
**Energy performance of buildings —
Schedule and condition of building,
zone and space usage for energy
calculation —**

**Part 1:
Non-residential buildings**

*Performance énergétique des bâtiments — Plan et conditions
d'utilisation des espaces, zones et bâtiments pour le calcul
d'énergie —*

Partie 1: Bâtiments non résidentiels

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 163, *Thermal Performance and energy use in the built environment*.

Introduction

There is a strong need to improve the environment to make the evaluation of energy performance of buildings more reliable and practical, so that energy efficiency of buildings is improved by referring to the evaluation results. To realize such environment, one important standard on how to prescribe the ways of using buildings has been missed, even though many assumptions on the building usage have appeared in standards relevant to the energy calculation.

This document prescribes the indispensable information on the formats to express the usage of building, zone and space in energy calculation for non-residential buildings.

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Energy performance of buildings — Schedule and condition of building, zone and space usage for energy calculation —

Part 1:

Non-residential buildings

1 Scope

This document specifies the formats to present schedule and condition of building, zone and space usage, which is to be referred to as input data of energy calculations for non-residential buildings.

The schedule and condition include schedules of occupancy, operation of technical building systems, ventilation rate, hot water usage and internal heat gains due to occupancy, lighting and equipment.

This document also gives categories of building, zone and space according to differentiating schedule and condition.

Depending on necessary minuteness of the energy calculation, different levels of schedule and condition from the view point of time and space averaging are specified.

The values and categories for the schedule and condition are given in annexes for more information for the application when the users of this document do not have detailed information on the values and categories for the schedule and condition.

The schedule and condition in this document is basically different from assumptions in order to determine the size of technical building systems in the process of design, where possible largest values are to be assumed. Instead, most usual and average values, which are assumed for the building energy calculation, are dealt with in this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Space

3.1.1

space

part of a room, a room or group of adjacent rooms with assumed uniform properties for all considered types of zones (3.1.2)

3.1.2

zone

part of a *building* (3.1.3) consisting of (part of) one or more spaces with assumed uniform properties related to a specific service or service component, or (in absence of a service) assumed uniform indoor environmental conditions

3.1.3

building

construction as a whole, including its envelope and all *technical building systems* (3.3.5), where energy is used to condition the indoor thermal environment and to provide domestic hot water, lighting according to visual tasks and other services related to the use of the building

3.1.4

thermally conditioned space

thermally conditioned zone

heated and/or cooled *space* (3.1.1) or *zone* (3.1.2)

3.1.5

thermally unconditioned space

thermally unconditioned zone

space (3.1.1) or *zone* (3.1.2) that is not heated nor cooled

3.2 Schedule

3.2.1

schedule

information on condition(s) of usage of *building* (3.1.3), *zone* (3.1.2) or *space* (3.1.1) throughout a cycle of period, such as day, week, month, season and year

3.2.2

daily schedule

conditions (3.3.1) of *occupancy* (3.3.2), service system operations, requirement for the functions of the service systems and internal heat gains in each time of a day

3.2.3

daily schedule with hourly conditions

set of hourly *conditions* (3.3.1) of *occupancy* (3.3.2), service system operations, requirement for the functions of the service systems and internal heat gains in a day

3.2.4

set of daily schedules

complete set of daily schedules representing usage of a category of *building* (3.1.3), *zone* (3.1.2) or *space* (3.1.1) in one year

3.2.5

daily operating hours

hours when service system is operated or the length of the hours

3.2.6

annual operating hours

total length of hours in the *standard year* (3.2.15) when *technical building system* (3.3.5) is operated

3.2.7**annual schedule**

allocation of *daily schedule(s)* (3.2.2) for one year

Note 1 to entry: Division of the year can be selected from 365 days, 53 weeks, 12 months, seasons or no division [a *set of daily schedules* (3.2.4) is uniformly applied throughout the year].

3.2.8**seasonal schedule**

allocation of *daily schedule(s)* (3.2.2) to each season of the year

3.2.9**monthly schedule**

allocation of *daily schedule(s)* (3.2.2) to each month of the year

3.2.10**weekly schedule**

allocation of *daily schedule(s)* (3.2.2) to each week of the year

3.2.11**whole set of annual schedules**

complete set of *annual schedules* (3.2.7) representing usage of all types of *building* (3.1.3), *zone* (3.1.2) and *space* (3.1.1), as objects of *energy calculation* (3.3.20)

3.2.12**whole set of seasonal schedules**

complete set of *seasonal schedules* (3.2.8) representing usage of all types of *building* (3.1.3), *zone* (3.1.2) and *space* (3.1.1), as objects of *energy calculation* (3.3.20)

3.2.13**whole set of monthly schedules**

complete set of *monthly schedules* (3.2.9) representing usage of all types of *building* (3.1.3), *zone* (3.1.2) and *space* (3.1.1), as objects of *energy calculation* (3.3.20)

3.2.14**number of days in one year**

total number of days, which shall be 365

3.2.15**standard year**

selected year, of which number of day has to be 365 and arrangement of weekdays, weekends and holidays are referred in weekly, monthly, seasonal and *annual schedules* (3.2.7)

3.3 Parameters for conditions of building, zone and space usage**3.3.1****condition**

status of *occupancy* (3.3.2), operation of service systems, requirement for the functions of the *technical building systems* (3.3.5) and internal heat gains

3.3.2**occupancy**

presence of users in *building* (3.1.3), *zone* (3.1.2) or *space* (3.1.1)

3.3.3

occupancy density

number of present user in *building* (3.1.3), *zone* (3.1.2) or space per unit floor area of the *space* (3.1.1)

Note 1 to entry: Occupancy density is used mainly for the calculations for space heating/cooling and ventilation.

3.3.4

simultaneous usage ratio (of a set of spaces)

ratio of the number of *zones* (3.1.2) or *spaces* (3.1.1), which belong to a group of zones and spaces and are occupied or used at the time, to the total number of zones or spaces in the group

Note 1 to entry: This concept is applied to a group of zones or spaces of the same category, such as a group of guest rooms in hotels, a series of personal office rooms in office buildings, etc.

3.3.5

technical building system

all energy-using or energy-distributing components in a *building* (3.1.3) that are operated to support the occupant or process functions housed therein

Note 1 to entry: These include HVAC, domestic hot water, illumination, transportation, laundering or similar functions.

3.3.6

luminaire

apparatus which distributes, filters or transforms the light transmitted from one or more lamps

Note 1 to entry: Except for the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply

[SOURCE: CIE S 017/E: 2011, 17–707]

3.3.7

in operation

status of a *technical building system* (3.3.5), in which the technical building system can function to satisfy the requirement for the technical building system, such as the set-point temperature and the *maintained average illuminance* (3.3.9)

Note 1 to entry: When the requirement is satisfied without its functioning, the technical building system stands by.

3.3.8

out of operation

status of a *technical building system* (3.3.5) in which the technical building system cannot function regardless of the relevant requirement or due to inexistence of any requirement for the technical building system

3.3.9

maintained average illuminance

value below which the average illuminance over the specified surface is not allowed to fall, lux

[SOURCE: CIE S 017/E: 2011, 17–750]

3.3.10**height of the working plane**

height of the plane, on which the assumed visual task is done, from the floor

Note 1 to entry: It is expressed in metres (m).

3.3.11**demand control ventilation**

ventilation, of which rate is controlled according to the necessity of the ventilation, such as to the emission rate of target pollutant

3.3.12**energy need for space heating and cooling**

heat to be delivered to or extracted from a conditioned *space* (3.1.1) to maintain the intended temperature and/or humidity conditions during a given period of time

3.3.13**energy use for space heating and cooling**

energy input to the heating and cooling system to satisfy the *energy need for space heating and cooling* (3.3.12)

3.3.14**energy need for ventilation for outdoor air supply**

work by electric motors to convey outdoor air to satisfy ventilation requirement

3.3.15**energy use for ventilation for outdoor air supply**

energy input to the ventilation system to satisfy the *energy need for ventilation for outdoor air supply* (3.3.14)

3.3.16**energy need for domestic hot water**

heat to be delivered to the needed amount of domestic hot water to raise its temperature from the cold network temperature to the prefixed delivery temperature at the delivery point

3.3.17**energy use for domestic hot water**

energy input to the domestic hot water system to satisfy the *energy need for domestic hot water* (3.3.16)

3.3.18**energy use for lighting**

energy consumed by *luminaires* (3.3.6) and lamps

3.3.19**energy use for transportation**

energy consumed by equipment for transportation, such as elevators

3.3.20**energy calculation**

calculation of energy uses for *technical building systems* (3.3.5)

3.4 Descriptions for daily schedule

3.4.1

reference ventilation requirement

most probable estimation of outdoor air supply (in volume flow rate per unit floor area or in air change per hour) to the *space* (3.1.1) or *zone* (3.1.2) in compliance with relevant regulation

3.4.2

reference domestic hot water usage

maximum hourly service hot water usage by users of the *space* (3.1.1) or *zone* (3.1.2) in volume flow rate per person, in volume flow rate per unit floor area or in volume flow rate per bed

Note 1 entry: The volume flow rate is calculated with the assumption on hot water temperature.

3.4.3

total daily usage of domestic hot water

total volume of service hot water usage in one day in volume per person, in volume per unit floor area or in volume per bed

Note 1 entry: The volume flow rate is calculated with the assumption on hot water temperature.

3.4.4

reference occupancy density

maximum hourly *occupancy density* (3.3.3) of the *space* (3.1.1) or *zone* (3.1.2) in person per unit floor area

Note 1 to entry: To be multiplied by *hourly ratios* (3.4.12), occupancy density at the time can be calculated.

3.4.5

reference heat gain due to person

maximum hourly total (sensitive and latent) heat gain due to person inside the room or *zone* (3.1.2) in watt per unit floor area

Note 1 to entry: To be multiplied by *hourly ratios* (3.4.12), heat gain due to person at the time can be calculated.

3.4.6

reference sensible heat gain due to person

maximum hourly sensible heat gain due to person inside the room or *zone* (3.1.2) in watt per unit floor area

Note 1 to entry: To be multiplied by *hourly ratios* (3.4.12), sensible heat gain due to person at the time can be calculated.

3.4.7

reference latent heat gain due to person

maximum hourly latent heat gain due to person inside the room or *zone* (3.1.2) in watt per unit floor area

Note 1 to entry: To be multiplied by *hourly ratios* (3.4.12), latent heat gain due to person at the time can be calculated.

3.4.8**reference heat gain due to lighting**

maximum hourly sensible heat gain due to lighting inside the room or *zone* (3.1.2) in watt per unit floor area

Note 1 to entry: To be multiplied by hourly ratios, heat gain due to lighting at the time can be calculated.

3.4.9**reference heat gain due to appliances**

maximum hourly total (sensible and latent) heat gain due to appliances inside the room or *zone* (3.1.2) in watt per unit floor area

Note 1 to entry: To be multiplied by *hourly ratios* (3.4.12), heat gain due to appliances at the time can be calculated.

3.4.10**reference sensible heat gain due to appliances**

maximum hourly sensible heat gain due to appliances inside the room or *zone* (3.1.2) in watt per unit floor area

Note 1 to entry: To be multiplied by *hourly ratios* (3.4.12), sensible heat gain due to appliances at the time can be calculated.

3.4.11**reference latent heat gain due to appliances**

maximum hourly latent heat gain due to appliances inside the room or *zone* (3.1.2) in watt per unit floor area

Note 1 to entry: To be multiplied by *hourly ratios* (3.4.12), latent heat gain due to appliances at the time can be calculated.

3.4.12**hourly ratio**

ratio of hourly value of parameters to their reference value

Note 1 to entry: Multiplying hourly ratios by the reference value, hourly values of the parameter can be calculated.

4 Framework of the schedule and condition for building energy calculation**4.1 Indispensable schedules**

The building energy calculations are characterized by the division number of the year, the calculation period or the calculation interval. Each calculation method has its appropriate calculation interval according to characteristics of the target physical phenomenon (for example, unsteadiness) and minuteness of the calculation responding to changes of climatic condition, occupants' behaviour, behaviour of service systems and so on.

Due to the variety of calculation method, there is a variety of form of the schedule and condition of building, zone and space usage. Nevertheless, there is a fundamental unit of form, daily schedule, which shall be included in forms for the schedule and condition. The daily schedule corresponds to the minimum cycle of building, zone and space usage, and also of climatic and solar condition.

Some nations adopt so called "monthly calculation" for space heating and cooling energy needs and uses, taking monthly variation of outdoor temperature and solar irradiance into consideration. One daily schedule for business day and the number of the business days is given to each month for each type of building, zone and space. Monthly means of outdoor air condition (for example, temperature)

and solar irradiance for different orientations and inclinations are given for the calculation. The expression of the daily schedule varies from detailed expression with hourly values to simplified expression such as daily mean values and the like. Additional schedule for closing day can be given in a simplified way such as only with daily mean values.

Similarly, in so called “seasonal calculation”, one daily schedule for business day and the number of the business days for each season are given to each season for each type of building, zone and space, and the calculation is done with seasonal mean values for climatic condition.

For the calculation of more steady phenomena, so called “annual calculation” can work if seasonal change of solar condition is integrated throughout the year and condensed in specific coefficients. Nevertheless, one daily schedule for business day and the number of annual business days are necessary. Additional daily schedule for closing day can be given.

For the calculation of lighting, monthly or yearly calculation is mainly used, but unsteady aspects of lighting still can be dealt with. In the calculation for lighting, when input parameters such as operating hours with and without daylight are prescribed, daily schedule as described in the column (2) of Table 1 and annual schedule by monthly allocation of daily schedules (Table 5) or annual schedule without division of the year (Table 7) should be explicitly given, so that the operating hours for light is well harmonized with those for other technical systems.

Therefore, for each category of building, zone and space, necessary number of daily schedules (e.g. two daily schedules for business day and closing day), and one of annual, seasonal, monthly and weekly schedules shall be given in order that the daily schedules are allocated for the year.

4.2 Daily schedule

The daily schedule shall contain hourly values of condition for one day or shall contain condensed or simplified information on conditions for the day. With some assumptions, the hourly detailed values can be generated from condensed or simplified information and used even for detailed calculation. If necessary, multiple daily schedules representing different daily patterns of usage should be given such as for weekdays, weekends and holidays. The number of daily schedules depends on minuteness of the schedule and condition, as well as on the category of building, zone and space under consideration.

The conditions described in the daily schedule are grouped into the following three categories:

- a) general information on occupancy and usage of building, zone and space;
- b) operation of technical building systems and requirement for their services;
- c) internal heat gains.

The basic structure of daily schedule is shown in Table 1.

Table 1 — Framework of daily schedule for building, zone or space

Parameters and their categories		(1) description by hourly values for 0 h to 24 h	(2) condensed or simplified description
a) General information on occupancy and usage	Occupancy density	Hourly occupancy density	Times of start and end of occupancy or total hours of occupancy, and average occupancy density during usage
	Simultaneous usage ratio of a set of rooms	Hourly simultaneous usage ratio	Mean simultaneous usage ratio during usage
b) Operation of technical building systems and requirement for their building services	Space heating and/or cooling	Hourly status of space heating and/or cooling system (in or out of operation)	Times of start and end of operation, or total hours of operation
		Hourly set-points of room temperature and/or humidity	Set-point temperature and/or humidity during operation, and/or information on set-back operation
	Ventilation for thermally conditioned zone or space	Hourly status of ventilation system (in or out of operation)	Times of start and end of operation, or total hours of operation
		Hourly ventilation requirement	Ventilation requirement during operation
	Lighting	Hourly status of lighting system (in or out of operation)	Times of start and end of operation, or total hours of operation
		Maintained average illuminance and height of working plane	Maintained average illuminance and height of working plane
	Domestic hot water	Hourly status of domestic hot water system	Times of start and end of operation, or total hours of operation
		Hourly service hot water usage	Daily total hot water usage
	Ventilation for thermally unconditioned zone or space	Hourly ventilation requirement	Ventilation requirement
		Set-point of room temperature (upper limit)	Set-point of room temperature (upper limit)
c) Internal heat gains (sensitive and/or latent)	Person (watt per unit floor area)	Hourly heat gains	Times of start and end of occupancy or total hours of occupancy
			Average heat gains during occupancy
	Lighting (watt per unit floor area)	Hourly heat gains	Times of start and end of lighting or total hours of lighting
			Average heat gain during operation
	Appliances (watt per unit floor area)	Hourly heat gains	Times of start and end of use of appliances or total hours of the usage
			Average heat gain during usage