SLOVENSKI STANDARD
SIST-TS CEN/TS 18335:2026

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Prezračevanje stavb - Ventilacijski hladilni sistemi - Načrtovanje

Ventilation for buildings - Ventilative cooling systems - Design

Lüftung von Gebäuden - Systeme für ventilative Kühlung - Planung

Ventilation des bâtiments - Systèmes de rafraichissement par surventilation - Conception

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ICS:

91.140.30	Prezračevalni in klimatski sistemi	Ventilation and air-conditioning systems

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Ventilation for buildings - Ventilative cooling systems - Design

Ventilation des bâtiments - Systèmes de rafraichissement par surventilation - Conception

Lüftung von Gebäuden - Systeme für ventilative Kühlung - Planung

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European foreword

This document (CEN/TS 18335:2026) has been prepared by Technical Committee CEN/TC 156 “Ventilation for buildings”, the secretariat of which is held by BSI.

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Introduction

0.1 Purpose and background

Rising global temperatures and urbanization increase the risk of overheating in buildings, affecting occupants' health and comfort throughout summer and increasingly in spring and autumn, periods during which an ageing population can be more vulnerable to this phenomenon. As people spend around 90 % of their time indoors, buildings ought to effectively protect occupants from heatwaves and rising temperatures.

Higher ambient temperatures significantly boost energy demands for active cooling, posing substantial environmental challenges. By 2050, global energy use for space cooling could triple compared to 2016 levels, potentially doubling related CO_2 emissions, with the residential sector accounting for about 70 % of this increase [1].

Implementing passive cooling strategies – such as better insulation, solar shading, and ventilative cooling – is critical to reducing overheating, decreasing energy use, and safeguarding occupant health, especially for vulnerable populations.

The increasing energy demand (for cooling) in buildings is putting a big strain on the electricity grid, which in many countries could cause grid congestion and intermittent power outages. When designing buildings for future resilience there should be a cooling strategy in place on how to reduce the potential for internal overheating with no or a minimal use of active cooling. The cooling ladder ethos, as part of this document [2] offers a design strategy for resilient buildings by firstly mitigating the solar and internal gains and later if overheating has taken place, to first provide cooling with use of passive means (e.g. ventilative cooling) prior to moving to active means (e.g. active cooling). To diminish the impact of (cooling) energy use in buildings on the climate change, appropriate guidelines of cooling design from free cooling solutions such as ventilative cooling, to supplementary free cooling and interventions are included in this document.

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Overheating relates to a range of conditions under which people experience thermal discomfort and cannot be adequately defined by a single measurable value of temperature. The rate of increase in temperature, the temperature reached, the time for which the temperature stays high and individual tolerance are all important factors, as well as humidity factors.

The necessary decarbonisation of the European Union building stock requires renovation at a large scale: almost 75 % of that building stock is inefficient according to current building standards, and 85 to 95 % of the buildings that exist today will still be standing in 2050 [3].

0.2 Addressing overheating risks through cooling strategies in buildings

Factors such as the same building envelope insulation, increased solar gains, and highly insulated windows can contribute to overheating, leading to higher energy usage due to increased active cooling. This is not ideal for the world's total energy usage, at the same time, the free cooling techniques (e.g. ventilative cooling, dynamic solar shading) are generally not yet taken properly into account; since guidelines, standards and legislation do not really consider the relevant potential of free cooling solutions and supplementary modulations sufficiently yet. Though some mitigation policies on limitation of overheating (e.g. heat protection) have been implemented nationally such as green roofs, criteria for green spaces, the need for solar shading systems etc.

However, buildings designed without consideration for potential overheating mitigation are foreseen in the future to be at risk of discomfort in cooling season and rising costs (and relative direct or indirect CO_2 emissions) for vast use of active cooling, causing higher energy usage in buildings, which in the long term is not sustainable for the planet.

In many new or renewed buildings, technical solutions for the building envelope in combination with the HVAC systems have in recent times become more complex. Moreover, there is a growing worry about potential overheating in Zero Emission Buildings (ZEB) design, paying a growing attention to the

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limitation of the potential extended use of air conditioning as an active cooling solution to provide indoor space cooling, encouraging at the same time a systematic approach to largely use free cooling techniques (e.g. ventilative cooling, dynamic solar shading, solar reflective index) as a first design action to mitigate overheating. It is essential to use the full potential of passive technologies to mitigate or reverse rising electricity use from space cooling, the use of ventilative cooling is considered a very important solution. There are already excellent approaches in this direction, for example, the cooling hierarchy defined into London's response to climate change, which seeks to reduce any potential overheating and to reduce as much as possible the need to cool a building through active cooling measures [2]. The cooling ladder described in this document implements this philosophy.

Ventilative cooling should find proper consideration in existing buildings undergoing major renovation or deep renovation (as defined in article 1(20) of EPBD) which in Europe will be a relevant part of work to be done to reach carbon neutrality by 2050, taking into consideration constraints and sometimes space limitations in existing buildings to be renewed. Regarding new buildings, ventilative cooling should also find proper consideration as these buildings can permit a much easier integration of several ventilative cooling techniques.

In situations where the additional ventilation air flow rate is increased above the standard ventilation air flow rate requirement (standard ventilation) for cooling purposes, the cooling contribution resulting from this additional air flow may be taken into account in calculations relating to renewable cooling as indicated by [4]. For more information see 4.2.

0.3 Means to overcome overheating

Ventilative cooling is one of many cooling solutions to mitigate overheating, which can, either alone or in combination with supplementary or active cooling systems, create acceptable thermal comfort or decrease cooling loads (can be both peak and annual) in buildings. Ventilative cooling is free cooling that relies on the actual temperature of natural elements such as outdoor air, aiming at mitigating overheating where air transfer may be by natural, mechanical or hybrid means.

Ventilative cooling enables new and refurbished buildings to adapt to climate change in terms of resilience, such as recoverability and this is integrated into the 9 key design steps for ventilative cooling system design.

Reducing the cooling load can reduce the reliance on active cooling systems and mitigate the risk of overheating. Under the right outdoor conditions, indoor air quality can be improved when air flow rates are increased compared to standard ventilation air flow rates. Often a combination of ventilative cooling, external solar shading and thermal mass is the optimal solution to achieving acceptable thermal comfort during prolonged hot spells and to mitigate the effect of climate change.

Reasons for choosing ventilative cooling:

— is a part of a resilient cooling strategy to ensure that buildings are enhanced for climate change in regard to:

  — energy shortage and grid congestion

  — availability

  — achieving acceptable thermal comfort during power outages.

— can reduce energy use during times when there is a cooling demand, possibly eliminating or reducing the need for active cooling systems under suitable outside conditions.

— can contribute to building flexibility by shedding or shifting thermal peaks

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— is a type of renewable energy, as outdoor air is a renewable source for cooling at air flows above the standard ventilation air flow rate (see 4.2 and Annex K). This includes natural, mechanical as well as hybrid ventilative cooling, as the outdoor air (unprocessed) is the source of ventilative cooling.

Generally, resilient cooling is used to denote low energy and low carbon cooling solutions that strengthen the ability of individuals, and the community as a whole to withstand, and also prevent, the thermal and other impacts of changes in global and local climates, particularly with respect to increasing ambient temperatures and the increasing frequency and severity of heat waves [5].

Finally, it is evident that resilient cooling solutions, such as free cooling provided as ventilative cooling and supplementary free cooling and additional design interventions (thermal mass, solar shading), offer potential technical solutions to respond to the expected increase space cooling demand.

0.4 Connection to European Standards

This document sets the design framework for how to design ventilative cooling systems to cope with the set criteria, estimating how much ventilative cooling can be used in residential and non-residential buildings before having to assist with supplementary free cooling or active cooling. Further it is a "system design" document much like EN 15665 [6] and EN 16798-3 [7] referencing existing EPB standards, e.g. thermal comfort criteria in EN 16798-1 or national regulations, see Figure 1.

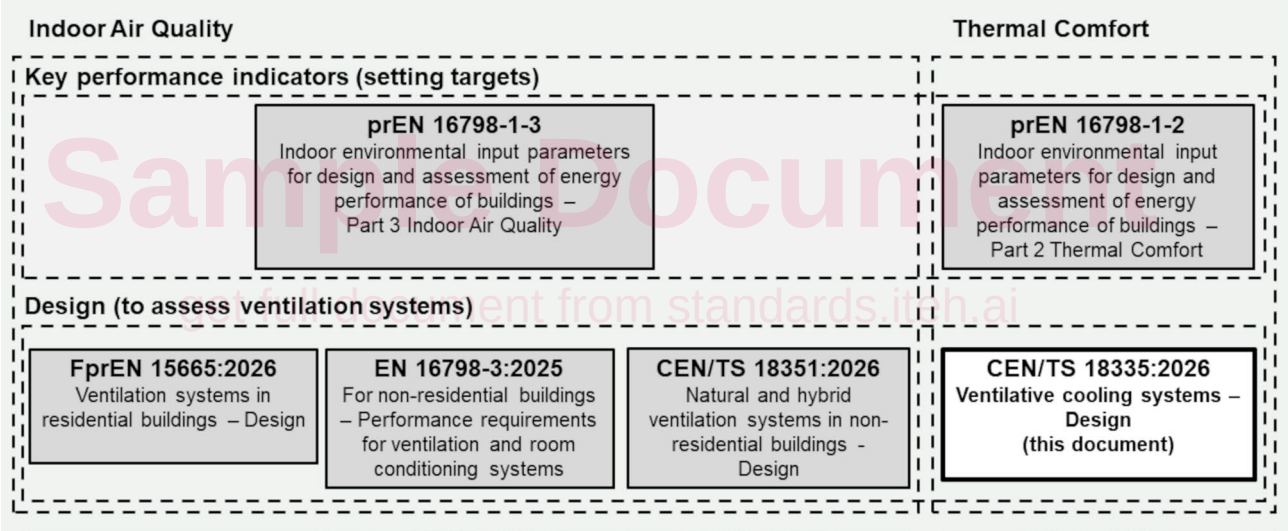

Figure 1 — Overview of design and KPI standards in Europe (existing and under development)

This document refers to the new edition of EN 16798-1 [8] for thermal comfort criteria to be reached by the design of buildings with ventilative cooling strategies. This document explains how to design ventilative cooling systems and could be used as a reference in relevant EPB standards.

NOTE The new editions of EN 15665 and EN 16798-1 will be adopted depending on document progress.

Table 1 shows the dependencies between this document and other related European EPB standards for residential and non-residential buildings.

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Table 1 — Dependencies between this document and EPB standards

	IEQ criteria	**Building energy needs**	**Building automation**	**Calculation of air flow rates**	**Ventilation energy**	**Ventilation energy**
"Ventilative cooling systems – Design" (CEN/TS)	EN 16798-1:2019 [9]	EN ISO 52016-1:2017 [10]	EN ISO 52120-1:2022 (only for Mechanical ventilation and active cooling) [11]	EN 16798-7:2017 [12]	EN 16798-5-1:2017 (only for Mechanical ventilation and active cooling) [13]	EN 16798-5-2:2017 (only for Hybrid and Mechanical ventilation) [14]

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1 Scope

This document gives guidance to the design of ventilative cooling systems while referring to relevant standards to ensure coherence and avoiding overlapping. In this document different design approaches for use of natural, mechanical or hybrid ventilative cooling can be found, starting at the feasibility phase before going into the design phase. In addition, this document gives guidance on where to find additional information on the design, calculation and maintenance of such systems.

This document is applicable to buildings specified according to the thermal indoor environmental aspects used for human occupancy where production processes don't have a major impact on the indoor environmental quality. This document is applicable to residential and non-residential buildings.

This document applies to all types of buildings: new and retrofit, residential and non-residential.

This document is applicable to:

— mechanical ventilative cooling

— natural ventilative cooling

— hybrid ventilative cooling

— airing as a supplement to ventilative cooling specifically relevant during e.g. power failures

— supplementary free cooling as a supplement to ventilative cooling

The design of supplementary free cooling systems and active cooling systems are not part of the normative part of the document. However, the interface between ventilative cooling systems and supplementary free cooling systems as well as the interface between ventilative cooling and active cooling systems are mentioned informatively.

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Design of ventilative cooling systems commonly considers other aspects like energy use, acoustic, draught, solar gain control, outdoor air quality, user acceptance, burglary and cleaning and maintenance, though these are not covered in detail in this document.

This document only covers temperature control.

This document does not apply to:

— moisture control

— waterborne

— heat losses.

2 Normative references

The following documents are referred to in the text in such a way that some or all 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 12792, *Ventilation for buildings - Symbols, terminology and graphical symbols*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12792 and the following apply.

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ISO and IEC maintain terminology 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/

3.1
air replacement
process of replacing the air within an enclosure with air coming directly from outdoors or passing through a transfer zone or both

Note 1 to entry: Air replacement can be done through ventilation, airing and air leakage airing.

3.2
standard ventilation
ventilation to achieve acceptable indoor air quality under normal occupancy

Note 1 to entry: Acceptable indoor air quality can be linked with occupants or building needs.

3.3
intensive ventilation
ventilation at significantly higher air flow rate than that of standard ventilation for a specific purpose limited in time

3.4
natural ventilation
ventilation whose operating principle is based solely on the effect of wind and the stack effect

Note 1 to entry: Open windows, e.g. roof windows, rooflights and roof hatches can be used for natural ventilation if they are purpose-provided.

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3.5
mechanical ventilation
ventilation whose operating principle is based solely on the operation of fans

3.6
hybrid ventilation
ventilation whose operating principle is based on the combination of natural ventilation and mechanical ventilation

Note 1 to entry: Natural ventilation and mechanical ventilation can take place simultaneously or alternately.

3.7
airing
air replacement by means that are not purpose-provided

Note 1 to entry: Usually done through manual opening of doors or windows, louvres or both.

3.8
stack effect
pressure difference caused by the difference in density between indoor air and outdoor air due to their temperature difference

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3.9
cross ventilation
natural ventilation which relies on vents located on different sides of a building or room

Note 1 to entry: Cross ventilation mainly relies on the effect of the wind.

Note 2 to entry: The concept of side includes façades and roofs.

3.10
cooling
removal of heat

Note 1 to entry: There are two types of heat: latent heat and sensible heat.

3.11
free cooling
natural cooling
cooling that relies on the actual temperature of natural elements or on the evaporation of water

Note 1 to entry: Free cooling includes ventilative cooling, supplementary free cooling, etc.

Note 2 to entry: Free cooling does not use any kind of mechanical compressors (like chillers, air-conditioners, or heat pumps).

Note 3 to entry: Examples of natural elements are outdoor air, surface water, groundwater and earth.

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3.12
ventilative cooling
free cooling, relying on outdoor air only, by means of ventilation or airing

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Note 1 to entry: Ventilation can be natural, mechanical or hybrid.

Note 2 to entry: While ventilative cooling is not limited to ventilation, the adjective “ventilative” has been retained because of its widespread use in the field.

3.13
natural ventilative cooling
free cooling by natural ventilation
ventilative cooling whose operation is based solely on the effect of wind and the stack effect

3.14
mechanical ventilative cooling
free cooling by mechanical ventilation
ventilative cooling whose operation is based solely on the operation of fans

3.15
hybrid ventilative cooling
free cooling by hybrid ventilation
ventilative cooling whose operation is based on the combination of natural and mechanical ventilative cooling

3.16
vent
opening in the building envelope that is intended for the passage of air

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EXAMPLE externally mounted air transfer device, intake air terminal device, wall and window louvres, façade windows, rooflights, roof outlet or roof windows

3.17
descriptive requirement
requirement in the form of a specified technical solution

EXAMPLE minimum opening area

3.18
performance-based approach
performance-based method
way of considering something guided by performance-based requirement(s)

Note 1 to entry: The assessment of the criteria is done through calculations or simulations.

3.19
intake air
air that is taken in from outside a building by ventilation or by airing

3.20
supply air
air that is provided inside a building by ventilation or by airing

3.21
extract air
air that is removed from inside a building by ventilation or by airing

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3.22
exhaust air
air that is discharged to outside a building by ventilation or by airing

3.23
hybrid cooling
combination of free cooling and active cooling

Note 1 to entry: The control can be alternation or simultaneous.

3.24
supplementary free cooling
cooling that relies not only on the actual temperature difference between outdoor air and indoor air but also uses additional natural potentials

EXAMPLE evaporative cooling or ground cooling

3.25
thermal resilience
ability to prepare and plan for, resist, adapt to, or recover from an adverse, potentially disruptive, event

Note 1 to entry: In the field of buildings, resilience concerns among others their thermal performance or their protection against precipitations, particularly during extreme weather events arising from climate change.

3.26
night cooling
ventilative cooling during nighttime

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3.27
active cooling
mechanical cooling
cooling by means of a device that uses energy to lower the temperature of a fluid or solid, except where the energy is used solely to move the fluid

Note 1 to entry: It includes for example mechanical cooling and thermoelectric cooling.

EXAMPLE vapour-compression refrigeration, fan coil units, chilled ceilings, beams cooled surfaces

4 Considerations for ventilative cooling design

4.1 Air replacement and thermal comfort

Ventilation is needed to provide oxygen for metabolism and to dilute pollutants (odour, CO_2 as a proxy for other pollutants etc.). Ventilation systems can also be designed for cooling purposes with elevated air flow rates above the standard ventilation air flow rate, where ventilative cooling is one of the solutions, to achieve an acceptable thermal comfort.

Air flow rates can also be significantly increased for a given period of time to address peak situations (intensive ventilation) with respect to ventilation but can also permanently be increased with the purpose of achieving acceptable thermal comfort using ventilative cooling. This can be done by whatever the operating principles (mechanical ventilative cooling, natural ventilative cooling or hybrid ventilative cooling).

An essential aspect of the design process is to identify how much air replacement is to be provided to a space, to at least maintain the indoor thermal comfort where too little can result in poor thermal comfort, while too much could result in an increased energy use and cause draught. Using descriptive requirements, air replacement rates can also be equivalently converted to design opening areas.

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For residential use, increased night cooling could ideally occur through roofs, facades or away from street level, in e.g. stairways or open areas if the vents are placed ideally. Further the possibility of increased day and night cooling can generally be assumed, however care should be taken to ensure there are no risks associated with burglary, noise, pollution etc. Effective night cooling, but also day cooling depends on aspects such as adequate thermal mass, placement of openings, occupancy, comfort zones, level of automated functioning etc. With a more optimized system and building design, higher air flow rates should be allowed.

For non-residential use, increased night cooling could occur in e.g. corridors if the vents are placed ideally and secured through actuators due to lack of occupancy during night in the buildings. Further indoor resistances are important to take into account.

NOTE For more information on night cooling see Annex C.

Under appropriate conditions, airing is a very effective means to cool down buildings during e.g. power failures or specific events like night cooling.

Ventilative cooling can be either manual or automatic operation of vents, like openable windows, rooflights and roof hatches for natural ventilative cooling. Wall switches can also control e.g. roof windows, louvres, rooflights and roof hatches.

For specific requirements on classifications of thermal comfort see EN 16798-1 [9]. For buildings without active cooling the adaptive comfort method should be considered, applying for occupants with sedentary activities without strict clothing policies where thermal conditions are regulated primarily by the occupants through opening and closing of elements in the building envelope (e.g. windows, ventilation flaps, louvres, rooflights).

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