

Ventilation for buildings — Air handling units — Ratings and performance for units, components and sections

The European Standard EN 13053:2001 has the status of a
British Standard

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National foreword

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Ventilation for buildings - Air handling units - Ratings and performance for units, components and sections

Ventilation des bâtiments - Caissons de traitement d'air -
Classification et performance des caissons, composants et
sections

Lüftung von Gebäuden - Zentrale raumluftechnische
Geräte - Leistungskennndaten für Geräte, Komponenten und
Baueinheiten

This European Standard was approved by CEN on 18 August 2001.

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Foreword

This European Standard 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of an identical text or by endorsement, at the latest by April 2002, and conflicting national standards shall be withdrawn at the latest by April 2002.

This European Standard is a part of a series of standards for air handling units used for ventilation and air conditioning of buildings for human occupancy. It considers the ratings and the performance of air handling units as a whole, the requirements and performance of specific components and sections of air handling units including hygiene requirements. It is supported by the standard for mechanical performance, EN 1886:1998. The position of this standard in the field of mechanical building services is shown in Figure 1.

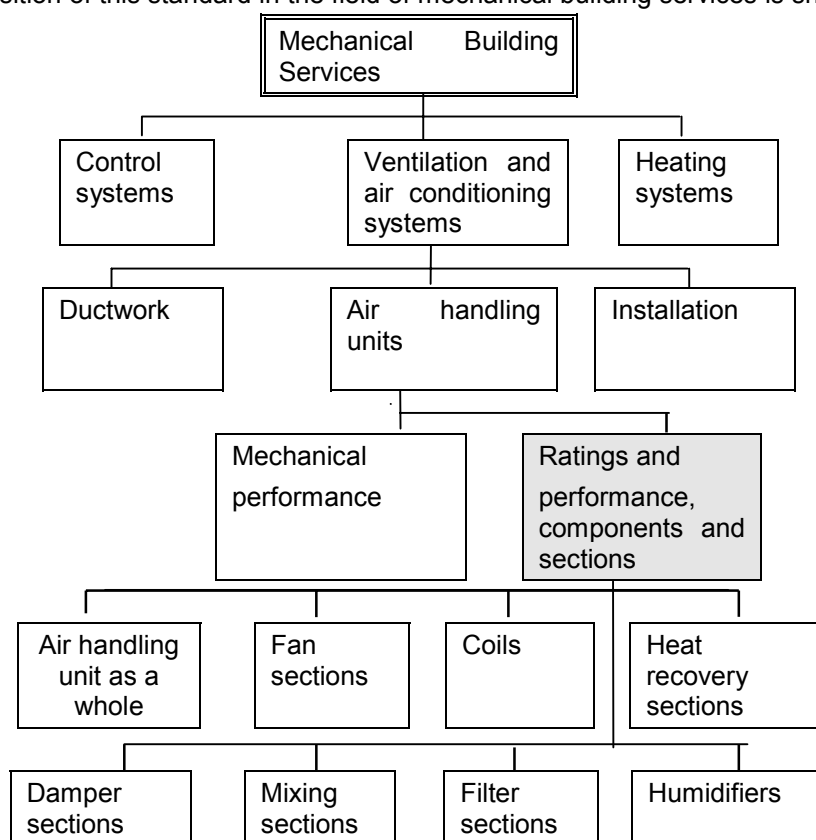


Figure 1 — Position in the field of mechanical building services

Annex A is normative. Annexes B and C are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies requirements and testing for ratings and performance of air handling units as a whole.

It also specifies requirements, classification, and testing of specific components and sections of air handling units. For many components and sections it refers to component standards, but it also specifies restrictions or applications of standards developed for standalone components.

This standard is applicable both to standardized designs, which may be in a range of sizes having common construction concepts, and also to custom-design units. It also applies both to air handling units, which are completely prefabricated, and to units which are built up on site. Generally the units within the scope of this standard include at least a fan, a heat exchanger and an air filter.

This standard is not applicable to the following:

- a) air conditioning units serving a limited area in a building, such as fan coil units;
- b) units for residential buildings;
- c) units producing ventilation air mainly for a manufacturing process.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 305, *Heat exchangers — Definitions of performance of heat exchangers and the general test procedure for establishing performance of all heat exchangers*

EN 308, *Heat exchangers — Test procedures for establishing performance of air to air and flue gases heat recovery devices*

EN 779, *Particulate air filters for general ventilation — Requirements, testing, marking*

EN 1216, *Heat exchangers — Forced circulation air-cooling and air-heating coils — Test procedures for establishing the performance*

EN 1751:1998, *Ventilation for buildings — Air terminal devices — Aerodynamic testing of dampers and valves*

EN 1886:1998, *Ventilation for buildings — Air handling units — Mechanical performance*

EN 10088-2, *Stainless steel — Part 2: Technical delivery conditions for sheet/plate and strip for general purposes*

CR 12792, *Ventilation for buildings — Symbols and terminology*

prEN 13030:1997, *Ventilation for buildings — Terminals — Performance testing of louvres subjected to simulated rain*

EN 25136, *Acoustics — Determination of sound power radiated into a duct by fans — In-duct method (ISO 5136:1990 and Technical Corrigendum 1:1993)*

EN ISO 3741, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for reverberation rooms (ISO 3741:1999)*

EN ISO 3744, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering methods in an essentially free field over a reflecting plane (ISO 3744:1994)*

EN ISO 3746, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995)*

EN ISO 7235, *Acoustics — Measurement procedures for ducted silencers — Insertion loss, flow noise and total pressure loss (ISO 7325:1991)*

EN ISO 9614-1, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points (ISO 9614-1:1993)*

EN ISO 9614-2, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning (ISO 9614-2:1996)*

prEN ISO 9614-3:2000, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 3: Precision method for measurement by scanning (ISO/DIS 9614-3:2000)*

ISO 3966, *Measurement of fluid flow in closed conduits — Velocity area method using pitot-static tubes*

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices – Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full*

ISO/TR 5168, *Measurement of fluid flow — Evaluation of uncertainties*.

ISO 5221, *Air distribution and air diffusion — Rules to methods of measuring air flow rate in an air-handling duct*

ISO 5801:1997, *Industrial fans — Performance testing using standardized airways*

3 Terms and definitions

For the purposes of this standard the terms and definitions given in CR 12792, together with the following, apply.

3.1

air handling unit

factory made encased assembly consisting of sections containing a fan or fans and other necessary equipment to perform one or more of the following functions: circulating, filtration, heating, cooling, heat recovery, humidifying, dehumidifying and mixing of air

3.2

section of air handling unit

functional element of an air-handling unit, consisting of one or more components in a single casing

3.3

component of air handling unit

smallest discrete functional element of an air-handling unit

3.4

blow-through unit

air handling unit with a section or sections downstream of the supply air fan

3.5

casing of an air-handling unit

enclosure of the unit, within which the components are mounted

3.6

openings for outdoor air, supply air, extract air, recirculation air and exhaust air

aperture through which air is taken in or discharged from the air-handling unit, such as openings for outdoor air, supply air, recirculation air and exhaust air

3.7

damper section

section of air handling unit including a damper or valve

3.8

mixing section

section where the outdoor air flow and the recirculation air flow are mixed in a controlled way. The section generally consists of one damper per air flow and a mixing chamber

3.9

filter section

section including a filter or filters and associated framework

3.10

heat recovery section

section in which heat (and possibly also moisture) is transferred from one airstream into another, either directly or using an intermediary heat transfer medium

3.11

air heating and cooling coils

heat exchangers by means of which heat is transferred from a heat transfer medium to air (heating coil) or the other way round (cooling coil)

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3.12

sound attenuation section

section in which sound transfer into ductwork or to ambient air is reduced

3.13

humidifier section

section in which moisture is added to the air

3.14

fan section

section in which one or more fans are installed

3.15

combined section

section within which two or more functions are combined

3.16

functions

3.16.1

air treatment

process by which the state of the air is modified with respect to one or more of its temperature, moisture content, dust content, bacterial count, gas and vapour contents

3.16.2

air type

designation of the air moving through a ventilation, air conditioning or air treatment installation as a function of its location relative to the installation, e.g. outdoor air, exhaust air, extract air etc

3.16.3

cooling

removal of latent and/or sensible heat

3.16.4

dehumidification

controlled reduction of water vapour from the air

3.16.5

filtration

removal of particulate material from a fluid or gas

3.16.6

heating

transfer of heat from one body or medium to another medium

3.16.7

humidification

controlled addition of water vapour to an air stream or space

3.16.8

sound reduction

controlled reduction of sound energy

3.17

characteristics

3.17.1

air flow

movement of air within set boundaries (such as ducts)

3.17.2**air flow rate**

mass or volume flow of air passing a given plane divided by time

3.17.3**bypass factor**

ratio of the diverted flow to the sum of the main flow and the diverted flow

3.17.4**bypass leakage**

unwanted and uncontrolled passing of untreated air into the treated air between the components within a casing, such as filters and coils

3.17.5**deflection of a casing [see: bulging, caving]**

deformation in mm of the external surfaces of the enclosure when subjected to a positive (bulging) or negative (caving) pressure. It is given as the measured difference in distance between a reference plane and the maximum point of deflection when subjected to air pressure

3.17.6**defrosting heat ratio**

ratio between the energy transferred into the supply air and the maximum recoverable energy in exhaust air, excluding the energy input for defrosting

3.17.7**air leakage factor f**

air tightness expressed as the air leakage per unit envelope area (external air leakage)

3.17.8**air leakage rate q_{vl}**

air leakage of the air handling unit, subject to air pressure (external air leakage)

3.17.9**external total pressure difference**

difference between the total gauge pressure at the outlet of the air handling unit and the total gauge pressure at the inlet

3.17.10**humidification efficiency**

ratio between the mass of water evaporated by the humidifier and the theoretical mass needed to achieve saturation at a given temperature

3.17.11**internal air leakage rate**

air leakage in between the two air streams within a section

3.7.12**thermal bridging factor k_b**

ratio between the lowest temperature difference between any point on the external surface and the mean internal air temperature, and the mean air to air temperature difference

3.17.13**thermal transmittance U**

heat flow per area and unit temperature difference

4 Symbols and units

For the purposes of this standard, symbols and units given in CR 12792 and in Table 1 apply, together with those defined with the formulae, in text and in the annexes of this standard.

Table 1 — Symbols, units and subscripts

Symbol	Term	Unit
A_c	Cross sectional area of a duct	m^2
c	sound velocity in the air	$m \cdot s^{-1}$
d	effective duct diameter	m
f	air leakage factor	$l \cdot s^{-1} \cdot m^{-2}$
k	number of measurements within the total measuring time	-
k_b	thermal bridging factor of the casing	-
L_e	Duct end correction value	dB
L_W	sound power level	dB
L_{WA}	weighted sound power level	dB(A)
n_F	rotational speed of the fan	s^{-1}
P_E	motor input power	W
p_a	atmospheric pressure	Pa
p_d	dynamic pressure	Pa
p_s	static gauge pressure	Pa
p_f	fan pressure	Pa
p_t	external total pressure difference	Pa
p_{tU}	external total pressure difference of the unit	Pa
p_v	partial pressure of water vapour	Pa
Q_{defr}	total energy input for defrosting during one complete frosting/defrosting cycle	J
q_{mn}	nominal air mass flow rate of the recovery device	$kg \cdot s^{-1}$
q_m	air mass flow rate	$kg \cdot s^{-1}$
q_v	air volume flow rate	$m^3 \cdot s^{-1}$
q_{vm}	measured and converted air volume flow rate	$m^3 \cdot s^{-1}$
q_{vs}	specified air volume flow rate	$m^3 \cdot s^{-1}$
t_a	dry-bulb temperature	$^{\circ}C$
$t_{m,i}$	local temperature at measurement point	$^{\circ}C$
t_i	mean internal air temperature	$^{\circ}C$
t	tolerance range	%
u	uncertainty range of measured data	%
u_{Loc}	local grade of uniformity	%
U	thermal transmittance of the casing	$W \cdot m^{-2} \cdot K^{-1}$
v	velocity of air at a point	$m \cdot s^{-1}$
$\Delta\tau$	sampling interval time	s
Δp_1	pressure drop on exhaust-air side	Pa
ε_D	defrosting heat ratio	-
η_t	temperature mixing efficiency	%
η_{Loc}	local mixing efficiency	%
ρ	density	$kg \cdot m^{-3}$

Table 1 — Symbols, units and subscripts [concluded]

Subscripts	
1	inlet
2	outlet
11	exhaust air in
12	exhaust air out
21	supply air in
22	supply air out
i	internal
H	air flow with higher temperature
L	air flow with lower temperature
M	mixed air flow [mean temperature]
tot	air flow downstream of the mixing section

5 Ratings and performance of the whole air handling unit

5.1 General

The performance of the whole air-handling unit cannot be defined as a sum of those of the individual components and sections. Hence, the procedures that follow shall be applied to a complete air-handling unit. In particular and agreed circumstances they can be applied to a part of an air-handling unit.

The methods described in 5.2 cover the measurement of air volume flow together with the external total pressure of the unit and the power consumption. By selecting an appropriate test system the procedures can be extended to include the measurement of sound level transmitted from the air-handling unit into the ductwork, at a known volume flow, as described in 5.3.

5.2 Testing of aerodynamic performance

5.2.1 Characteristics and quantities

5.2.1.1 Characteristics

- External total pressure difference of the unit: Air volume flow - characteristic.* The difference in total pressure between outlet and inlet of the air-handling unit, related to the air volume flow at the measurement plane.
- Motor input power: Air volume flow - characteristic.* The relationship between the power input to the fan motor and the air volume flow.

These characteristics shall be converted from the ambient temperature and pressure measured at the time of the test to standard conditions with air density of $1,2 \text{ kg.m}^{-3}$. The characteristics shall be presented for a stated nominal fan speed but without adjustment for inherent speed deviation during the test.

5.2.1.2 Quantities

- Air volume flow rate (q_v).* This shall be measured by any method, which is in accordance with ISO 5221, ISO 5167-1 or ISO 3966, e.g. a nozzle, an orifice plate or a pitot-static tube.
- External total pressure difference of the unit (p_{tU}).* This shall be calculated from the pressure measurements defined in 5.2.3.2, and is the difference between the total pressure at the outlet of the air handling unit and the total pressure at the inlet. The duct sizes shall be the sizes defined by the manufacturer.

NOTE International agreement defines the fan pressure p_t in terms of the difference in stagnation pressures between outlet and inlet, but the Mach Number applicable to an air handling unit will be sufficiently low (less than 0,15) for total pressures to be determined by conventional means. Hence, external total pressure difference is:

$$p_t = p_{t2} - p_{t1} \quad (1)$$

where

p_t is the sum of the static pressure p_s and the dynamic pressure p_d , in pascals (p_{t2} for outlet, p_{t1} for inlet)