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Introduction

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

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Design and assessment process of whole-building mechanical ventilation systems in residential buildings

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 205, *Building environment design*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Energy conservation in the buildings is a pressing issue today. On the other hand, the demand of the occupants for indoor comfortable environment becomes higher nowadays. In addition, it has been recognized that the ventilation is important to keep a good indoor air quality and prevent infection. However, ventilation gets cold/hot outdoor air into the room in winter/summer season, which increases the heating/cooling demand. Therefore, the designer should consider reconciling a good indoor environment and energy conservation in the process of designing the whole-building ventilation system for residential buildings.

There exist other National and International standards, and technical reports, which specify criteria for indoor air quality, thermal comfort, and auditory environment. And other standards specify the method for evaluating the energy performance of ventilators, heat and energy recover components, heating and cooling equipment, and buildings. The designers can assess these factors with relevant standards, however, there are risks of omitting one or more factors in designing the ventilation system because the designers consider and organize by themselves the factors relevant to thermal comfort, indoor air quality, auditory environment, and energy performance. Furthermore, the ventilation system's performance varies according to the ways of the design even though the designer chooses the same components.

This document specifies the steps of designing the whole-building ventilation system for residential buildings, and the points to be considered regarding indoor environment and energy consumption. This document helps the designers consider and organize the factors in designing the whole-house ventilation system, which can attain both a good indoor environment and energy conservation.

Design and assessment process of whole-building mechanical ventilation systems in residential buildings

1 Scope

This document describes the steps of designing and assessing the whole-building ventilation system for residential buildings and the points to be taken into account regarding indoor environment and energy consumption. This standard allows the designer to plan a whole-building ventilator that improves indoor air quality, the auditory environment and thermal comfort, and that also uses energy in a practical way. They also touch on performance of the building in order to operate a whole-building ventilator well.

Excluded:

- Criteria for indoor air quality
- Criteria for indoor thermal comfort (covered by ISO/TC 159)
- Criteria for auditory environment (covered by ISO/TC 43)
- Evaluation method of energy performance of heating and cooling equipment
- Evaluation method of energy performance of ventilators (covered by ISO/TC 86)
- Evaluation method of energy performance of heat recovery components (covered by ISO/TC 86)
- Evaluation method of building performance (covered by ISO/TC 163)
- Design steps and evaluation method of localized ventilation equipment
- Ventilation systems using natural driving force in all ventilation airflow path

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.

ISO 7730, *Ergonomics of the thermal environment — Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria*

ISO 16000-3, *Building environment design — Indoor air quality — Methods of expressing the quality of indoor air for human occupancy*

ISO 16000-6, *Indoor air — Part 6: Determination of organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling on sorbent tubes, thermal desorption and gas chromatography using MS or MS FID*

ISO 16814, *Building environment design — Indoor air quality — Methods of expressing the quality of indoor air for human occupancy*

ISO 16890-1, *Air filters for general ventilation — Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM)*

ISO 17772-1, *Energy performance of buildings — Indoor environmental quality — Part 1: Indoor environmental input parameters for the design and assessment of energy performance of buildings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17772-1, ISO 52000-1 and the following 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/>

3.1
Whole-building mechanical ventilation system
system for providing integrated or simultaneous ventilation for two or more spaces in a building including one or more habitable rooms

3.2
Airtightness
quantitative index showing amount of gap in the building envelope

3.3
Outdoor airflow (OA)
air goes from outdoor to ventilator

3.4
Outdoor airflow rate
amount of outdoor airflow

3.5
Return airflow (RA)
air goes from rooms to ventilator

3.6
Return airflow rate
amount of return airflow

3.7
Air change rate
value obtained by dividing air supply by room air volume, expressed as the number of air changes per hour (1/h)

3.8
Supply airflow (SA)
air goes from ventilator to rooms

3.9
Supply airflow rate
amount of supply airflow

3.10
Localized ventilation equipment
ventilation equipment used only for a specific room(s) where pollutants emitted, not for whole-building

3.11
Power consumption
total power consumed by a component (W)

3.12

Designed airflow

flow rate (m^3/h) for ventilation equipment estimated based on the characteristics of the blower static pressure flow rate and the characteristics of the static pressure flow rate of the air conveyance path composed of ducts, etc.

3.13

Designed airflow rate

amount of designed airflow

3.14

Whole-building ventilator power consumption

total power consumption for auxiliary equipment included in electric motors and ventilation equipment during continuous operation of whole-building ventilator under normal usage conditions

3.15

Type 1 ventilation system

ventilation system using mechanical fans for both supply air and exhaust air

3.16

Type 2 ventilation system

ventilation system using one or more mechanical fans only for supply air

3.17

Type 3 ventilation system

ventilation system using one or more mechanical fans only for exhaust air

3.18

Ducted ventilator

ventilator using a duct totalling 1 meter or longer per unit

3.19

Duct inner diameter

inner dimension of duct

3.20

Exhaust airflow (EA)

air goes from ventilator to outdoor

3.21

Exhaust airflow rate

amount of exhaust airflow

3.22

Specific fan power

value obtained by dividing mechanical ventilating system power consumption by designed airflow, expressed as $\text{W}/(\text{m}^3/\text{h})$

3.23

Net supply airflow rate

outdoor airflow rate effectively supplied indoors without affecting environmental hygiene

3.24

Net supply airflow ratio (NSAR)

ratio of net supply air flow rate to supply airflow rate

3.25**Space to be ventilated**

space consisting of one or several rooms connected by openings, viewed as a single unit for the purpose of ventilation system design.

Note 1 to entry: For example, if several rooms are connected by hallways or stairs and ventilation paths are provided by means of air vents or undercuts in doors, furniture or partitions, hallways and stairs are included in the space to be ventilated.

Note 2 to entry: Depending on the style, specifications or countries' laws, regulations or guidelines related to the building for which a ventilation system is designed, the space to be ventilated may also include attics, underfloor areas and space inside the building frame.

4 Design flow for a mechanical ventilation system in a residential building**4.1 Stage I – Formulation of project definition****4.1.1 General**

Design and assessment process of whole-building mechanical ventilation systems in residential buildings allow design teams to plan a whole-building ventilator that improves indoor air quality, auditory environment and thermal comfort, and that also uses energy in a practical way.

[Figure 1](#) shows a design flow for a whole-building mechanical ventilation system for residential buildings. The designer should consider reconciling a good indoor environment and energy conservation in the process of designing the system.

4.1.2 Project requirements and constraints

The designer shall clarify the project requirements and constraints. The client defines the requirements of the building or the space where the ventilation system is installed, and the designer checks for any constraints that would prevent the project from being completed. The designer should check the characteristics of the building site and also confirm the standards, regulations, and codes related to the requirements. For example, the characteristics of the building site are the following:

- Climate
- Geometry
- Geography
- Culture

4.1.3 Assumptions

The designer also confirms the following:

- Building scale
- Building use
- The performance required for the building

4.1.4 Output – Document I

Document I shall be issued as an output of the project definition process. It contains building characteristics, a description of the project definition, the requirements, the constraints, and the assumptions.

4.1.5 Evaluation I

Evaluation I is the process of approving Document I. The designer shall verify the consistency of the requirements, the constraints, and the assumptions.

4.1.6 Iteration

If Document I is not approved, the document shall be revised by iterating the steps from the project definition.

4.2 Stage II – Conceptual and schematic design

4.2.1 General

In conceptual design, the designer makes a rough consideration to realise the requirements confirmed in [clause 4.1](#). For example, the designer should take the following into account:

- Number and approximate distribution of the occupants
- General equipment used in the room or the area
- Ventilation flow rate, air change rate
- Ventilation airflow path
- Usage of the energy recovery device

4.2.2 Choose target values or levels

The designer set the target value or level for each item: indoor air quality, indoor thermal comfort, energy use, and acoustic environment. [Clause 5](#) helps to set the target of indoor air quality, [clause 6](#) helps to set the target of indoor thermal comfort, [clause 7](#) helps to set the target of energy use, and [clause 8](#) helps to set the target of acoustic environment. The designer shall check the performance of the building as well, since the indoor environments are also affected by its performance. [Clause 9](#) helps to confirm the building performance. In addition, some environmental factors have a mutual effect on each other. In some cases, this may be a multiplier effect, but in others, trade-offs are involved. [Clause 10](#) helps to understand the interactions of the factors.

4.2.3 Output – Document II

Document II shall be issued as an output of the schematic design process. It contains the outline of the whole-building mechanical ventilation system and target values or levels of indoor air quality, thermal comfort, energy use, and acoustic environment.

4.2.4 Evaluation II

Evaluation II is the process of approving Document II. The designer shall verify the consistency of the requirements, the target values or levels, and the ventilation system.

4.2.5 Iteration from conceptual design and schematic design

If Document II is not approved and there is room to meet the requirements by reconsidering the conceptual or schematic design, the document shall be revised by iterating the steps from conceptual design and schematic design.

4.2.6 Iteration from project definition

If Document II is not approved, and it is not easy to meet the requirements by reconsidering the conceptual or schematic design, the project definition shall be revised.

4.3 Stage III – Detailed design

4.3.1 General

In detailed design, the concrete plan is put into practice. The designer should consider the following:

- The type of ventilation system
- The kind of energy recovery device or system
- Ducting and separation layout
- Layout of air supply and return air terminal devices
- The kind of mechanical fans
- Location of mechanical fans

4.3.2 Analysis

The analysis should be carried out to at least indoor air quality and energy use of the ventilation system. A mass system simulation should be carried out at least to verify the indoor thermal comfort, and the mean sound pressure level of the room should be calculated to verify the acoustic environment.

4.3.3 Output – Document III

Document III shall be issued as an output of the detailed design process. Document IIIa contains the specifications of the ventilation system and the physical properties of the building where the ventilation system is installed. Document IIIb contains the analysis results, i.e., the predicted performance of the ventilation system.

4.3.4 Evaluation III

Evaluation III is the process of approving Document III. The designer shall verify the consistency of the requirements in Document I, the target values or levels in Document II, and the description and analysis result in Document III. Stage IV cannot be started without the approval of Document III.

4.3.5 Iteration into detail design

If the current design does not meet the target described in Document II, an alternative design shall be provided. If it is necessary to change the concept or scheme to meet the target, the design shall be revised by iterating the steps from conceptual and schematic designs. If it is not easy to meet the requirements by reconsidering the conceptual or schematic design, the project definition shall be revised.

4.4 Stage IV – Final design

4.4.1 general

Stage IV is the final stage of the design process, where the actual information of the ventilation system is handed over to the constructors. At this stage, a detailed assessment plan shall be developed.

4.4.2 Output – Final design document

The final design document shall consist of the specifications of the ventilation system and building characteristics, as well as the assessment plan for the performance of the ventilation system.

4.5 End of design

If no problems are found with the final design, the design work ends.