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Building automation and control systems (BACS) —

Part 4: Control applications

Systèmes d'automatisation et de contrôle des bâtiments (BACS) —

Partie 4: Applications de contrôle

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Foreword

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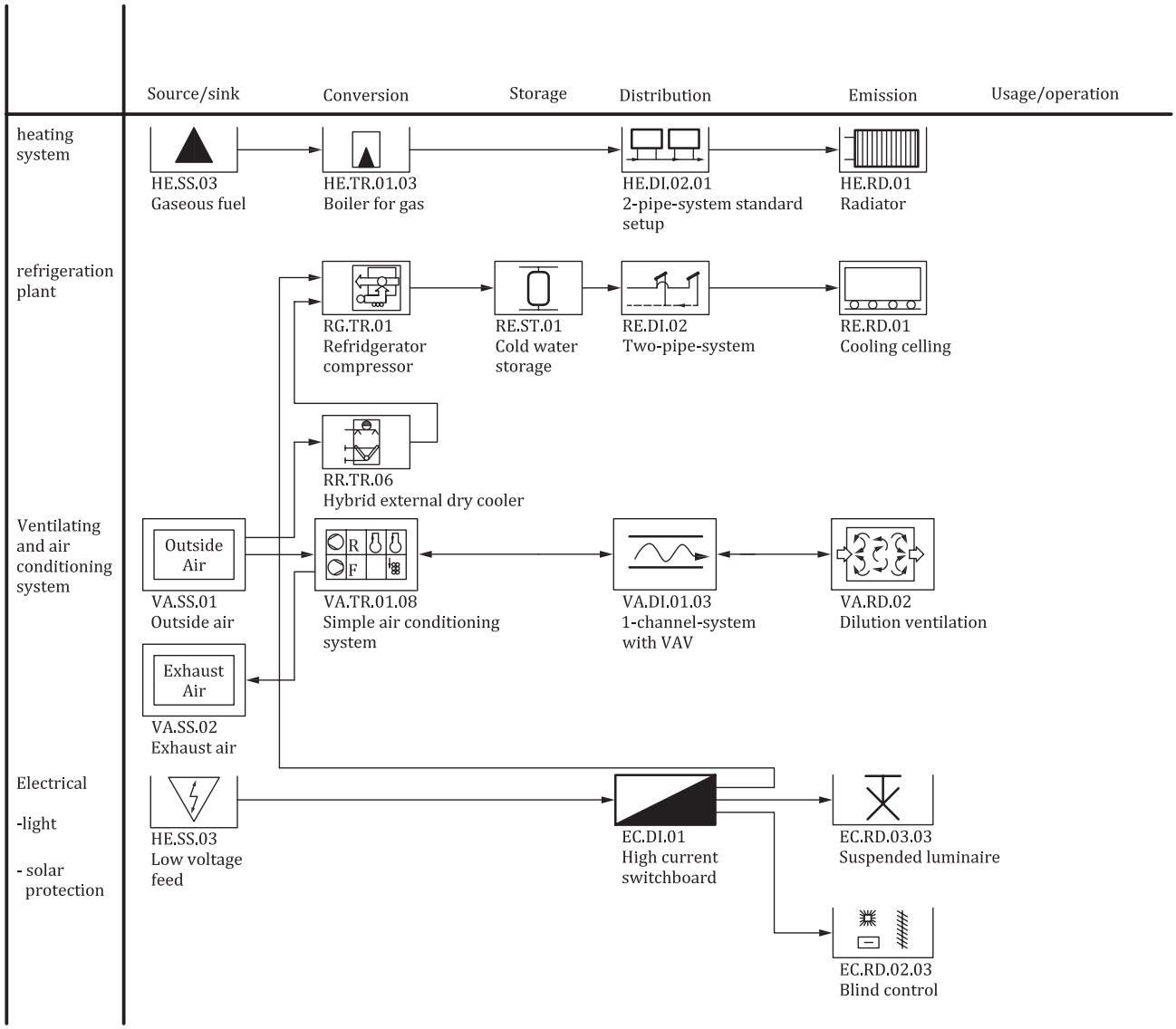
Introduction

Buildings are built and operated to serve a specific purpose, e.g. as an office workspace, a manufacturing floor, or a data centre. In each case, the usage of the space requires specific environmental conditions, e.g. temperature, light level or air quality.

Increasing the efficient usage of energy to provide these environmental conditions is a key aspect of building design as addressed in ISO 52120-1.

Energy efficiency requirements cannot be fulfilled by optimizing the primary systems of a building alone. A holistic view on the building and especially on the room control systems for lighting, solar protection and heating, ventilation and air conditioning (HVAC) is the basis for optimizing the energy efficiency of buildings. This requires integration of the room and building controls and management systems from the design phase through installation and commissioning to the building operation.

The planning process for the technical infrastructure of a building and its spaces includes several steps starting with a rough set of requirements. With each step in the planning process the design becomes more detailed. Firstly, basic design choices or decisions allow for a budget estimate. These first design choices can be documented as depicted in Figure 1.



SOURCE SN 502411:2016 / SIA 411:2016

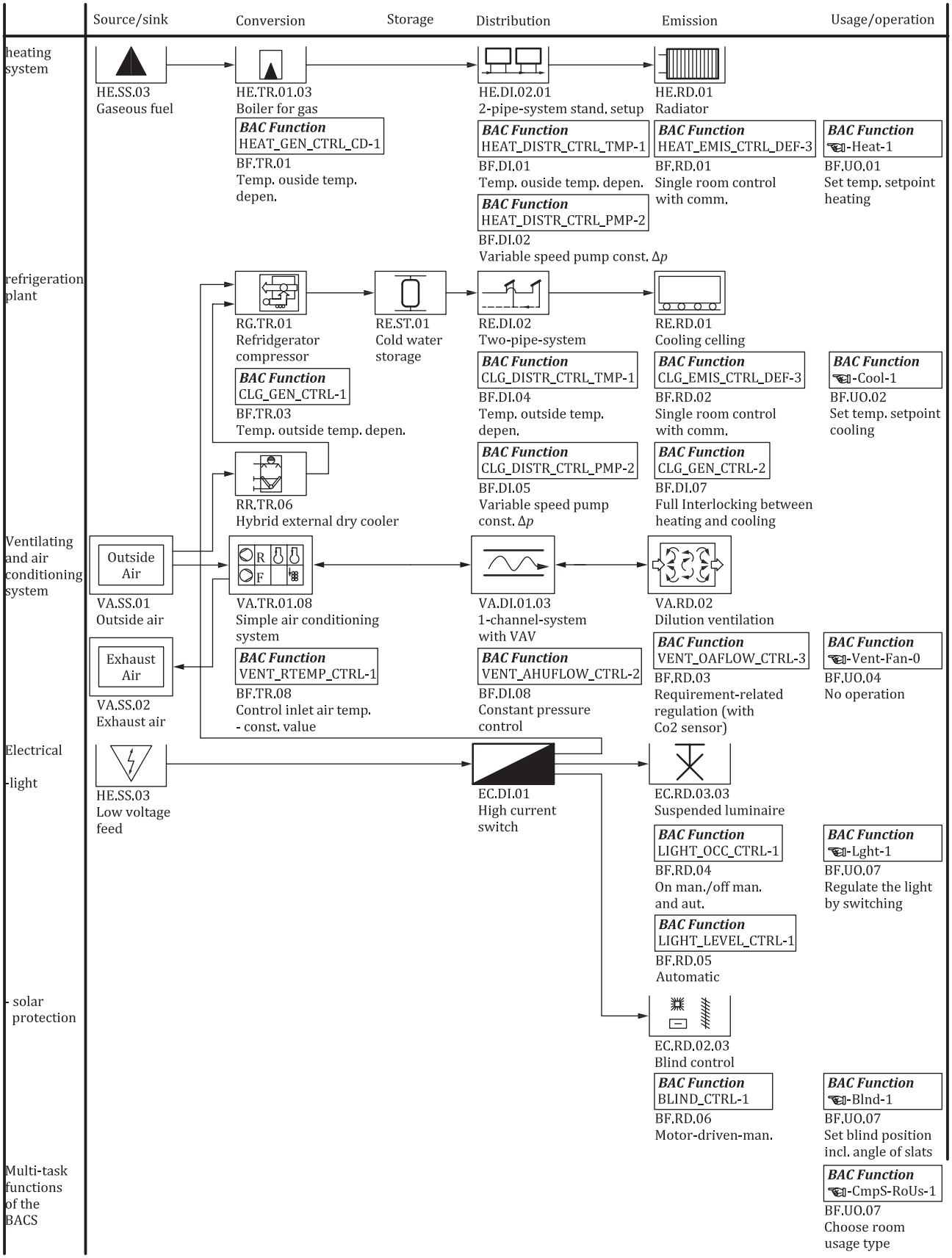
Figure 1 — Example for documentation of design choices for technical infrastructure of a building

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Figure 1 shows equipment used for the different technical building disciplines (e.g. heating, cooling, ventilation, lighting, solar protection) in the space including energy related interconnections between the equipment of the respective disciplines. The schema depicts source/sink, conversion, storage, distribution, and emission elements and their interconnections in a simple manner. This is a high-level view on the mechanical and electrical equipment. It does not yet include the automation requirements associated with the equipment.

In a further planning step, the control functions (BAC functions) associated with the technical infrastructure equipment of a building are added as depicted in Figure 2.

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Figure 2 — Example for documentation of design choices for technical infrastructure and associated control functions of a building

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The column “usage/operation” contains control functions used either for user interaction with the technical building infrastructure in the space or for super-ordinated (e.g. building-wide) functions and requirements or both.

Whereas the control functions are determined by the technical building equipment and the user operation interface in general, the sophistication of these control functions is determined by the desired level of energy efficiency of a building or comfort and operational requirements. Hence, in both views, the desired level of energy efficiency of a building and the comfort and operational requirements, are considered and documented such that this documentation serves as a requirement specification for building control applications (e.g. heating, cooling, ventilation, lighting, solar protection) in a space.

In Figure 2, BAC functions have been added to the equipment. The labels refer to BAC functions listed in ISO 52120-1:2021, Table 5. These BAC functions are not specified in detail in ISO 52120-1.

Clause 5 of this document provides a method to transfer energy performance, comfort, and operational requirements as defined in ISO 52120-1:2021 into a more detailed specification of building automation functions.

ISO 52120-1:2021, Table 5, contains a list of functions contributing to achieve the desired level of energy performance. Whereas ISO 52120-1 only provides a very brief description of the functionality, Clause 5 contains a more detailed description.

NOTE Application of automated control improves the energy performance of buildings. Clause 5 of this document covers automated control applications only. Any manual or non-automated control listed in ISO 52120-1:2021, Table 5, is not covered in this document.

For the purpose of clarity, each subclause in Clause 5 identifies the corresponding entry in ISO 52120-1:2021, Table 5 directly after the sub-clause heading.

The more detailed description includes information about mandatory and optional inputs as well as mandatory and optional outputs for the control function. The control function is not described in detail but rather is a “black box” as the actual implementation can be project or manufacturer specific.

Figure 3 provides an informative schematic view with the function (box), mandatory (blue) and optional (grey) inputs and mandatory (blue) and optional (grey) outputs. The informative schematic drawing also shows if inputs can be controlled, e.g. by manual operation or by a schedule, and if output values are associated, e.g. with an alarm or a trend.

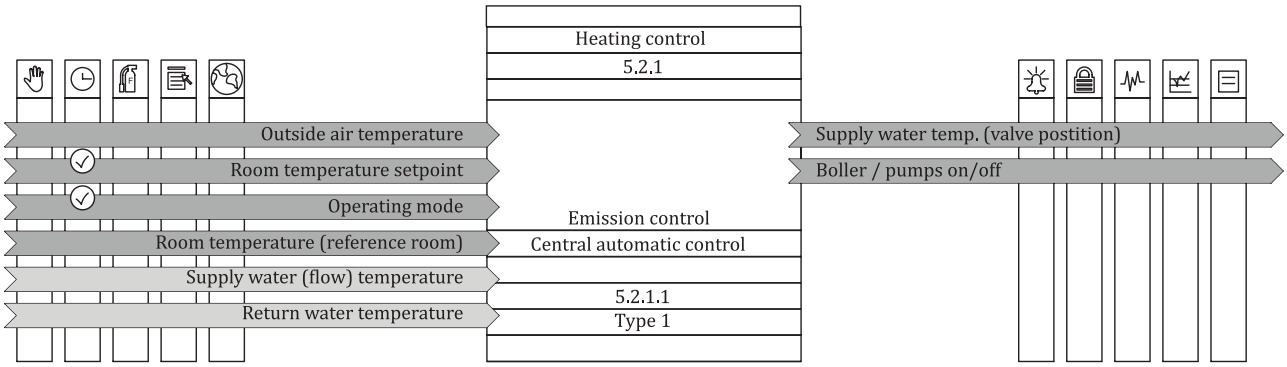


Figure 3 — Informative depiction of control application scheme for heating control — Emission control — Type 1: Central automatic control

Clause 5 contains in each sub-clause a brief description of the control function itself, the target of the function, different operating modes, where applicable, and a description of the inputs and outputs of the function. Optionally, parameters and implementation equipment may be described.

For some of these functions, more than one version is described, covering different technological implementations.

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Building control functions may be associated with a specific zone, a room, a building segment, or the whole building.

The result of applying Clause 5 is a collection of building automation control function blocks. This does not yet depict how these blocks work in detail or how they are linked to each other. A more detailed control scheme description can be provided using the function blocks described in Clause 6.

Clause 6 of this document provides function blocks, which can be used to describe building control functions in more detail independent of a specific building control system or vendor.

Applications can be described by a combination of sensor input, actuator output, user interaction, and control and monitoring functions. Certain functions in a room (e.g. presence detection) can be shared by two or more applications. A common set of function blocks covering sensor input, actuator output, user interaction, and control functions for the different applications in a room serves as the basis for describing room automation, controls and management systems.

NOTE Room automation is coordinated control of lighting, solar protection, heating/ventilation/air conditioning devices and systems in a room providing the desired comfort level with maximum energy efficiency. Using a typical example, Figure 4 shows the relationship between sensor, display/operation, control and actuator functions. Information exchanged between functions is provided from outputs to inputs. Physical inputs and outputs associated with sensor and actuator functions are not depicted in the Figure 3. As some functions can require parameters, these are also depicted in each function block.

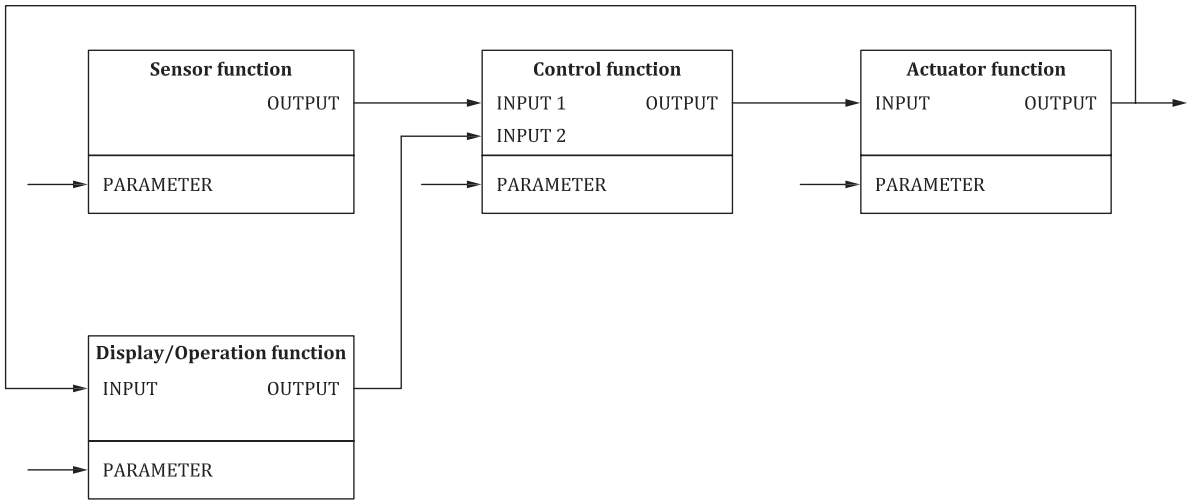


Figure 4 — Relationship between automation functions (typical example)

A sensor function typically includes a physical input (e.g. a temperature sensor, not depicted in Figure 4) and provides a logical output (OUTPUT of the Sensor function block in Figure 4) for use by other functions.

A display and operation function includes physical inputs or outputs depending on its functionality and provides logical inputs for display purposes and logical outputs for use by other functions (Display and Operation function block in Figure 4).

Control functionality as depicted in Figure 4 is assigned to specific control functions with one or more logical inputs (INPUT 1 and INPUT 2 of the Control function block in Figure 4) and at least one logical output (OUTPUT of the Control function block in Figure 4). Control functions are not directly associated with physical inputs or outputs.

Actuator functionality is assigned to specific actuator functions. An actuator function typically includes a physical output (controlling a valve for example) and provides a logical input (INPUT of the Actuator function in Figure 4) and logical output. This logical output can be used as a feedback status information.

The generalized description format used in Clause 6 for functions includes a brief description of the function, of the physical input(s), of the logical input(s) expected from other functions, of the logical output(s) provided

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to other functions, and of the physical output(s). In addition, parameters are listed that are required to more precisely define the function for a specific project.

The description of the functions blocks follows this uniform scheme:

— short description of the function;

— physical input(s);

— logical input(s);

— logical output(s);

— physical output(s);

— parameters (optional).

The list of functions can be extended where necessary.

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Building automation and control systems (BACS) —

Part 4:
Control applications

1 Scope

This document specifies control applications and function blocks focusing on, but not limited to, lighting, solar protection and heating, ventilation and air conditioning (HVAC) applications.

It describes how energy performance, comfort, and operational requirements of buildings are translated into functional specifications for integrated plant and room control.

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 52120-1:2021, *Energy performance of buildings — Contribution of building automation, controls and building management — Part 1: General framework and procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 52120-1 and the following apply.

ISO and IEC maintain terminology 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
display function
presentation of information coming from an actuator, control, monitoring or sensor function in a visible format understandable by a human user

Note 1 to entry: Information may be displayed in text form (e.g. 18 °C, 100 %) or in a graphical form (e.g. light blue for cool, bar graph).

3.2
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; 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. Additionally, they need to be measurable.

[SOURCE: ISO 52120-1:2021, 3.9]

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3.3
building automation
coordinated control of lighting, solar protection, heating, ventilation, and air conditioning (HVAC) devices and systems in a building providing the desired comfort level with maximum energy efficiency

Note 1 to entry: Coordinated control may also encompass access control via information links from those devices and systems to other building control devices and systems.

3.4
logical input
interface of a function receiving data from an output of another function

3.5
logical output
interface of a function sending data to an input of another function

3.6
operation function
means for input of information by a human user intended for use by an actuator, control, monitoring or display function

Note 1 to entry: Operation of, for example, a wall switch or touch panel area, may be used as input.

3.7
plant
equipment for generation of either hot or cold water, or conditioned air, or both

3.8
room
one or more zones with a joint perimeter typically determined by walls or other types of partitions

Note 1 to entry: Typically, a room is a part of a building segment.

3.9
solar protection
means for reducing heat losses at night and for controlling the impact of solar radiation on the temperature in a space or on the visual comfort of an occupant of a space, or both

Note 1 to entry: The impact of solar radiation on the temperature can lead to an undesired (in warm climates) or a desired (in in cold climates) temperature rise.

3.10
space
complete building, building part, room, or zone

3.11
zone
smallest space determined by the minimum technical infrastructure required to operate that space

Note 1 to entry: The minimum technical infrastructure may be a heating radiator, ventilation outlet, or other mechanical or electrical equipment element.

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