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Free-standing chimneys - Part 1: General requirements

Freistehende Schornsteine - Teil 1: Allgemeine Anforderungen

Cheminées autoportantes - Partie 1 : Exigences générales

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Free-standing chimneys - Part 1: General requirements

Cheminées auto-portantes - Partie 1 : Exigences
générales

Freistehende Schornsteine - Teil 1: Allgemeine
Anforderungen

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

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

Contents	Page
European foreword	4
1 Scope.....	5
2 Normative references.....	5
3 Terms and definitions	5
3.1 General terms.....	6
3.2 Terms for chimney parts.....	7
3.3 Terms for operation.....	8
4 Performance requirements; general design	9
4.1 Materials.....	9
4.2 Flue gas considerations	9
4.2.1 General.....	9
4.2.2 Design parameters	9
4.2.3 Heat flow calculations	10
4.2.4 Flow calculations.....	13
4.2.5 Chemical attack.....	13
4.3 Environmental aspects.....	16
4.3.1 Pollutants dispersion.....	16
4.3.2 Noise	16
4.3.3 Temperature.....	16
4.3.4 Fire	16
4.3.5 Gas tightness.....	17
4.4 Connecting flue pipe.....	17
4.5 Insulation	17
4.6 Ventilation	18
4.7 Protective coatings	18
4.8 Foundation	19
4.9 Accessories	19
4.9.1 Access	19
4.9.2 Lightning protection	20
4.9.3 Aircraft warning system	20
4.9.4 Additional accessories	20
5 Performance requirements: Structural design.....	21
5.1 Basic design principles	21
5.2 Actions.....	22
5.2.1 General.....	22
5.2.2 Permanent actions.....	22
5.2.3 Variable actions.....	22
5.2.4 Accidental actions	24
5.3 Imperfections	25
5.4 Foundation	25
5.5 Liner.....	25
6 Site activities.....	25

7	Lifetime management, monitoring, inspection, maintenance, cleaning, repair and remedial work including the reporting; operations and actions required	25
8	Instrumentation.....	25
Annex A (normative) Gas flow calculation		27
A.1	Principal features of the method of calculation	27
A.2	Parameters related to construction type.....	27
A.2.1	Roughness	27
A.2.2	Thermal resistance	27
A.3	Basic values for the calculation	28
A.3.1	Air temperature	28
A.3.2	Outside air pressure	28
A.3.3	Flue gas.....	28
A.3.4	Gas constant.....	29
A.3.5	Density of outside air	30
A.3.6	Specific heat capacity	30
A.3.7	Correction factor for temperature	31
A.3.8	Flow safety coefficient	31
A.4	Determination of temperatures	31
A.4.1	Flue gas temperatures	31
A.4.2	Coefficient of cooling	32
A.4.3	Heat transmission coefficient	32
A.4.4	Internal heat transfer coefficient.....	32
A.5	Density of flue gas.....	34
A.6	Flue gas velocity	35
A.7	Pressure at entry of flue gas into chimney	35
A.7.1	Calculation of pressure.....	35
A.7.2	Theoretical draught available due to chimney effect.....	35
A.7.3	Pressure resistance of the flue gas carrying tube	36
A.7.4	Flue friction coefficient.....	36
A.7.5	Individual resistance coefficient.....	37
A.7.6	Change in pressure due to change of velocity	37
A.7.7	Pressure caused by sudden interruption of the flue gas stream (Implosion)	37
A.8	Minimum velocity	38
Annex B (informative) Calculation method for combined flue gases with different temperatures.....		43
Bibliography		46

prEN 13084-1:2023 (E)**European foreword**

This document (prEN 13084-1:2023) has been prepared by Technical Committee CEN/TC 297 “Free-standing industrial chimneys”, the secretariat of which is held by AFNOR.

This document is currently submitted to the Formal Vote.

This document will supersede EN 13084-1:2000.

This document is part 1 of a package of standards as listed below:

- EN 13084-1, *Free-standing chimneys — Part 1: General requirements*
- EN 13084-2, *Free-standing chimneys — Part 2: Concrete chimneys*
- EN 13084-4, *Free-standing chimneys — Part 4: Brick liners — Design and execution*
- EN 13084-5, *Free-standing chimneys — Part 5: Material for brick liners — Product specifications*
- EN 13084-6, *Free-standing chimneys — Part 6: Steel liners – Design and execution*
- EN 13084-7, *Free-standing chimneys — Part 7: Product specifications of cylindrical steel fabrications for use in single wall steel chimneys and steel liners*
- EN 13084-8, *Free-standing chimneys — Part 8: Design and execution of mast construction with satellite components*
- EN 13084-9, *Free-standing chimneys — Part 9: Monitoring, inspection, maintenance, remedial and reporting; operations and actions required*

Additionally applies:

- EN 1993-3-2:2006, *Eurocode 3 — Design of steel structures — Part 3-2: Towers, masts and chimneys — Chimneys*

In comparison with its previous edition EN 13084-1:2000, the current edition prEN 13084-1:2023 includes the following:

- reorganization of terms and definitions;
- addition of the paragraph on connecting flue pipe;
- additional information on access systems;
- new informative Annex B “Calculation method for combined flue gases with different temperatures”.

1 Scope

This document deals with the general requirements and the basic performance criteria for the design and construction of all types of structurally independent chimneys including their liners.

This document also applies to chimneys connected to buildings when at least one of the following criteria is met:

- the distance between the lateral guides is more than 4 m;
- the free-standing height above the uppermost structural support attachment is more than 3 m;
- the free-standing height above the uppermost structural support attachment for chimneys with rectangular cross section is more than five times the smallest external dimension.

Structurally independent chimneys take into account in their design: operational conditions and other actions to verify mechanical resistance and stability and safety in use. Detailed requirements relating to specialized designs are given in the standards for concrete chimneys, steel chimneys and their liners, as well as masts construction with satellite components.

In other parts of the EN 13084 series, rules will be given where system chimney products in accordance with EN 1443 (and the relating product standards) are used in structurally independent chimneys.

This document does not cover the design and construction of connecting flue pipes.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1990, *Eurocode — Basis of structural and geotechnical design*

EN 1991-1-1, *Eurocode 1: Actions on structures — Part 1-1: General actions — Densities, self-weight, imposed loads for buildings*

EN 1991-1-4:2005, *Eurocode 1: Actions on structures — Part 1-4: General actions — Wind actions*

EN 1998-6, *Eurocode 8: Design of structures for earthquake resistance — Part 6: Towers, masts and chimneys*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

prEN 13084-1:2023 (E)**3.1 General terms****3.1.1****chimney**

vertical structure comprising one or more walls delimiting one or more liners used to carry off air or combustion products to the outside up to a height from the ground defined to ensure dispersion of the pollutants in order to avoid, prevent or reduce harmful effects on human health and the environment

3.1.2**structurally independent chimneys****free-standing chimneys (Syn.)**

chimney designed and manufactured in order to be self-supporting and resist other operational conditions like wind, oscillations, vibrations, etc.

Note 1 to entry: A chimney may also be considered as structurally independent, if it is guyed or laterally supported or if it stands on another structure.

3.1.3**guyed chimney**

chimney, the stability of which is ensured by guy ropes

3.1.4**concrete chimney**

chimney, the windshield of which is made of concrete

3.1.5**steel chimney**

chimney, the windshield of which is made of steel

3.1.6**masonry chimney**

chimney the windshield of which is made of masonry

3.1.7**single-wall chimney**

chimney whose structural shell also conducts the flue gases. It may be fitted with thermal insulation and/or internal lining

3.1.8**double-wall chimney**

chimney consisting of an outer steel structural shell and one inner liner which carries the flue gases

3.1.9**multi-flue chimney**

group of two or more chimneys structurally interconnected or a group of two or more liners within a structural shell

3.1.10**effective chimney height**

vertical distance between the inlet (centre axis) and the chimney outlet level

3.2 Terms for chimney parts

3.2.1

windshield

structural shell designed for load bearing purposes and to protect the flue from wind actions

Note 1 to entry: It may also function as a flue.

3.2.2

structural shell

main load-bearing steel structure of the shell structure, excluding any flanges

3.2.3

mast

structural steel construction designed and manufactured to be self-supportive and/or free standing and supports the attached satellite components

3.2.4

lining system

total system, if any, which separates the flue gases from the windshield

Note 1 to entry: This comprises a liner and its supports, the space between liner and windshield and insulation, where existing.

3.2.5

liner

structural element (membrane) of the lining system, contained within the structural shell

3.2.6

lateral guide

component of a chimney or connecting flue pipe/duct used to fix it to a structural element (building, mast, wind shield...) in order to withstand lateral loads (wind load for instance)

3.2.7

accessible space

space between windshield and liner that is designed for entry by personnel

3.2.8

connecting flue pipe/duct

component or components connecting the appliance outlet to the chimney

3.2.9

cladding

additional non-structural outer wall around a chimney and/or liner for protection against heat transfer and/or weathering, and/or for decorative purposes

3.2.10

coating

paint or other surface treatment to protect the outer surface of a liner or chimney against atmospheric corrosivity and/or plume downwash

prEN 13084-1:2023 (E)**3.2.11****insulation**

material and/or air gap between the flue liner and the outer wall, designed to increase the thermal resistance of the chimney, reduce condensates and improve buoyancy

3.2.12**spoiler**

device attached to the surface of a chimney with the objective of reducing cross wind response

3.2.13**protective cap**

cap at the top of the chimney which covers the space between windshield and liner

3.2.14**climbing sockets**

threaded sockets inserted in the concrete windshield to enable climbing dogs to be attached to the surface

3.3 Terms for operation**3.3.1****inlet**

location where gases come into the chimney

3.3.2**outlet**

top of the chimney, where the flue gases are released to the atmosphere

3.3.3**flue gas**

gaseous products of combustion or other processes, including air, which may comprise of solids or liquids

3.3.4**gas tightness**

ability of the liner to prevent smoke/exhaust gases from escaping out of the liner into the chimney or the outside atmosphere under the outlet level

3.3.5**positive pressure**

pressure inside the liner which is greater than the pressure outside the liner

3.3.6**negative pressure**

pressure inside the liner which is lower than the pressure outside the liner

3.3.7**flow resistance**

pressure loss in a flue or in a combustion circuit opposed to the flow of the flue gas and/or combustion air in motion at a given temperature and velocity

3.3.8**individual resistance coefficient**

dimensionless quantity that defines the flow resistance of an incident or an equipment on the flue

3.3.9**thermal resistance**

resistance to heat transfer from the inside to the outside of the chimney

3.3.10**thermal shock resistance**

ability of the chimney and/or liner to withstand sudden changes in temperature either during heating or cooling

3.3.11**intransient heat flow**

flow of heat, where the temperature of each point does not change with time

3.3.12**transient heat flow**

flow of heat, where the temperature changes with time

3.3.13**mean roughness**

average of the surface roughness of the liner or the component

3.3.14**down draught**

negative pressure on the lee-side of the chimney top, which can cause the flue gases to be drawn down

3.3.15**gas flow**

mass or volume of gas through the liner per unit of time

4 Performance requirements; general design**4.1 Materials**

Materials shall conform to the appropriate CEN or ISO standards. Where no such standards exist, other materials may be used if their properties are well defined and their suitability has been proven. This proof shall take account of the mechanical, thermal and chemical loads.

For concrete and steel chimneys as well as for liners see EN 13084-2, EN 13084-4, EN 13084-5, EN 13084-6, EN 13084-7, EN 13084-8 and EN 1993-3-2:2006.

4.2 Flue gas considerations**4.2.1 General**

Thermal and flow calculations shall be carried out to ensure that the flue gases will be conveyed from the combustion appliance to atmosphere taking into account the effects of the flue gases on the environment and the safety in use. However, the effect of the flue gases concerning the pollution with gaseous and particle components is not the subject matter of this document.

4.2.2 Design parameters

To carry out these calculations, design parameters as stated in 4.2.2 are required. These also apply to the assessment of chemical attack on those structural elements which are in contact with flue gases.

prEN 13084-1:2023 (E)

The following design parameters based on information given at design stage shall take into account the various operating conditions during normal and defined abnormal operations:

- a) nature of chimney operation, whether continuous, intermittent or occasional;
- b) planned frequency of shut-downs for internal inspection and maintenance;
- c) composition of the flue gases and concentrations of chemicals in the flue gases deleterious for the chimney;
- d) concentration of dust and particularly of abrasive dust in the flue gas;
- e) mass flow of each flue gas stream;
- f) flue gas temperature at entry of each flue gas duct into chimney;
- g) range of maximum acid dew point temperatures of the flue gases;
- h) admissible or required pressure at entry of flue gas ducts into chimney;
- i) altitude of the site and any special local topographic features (e.g. nearby hills, cliffs);
- j) maximum, average and minimum outside temperature;
- k) maximum, average and minimum atmospheric pressure;
- l) maximum, average and minimum humidity of the ambient air;
- m) relevant design parameters used for appliances (for example boiler) to which the chimney is connected.

4.2.3 Heat flow calculations

Temperatures in the flue gas carrying tube, in thermal insulating layers and in the windshield shall be determined. The drop in the temperature of the flue gases as they pass up to the outlet shall be calculated. The calculation could be carried out in accordance with Annex A or with EN 13384-1 provided that in both cases the implosion and minimum velocity are respected.

Values for thermal conductivity and the heat transfer coefficient may be taken from Table 1 and Table 2 respectively. Values for materials not included in these tables or values differing from these, may be taken if their source is referenced.

Table 1 — Indicative thermal conductivity values for building materials

Material	Description	Bulk density ρ kg/m ³	Temperature T °C	Thermal conductivity λ W/(m·K)
Concrete		2 400		2,1
Lightweight concrete		1 000		0,47
		1 200		0,59
		1 400		0,72
		1 600		0,87
		1 800		0,99
		2 000		1,20
Brickwork		1 800		0,81
		2 000		0,96
		2 200		1,00
Acid resistant brickwork				1,2
Brickwork of diatomaceous clay		800	200	0,18
			400	0,19
			600	0,21
		500 a	200	0,09
			400	0,10
			600	0,11
Cellular glass		130	20	0,05
			200	0,09
			300	0,12
Structural steel and weather resistant structural steel		7 850		60