

**Luftbehandling – Beräkningsmetoder för
energiförluster, orsakade av ventilation och
infiltration, hos kommersiella fastigheter**

**Ventilation for buildings – Calculation methods
for energy losses due to ventilation and
infiltration in commercial buildings**

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Ventilation for buildings - Calculation methods for energy losses due to ventilation and infiltration in commercial buildings

Ventilation des bâtiments - Méthode de calcul des pertes d'énergie dues à la ventilation et aux infiltrations dans les bâtiments commerciaux

Lüftung von Gebäuden - Berechnungsverfahren für den Energieverlust aufgrund der Lüftung und Infiltration in Nichtwohngebäuden

This European Standard was approved by CEN on 26 March 2007.

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Contents	Page
Foreword.....	3
1 Scope.....	6
2 Normative references	6
3 Terms and definitions.....	6
4 Symbols and abbreviations	7
5 General approach.....	8
6 Steady state calculation	9
6.1 Basis of the calculation method.....	9
6.2 Air entering through infiltration, passive air inlets or windows	9
6.3 Air entering through balanced or supply only system calculation	9
6.3.1 General.....	9
6.3.2 Duct heat losses.....	10
6.3.3 Duct flow losses.....	10
6.3.4 Fan.....	10
6.3.5 heat exchanger.....	13
6.3.6 Mixing boxes	15
6.3.7 Pre-heating	16
6.3.8 Pre-cooling	16
6.3.9 Humidifying in winter.....	17
6.3.10 Dehumidification	17
7 Implementation of the method.....	18
7.1 General.....	18
7.2 Hourly method.....	18
7.3 Monthly methods	19
7.3.1 System with no or low humidity impact	19
7.3.2 System with medium or high humidity impact	19
7.4 Statistical approach to be applied at national level	20
Annex A (informative) A simplified model of a Ground to Air Heat Exchanger.....	21
A.1 Background and summary.....	21
A.2 Overview of program links, variables, parameters and constants	22
A.3 Physical description of the ground to air heat x-change model.....	23
Bibliography	26

Foreword

This document (EN 15241:2007) has been prepared by Technical Committee CEN/TC 156 "Ventilation for buildings", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2007, and conflicting national standards shall be withdrawn at the latest by November 2007.

This standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/343), and supports essential requirements of EU Directive 2002/91/EC on the energy performance of buildings (EPBD). It forms part of a series of standards aimed at European harmonisation of the methodology for the calculation of the energy performance of buildings. An overview of the whole set of standards is given in CEN/TR 15615, Explanation of the general relationship between various CEN standards and the Energy Performance of Buildings Directive (EPBD) ("Umbrella document").

Attention is drawn to the need for observance of relevant EU Directives transposed into national legal requirements. Existing national regulations with or without reference to national standards, may restrict for the time being the implementation of the European Standards mentioned in this report

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EN 15241:2007 (E)

Introduction

This standard defines the way to calculate the energy impact of airflows due to the ventilation system. Ventilation system impact is calculated as direct (energy devoted to the air treatment and move in the ventilation system), and indirect (impact on cooling and heating of the building). The relationships with some other standards are as follows:

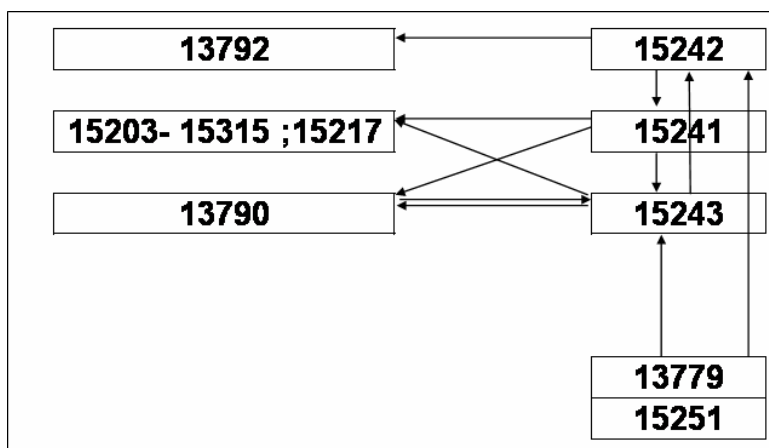


Figure 1 - Scheme of relationship between standards

Table 1 - Relationship between standards

from	To	Information transferred	variables
15251	15243	Indoor climate requirements	Heating and cooling Set points
13779 15251	15242	Airflow requirement for comfort and health	Required supply and exhaust Air flows
15242	15241	Air flows	Air flows entering and leaving the building
15241	13792	Air flows	Air flow for summer comfort calculation
15241	15203-15315 ;15217	energy	Energies per energy carrier for ventilation (fans, humidifying, precooling, pre heating), + heating and cooling for air systems
15241	13790	data for heating and cooling calculation	Temperatures, humidities and flows of air entering the building
15243	15243	Data for air systems	Required energies for heating and cooling
15243	15242	Data for air heating and cooling systems	Required airflows when of use
15243	13790	data for building heating and cooling calculation	Set point, emission efficiency, distribution recoverable losses, generation recoverable losses
13790	15243	Data for system calculation	Required energy for generation

EN titles are:

prEN 15217, *Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings*

prEN 15603, *Energy performance of buildings — Overall energy use and definition of energy ratings*

prEN 15243, *Ventilation for buildings — Calculation of room temperatures and of load and energy for buildings with room conditioning systems*

prEN ISO 13790, *Thermal performance of buildings — Calculation of energy use for space heating and cooling (ISO/DIS 13790:2005)*

EN 15242, *Ventilation for buildings — Calculation methods for the determination of air flow rates in buildings including infiltration*

EN 15241, *Ventilation for buildings — Calculation methods for energy losses due to ventilation and infiltration in commercial buildings*

EN 13779, *Ventilation for non-residential buildings — Performance requirements for ventilation and room-conditioning systems*

EN 13792, *Colour coding of taps and valves for use in laboratories*

EN 15251, *Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics*

The target audience of this standard is policy makers in the building regulation sector, software developers of building simulation tools, industrial and engineering companies.

EN 15241:2007 (E)

1 Scope

This European Standard describes the method to calculate the energy impact of ventilation systems (including airing) in buildings to be used for applications such as energy calculations, heat and cooling load calculation.

Its purpose is to define how to calculate the characteristics (temperature, humidity) of the air entering the building, and the corresponding energies required for its treatment and the auxiliaries electrical energy required.

This standard can also be used for air heating and cooling systems when they assure the provision of ventilation, considering that prEN 15243 will provide the required heating or cooling load and the corresponding air flows and/or air temperatures.

2 Normative references

The following referenced documents are indispensable for the application 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 12792:2003, *Ventilation for buildings — Symbols, terminology and graphical symbols*

EN 13053:2006, *Ventilation for buildings — Air handling units — Rating and performance for units, components and sections*

EN 13779, *Ventilation for non-residential buildings — Performance requirements for ventilation and room-conditioning systems*

prEN 15232, *Energy performance of buildings — Impact of Building Automation, Controls and Building Management*

EN 15242, *Ventilation for buildings — Calculation methods for the determination of air flow rates in buildings including infiltration*

prEN 15243, *Ventilation for buildings — Calculation of room temperatures and of load and energy for buildings with room conditioning systems*

prEN ISO 13790, *Thermal performance of buildings — Calculation of energy use for space heating and cooling (ISO/DIS 13790:2005)*

3 Terms and definitions

For the purposes of this document the terms and definitions given in EN 12792:2003 and the following apply.

3.1

defrosting coil

coil used before the heat exchanger to prevent its frosting

3.2

pre-heating coil

coil used to warm up the air entering the supply ducted system to a predefined value (e.g.; not controlled according to indoor temperature)

3.3

pre-cooling coil

coil used to cool down the air entering the supply ducted system to a predefined value

3.4

building height

height of the building from the entrance ground level to the roof top level

3.5

building leakage

overall leakage airflow for a given test pressure difference across building

3.6

building volume

volume within internal outdoor walls of the purposely conditioned space of the building (or part of the building). This generally includes neither the attic, nor the basement, nor any additional structural annex of the building

3.7

building air temperature

average air temperature of the rooms

4 Symbols and abbreviations

Table 2 — symbols and abbreviations

Symbol	Unit	description
<i>A</i>	m ²	area
<i>Bh</i>	m	building height
<i>C_{ductleak}</i>	ad	coefficient taking into account lost air due to duct leakages
<i>C_{syst}</i>	ad	coefficient taking into account the component and system design tolerances
<i>C_{use}</i>	ad	coefficient taking into account the switching on and off of fans
<i>C_{cont}</i>	ad	coefficient depending on local air flow control
<i>Eff</i>	ad	efficiency
<i>H</i>	W/K	heat loss
<i>q_v(dP)</i>	curve or formula	airflow/pressure difference characteristic
<i>q_v 4Pa,n or n50,n</i>	m ³ /h	external envelope airtightness expressed as an airflow for a given pressure difference, exponent
<i>q_v 4Pa,n or n50,n</i>	m ³ /h	partial air tightness for altitude (z), orientation (or), tilt angle (Tilt)
<i>q_{v-exh}</i>	m ³ /h	exhaust air flow
<i>q_{v-sup}</i>	m ³ /h	supply air flow
<i>P</i>	W	heating power
<i>R</i>	Ad	ratio
<i>θ</i>	°C	temperature
<i>x</i>	g/kg of dry air	moisture content of the air

EN 15241:2007 (E)

Table 3 — Indices used in the documents

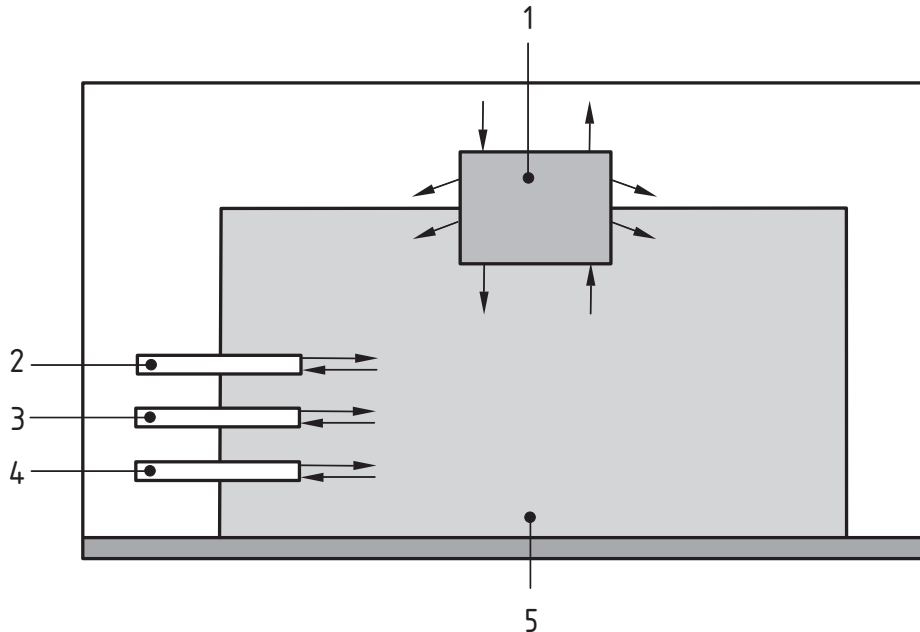
sup	Concerns supply air as defined in EN 13779	rec	Concerns recirculation
exh	Concerns exhaust air as defined in EN 13779	ductsurr	Concerns air surrounding the duct
e1	Concerns exhaust air entering unit	e2	Concerns exhaust air at unit's exit
s1	Concerns supply air entering unit	s2	Concerns supply air at unit's exit
PC	Concerns precooling	PH	Concerns pre-heating
hum	Concerns humidifying	Fan or f	Concerns fan
HE	Concerns heat exchanger	f,r	Concerns heat recovered from fan
ext	external	int	internal
duct	Concerns the duct	cont	control

5 General approach

EN 15242 defines the procedure to calculate the following air flows (either entering or leaving the heated/conditioned area) through leakages, opened windows, purpose provided openings (considered as part of the ventilation system) and the ventilation system.

For overall heating and cooling needs calculation, prEN ISO 13790, uses directly the airflows entering the building through leakages, opened windows, and purpose provided opening, as there's is no additional energy impact when these air flows are known. Therefore this standard focuses on the impact on the ventilation system itself both for the air treatment and move.

For air heating and cooling system, prEN 15243 provides the required airflow and supply temperatures.



Key

- 1 ventilation system
- 2 window opening
- 3 opening
- 4 leakage
- 5 internal reference pressure

Figure 2 — general scheme for airflows

The ventilation system here considered does not directly include room controlled heating and cooling, but only preheating and precooling coils. The local heating or cooling system description and calculation is not considered directly. Its possible impact on the exhaust air temperature or on the required airflows set points and controls can nevertheless be taken into account.

The aim of this standard is therefore to provide the "air information" for heating and cooling calculation methods, which means:

- Air flows (from standard EN 15242), temperature, humidity entering the heated/conditioned area both for ventilation and infiltration.
- Electrical needs for fan and ventilation system auxiliaries;
- Required energy for defrosting, preheating, precooling, humidifying, dehumidifying;
- The heating and cooling energy needs due to infiltration are not part of the standard.

Required energy for heating and cooling for air heating and cooling systems can be taken into account using the same formulas in connection with prEN 15243.

These energies will be provided by energy carrier and use (heating, cooling, ventilating). In some cases it will require some specific assumptions as for example if a fan is used for ventilation, heating and cooling.

Three implementation possibilities of the calculation procedure described in Clause 6 are shown in Clause 7.

6 Steady state calculation

6.1 Basis of the calculation method

Starting from the airflows, the aim of the procedure is to calculate:

- Temperature and humidities of the airflows entering the heated or cooled areas.
- Energy devoted to the air treatment.

6.2 Air entering through infiltration, passive air inlets or windows

It is basically considered that the air characteristics are the outdoor air ones.

Preheated air inlets and ground coupling are part of this standard

If the air is taken in an adjacent space the air temperature in this space shall be calculated according to prEN ISO 13790.

6.3 Air entering through balanced or supply only system calculation

6.3.1 General

The following subclauses describe how the air characteristics are modified in each component, and the energy required for that treatment.