



SLOVENSKI STANDARD

SIST EN 15232:2007

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Grelni sistemi v stavbah - Vpliv avtomatizacije stavb in izvršnih elementov ter upravljanja stavb

Energy performance of buildings - Impact of Building Automation, Controls and Building Management

Energieeffizienz von Gebäuden - Auswirkungen der Gebäudeautomation und des Gebäudemanagements

Performance énergétique des bâtiments - Impact de l'automatisation de la régulation et de la gestion technique du bâtiment

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Energy performance of buildings - Impact of Building Automation, Controls and Building Management

Performance énergétique des bâtiments - Impact de l'automatisation de la régulation et de la gestion technique du bâtiment

Energieeffizienz von Gebäuden - Auswirkungen der Gebäudeautomation und des Gebäudemanagements

This European Standard was approved by CEN on 16 May 2007.

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Foreword

This document (EN 15232:2007) has been prepared by Technical Committee CEN/TC 247 "Building automation, controls and building management", the secretariat of which is held by SNV.

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of an identical text or by endorsement, at the latest by January 2008, and conflicting national standards shall be withdrawn at the latest by January 2008.

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.

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.

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Introduction

This European Standard was devised to establish conventions and methods for estimation of the impact of building automation control systems (BACS) and technical building management (TBM) on energy performance and energy use in buildings.

This European Standard also provides guidance for taking BACS and TBM functions as far as possible into account in the relevant standards prepared under the mandate M/343. Therefore it is coordinated between CEN/TC 247 and CEN/TC 89, CEN/TC 156, CEN/TC 169 and CEN/TC 228 to support these TCs by strong cooperation in specifying how the impacts of the BACS and TBM functions are taken into account in their standards. The results about BACS and TBM in the relevant standards are summarized in Clause 5.

This European Standard specifies a method to estimate energy saving factors which can be used in conjunction with energy assessment of buildings. This European Standard supplements a series of standards which are drafted to calculate the energy efficiency of technical building services e.g. heating, cooling, ventilation, lighting systems. This European Standard takes into account the fact that with BAC and BM the energy consumption of a building can be reduced.

This European Standard should be used for existing buildings and for design of new or renovated buildings.

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EN 15232:2007 (E)**1 Scope**

This European Standard specifies:

- a structured list of control, building automation and technical building management functions which have an impact on the energy performance of buildings;
- a method to define minimum requirements regarding the control, building automation and technical building management functions to be implemented in buildings of different complexities;
- detailed methods to assess the impact of these functions on a given building. These methods enable to introduce the impact of these functions in the calculations of energy performance ratings and indicators calculated by the relevant standards;
- a simplified method to get a first estimation of the impact of these functions on typical buildings.

This European Standard is defined for:

- building owners, architects or engineers, defining the functions to be implemented for a given new building or for the renovation of an existing building;
- public authorities, defining minimum requirements for BAC and TBM functions for new buildings as well as for renovation as defined in the relevant standard;
- public authorities, defining inspection procedures of technical systems as well as inspectors applying these procedures to check if the level of BAC and TBM functions implemented is appropriate;
- public authorities, defining calculation methods which take into account the impact of BAC and TBM functions on the energy performance of buildings as well as software developers implementing these calculation methods and designers using them;
- designers, checking that the impact of all BAC and TBM functions are taken into account when assessing the energy performance of a building.

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.

2.1 BAC products and system standards

EN 215, *Thermostatic radiator valves - Requirements and test methods*

EN 12098-1, *Controls for heating systems - Part 1: Outside temperature compensated control equipment for hot water heating systems*

EN 12098-2, *Controls for heating systems - Part 2: Optimum start-stop control equipment for hot water heating systems*

EN 12098-3, *Controls for heating systems - Part 3: Outside temperature compensated control equipment for electrical heating systems*

EN 12098-4, *Controls for heating systems - Part 4: Optimum start-stop control equipment for electrical systems*

EN 12098-5, *Controls for heating systems - Part 5: Start-stop schedulers for heating systems*

prEN 15500:2006, *Electronic individual zone control equipment*

EN ISO 16484-3:2005, *Building automation and control systems (BACS) - Part 3: Functions (ISO 16484-3:2005)*

2.2 Energy performance of building

EN 13363-1:2003, *Solar protection devices combined with glazing - Calculation of solar and light transmittance - Part 1: Simplified method*

EN 15217:2007, *Energy performance of buildings - Methods for expressing energy performance and for energy certification of buildings*

EN 15255, *Thermal performance of buildings - Sensible room cooling load calculation - General criteria and validation procedures*

prEN 15203:2005, *Energy performance of buildings - Overall energy use and definition of energy ratings*

EN ISO 13790:2004, *Thermal performance of buildings - Calculation of energy use for space heating (ISO 13790:2004)*

2.3 Energy performance of heating and domestic hot water

EN 15316-1:2007, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 1: General*

EN 15316-2-1:2007, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 2-1: Space heating emission systems*

EN 15316-2-3:2007, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 2-3: Space heating distribution systems*

prEN 15316-4-1, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-1: Space heating generation systems, boilers*

prEN 15316-4-2, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-2: Space heating generation systems, heat pump systems*

EN 15316-4-3, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-3: Space heating generation systems, thermal solar systems*

prEN 15316-3-2, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 3-2: Domestic hot water systems, distribution*

prEN 15316-3-3, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 3-3: Domestic hot water systems, generation*

EN 15316-4-4, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-4: Heat generation systems, building-integrated cogeneration systems*

EN 15316-4-5, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-5: Space heating generation systems, the performance and quality of district heating and large volume systems*

EN 15316-4-6, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-6: Heat generation systems, photovoltaic systems*

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prEN 15316-4-7, *Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-7: Space heating generation systems, biomass combustion systems*

prEN 15378, *Heating systems in buildings - Inspection of boilers and heating systems*

EN 60675, *Household electric direct-acting room heaters - Methods for measuring performance (IEC 60675:1994)*

2.4 Ventilation and air conditioning

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

EN 15239, *Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of ventilation systems*

EN 15240, *Ventilation for buildings — Energy performance of buildings — Guidelines for inspection of air-conditioning systems*

EN 15241:2007, *Ventilation for buildings — Calculation method for energy losses due to ventilation and infiltration in commercial buildings*

EN 15242:2007, *Ventilation for buildings — Calculation methods for the determination of air flow rates in buildings including infiltration*

prEN 15243:2005, *Ventilation for buildings — Calculation of room temperatures and of load and energy for buildings with room conditioning systems*

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2.5 Energy performance of lighting

EN 15193:2007, *Energy performance of buildings — Energy requirements for lighting*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE 1 The terms and definitions listed in this standard but defined by other relevant ISO/IEC International Standards and/or European Standards are repeated below for convenience in most cases.

NOTE 2 Other language versions may contain an alphabetical index in national annexes.

3.1 auxiliary energy
electrical energy used by heating, cooling and/or domestic water systems to transform and transport the delivered energy into the useful energy

[CEN/TR 15615]

NOTE 1 This includes energy for fans, pumps, electronics etc., but not the energy that is transformed. Pilot flames are considered as part of the energy use by the system.

NOTE 2 In EN ISO 9488 the energy used for pumps and valves is called "parasitic energy".

3.2**building automation and controls****BAC**

description for 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

[EN ISO 16484-2:2004]

NOTE The trade designation and the industry branch are also referred to as building automation and/or building control.

3.3**building automation and control systems****BACS**

comprising all products 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

[EN ISO 16484-2:2004]

NOTE 1 The use of the word 'control' does not imply that the system/device is restricted to control functions. Processing of data and information is possible.

NOTE 2 When a Building Control System, Building Management System or Building Energy Management System is in compliance with the requirements of the EN ISO 16484 standard series, it should be designated as a Building Automation and Control System (BACS).

3.4**building management****BM**

the totality of services involved in the management operation and monitoring of buildings (including plants and installations). Building management can be assigned as part of Facility Management

[CEN/TS 15379:2006]

3.5**building management system****BMS**

cf. building automation and control system

[EN ISO 16484-2:2004]

NOTE 1 Building services is divided in technical, infrastructural and financial building services and energy management is part of technical building management.

NOTE 2 Building energy management system is part of a BMS.

NOTE 3 Building energy management system comprising 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, as well as optimize energy usage and reducing its cost.

3.6**delivered energy**

total energy, expressed per energy ware, supplied to the building through the system boundary from the last market agent, to satisfy the uses taken into account (heating, cooling, ventilation, domestic hot water, lighting, appliances etc.)

[CEN/TR 15615]

EN 15232:2007 (E)

NOTE 1 For active solar and wind energy systems the incident solar radiation on solar panels or the kinetic energy of wind is not part of the energy balance of the building. The losses resulting from the transformation of these renewable energy carriers into heat or electricity are also not taken into account. Only the energy delivered by the generation devices and the auxiliary energy needed to supply the energy from the source (e.g. solar panel) to the building are taken into account in the energy balance and hence in the delivered energy.

NOTE 2 Delivered energy can be calculated for defined energy uses or it can be measured.

3.7 energy carrier

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

[ISO 13600:1997]

NOTE The energy content of fuels is given by their gross calorific value.

3.8 energy need for heating or cooling

heat to be delivered to or extracted from a conditioned space to maintain the intended temperature conditions during a given period of time

3.9 energy use for space heating or cooling or domestic hot water

energy input to the heating, cooling or hot water system to satisfy the energy need for heating, cooling or hot water respectively. It is the sum of the energy needs and the non-recovered technical system thermal losses

[prEN 15306]

NOTE The energy use for lighting is also considered in this European Standard.

3.10 energy performance of a building

calculated or measured amount of weighted net delivered energy actually used or estimated to meet different needs associated with a standardised use of a building, which may include, inter alia, energy used for heating, cooling, ventilation, domestic hot water and lighting

[CEN/TR 15615]

3.11 control function

BACS effect of programs and parameters

[EN ISO 16484-2:2004]

NOTE 1 Functions within a BACS are referred to as control functions, I/O, processing, optimization, management and operator functions. They are listed in the BACS FL (function list) for a specification of work.

[EN ISO 16484-2:2004]

NOTE 2 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.

[IEC 61131-3:2003]

3.12**integrated building automation and control systems**

BACS designed to be interoperable and with the ability to be connected to one or more specified 3rd party building automation and control devices/systems through open data communication network or interfaces performed by standardized methods, special services and permitted responsibilities for system integration

EXAMPLES Interoperability between 3rd party BAC devices/systems for HVAC, domestic hot water, lighting, electrical power distribution, energy metering, elevators and escalators, other plants, as well as systems for communications, access control, security, life safety etc.

3.13**integrated function**

BACS effect of programs, shared data points and parameters for multi-discipline interrelationships between various building services and technologies

3.14**measured energy rating**

energy rating based on measured amounts of delivered and exported energy

NOTE 1 The measured rating is the weighted sum of all energy carriers used by the building, as measured by meters or other means. It is a measure of the in-use performance of the building. This is particularly relevant to certification of actual energy performance.

NOTE 2 Also known as "operational rating".

3.15**technical building management
TBM**

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

NOTE The disciplines and trades comprise all technical building services for the purpose of optimized maintenance and energy consumption.

EXAMPLES 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 its services, including communications and maintenance and to its management.

3.16**technical building system**

technical equipment for heating, cooling, ventilation, domestic hot water, lighting and electricity production

[CEN/TR 15615]

NOTE A technical building system is composed of different subsystems.

3.17**set-point temperature of a conditioned zone**

internal (minimum) temperature, as fixed by the control system in normal heating mode, or internal (maximum) temperature, as fixed by the control system in normal cooling mode

[CEN/TR 15615]

NOTE The corrected value of a temperature set point is used for the calculation of energy performance. It enables the impact of the accuracy of the control system on the energy performance to be taken into account.

4 Abbreviations and acronyms

For the purposes of this document, the following abbreviations and acronyms apply.

BAC	Building Automation and Control
BACS	Building Automation and Control System
BM	Building Management
HVAC	Heating, Ventilation and Air Conditioning
TBM	Technical Building Management

5 Impact of BACS and TBM on the energy performance of buildings

5.1 General

Building Automation and Control (BAC) equipment and systems provides effective control functions of heating, ventilating, cooling, hot water and lighting appliances etc., that lead to increased operational and energy efficiencies. Complex and integrated energy saving functions and routines can be configured on the actual use of a building depending on the real user needs to avoid unnecessary energy use and CO₂ emissions.

Technical Building Management (TBM) functions as part of Building Management (BM) provide information about operation, maintenance, services and management of buildings especially for energy management – Measurement, recording trending, and alarming capabilities and diagnosis of unnecessary energy use. Energy management is a requirement about documentation, controlling, monitoring, optimisation, determination and to support corrective action and preventive action to improve the energy performance of buildings.

5.2 BAC Efficiency Class

Functions having an impact on the energy performance of buildings are listed in Table 1.

They are split in three groups: functions for automatic control, functions for home automation system/building automation and control system and functions for technical home and building management.

Four different BAC efficiency classes (A, B, C, D) of functions are defined either for non – residential and residential building.

- Class D corresponds to non energy efficient BACS. Building with such systems shall be retrofitted. New buildings shall not be built with such systems.
- Class C corresponds to standard BACS.
- Class B corresponds to advanced BACS and some specific TBM functions.
- Class A corresponds to high energy performance BACS and TBM.

Table 1 defines the list of functions corresponding to each level.

To be in class C minimum functions defined in Table 1 shall be implemented.

NOTE In addition the hydraulic system shall be properly balanced.

To be in class B **Building automation function** plus some specific functions defined in Table 1 shall be implemented in addition to class C. Room controllers shall be able to communicate with a building automation system.

To be in class A **Technical building management function** plus some specific functions defined in Table 1 shall be implemented in addition to class B. Room controllers shall be able for demand controlled HVAC (e.g. adaptive set point based on sensing of occupancy, air quality etc.) including additional integrated functions for multi-discipline interrelationships between HVAC and various building services (e.g. electricity, lighting, solar shading etc.)

One is in class D if the minimum functions to be in class C are not implemented.

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

The most common BAC and TBM functions having an impact on the energy performance of buildings have been summarized in Table 1. Functions are assigned to the BAC efficiency classes as defined in clause 5.2 depending on their use in residential or non-residential buildings.

Table 1 should be applied in the following way by:

- a) building owners, architects or engineers defining the building automation and controls (BAC) and technical building management (TBM) functions to be implemented for a given new building or for the renovation of an existing building:
 - 1) They can put an X in front of each of the functions they want to be implemented. They will use the shaded boxes as an help-tool to determine in which class A, B, C, D the function they have specified is located. To achieve for example category B the X shall all be put in a shaded box for category B;
 - 2) It will be a simplified alternative especially for specification at an early stage of a project to specify only the classes of function A, B, C, D;
- b) public authorities defining minimum requirements for BAC and TBM functions for new buildings as well as for renovations as defined in EN 15217:2005, D.3:
 - 1) They can define the minimum class to be achieved. Unless differently specified this class is C;
- c) public authorities defining inspection procedures of technical systems as well as inspectors applying these procedures to check if the level of BAC and TBM functions implemented is appropriate:
 - 1) Public authorities can request the use of the table to inspect the BACS in place;
 - 2) Inspectors can put an X in front of each of the BAC functions which are implemented;
 - 3) They will then be able to determine the class A, B, C, D of functions already implemented. To be in a given class all the X shall correspond to shaded boxes for this class;
- d) public authorities defining calculation methods which take into account the impact of BAC and TBM functions on the energy performance of buildings as well as software developers implementing these calculation methods and designers using them:
 - 1) Public authorities can request that the impact of the BAC and TBM functions defined in the list is taken into account;
 - 2) Software developers can develop software user interfaces enabling to input the list of BAC and TBM functions which are implemented according to Table 1. They can provide a simplified input mode based on the class of functions A, B, C, D;