FINAL
DRAFT

INTERNATIONAL STANDARD

ISO/FDIS 52120-1

Energy performance of buildings — Contribution of building automation and controls and building management —

Part 1:
General framework and procedures

ISO/CEN PARALLEL PROCESSING

© ISO 2021

iTeh STANDARD PREVIEW
(standards.iteh.ai)

COPYRIGHT PROTECTED DOCUMENT

Contents

iTeh STANDARD PREVIEW
(standards.iteh.ai)

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 247, *Building Automation, Controls and Building Management*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 52120 series can be found on the ISO website.

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

This document belongs to the family of standards aimed at international harmonization of the methodology for the assessment of the energy performance of buildings. Throughout, this group of standards is referred to as a "set of, called "EPB set of standards".

All EPB standards follow specific rules to ensure overall consistency, unambiguity and transparency. This document is clearly identified in the modular structure developed to ensure a transparent and coherent set of EPB standards, as set out in ISO 52000-1, the overarching EPB standard. BAC (building automation and control) is identified in the modular structure as technical building system M10. However, other International Standards issued by ISO TC 205 deal with control accuracy, control functions and control strategies using standards communications protocol (these last standards do not belong to the set of EPB standards).

To avoid a duplication of calculation due to the BAC (avoid double impact), no calculation is done in a BAC EPB standard set, but in each underlying standard of the set of EPB standards (from M1 to M9 in the modular structure), an identifier developed and present in the M10 covered by this document is used where appropriate. This way of interaction is described in detail in ISO/TR 52000-2, the Technical Report accompanying ISO 52000-1. As consequence, the concept of a normative template for specific (national) choices in Annex A, and Annex B with informative default choices, as commonly used in the set of EPB standards is not applicable for this document.

The main target groups of this document are all the users of the set of EPB set of standards (e.g. architects, engineers, regulators).

Further target groups are parties wanting to motivate their assumptions by classifying the building energy performance for a dedicated building stock.

More information is provided in the Technical Report accompanying this document (ISO/TR 52120-2[5]).

NOTE 1   Table 1 shows the relative position of this document within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.

NOTE 2   In ISO/TR 52000-2 the same table can be found, with, for each module, the numbers of the relevant EPB standards and accompanying technical reports that are published or in preparation.

NOTE 3   The modules represent EPB standards, although one EPB standard can cover more than one module and one module can be covered by more than one EPB standard, for instance a simplified and a detailed method respectively. See also Clause 2 and Tables A.1 and B.1.

Table 1 — Position of this document (in casu M10–4,5,6,7,8,9,10), within the modular structure of the set of EPB standards

| Submodule | Over-arch-ing | Building (as such) | Technical building system | | | | | | | | | |
	Descriptions	Descriptions	Descriptions	Heating	Cooling	Ventilation	Humidification	Dehumidification	Domestic hot waters	Lighting	Building automation and control	PV, wind, etc.
sub1	**M1**	**M2**		**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
1	General	General	General									
a The shaded modules are not applicable.												

Table 1 *(continued)*

Submodule	Over-arching Descriptions	Building (as such) Descriptions	Technical building system Descriptions	Heating	Cooling	Ventilation	Humidification	Dehumidification	Domestic hot waters	Lighting	Building automation and control	PV, wind, etc.
sub1	M1	M2		M3	M4	M5	M6	M7	M8	M9	M10	M11
2	Common terms and definitions; symbols, units and subscripts	Building energy needs	Needs									
3	Application	(Free) indoor conditions without systems	Maximum load and power									
4	Ways to express energy performance	Ways to express energy performance	Ways to express energy performance								x	
5	Building functions and building boundaries	Heat transfer by transmission	Emission and control								x	
6	Building occupancy and operating conditions	Heat transfer by infiltration and ventilation	Distribution and control								x	
7	Aggregation of energy services and energy carriers	Internal heat gains	Storage and control								x	
8	Building partitioning	Solar heat gains	Generation and control								x	
9	Calculated energy performance	Building dynamics (thermal mass)	Load dispatching and operating conditions								x	
10	Measured energy performance	Measured energy performance	Measured energy performance								x	
11	Inspection	Inspection	Inspection									
12	Ways to express indoor comfort		BMS									
13	External environment conditions											
14[a]	Economic calculation											

[a] The shaded modules are not applicable.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Energy performance of buildings — Contribution of building automation and controls and building management —

Part 1:
General framework and procedures

1 Scope

This document specifies:

— a structured list of control, building automation and technical building management functions which contribute to the energy performance of buildings; functions have been categorized and structured according to building disciplines and building automation and control (BAC);

— a method to define minimum requirements or any specification regarding the control, building automation and technical building management functions contributing to energy efficiency of a building to be implemented in building of different complexities;

iTeh STANDARD PREVIEW
— a factor-based method to get a first estimation of the effect of these functions on typical buildings types and use profiles; (standards.iteh.ai)

— detailed methods to assess the effect of these functions on a given building.

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 50001:2018, *Energy management systems — Requirements with guidance for use*

ISO 52000-1:2017, *Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures*

ISO 7345:2018, *Thermal performance of buildings and building components — Physical quantities and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7345:2018, in ISO 52000-1:2017 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
auxiliary energy
electrical energy used by *technical building systems* (3.14) to support energy transformation to satisfy energy needs

Note 1 to entry: This includes energy for fans, pumps, electronics, etc. Electrical energy input to the ventilation system for air transport and heat recovery is not considered as auxiliary energy, but as energy used for ventilation.

Note 2 to entry: In ISO 9488 the energy used for pumps and valves is called "parasitic energy".

[SOURCE: ISO 13612-2:2014, 3.3, modified — Note 3 to entry was removed.]

3.2
building automation and control
BAC
products, software, and engineering services for automatic controls, monitoring and optimization, human intervention and management to achieve energy-efficient, economical, and safe operation of building services equipment

[SOURCE: ISO 52000-1:2017, 3.4.4, modified – The term BAC was added.]

3.3
building automation and control system
BACS
system, comprising all products, software and engineering services for automatic controls (including interlocks), monitoring, optimization, for operation, human intervention, and management to achieve energy-efficient, economical, and safe operation of building services

Note 1 to entry: BACS is also referred to as BMS (building management system).

Note 2 to entry: The use of the word 'control' does not imply that the system or device is restricted to *control functions* (3.5). Processing of data and information is possible.

Note 3 to entry: If a building control system, *building management* (3.4) system, or building energy management system complies with the requirements of the ISO 16484 series, it should be designated as a building automation and control system (BACS).

Note 4 to entry: Building services are divided in technical, infrastructural and financial building services and energy management is part of *technical building management* (3.13).

Note 5 to entry: Building energy management system is part of a BMS.

Note 6 to entry: The building energy management system comprises data collection, logging, alarming, reporting, and analysis of energy usage, etc. The system is designed to reduce the energy consumption, improve the utilization, increase the reliability, and predict the performance of the *technical building systems* (3.14), as well as optimize energy usage and reducing its cost.

[SOURCE: ISO 16484-2:2004, 3.31, modified – Notes to entry 1, 4, 5 and 6 have been added.]

3.4
building management
BM
totality of services involved in the management operation and monitoring of buildings (including plants and installations)

Note 1 to entry: Building management can be assigned as part of facility management.

[SOURCE: CEN/TS 15379:2009, 3.4, modified – Second part of the definition became Note 1 to entry.]

3.5
control function
BAC (3.2) effect of programs and parameters

Note 1 to entry: BAC functions are referred to as control functions, I/O, processing, optimization, management and operator functions. They are listed in the BAC FL (function list) for a specification of work.

Note 2 to entry: Function is a program unit that delivers exactly one data element, which can be a multiple value (i.e. an array or a structure). Functions can be an operand in a program as described in EN 61131–3.

3.6
delivered energy
energy, expressed per *energy carrier* (3.7), supplied to the *technical building systems* (3.14) through the assessment boundary, to satisfy the uses taken into account or to produce the exported energy

Note 1 to entry: Delivered energy can be calculated for defined energy uses or it can be measured.

[SOURCE: ISO 52000-1:2017, 3.4.6]

3.7
energy carrier
substance or phenomenon that can be used to produce mechanical work or heat or to operate chemical or physical processes

[SOURCE: ISO 52000-1:2017, 3.4.9]

3.8
energy need for heating and cooling
heat to be delivered to or extracted from a thermally conditioned space to maintain the intended space temperature conditions during a given period of time

Note 1 to entry: The energy need can include additional heat transfer resulting from non-uniform temperature distribution and non-ideal temperature control, if they are taken into account by increasing (decreasing) the effective temperature for heating (cooling) and not included in the heat transfer due to the heating (cooling) system.

[SOURCE: ISO 52000-1:2017, 3.4.13 — Note 1 to entry added and the term was originally "energy need for heating or cooling".]

3.9
energy efficiency
ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy

EXAMPLE   Efficiency conversion; energy required/energy used; output/input; theoretical energy used to operate/energy used to operate.

Note 1 to entry: Both input and output need to be clearly specified in quantity and quality, and be measurable.

[SOURCE: ISO 50001:2018, 3.5.3 modified—- "commodities" was removed from the definition and the example has been modified.]

3.10
integrated function
BAC (3.2) effect of programs, shared data points and parameters for multi-discipline interrelationships between various building services and technologies

3.11
measured energy performance
energy performance based on measured amounts of delivered and exported energy

Note 1 to entry: The measured rating is the weighted sum of all *energy carriers* (3.7) used by the building, as measured by meters or derived from measured energy by other means. It is a measure of the in-use performance of the building after correction or extrapolation. This is particularly relevant to certification of actual energy performance.

Note 2 to entry: Also known as "operational rating".

[SOURCE: ISO 52000-1:2017, 3.5.16, modified — "weighted measured amounts" has been replaced by "measured amounts" in the definition and "energy performance" has been replaced by "rating".]

3.12
thermally activated building system
TABS
massive building fabric actively heated or cooled by integrated air- or water-based systems

3.13
technical building management
TBM
process(es) and services related to operation and management of buildings and *technical building system* (3.14) through the interrelationships between the different disciplines and trades

Note 1 to entry: The disciplines and trades comprise all technical building services for the purpose of optimized maintenance and energy consumption.

EXAMPLE   Optimization of buildings through interrelationships ranging from heating, ventilation and air conditioning (HVAC), to lighting and day lighting, to life safety and security, to electric power systems and energy monitoring and metering, to services, including communications and maintenance and to management.

[SOURCE: ISO 52127-1:2021, 3.2]

3.14
technical building system
technical equipment for heating, cooling, ventilation, humidification, dehumidification, domestic hot water, lighting and electricity production

Note 1 to entry: A technical building system can refer to one or to several building services (e.g. heating, heating and DHW).

Note 2 to entry: A technical building system is composed of different subsystems.

Note 3 to entry: Electricity production can include cogeneration and photovoltaic systems.

[SOURCE: ISO 52000-1:2017, 3.3.13, modified — The phrase "building automation and control" was deleted from the definition.]

3.15
EPB standard
standard that complies with the requirements given in ISO 52000-1, CEN/TS 16628 and CEN/TS 16629

Note 1 to entry: These three basic EPB documents were developed under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/480), and support essential requirements of EU Directive 2010/31/EC on the energy performance of buildings (EPBD). Several EPB standards and related documents are developed or revised under the same mandate. CEN/TS 16628[5] and CEN/TS 16629[6] are available as N-documents in ISO/TC 163 and ISO/TC 205.

[SOURCE: ISO 52000-1:2017, 3.5.14, modified — The last sentence of the Note 1 to entry has been added.]

4 Symbols, subscripts and abbreviated terms

4.1 Symbols

For the purposes of this document, the symbols given in ISO 52000-1 and Table 2 apply.

Table 2 — Symbols

Symbol	Quantity	Unit
a	normalized level, e.g. occupancy or gains	-
$\bar{\beta}$	mean part load	-
Φ	heat flow rate, thermal power	kW

4.2 Subscripts

For the purposes of this document, the subscript given in ISO 52000-1:2017, Clause 4 and Annex C and the specific subscripts listed in Table 3 apply.

NOTE   Relevant subscripts already given in ISO 52000-1 are included if necessary for the understanding of this document.

Table 3 — Subscripts

Subscript	Term	Subscript	Term	Subscript	Term
amb	ambient	end	end	th	thermal
BAC	building automation and control	r	room	trans	transfer
cor	correction	ref	reference		
ctr	control	set	setpoint		
DHW	domestic hot water	sta	start		

4.3 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO 52000-1 and Table 4 apply.

Table 4 — Abbreviated terms

AHU	air handling unit
BAC	building automation and control
BM	building management
COP	coefficient of performance
DHW	domestic hot water
HVAC	heating, ventilation and air conditioning
TABS	thermally activated building systems
TBM	technical building management
VFD	variable flow dependant
VRF	variable room flow

5   Description of the method

5.1   Output of the method

This document describes two methods of how to calculate the contribution of building automation and controls to the energy performance of buildings. The two methods are the following.

— The detailed method: output of the detailed method is a list of automation, control and management function types that is used to run a detailed calculation of building energy performance based on other EPB standards. In addition, the detailed method would also allow classification of a building automation and control system according to a set of criteria defined in this document. There is no limitation regarding the time interval.

— The factor-based method: output of the factor-based method is the energy demand of a building according to a given building automation and control classification. The time interval of the output is a yearly step.

5.2   General description of the method(s)

Two methods are given:

— method 1, defined in Clause 6, is meant for a detailed energy performance analysis of a building in case detailed information about the building, the HVAC systems and especially the type of automation, control and management functions are available that can be applied in a holistic EPB calculation method;

— method 2, defined in Clause 7, is intended for easily calculating a rough estimate of the impact of building automation, control and management on the energy performance of a building based on a given energy performance (either a consumption metered, or a demand calculated) correlated to a certain BAC efficiency classification of the building.

In this document, "factor-based method" is exemplified by "BAC factor method".

5.3   Selection criteria between the methods

For the calculation of the impact of building automation, control and management functions on the building energy performance the detailed method is method 1 in this document. Figure 1 illustrates how to use the detailed method compared to the simplified BAC factor method.

iTeh STANDARD PREVIEW

(standards.iteh.ai)
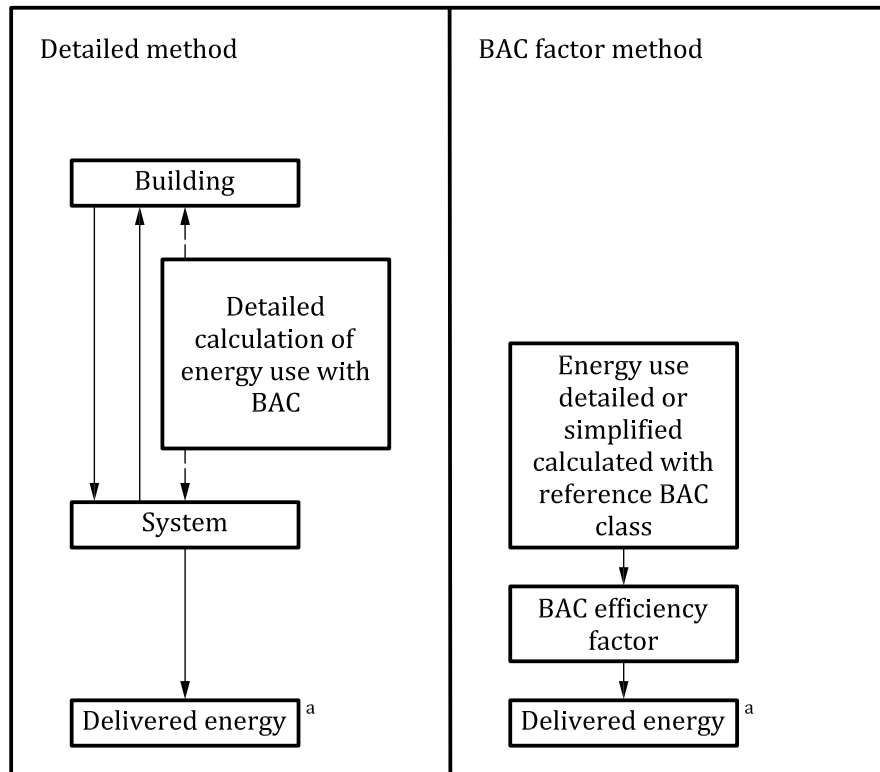
a   Delivered energy is the total energy, expressed per energy carrier (gas, oil, electricity etc.) used for heating, cooling, ventilation, domestic hot water or lighting.

NOTE   Arrows illustrate only the calculation process and do not represent energy and/or mass flows.

Figure 1 — Detailed method in comparison with BAC factor method

The detailed method should be used only when a sufficient knowledge about automation, control and management functions used for the building and the energy systems is available. The application of the detailed calculation procedure implies that all automation, control and management functions that have to be accounted for the operation of a building and its energy systems are known. Clause 6 gives a general survey of those functions and describes how to use them in the context of energy performance calculations.

5.4   BAC and TBM functions having an impact on the energy performance of buildings

Building automation and control (BAC) provide effective control functions for any building energy system, for example, heating, ventilating, cooling, hot water and lighting appliances, that lead to improve operational and energy efficiencies. Complex and integrated energy saving functions and routines can be configured based on the actual use of a building, depending on real user needs, to avoid unnecessary energy use and CO_2 emissions.

Technical building management (TBM) functions as part of building management (BM) and provides information about operation, maintenance, services and management of buildings, especially for energy management, e.g. measurement, recording trending, and alarming capabilities and diagnosis of unnecessary energy use. Energy management provides requirements for documentation, controlling, monitoring, optimization, determination and to support corrective action and preventive action to improve the energy performance of buildings. This document can be used to evaluate the contribution of these building management functions to the energy performance of buildings.

The BAC functions described in Table 5 are based on the energy demand and supply model for a building in Figure 2.