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BSI Standards Publication

Free-standing chimneys

Part 9: Lifetime management — Monitoring, inspection, maintenance, remedial and reporting; Operations and actions required

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National foreword

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

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European foreword

This document (EN 13084-9:2022) has been prepared by Technical Committee CEN/TC 297 "Free standing industrial chimneys", the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by April 2023, and conflicting national standards shall be withdrawn at the latest by April 2023.

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

This document is Part 9 in a series of standards and as such is not a stand-alone document. The requirements in Parts 1 to 8 of this series are integral to Part 9.

EN 13084, *Free-standing chimneys* consists of the following parts:

— *Part 1: General requirements*

— *Part 2: Concrete chimneys*

— *Part 4: Brick liners — Design and execution*

— *Part 5: Material for brick liners — Product specifications*

— *Part 6: Steel liners — Design and execution*

— *Part 7: Product specifications of cylindrical steel fabrications for use in single wall steel chimneys and steel liners*

— *Part 8: Design and execution of mast construction with satellite components*

— *Part 9: Life-Time Management — Monitoring, Inspection, Maintenance, Remedial and Reporting; operations and actions*

The following documents additionally apply:

— EN 1993-3-1, *Eurocode 3 — Design of steel structures — Part 3-1: Towers, masts and chimneys — Towers and masts*

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

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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Introduction

EN 1990 indicates as a principle that to ensure adequate durability of the structure, several factors should be considered including the expected maintenance during the period of project use.

The same standard also states as a principle that proper inspections and maintenance according to the procedures specified in the project documentation should be stated to ensure the required level of reliability.

EN 13084-1 requires in Clause 7 that the chimneys be checked at regular intervals by an expert. The interval should not exceed two years between any checks. A written report should include recommendations for maintenance and repair.

When planning new-build or refurbishment projects, architects, designers, manufacturers and contractors have duties under European Directive 92/57/EEC 24th June 1992 on the implementation of minimum safety and health requirements at constructions sites), to consider the need for work to be carried out at height over the lifespan of a building, e.g. to clean, maintain and repair it, and they should design out the need to work at height if possible.

It is therefore necessary to specify the various operations to be carried out both in inspection and maintenance to clarify the various points of intervention to prolong the duration of use and reliability of the structure. This document describes these operations according to the summary of contents on page 2.

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1 Scope

This document covers the general requirements and the basic criteria for lifetime management of all kinds of free-standing chimneys, comprising monitoring, inspection, maintenance, repair, reporting, and necessary actions and procedures. This document applies to any windshield, single stack, tower, mast and liner covered by the EN 13084 series.

The Lifetime management considers the original structural and operating design of the structurally independent chimneys under operational conditions and other actions to verify that mechanical resistance and stability and safety in use are continued at the designed for level as expected and/or adapted to changes in the operational requirements of the structure and/or its environment.

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

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 365, *Personal protective equipment against falls from a height — General requirements for instructions for use, maintenance, periodic examination, repair, marking and packaging*

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

EN 1990, *Eurocode — Basis of structural design*

EN 1993-1-11, *Eurocode 3 — Design of steel structures — Part 1-11: Design of structures with tension components*

EN 13084-1, *Free-standing chimneys — Part 1: General requirements*

EN 62305 (all parts), *Protection against lightning*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13084-1 and the following apply.

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

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

3.1
condition monitoring
visual inspection, on a regular basis, of the structure and its components to identify any significant change

3.2
criticality level
index of the severity of a failure or a fault combined with the probability or frequency of its occurrence defined with three possible values: high, medium, and low

3.3
design working life
period for which a structure is expected to be used for its intended purpose to ensure durability against environmental actions and fatigue

3.4
expert
person who has scientific and/or technical theoretical and practical knowledge in a field of activity validated by approved education certificates and / or as well as in-depth knowledge and practical skills validated by a recognized experience of a professional activity of several years in the field of activity concerned

3.5
general inspection
assessment of the complete structure by an expert to ensure that it is still in serviceable condition or to indicate necessary maintenance or repairs

3.6
maintenance operations
combination of all technical, administrative, and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function

3.7
repair operations
physical actions to be taken or taken to restore and or maintain the required function of a faulty item

3.8
windshield
structural independent shell designed for load bearing purposes and to protect and support the liner(s), flue from wind actions

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4 Maintenance and inspection

4.1 General structure of the maintenance operations

Eurocode EN 1990 requires that the structures shall be designed such that deterioration over its design working life does not impair the performance of the structure below that intended, having due regard to its environment and the anticipated level of maintenance. The following should also be considered:

— the intended or foreseeable use of the structure (chemical and thermal loads caused by the conveying of flue/exhaust gases, the operating of the installation - on-/off operation, bypass-operation, wet stack -, foreseeable and not foreseeable operational interruptions and shutdowns, etc…;

— the required design criteria;

— the expected environmental conditions;

— the composition, properties and performance of the materials and products;

— the properties of soil;

— the choice of the structural system;

— the shape members and the structural detailing;

— the quality of workmanship and the level of control;

— the protective measures;

— the intended maintenance during the design working life.

For all types of structurally independent chimneys structures, the maintenance operations shall be done according to the following steps to preserve durability and performances:

— maintenance required by the chimney manufacturer (see 4.2);

— survey and maintenance to be done by the owner/operator (see 4.3);

— general inspection of the installation (see 4.4).

4.2 Maintenance and inspection plan by the manufacturer

As required by EN 1990, the manufacturer should include the inspection and maintenance plans in the project documentation (Operating and Maintenance manual) delivered at the commissioning and handover phase of a new project, to ensure the required level of reliability as per the structure and plant design and calculations.

The manufacturer's maintenance and inspection plan shall at least include all relevant points of 4.3 for chimney and equipment and a full set of the structural design calculations and thermal fluid design calculations.

If necessary, depending on the project specifications, manufacturers can provide more restrictive recommendations for some or all parts and equipment.

If no maintenance plan was provided by the manufacturer, such a document adapted to the specifications of the project can be drafted by a chimney expert.

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4.3 Maintenance and inspection plan by the owner/operator

4.3.1 Maintenance operations

4.3.1.1 General

It is the responsibility of the owner to maintain the installation in a good state. To guarantee the good and safe operation of the installation and to spot any deterioration which could lead to a fault, the owner shall ensure all the maintenance and inspection operations detailed in the Operating and Maintenance manual provided by the manufacturer.

4.3.1.2 Introduction

Without any other recommendations, the following maintenance operations shall be carried out.

4.3.1.3 Safety valves

If the installation includes explosion or implosion relief valves, these safety systems shall be dismantled and sent back to the manufacturer at least once a year to be recalibrated and reconditioned.

NOTE A spare new set can be kept on site to allow for continuous use of the plant.

4.3.1.4 Cleaning operations

The following cleaning operations shall be carried out:

— cleaning of base drains;

— cleaning of condensate drain-pipes;

— cleaning of rainwater drain-pipes;

— sweeping of flue liners and connecting flue pipes with appropriate brushes, plastic-based for stainless steel flues and metallic-based for mild steel flues;

— if a silencer is installed, cleaning of the condensate pipes and the baffles if applicable.

4.3.1.5 Coating system

To achieve the stated coat life span and increase the life span of the finish, it is necessary to provide on-going site maintenance / repair and/or overcoating of the paint finish. This operation shall be carried out as per the paint manufacturer's recommendations and requirements for site application with the objective to provide the same level of protection (where possible taking into full account the conditions of on-site application and environment) in durability and time as per the original factory finished coating specification.

For corrosion protection of steel structures by protective paint systems, EN ISO 12944-8:2017 provides requirements on maintenance works.

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4.3.2 Condition Monitoring

4.3.2.1 General

Regular condition monitoring is required and should extend to all visually and audibly recognizable changes to the structure and components.

This inspection is carried out from ground level and/or-by entering the chimney's accessible space if any. The chimney shall be inspected by using all available fixed ladders and platforms. Binoculars, cameras with long-distance lenses and drones with cameras can be appropriate equipment to inspect all the surfaces of the chimneys.

Visual inspection of the following elements shall be carried out.

4.3.2.2 Windshield and liner(s)

As a minimum, the following points shall be checked on the windshield and liner(s):

— leaning, sinking and loosening of guy wires;

— circular oscillation of the chimney of large amplitude even under low wind speeds;

— cracks, splits, perforations, impacts, and any structural damage;

— loosening and oxidation of nuts and bolts (anchorage, joints, base plate, guy wires);

— jamming of inspection doors and measuring plugs;

— piece of material on the surrounding grounds for a brick or concrete chimney;

— staining, dripping, corrosion marks;

— colouring, stains or runs of condensates on the windshield or liner(s);

— large amount of condensation inside the windshield.

4.3.2.3 Thermal insulation (Liner and/or windshield)

As a minimum, the following points shall be checked on thermal insulations:

— deterioration of the insulation material;

— deterioration of the cladding if any like hole, bump, twisted or missing elements;

— trace of liquid runoff.

An Infrared image examination of hot chimneys could be used to identify hot spots and thermal bridges where insulation's thermal properties are altered or where the insulating function is not given any longer.

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4.3.2.4 Equipment and accessories

As a minimum, the following points shall be checked on equipment and accessories:

— presence of loose elements (platform plates or gratings, ladder parts, cladding plates, lightning protection, cables, etc.);

— discontinuity in the lightning protection system;

— deterioration of the daytime or night-time aircraft warning systems (lights or painting);

— in silencers, damage to the absorbing material or its casing (tear), obstruction of condensate pipes, issue with general design (impact, perforation, condensate staining);

— physical deterioration/burst or any trace of leakage on the damper if any.

It is the responsibility of the owner/operator to make sure that any additional local requirements or manufacturer requirements in terms of frequency and/or content are taken on board.

4.3.3 Frequency (Intervals)

Maintenance operations and condition monitoring shall be carried out no later than 3 months after the chimney / exhaust has been commissioned and put into operation to detect any potential troubles on the plant.

Afterwards, the maintenance operations and condition monitoring shall be performed every 6 months or before restart after a long-term shutdown, or after any extraordinary occurrences like heavy storms, unusually heavy icing.

The frequency may be reduced according to the Operating and Maintenance manual provided by the manufacturer.

For specific cases where installations work continuously for periods longer than six months, the maintenance and inspection of the external parts of the chimney shall be carried out at the normal frequency. The internal parts of flue liners, connecting ducts and specific equipment shall be inspected each time the installation is stopped.

4.3.4 Record and repair actions if necessary

The maintenance operations and condition monitoring shall be recorded in a report which shall be attached to the operating and maintenance manual for future record reviews.

Any anomaly spotted during the condition monitoring shall be reported to the chimney manufacturer or to an expert without delay. The further course of action will then be advised by the chimney manufacturer or by the expert according to the risks presented by the installation.

4.4 General Inspection by a chimney expert

4.4.1 General

The general inspection will assess the performance and the state of the installation as a whole, according to the design operating requirements of the chimney(s) and plant(s).

The objective is to ascertain that the chimney, lining and components are all still in serviceable condition and fulfilling their designed requirements and tasks and to indicate if further actions like maintenance or repair operations are necessary.

This inspection is to be entrusted to an expert who can also assess the structural conditions of the structures.

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