given time in g/h	± 1 g
dimensions of the terminal in mm	± 1 mm

K.2.4 Test condition

The following parameters are recommended for an assessment of a terminal in a vertical position. Individual product standards may prefer additional orientations.

— ambient air temperatures in the test room in a range between 20 °C and 30 °C;

— wind velocity w_W = 0 m/s for calibration and (12 ± 0,5) m/s for the test;

— air velocity in the flue duct w_F = 0 m/s.

K.2.5 Test procedure

The test shall be done as follow:

Before commencing the rain ingress tests, the test assembly has to be calibrated. For this calibration, 5 buckets of a diameter of 150 mm, one on each corner of a rectangular area and one in the middle, shall be positioned at a level corresponding to the level of the centre between the flue gas outlet and the air inlet. Make sure that the largest area of the top of the terminal is less than 20 % of the area within the line circumscribing

the buckets. Start the calibration test during 10 min without wind and determine if the rain intensity is (1,6 ± 0,2) mm/min by weighing the 5 buckets. Repeat the calibration test with a horizontal airflow of 12 m/s.

Mount the terminal in the roof plane if required, in accordance with the manufacturer's installation instructions. Place the roof plane (if required) with the air flue terminal under the rain system and in front of the wind generator in accordance with Figure K.2 and in such a way that the centres of the inlet and the outlet openings are in line with the centre of the wind generator outlet opening.

Prior to the final tests, the air flue terminal is exposed in a vertical position for 20 min to the rain at a horizontal airflow of (12 ± 0,5) m/s.

Now expose the roof terminal at a horizontal airflow of (12 ± 0,5) m/s for 20 min to the rain under the following tests:

a) vertical;

b) turned 10° into the wind;

c) turned 10° away from the wind;

and determine the ingress of rainwater after each test.

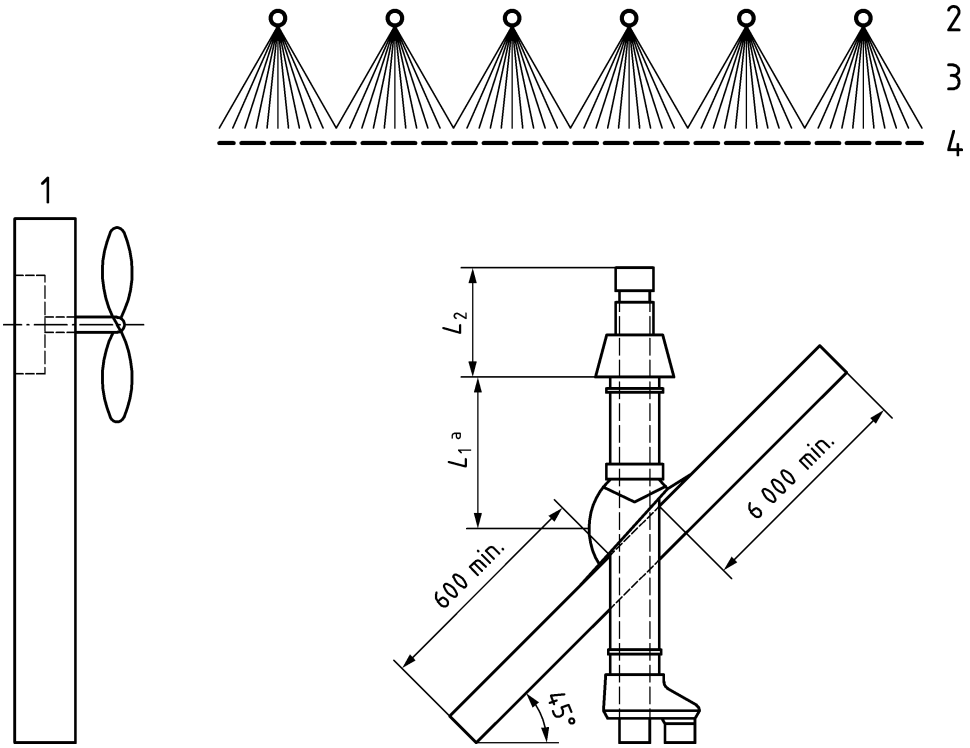
No more than 0,05 mm^3/s of rainwater per mm of the nominal diameter of the flue shall enter the flue outlet or the air inlet, during each test period.

K.2.6 Test result

The results shall be presented for the flue and when relevant for the air supply duct:

— weight of water collected in a given time.

Dimensions in millimetres



Key

1 wind generator
2 pipes with spray hole
3 rainwater
4 mesh screen

Figure K.2 — Rainwater resistance with wind load, spray apparatus

Annex L
(normative)

Test method of icing effects

L.1 For terminal Type II and III, test method for icing behaviour

L.1.1 Test apparatus

For the test is necessary:

The test assembly shall consist of:

— a cooling chamber large enough to contain the terminal and capable of maintaining a temperature of –15 ºC with the heat load from the flue gas entering the room;

— a heat generator, Figure L.1 may be used;

— a steam generator suitable for injecting steam into the flue in order to maintain saturated flue gas. The relative humidity of the flue gas should be 90 % up to 100 % within the flue duct of the terminal.

For more details, see Figure L.1.

L.1.2 Test sample

The test shall be done with a test sample:

— as specified in the relevant product standards;

— the size shall be the largest size produced up to 200 mm flue diameter, in the range produced.

L.1.3 Measurement parameters

The test shall specify the following parameters with the given tolerances (see Table L.1):

Table L.1 — Measurement parameters and tolerances

Measurement parameter	Tolerance
ambient air temperature in the test room in °C	± 1 °C
atmospheric pressure value in Pa	± 50 Pa
temperature of the cooling camber in °C	± 2 °C
flue gas temperature in the duct in °C	± 2 °C
relative humidity in the duct in %	± 5 %
flue gas velocity in m/s	± 0,1 m/s
weight in g	± 1 g
flue gas velocity in the duct in m/s	± 0,2 m/s
dimensions of the terminal in mm	± 1 mm

L.1.4 Test condition

The following parameters are recommended for an assessment of the icing behaviour of a terminal in a vertical position. Individual product standards may prefer additional orientations:

— ambient air temperature in the test room shall remain in the range between 10 °C and 30 °C;

— temperature of the flue gas at the entry = 60 °C ± 5 °C;

— flue gas velocity in the duct w_F = 2,0 m/s ± 0,25 m/s;

— temperature in the climate chamber t_{cc} = - 15 °C ± 3 °C.

L.1.5 Test procedure

The test shall be done as follows:

Weigh the terminal and mount it vertically in the test cooling chamber in accordance with the manufacturers instructions. Connect the terminal to the heat generator and adjust the fan and heat input to the heat generator such that hot air enters flue inlet at a temperature of 60 °C ± 5 °C and with a flow rate of 2 m/s ± 0,2 m/s.

Inject sufficient steam into the flue to ensure saturated flue gas. The relative humidity of the flue gas should be 90 % up to 100 % within the terminal.

The hot air and steam injection are simultaneously cycled 3 min on and 7 min off for a period of 4 h.

At the end of the test, before the ice starts to melt, measure the increase in weight of the terminal and the dimensions of any ice formation in any direction on or inside the terminal.

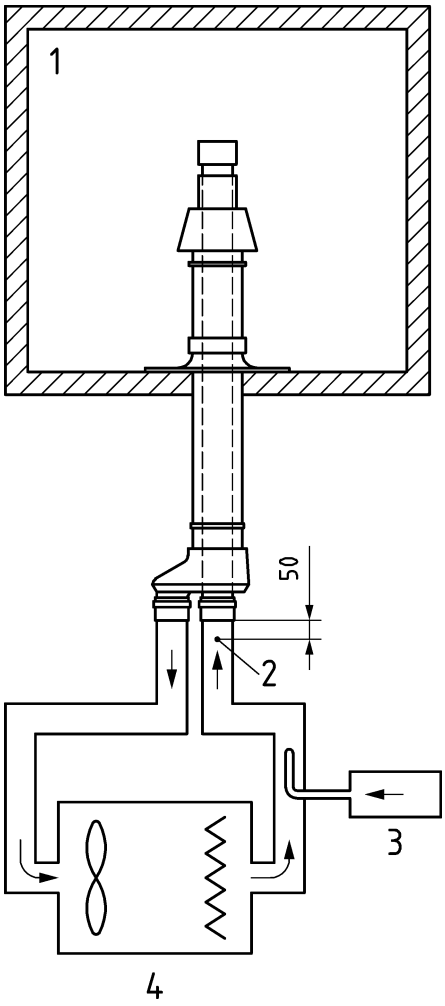
L.1.6 Test result

The results shall be presented as:

— weight of ice in a given time,

— dimensions of the ice-formation.

Dimensions in millimetres



Key

1 cooling chamber
2 measuring point
3 steam generator
4 hot gas generator

Figure L.1 — Icing behaviour - test rig

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/105 'Chimneys, flues and specific products as amended by Mandates M117 and M130 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 the CE marking of the System chimneys with plastic flue liners and terminals intended for the uses indicated in Tables ZA.1.1 to ZA.1.2 and shows the relevant clauses applicable.

This annex has the same scope as in Clause 1 of this standard related to the aspects covered by the mandate and is defined by Tables ZA.1.1 to ZA.1.2.

Table ZA.1.1 — Relevant clauses for system chimneys and intended use

Product: System chimneys with plastic flue liners **Intended use:** Conveying products of combustion from an appliance to the outside atmosphere			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Compressive strength	6.2 Resistance to the combination of mechanical and thermal load 6.7.2 Characterization	-	Pass/fail criteria The product is classified into a temperature class. This reflects a stability after a combination of thermal and mechanical load tests
Resistance to wind load	6.3 Components subject to wind load	-	Pass/fail criteria based on manufacturer's declaration of free standing height and support spacing for external sections
Fire resistance	6.4 Fire resistance	O	This European Standard is not applicable to chimneys with sootfire resistance class G. Fire resistance shall be declared "O".

Table ZA.1.1 *(continued)*

Product: System chimneys with plastic flue liners **Intended use:** Conveying products of combustion from an appliance to the outside atmosphere			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Gas tightness	6.5.1 Gas tightness	-	The product is classified into a pressure class. This reflects a gas tightness determined by a threshold leakage rate appropriate to the pressure class
Thermal performance	6.6.1 Thermal performance	-	Pass/fail criteria in combination with manufacturer's declaration
Dimensioning	5 Dimensions and tolerances	-	declared value
Thermal resistance	6.6.2 Thermal resistance	-	If the thermal resistance is not declared to be zero, the declared value is verified.
Flow resistance	6.6.5 Flow resistance	-	Characteristics to be provided by the manufacturer
Flexural tensile strength	6.2.2 Mechanical behaviour and stability 6.7.2 Characterization 6.7.3 Long-term resistance to thermal load 6.7.4 Long-term resistance to condensate exposure 6.7.5 Resistance to wet/dry cycling	-	Pass/fail criteria based on testing the resistance to the combination of mechanical and thermal load
Durability against chemicals	6.6.3 Tightness against moisture and condensate 6.6.4 Rainwater penetration resistance for insulated chimneys for external installation 6.7.4 Long-term resistance to condensate exposure 6.7.5 Resistance to wet/dry cycling	-	Pass/fail criteria
Durability against UV	6.7.6 Resistance to UV	-	Pass/fail criteria
Durability against thermal load	6.7.3 Long-term resistance to thermal load 6.7.7 Geometrical stability	-	Pass/fail criteria
Reaction to fire	6.7.8 Reaction to fire	A1 to F	Declared class classification in accordance with EN 13501-1:2007+A1:2009

Table ZA.1.1 *(continued)*

Product: System chimneys with plastic flue liners **Intended use:** Conveying products of combustion from an appliance to the outside atmosphere			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Freeze thaw resistance	6.7.9 Freeze thaw resistance	-	EN 14297 for system chimney components with fibre-stabilization
Dangerous substances	8	-	Relevant national regulations

Table ZA.1.2 — Relevant clauses for terminals and intended use

Product: Terminals **Intended use:** Conveying products of combustion from an appliance to the outside atmosphere			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Flow resistance	6.6.6.1 Flow resistance of terminals	-	Coefficient of flow resistance.

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 for AVCP of system chimneys with plastic flue liners and terminals

ZA.2.1 Systems of AVCP

The AVCP systems of System chimneys with plastic flue liners and terminals indicated in Tables ZA.1.1 to ZA.1.2, established by EC Decisions 95/467/EC as amended by 01/596/EC and 2010/679/EU of 8 November 2010 (published as C (2010) 7542 L 292/55 are shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es) of performance.

Table ZA.2 — Systems of AVCP

Products	Intended uses	Levels or classes of performance	AVCP systems
Prefabricated chimneys (storey height elements), flue liners (elements or blocks), multi-shell chimney (elements or blocks), single walled chimneys blocks, kits of free standing chimneys and attached chimneys	Chimneys	Any	2+
Chimneys terminals	Chimneys	Any	4
Prefabricated chimneys (storey height elements), flue liners (elements or blocks), multi-shell chimney (elements or blocks), single walled chimneys blocks, kits of free standing chimneys and attached chimneys, chimney terminals	For uses subject to regulations on reaction to fire	(A1, A2, B, C) (*)	1
		A1, A2, B, C) (**), D, E	3
		(A1 to E) (***), F	4

System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2

System 2+: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.3 including certification of the factory production control by a notified production control certification body on the basis of initial inspection of the manufacturing plant and of factory production control as well as of continuous surveillance, assessment and evaluation of factory production control. System 4: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.5

System 3: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.4

System 4: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.5

(*) Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

(**) Products/materials not covered by footnote * .

(***) Products/materials that do not require to be tested for reaction to fire (e.g. Products/materials of Class A1 according to Commission Decision 96/603/EC, OJ L 267, 19.10.1996, p. 23).

The AVCP of the System chimneys with plastic flue liners and terminals in Tables ZA.1.1 to ZA.1.2 shall be according to the AVCP procedures indicated in Tables ZA.3.1 to ZA.3.6 resulting from application of the clauses of this or other European Standard 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.3.1 — Assignment of AVCP tasks for plastic chimneys of Euroclasses A1*, A2*, B* or C * subject to reaction to fire regulations under systems 2+ plus 1(for RtF)

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.1 relevant for the intended use which are declared	10.5
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1.1 relevant for the intended use which are declared	10.3
	Determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1.1 relevant for the intended use except reaction fire.	10.2
Tasks for the notified product certification body	Determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristic of Table ZA.1.1 relevant for the intended use : reaction to fire	10.2
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristic of Table ZA.1.1, relevant for the intended use which is declared, namely reaction to fire. Documentation of the FPC.	10.5
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristic of Table ZA.1.1, relevant for the intended use which is declared, namely reaction to fire. Documentation of the FPC.	10.4 and 10.5

Table ZA.3.2 — Assignment of AVCP tasks for terminals of Euroclasses A1*, A2*, B* or C * subject to reaction to fire regulations under systems 4 plus 1(for RtF)

Tasks		**Content of the task**	**AVCP clauses to apply**
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.2 relevant for the intended use which are declared	10.5
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1.2 relevant for the intended use which are declared	10.3
	Determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1.2 relevant for the intended use except reaction fire.	10.2
Tasks for the notified product certification body	Determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristic of Table ZA.1.2 relevant for the intended use : reaction to fire	10.2
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristic of Table ZA.1.2, relevant for the intended use which is declared, namely reaction to fire. Documentation of the FPC.	10.5
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristic of Table ZA.1.2, relevant for the intended use which is declared, namely reaction to fire. Documentation of the FPC.	10.4 and 10.5

Table ZA.3.3 — Assignment of AVCP tasks for plastic chimneys of Euroclasses A1, A2**, B**, C**, D or E subject to reaction to fire regulations under systems 2+ plus 3(for RtF)**

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.1 relevant for the intended use which are declared	10.5
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Parameters related to essential characteristics of Table ZA.1.1 relevant for the intended use which are declared except reaction to fire	10.3
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1.1 relevant for the intended use which are declared	10.2
Tasks for a notified testing laboratory	Determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product	Essential characteristic of Table ZA.1.1 relevant for the intended use: reaction to fire .	10.2
Tasks for the notified production control certification body	Initial inspection of the manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1.1, relevant for the intended use which is declared. Documentation of the FPC.	10.5
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1.1, relevant for the intended use which is declared. Documentation of the FPC.	10.4 and 10.5

Table ZA.3.4 — Assignment of AVCP tasks for terminals of Euroclasses A1, A2**, B**, C**, D or E subject to reaction to fire regulations under systems 4 + 3 (for RtF)**

Tasks		**Content of the task**	**AVCP clauses to apply**
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.2 relevant for the intended use which are declared	10.5
	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.1.2 relevant for the intended use which are declared except reaction to fire	10.2
Tasks for a notified testing laboratory	Determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product	Essential characteristic of Table ZA.1.2 relevant for the intended use: reaction to fire	10.2

Table ZA.3.5 — Assignment of AVCP tasks for plastic chimneys not subject to reaction to fire regulations or of Euroclasses (A1 to E)* or F subject to reaction to fire regulations under systems 2+ and 4**

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.1 relevant for the intended use which are declared	10.5
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Parameters related to essential characteristics of Table ZA.1.1 relevant for the intended use which are declared	10.2
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1.1 relevant for the intended use which are declared	10.3
Tasks for the notified production control certification body	Initial inspection of the manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1.1, relevant for the intended use which are declared, namely : -Reaction to fire -Resistance to wind load -Compressive strength Documentation of the FPC.	10.5
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1.1, relevant for the intended use which is declared. Documentation of the FPC.	10.4 and 10.5

Table ZA.3.6 — Assignment of AVCP tasks for terminals not subject to reaction to fire regulations or of Euroclasses (A1 to E)* or F subject to reaction to fire regulations under system 4**

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.2 relevant for the intended use	10.5
	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.1.2 relevant for the intended use which are declared	10.2

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 different AVCP systems set out in Annex V of the Regulation (EU) No 305/2011:

In case of products under system 1

— the factory production control and further testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer; 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.

In case of products under system 2+

— the determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; the factory production control and the testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer; and

— the certificate of conformity of the factory production control, issued by the notified production control certification body on the basis of:

  — initial inspection of the manufacturing plant and of factory production control and

  — continuous surveillance, assessment and evaluation of factory production control.

In case of products under system 3

— the factory production control carried out by the manufacturer and

— the determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product, carried out by the notified testing laboratory.

In case of products under system 4

— the factory production control carried out by the manufacturer and

— the determination by the manufacturer of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product.

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 or uses;

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

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 system chimneys with plastic flue liners.

DECLARATION OF PERFORMANCE
No. 001DOP2013-07-14

1) Unique identification code of the product-type:

System chimneys with plastic flue liners
T120 P1 W1 O50 LI E U0

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

Base kit
12345678910

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

Convey products of combustion from appliances to the outside atmosphere, convey air for combustion where required.

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. +321087654321
Fax: +321234567810
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-5810645 United Kingdom
Tel. +441087654321
Fax: +441234567810
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 2+

7) In case of the declaration of performance concerning a construction product covered by a harmonized standard:

Notified factory production control certification body No. 5678 performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control.

8) Declared performance

Essential Characteristic	**Performance**	**Harmonized technical specification**
Compressive strength (maximum height)	26 m	EN 14471
Resistance to wind load (free standing height above last support)	2 m	EN 14471
Fire resistance (class)	O	EN 14471
Gas tightness (pressure class)	P1	EN 14471
Thermal performance (temperature class)	T120	EN 14471
Dimensioning in mm	DN 80	EN 14471
Thermal resistance in m²K/W	R00	EN 14471
Flow resistance of chimney sections (r = mean value of roughness of the inner wall)	0,5 mm	EN 14471, 13.12
Flow resistance of chimney fittings (ζ =coefficient of flow resistance)	0,4	EN 14471, 3.11
Flexural tensile strength (real length of the lateral displacement)	1 000 mm	EN 14471
Flexural tensile strength (maximum inclination)	45 °	EN 14471
Durability against chemicals (condensate resistance class)	W	EN 14471

Essential Characteristic	Performance	Harmonized technical specification
Durability against chemicals (corrosion resistance class)	2	EN 14471
Durability against UV (location class)	LE	EN 14471
Reaction to fire	E	EN 13501-1
Freeze thaw resistance	-	EN 14471
Dangerous substances	Declared substances	Relevant national regulations

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 system chimneys with plastic flue liner

or

— to a label attached to it.

Where this is not possible or not warranted on account of the nature of the product, it shall be affixed:

— to the packaging

or

— to the accompanying documents.

The CE marking shall be followed by:

— the last two digits of the year in which it was first affixed;

- the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity;
- the unique identification code of the product-type;
- the reference number of the declaration of performance;
- the level or class of the performance declared;
- the dated reference to the harmonized technical specification applied;
- the identification number of the notified body, *[only for products under systems 1, 2+ and 3]*;
- the intended use as laid down in 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 products subject to AVCP under each of the different systems to be given on the plastic flue liner or with the accompanying documents.

CE 4567	*CE marking, consisting of the "CE"-symbol* *Identification number of the notified production control certification body*
AnyCo Ltd, PO Box 21, B-1050, Brussels, Belgium **13** 001DOP2013-07-14	*name and the registered address of the manufacturer, or identifying mark* *Last two digits of the year in which the marking was first affixed* *Reference number of the DoP*
EN 14471:2013 System Chimneys with plastic flue liners intended to be used to convey products of combustion from an appliance to the outside atmosphere **Compressive strength: 26 m** **Resistance to wind load: 2 m** **Fire resistance: O** **Gas tightness: P1** **Thermal performance: T120** **Dimensioning: DN 80** **Flow resistance (sections): r = XX m** **Flow resistance (sections): ζ = XX** **Flexural tensile strength (real length of lateral displacement): 1 000 mm** **Flexural tensile strength (maximum inclination): 45 °** **Durability against chemicals (condensate resistance): W** **Durability against chemicals (corrosion resistance): 2** **Durability against UV: LE** **Reaction to fire: E** **Freeze-thaw resistance: -** **Dangerous substances: declared substances**	*No. of European Standard applied, as referenced in OJEU (see note 14)* *Unique identification code of the product-type* *Intended use of the product as laid down in the European Standard applied* *Level or class of the performance declared [see note 15]*

Figure ZA.1 — Example CE marking information of products under AVCP system 2+

CE	*CE marking, consisting of the "CE"-symbol*
AnyCo Ltd, PO Box 21, B-1050, Brussels, Belgium **13** 001DOP2013-07-14	*name and the registered address of the manufacturer, or identifying mark* *Last two digits of the year in which the marking was first affixed* *Reference number of the DoP*
EN 14471:2013 Terminal for system chimney with plastic flue liner intended to be used to convey products of combustion from an appliance to the outside atmosphere **Flow resistance for terminals type I, II, III (flue duct): 0,3** **Flow resistance for terminals type III (air duct): 1,2**	*No. of European Standard applied, as referenced in OJEU (see note 14)* *Unique identification code of the product-type* *Intended use of the product as laid down in the European Standard applied* *Level or class of the performance declared [see note 15]*

Figure ZA.2 — Example CE marking information of products under AVCP system 4

Bibliography

[1] CEN/TR 1749, *European scheme for the classification of gas appliances according to the method of evacuation of the combustion products (types)*

[2] EN 513, *Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors — Determination of the resistance to artificial weathering*

[3] EN 1856-1, *Chimneys — Requirements for metal chimneys — Part 1: System chimney products*

[4] EN 13084-1:2007, *Free-standing chimneys — Part 1: General requirements*

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