

Republic of Latvia

Cabinet

Regulation No. 348

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## **Methodology for Calculating the Energy Performance of a Building**

*Issued pursuant to  
Section 6, Paragraph five  
of the Law On the Energy Performance of Buildings*

### **1. General Provisions**

1. This Regulation prescribes the methodology for calculating the energy performance of a building. The methodology shall be used in drawing up an energy balance at the building level. If an energy balance is being drawn up at the level of technical building systems or if the energy required for heating that has been calculated for the building is lower than 50 kilowatt-hours per square metre of the area under calculation, a detailed calculation shall be carried out in accordance with Standard LVS EN ISO 13790:2009 L “Energy performance of buildings. Calculation of energy use for space heating and cooling” (hereinafter – Standard LVS EN ISO 13790:2009 L).

2. The following terms are used in this Regulation:

2.1. energy required for heating and cooling – the calculated energy that must be supplied by a heating or cooling system to conditioned space or released from it, in order to maintain a preferable temperature during a definite time period, without taking into consideration the technical building system;

2.2. heating or cooling season – a period of a year when a definite amount of energy is used for the purpose of heating or cooling;

2.3. calculated energy rating – an energy performance assessment, which has been obtained on the basis of calculations as regards the consumption of energy required for heating, cooling, ventilation, preparation of hot water and lighting needs;

2.4. calculation model of a building – a mathematical model of a building, which is used for energy consumption calculations;

2.5. exported energy – energy, expressed in energy carriers, which is supplied by a building through the system boundary and which is used behind the system boundary;

2.6. energy carrier – a substance or phenomenon that is used for producing heat, as well as for ensuring mechanical work, physical or chemical processes;

2.7. internal energy losses and gains – thermal energy, which is produced in a building by the building residents (metabolic heat) and appliances (for example, lighting, household appliances, office equipment);

2.8. measured energy rating – an energy performance assessment, which has been obtained on the basis of the measured amounts of the delivered and exported energy;

2.9. conditioned space – a building unit, which is heated or cooled;

2.10. conditioned zone – conditioned spaces with a definite set-point temperature controlled by one heating system, cooling system or ventilation system;

2.11. carbon dioxide (CO<sub>2</sub>) emission factor – an amount of carbon dioxide (CO<sub>2</sub>), which is emitted into the atmosphere per each unit of delivered energy. The carbon dioxide

(CO<sub>2</sub>) emission factor comprises all emissions of carbon dioxide (CO<sub>2</sub>), which are related to the primary energy consumed by a building. The carbon dioxide (CO<sub>2</sub>) emission factors are specified in Annex 1 to this Regulation;

2.12. auxiliary energy – electricity, which is used in heating, domestic hot water, air-conditioning, ventilation and lighting systems, in order to produce and transform the supplied energy into effective energy (for example, for fans, pumps, electronics). Energy that is produced is not auxiliary energy;

2.13. delivered energy – the total energy, expressed in energy carriers, which is supplied to technical building systems through the system boundary, in order to ensure the required energy (for example, for heating, hot water supply, cooling, ventilation, lighting, appliances) or in order to produce electricity. Delivered energy can be calculated or measured according to the definite energy use types;

2.14. primary energy – energy from renewable and non-renewable sources, which has not undergone any conversion or transformation process;

2.15. thermal energy gains – thermal energy, which is generated inside a conditioned space or is supplied to it from another source of heat and which is not energy used for heating, cooling or centralised preparation of hot water. Thermal energy gains include internal heat gains and solar heat gains;

2.16. system boundary – a boundary, which comprises all fields related to the building (interior and exterior of the building) where energy is consumed or produced;

2.17. system thermal losses – thermal energy losses, which are caused by the technical building system not participating in the effective output of the system. Losses of a system can become internal thermal energy gains of a building, if they are recoverable. Thermal energy that has been recovered in the system shall not be thermal energy losses, but thermal energy gains;

2.18. solar heat gains – thermal energy provided by the solar irradiation entering a building directly or indirectly through the windows (after absorption in the building elements), through non-transparent walls and roofs or passive constructions for the use of the sun (for example, winter gardens, transparent insulation). Active solar systems (for example, sun collectors) shall be part of the technical building system;

2.19. space heating – the process of thermal energy supply aimed at ensuring the thermal comfort;

2.19. space cooling – the process of thermal energy release aimed at ensuring the thermal comfort;

2.21. set-point temperature – the minimum internal temperature in the heating period or the maximum internal temperature in the cooling period, which is maintained by control systems and intended for the normal mode.

## **2. Technical Building Systems to Be Included in an Energy Rating**

### **2.1. Main Provisions**

3. An energy rating, when determining annual energy consumption, shall include the technical building systems, which ensure:

- 3.1. heating;
- 3.2. cooling (and air drying);
- 3.3. ventilation (and air humidification);
- 3.4. hot water supply;
- 3.5. lighting.

4. Other energy-consuming systems, which are built in the building and ensure functional needs of the building (for example, elevators, escalators and industrial technological

equipment), shall be taken into consideration in calculations of the energy rating, however, they shall not be taken into consideration when determining annual energy consumption indicators.

5. An assessment of energy consumed in the building shall include the auxiliary energy supply and energy losses of the technical building systems.

6. Energy consumption for heating, cooling, heat transmission losses and heat losses through ventilation shall be assessed in accordance with Chapters III, IV, V and VI of this Regulation, taking into consideration internal and solar heat gains and recoverable losses of the technical building system.

## 2.2. Domestic hot water system

7. For buildings to be designed energy consumption in a domestic hot water system shall be assessed in accordance with Section 5.2., Annex A, Tables A1 and A2 or Section 5.3. and Annex B of the Standard LVS EN 15316-3-1:2009 L “Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies - Part 3-1: Domestic hot water systems, characterisation of needs (tapping requirements)”, Standard LVS EN 15316-3-2:2008 “Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies - Part 3-2: Domestic hot water systems, distribution”, and Standard LVS EN 15316-3-3:2009 L “Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 3-3: Domestic hot water systems, generation”.

8. For existing buildings the energy consumption in a domestic hot water system shall be assessed on the basis of the measured data regarding the heat consumption and hot water consumption.

9. Energy consumption  $Q_{k\bar{u}}$  for heating of hot water in the calculation period shall be determined by using the following formula:

$$Q_{k\bar{u}} = V \frac{\rho_{k\bar{u}} C_{\bar{u}}}{3600} \times (\theta_{\bar{u}, pieg} - \theta_{k\bar{u}}) \quad (1)$$

, where

$Q_{k\bar{u}}$  – energy consumption for heating of hot water (kWh);

$V$  – hot water consumption in the period ( $m^3$ );

$\rho_{k\bar{u}}$  – density of water at hot water temperature  $\theta_{w,o}$  ( $kg/m^3$ );

$C_{\bar{u}}$  – specific heat capacity of water ( $J/kg K$ );

$\theta_{\bar{u}, pieg}$  – cold water temperature ( $^{\circ}C$ );

$\theta_{k\bar{u}}$  – hot water temperature ( $^{\circ}C$ );

3600 – conversion coefficient, in order to take into account the conversion from megajoules to kilowatt-hours.

10. If there is a common accounting of thermal energy for the heating and domestic hot water systems in a building, then, on the basis of data regarding the energy and hot water consumption in the period when heating is not used, the following calculation simplification shall be admissible for existing buildings – the energy consumption in the water supply system (for heating and circulation of hot water) for a year period shall be calculated by using linear extrapolation. In such case the distribution of heat losses of hot water circulation must be determined:

10.1. losses in unconditioned zones (for example, in a cellar or attic);

10.2. losses in conditioned zones, which during the heating period are considered as heat gains.

### **2.3. Lighting**

11. For buildings to be designed the assessment of energy consumption for lighting shall be carried out in accordance with Standard LVS EN 15193:2009 L “Energy performance of buildings – Energy requirements for lighting” (hereinafter – Standard LVS EN 15193:2009 L).

12. For existing buildings the assessment of energy consumption for lighting shall be carried out on the basis of the lighting system (luminaires and their control equipment) output, assessment of the actual work hours and measured electricity consumption in the building.

13. For residential houses the energy consumption of the lighting systems of a building shall not be taken into consideration and shall not be included in the annual energy consumption indicators.

## **3. Boundaries and Types of an Energy Rating**

### **3.1. Boundaries of an Energy Rating**

14. Boundaries of an energy rating shall be determined prior to commencing the assessment. A system boundary is related to the object under assessment (for example, building, building unit, apartment) and comprises all elements of the interior and exterior, which are related to the building where the energy is produced or consumed. System losses within the system boundaries shall be calculated in detail, while outside the system boundaries they shall be calculated by using conversion coefficients. Boundaries of an energy rating and the energy flow scheme are specified in Annex 2 to this Regulation.

15. Energy can be imported or exported through the building boundary. If the system equipment (for example, boiler, cooler, cooling tower) is located outside the building envelope, consumption of an energy carrier (for example, for gas, electricity, thermal energy, water) shall be determined by using a meter.

16. The boundary of an energy rating for energy carriers (gas, electricity, thermal energy and water) shall be a meter, while for liquid and solid energy resources – the boundary of the storage system. If part of technical building systems (for example, boiler, cooler, cooling tower) is located outside the building envelope, it shall be considered that they are inside the boundary, and the losses of the relevant system shall be taken into account.

17. Active solar, wind and water energy shall not be part of the energy balance of a building. An energy balance shall include energy, which is delivered by the energy production equipment for the building consumption, and auxiliary energy required for delivering to the building energy from heat sources (for example, from a solar collector).

18. When carrying out calculation of the primary energy consumption indicators, an assessment shall include systems that are within the boundaries of the building or building space in accordance with Annex 3 to this Regulation.

19. A calculated energy rating for a group of buildings may be carried out, if all of the following conditions are in force:

- 19.1. buildings use common heating or cooling systems;
- 19.2. buildings are located in one property;
- 19.3. total conditioned area of the buildings does not exceed 1000 square metres.

### **3.2. Types of an Energy Rating**

20. A measured energy rating shall be determined in accordance with Chapter 4 of this Regulation. A calculated energy rating shall be determined in accordance with Chapter 5 of this Regulation.

21. For buildings to be designed, reconstructed or renovated the following output data shall be applied when acquiring the calculated energy rating at the design stage:

21.1. the climatic data specified in the Latvian Construction Standard LBN 003-01 “Construction Climatology” approved by the Cabinet Regulation No. 376 of 23 August 2001, Regulations Regarding the Latvian Construction Standard LBN 003-01 “Construction Climatology” (hereinafter – LBN 003-01 “Construction Climatology”);

21.2. the parameters of indoor comfort and occupancy, which are laid down in laws and regulations in the field of construction, health and hygiene, working environment and other fields;

21.3. the properties of the outer building envelope and technical building systems of the designed building.

22. If in the course of construction deviations from the initial building design affect the energy performance indicators of a building, then, when putting the building into operation, an adjustment of calculations shall be carried out, taking into consideration the actual properties of the outer building envelope and technical building systems.

23. For buildings in operation a measured and calculated energy rating shall be determined by using data regarding:

23.1. actual energy consumption;

23.2. actual outdoor climate conditions;

23.3. actual parameters of indoor comfort and occupancy;

23.4. actual properties of the outer building envelope and technical building systems.

24. For buildings in operation a measured and calculated energy rating shall be validated in accordance with Chapter 6 of this Regulation.

## **4. Measured Energy Rating**

### **4.1. General Requirements for the Assessment Period**

25. Energy consumption for all energy carriers must be assessed in an equal time period. If in the previous time period accounting of energy carriers has not been carried out, an assessment of the measured energy performance of a building may not be performed.

26. An assessment period shall be the full number of years. If an assessment period is not the full number of years, the annual energy consumption shall be obtained by using the extrapolation method.

27. If an assessment period is shorter than five years, an adjustment of the energy consumption due to climatic conditions shall be performed.

28. If changes have been made to a building in the assessment period, which affect the energy performance thereof for more than 10 per cent, the previously obtained data may not be used for the assessment of the energy performance of the building. If changes made to the building affect the energy performance of the building up to 10 per cent, the previously obtained data may be used with an adjustment that is justified by appropriate calculations.

## **4.2. Data Obtaining and Adjustment (Extrapolation)**

### **4.2.1. Energy Carriers Measured with a Meter**

29. Consumption of energy carriers (electricity, gas, thermal energy) measured with a meter shall be the difference between two meter readings that shall be read at the beginning and at the end of the assessment period.

30. Bills from electricity, gas and thermal energy suppliers or the building manager may be used for assessing the consumption of such energy carriers (assessment period – full years).

31. If an energy carrier is used in several technical building systems and for several purposes, the consumption of the energy carrier shall be distributed by technical systems and purposes.

### **4.2.2. Liquid Fuel in Tanks**

32. The level of liquid fuel in a tank shall be measured at the beginning and at the end of the assessment period by using a calibrated scale. Consumption of liquid fuel in the assessment period shall be the contents of the tank at the beginning of the assessment period, from which the contents of the tank at the end of the assessment period have been deducted and to which the amount of the fuel purchased in the assessment period has been added.

33. If gas is delivered in gas containers, fuel shall be assessed by adding up the number of the used containers (volume of the containers shall be taken into account).

34. If a burner runs with a fixed output (without modulation) and is equipped with a burning time meter, consumption of the fuel shall be the difference between two readings that have been performed at the beginning and at the end of the assessment period, multiplied by the flow speed in the burner. The flow speed in a burner shall be measured before the first reading and after each setting or cleaning.

35. The consumed amount of delivered energy shall be determined in one of the following manners:

35.1. by multiplying the amount of the used liquid fuel by its net calorific value and the effectiveness coefficient of the boiler, which has been determined according to the net calorific value of the fuel (amount of heat per one fuel unit when it is burnt completely, and from which the heat from evaporation of water generated in the burning process has been deducted). The net calorific values of fuel shall be determined in accordance with Clause 1 of Annex 1 to this Regulation;

35.2. by multiplying the amount of the used liquid fuel by its gross calorific value and the effectiveness coefficient of the boiler, which has been determined according to the gross calorific value of the fuel (amount of heat per one fuel unit when it is burnt completely). The gross calorific values of fuel shall be determined in accordance with Clause 2 of Annex 1 to this Regulation.

### 4.2.3. Solid Fuel

36. The energy content of solid fuel (for example, coal, wood) depends on the quality and density thereof. Consumption of solid fuel shall be the weight of fuel in stock at the beginning of the assessment period, from which the weight of fuel in stock at the end of the assessment period has been deducted and to which the weight of fuel purchased in the assessment period has been added.

37. The consumed amount of delivered energy shall be determined in one of the following manners:

37.1. by multiplying the amount of the used solid fuel by its net calorific value and the effectiveness coefficient of the boiler, which has been determined according to the net calorific value of the fuel; or

37.2. by multiplying the amount of the used solid fuel by its gross calorific value and the effectiveness coefficient of the boiler, which has been determined according to the gross calorific value of the fuel.

38. In order to obtain the weight of solid fuel, the measured volume shall be multiplied by the density of the fuel. When calculating the confidence interval of the weight, the ambiguity of density and moisture shall be taken into consideration.

### 4.2.4. Consumption of Energy Carriers, if the Average Output of Equipment is Constant, and Energy Carriers for Heating and Cooling

39. For energy carriers that are used, if the average output of equipment is constant and the extrapolation is linear, the amount shall be calculated by using the following formula:

$$E = \frac{t_{kop}}{t_{per}} E_{per} \quad (2)$$

, where

E – adjusted amount of the energy carrier (kg, m<sup>3</sup> or Wh);

E<sub>per</sub> – amount of the energy carrier that has been consumed in the accounting period of the energy carrier (kg, m<sup>3</sup> or Wh);

t<sub>kop</sub> – duration of the assessment period (year or season);

t<sub>per</sub> – duration of the accounting period of the energy carrier (years or seasons).

40. For energy carriers that are used for heating or cooling the extrapolation shall be carried out by using the energy accounting or simplified calculation in accordance with Paragraph 42 of this Regulation.

41. If an assessment is carried out by using the energy accounting, the assessment period shall cover a wide (at least month) range of the average external temperatures.

42. The simplified extrapolation calculation shall be used for calculating the amount of an energy carrier, which is used for heating or cooling during the whole year. It shall be calculated by using the following formula:

$$E_{kop} = \frac{Q_{kop,apr}}{Q_{nov,apr}} E_{nov} \quad (3)$$

, where

Q<sub>kop,apr</sub> – energy required for heating and cooling calculated for a year (Wh);

Q<sub>nov,apr</sub> – energy required for heating and cooling calculated for the assessment period (Wh);

E<sub>nov</sub> – amount of the energy carrier used for heating and cooling in the assessment period (kg, m<sup>3</sup> or Wh).

43. Energy required for heating and cooling calculated for a year  $Q_{kop,apr}$  shall be calculated by using the 4<sup>th</sup> formula and individually calculating the energy required for heating and cooling that has been calculated by using the 5<sup>th</sup> and 6<sup>th</sup> formula:

$$Q_{kop,apr} = Q_{apk,apr} + Q_{dz,apr} \quad (4)$$

$$Q_{apk,apr} = H_K (T_1 - T_2) t - \eta_{apk} (A_{sol} E_{sol} + Q_{iek}) \quad (5)$$

$$Q_{dz,apr} = (A_{sol} E_{sol} + Q_{iek}) - \eta_{dz} H_K (T_1 - T_2) t \quad (6)$$

where:

$Q_{apk,apr}$  – energy required for heating (Wh);

$Q_{dz,apr}$  – energy required for cooling (Wh);

$H_K$  – total heat loss coefficient of the building (W/K), which shall be determined in accordance with Paragraph 133 of this Regulation;

$t$  – assessment period, one full heating ( $t_{apk}$ ) or cooling ( $t_{dz}$ ) season (hours);

$T_1$  – average set-point temperature in the assessment (heating or cooling) period (°C);

$T_2$  – average external temperature in the calculation period (°C);

$\eta_{apk}$  – gain use coefficient for heating in accordance with Paragraph 99 of this Regulation or Standard LVS EN ISO 13790:2009 L;

$\eta_{dz}$  – gain use coefficient for cooling in accordance with Paragraph 101 of this Regulation or Standard LVS EN ISO 13790:2009 L;

$A_{sol}$  – area of collecting useful solar energy of the building (m<sup>2</sup>);

$E_{sol}$  – solar irradiation in the assessment period  $t$  per area  $A_{sol}$  (Wh/m<sup>2</sup>);

$Q_{iek}$  – interior gains of the whole building in the assessment period  $t$  (Wh).

### 4.3. Adjustment of Energy Consumption Due to Climatic Conditions

44. If a measured energy rating is based on energy consumption data obtained in a period that is shorter than five full years, an adjustment of the measured energy performance due to climatic conditions shall be required for ensuring the correspondence between the consumed energy measured in the measurement period and the average local climatic conditions.

45. The measured energy consumption for heating and cooling shall be adapted according to the local climatic conditions at the place of location of a building. In order to adjust energy consumption according to climatic conditions, the values of the heating period duration and the average external temperature specified in Table 7 of LBN 003-01 “Construction Climatology” shall be used.

46. Adjustment of energy consumption due to climatic conditions shall be calculated in accordance with Paragraphs 47 and 48 of this Regulation.

47. Adjustment of energy consumption, using the degree days, shall be carried out by using the following formula:

$$Q = Q_1 \frac{GDD_1}{GDD}, \text{ where} \quad (7)$$

$Q$  – adjusted energy consumption (Wh);

$Q_1$  – energy consumption in the assessment period (Wh);

$GDD_1$  – standard number of degree days that determined in accordance with Paragraph 48 of this Regulation;

$GDD$  – number of degree days in the assessment period determined in accordance with Paragraph 48 of this Regulation.



48. The number of degree days shall be determined by using the following formulas:

$$48.1. \text{GDD}_1 = D_{\text{napk}} (T_1 - T_2) \quad (8)$$

$$48.2. \text{GDD} = D_{\text{apk}} (T_1 - T_3) \quad (9)$$

where:

$\text{GDD}_1$  – standard number of degree days;

$\text{GDD}$  – number of degree days in the assessment period;

$D_{\text{napk}}$  – standard number of heating days according to LBN 003-01 “Construction Climatology”;

$D_{\text{apk}}$  – number of heating days in the assessment period;

$T_1$  – internal temperature in the assessment period (°C);

$T_2$  – average external temperature according to LBN 003-01 “Construction Climatology” (°C);

$T_3$  – actual average external temperature in the assessment period (°C).

## **5. Calculated Energy Rating**

### **5.1. Data Required and Data to Be Obtained**

49. Data required for the calculated energy rating shall be obtained:

49.1. by inspecting the building;

49.2. by using the characteristics specified in the laws and regulations governing the field of construction and energy performance of buildings;

49.3. from the technical documentation of the building (for example, technical design, inventory plan).

50. The following data is required for the calculated energy rating:

50.1. properties of heat transmission and ventilation;

50.2. heat gains from internal heat resources, properties of solar heat gain;

50.3. climatic indicators;

50.4. description of the building and building components, systems and utilisation;

50.5. comfort requirements – indicators of the set-point temperature and air exchange.

51. The following information shall be required for the assessment of the technical building systems of a building:

51.1. partitioning of the building by zones (different technical building systems may be used for different zones);

51.2. division or recovery of the building thermal energy losses in the building (internal heat gains, heat recovery of ventilation thermal energy);

51.3. exchange indicators and temperature of the ventilation incoming air, if the building has district heating or cooling and the energy use for the air circulation and heating or cooling is joined.

52. The following data shall be obtained when using the calculation method:

52.1. total energy required for heating and cooling;

52.2. total energy consumption for heating and cooling;

52.3. duration of the heating and cooling season (number of working hours of the system);

52.4. consumption of auxiliary energy for heating, cooling and ventilation systems.

## **5.2. Procedure for Calculating the Energy Rating**

### **5.2.1. Energy Required for the Heating and Cooling of a Building and Indicators**

53. Required energy shall be calculated on the basis of the thermal energy balance of building zones. Energy required for heating and cooling shall be the main data of the energy balance of technical building systems. When acquiring the calculated energy rating, the energy balance shall be divided:

53.1. at the building level, in order to determine common energy consumption indicators;

53.2. at the engineering system level, in order to determine primary energy consumption indicators and the assessment of carbon emission.

54. Indicators required for the calculated energy rating shall be obtained according to the following procedure:

54.1. method for calculating heat balance shall be selected in accordance with Sub-chapter 5.2.2. of this Regulation;

54.2. common boundaries of conditioned and unconditioned spaces shall be determined in accordance with Sub-chapter 5.3 of this Regulation;

54.3. boundaries of calculation zones shall be determined in accordance with Sub-chapter 5.3 of this Regulation;

54.4. calculation provisions for indoor spaces, outdoor climatic conditions and other environment data shall be defined;

54.5. amount of energy required for the building and separate zones thereof for heating  $Q_{apk}$  and the amount of energy for cooling  $Q_{dz}$  in the relevant period shall be calculated:

54.5.1. heat losses through heat transmission shall be calculated in accordance with Sub-chapter 5.5 of this Regulation;

54.5.2. heat losses through ventilation shall be calculated in accordance with Sub-chapter 5.6 of this Regulation;

54.5.3. internal heat gains shall be calculated in accordance with Sub-chapter 5.7 of this Regulation;

54.5.4. solar heat gains shall be calculated in accordance with Sub-chapter 5.8 of this Regulation;

54.5.5. dynamic parameters shall be calculated in accordance with Sub-chapter 5.9 of this Regulation;

54.6. duration of the heating and cooling season shall be calculated in accordance with Sub-chapter 5.4.1 of this Regulation.

### **5.2.2. Selection of a Method for Calculating Heat Balance**

55. The following shall be taken into consideration for determining the heat balance of a building or its zones:

55.1. transmission heat flow between the conditioned space and outdoor environment – the difference between the set-point temperature in the conditioned space and the external temperature;

55.2. transmission and ventilation heat flow between the adjacent zones – the difference between the set-point temperature in the conditioned zone and the internal temperature in the adjacent spaces;

55.3. natural or mechanic ventilation heat flow – the difference between the set-point temperature in the conditioned space and the incoming air temperature;

55.4. internal heat gains (including also negative gains from heat losses), for example, from people, appliances, lighting and heat flow or absorption from the technical building systems;

55.5. solar heat gains that can be gained directly (for example, through the windows) or indirectly (for example, with absorption through the building elements);

55.6. heat accumulation in the technical building systems and depending on the thermal inertia in the building;

55.7. energy required for heating, if the technical building systems deliver heat in order to raise the internal temperature to the required minimum level (set-point temperature for heating);

55.8. energy required for cooling, if the cooling systems of the building release heat in order to lower the internal temperature to the required maximum level (set-point temperature for cooling).

56. The energy balance of a building shall also include the energy recovered in the buildings from different technical building systems.

57. One of the following methods shall be used for calculating the energy balance of a building:

57.1. steady-state method. Heat balance shall be calculated during a sufficiently long time period – one month or the whole season. Part of the accumulated and released heat shall be disregarded, while dynamic effects shall be taken into consideration, empirically determining the gain and loss utilisation factor;

57.2. dynamic method. It shall be used for calculating heat balance in short time periods (for example, per hour). Heat accumulations and part of the heat released from the building, which depends on the thermal inertia of the building, shall be taken into consideration. When applying the dynamic method, calculations shall be performed according to Annex C to the Standard LVS EN ISO 13790:2009 L.

58. The dynamic method models thermal resistance, thermal capacity and internal and solar heat gains in the building or building zones. When applying the dynamic method, it shall be taken into consideration that during the heating season under the influence of the heat surplus the internal temperature exceeds the set-point temperature, which transmits the surplus heat with an additional transmission, ventilation and accumulation, if the mechanic cooling is not used. Switching off of the thermostat may not be applied for lowering the internal temperature, because it depends on the building inertia (heat release from the building). In calculations of the cooling period it shall be taken into consideration that the set-point internal temperature lowers below the set-point temperature.

59. When using the steady-state method, dynamic effects, which shall be calculated by using correlation factors, shall be taken into consideration. It shall be taken into consideration in the calculation of the internal and solar heat gain utilisation for heating that only part of the gains is used when reducing the energy required for the heating of a building, if the internal temperature is raised over the set-point temperature.

60. The following factors shall be taken into consideration in the cooling calculation when using the steady-state method:

60.1. utilisation of losses – it shall be taken into consideration in the calculation of transmission and ventilation heat losses that only part of the transmission and ventilation heat losses is used when reducing the necessity for cooling. Unused transmission and ventilation heat flow is generated at time periods or intervals (for example, at night), when cooling is not

needed, but it can be necessary at other time periods or intervals (for example, during the day);

60.2. utilisation of gains – it shall be taken into consideration in the calculation of the internal and solar heat gains that only part of the internal and solar heat gains compensates for the heat transmission and ventilation losses, accepting the definite maximum internal temperature. Part of unused heat causes the necessity for cooling, in order to avoid raising of the internal temperatures over the set-point temperature.

### **5.3. Boundaries and Zones of a Building**

#### **5.3.1. Specification of Boundaries and Zones of a Building**

61. For the calculation of energy required for heating and cooling the boundaries of a building shall be determined. Building boundaries comprise all the building elements separating conditioned spaces from the outdoor environment (air, ground or water) and adjacent buildings or separate unconditioned spaces.

62. For the calculation of energy required for heating and cooling the building shall be partitioned into:

62.1. one zone;

62.2. several zones (multi-zone calculation), taking into consideration the heat flow between the zones;

62.3. several zones (multi-zone calculation), not taking into consideration the heat flow between the zones.

63. If a building is partitioned into several parts, energy required for the heating and cooling of the building shall be calculated separately for each zone. Heat flows between the zones shall be taken into consideration, if it is necessary for the assessment of recommended energy performance measures or for getting additional results.

#### **5.3.2. Partitioning of a Building into Zones**

64. Small (up to five per cent of the zone area) non-heated spaces (unconditioned spaces) may be included into conditioned (heated) zones and considered to be conditioned. Partitioning of a building into several parts shall not be necessary, if all of the following conditions refer to the building:

64.1. set-point temperature in heated spaces does not exceed 4 °C;

64.2. all spaces (areas) are not mechanically cooled or are mechanically cooled and the difference of set-point temperatures in cooled spaces does not exceed 4 °C;

64.3. uniform heating systems (if such exist) and uniform cooling systems (if such exist) are used in the spaces;

64.4. uniform ventilation systems (if such exist) are used at least in 80 per cent of the common floor area in the building;

64.5. in at least in 80 per cent of the common floor area in the building the amount of ventilation air exchange ( $\text{m}^3$ ) indoors per floor area ( $\text{m}^2$ ) in one time unit does not differ for more than four times.

65. If at least one of the conditions referred to in Paragraph 64 of this Regulation is not met, the building shall be partitioned into zones and one zone calculation conditions shall be applied to each zone.

### 5.3.3. One Zone Calculation

66. The following formula shall be used for determining the set-point temperature for heating in one zone calculation:

$$T_{apk} = \frac{\sum A_{apr} T_{uzst,apk}}{\sum A_{apr}}, \text{ where} \quad (10)$$

$T_{apk}$  – set-point temperature for heating of the building or building zones (°C);

$T_{uzst,apk}$  – set-point temperature for the heated area (°C), which shall be determined in accordance with Sub-chapter 5.10 of this Regulation;

$A_{apr}$  – calculation area (m<sup>2</sup>), which shall be determined in accordance with Sub-chapter 5.3.5 of this Regulation.

67. The following formula shall be used for determining the set-point temperature for cooling in one zone calculation:

$$T_{dz} = \frac{\sum A_{apr} T_{uzst,dz}}{\sum A_{apr}}, \text{ where} \quad (11)$$

$T_{dz}$  – set-point temperature for cooling the building or building zones (°C);

$T_{uzst,dz}$  – set-point temperature for the cooled area (°C), which shall be determined in accordance with Sub-chapter 5.10 of this Regulation;

$A_{apr}$  – calculation area (m<sup>2</sup>), which shall be determined in accordance with Sub-chapter 5.3.5 of this Regulation.

### 5.3.4. Calculation for Several Zones

68. If a building is partitioned into several zones and the heat flow between the zones is not taken into consideration (calculation with uncoupled zones), then, when performing calculations, none of the heat transmission types (for example, air movement) shall be taken into consideration. In this case, calculations shall be carried out individually for each zone according to the procedure for one zone calculation.

69. For separate zones, which have a common heating and cooling system, the energy required for heating and cooling shall be the sum of the required energy calculated for separate zones. For separate zones, which do not have a common heating and cooling system, the energy consumption in the building shall be the sum of the used energy calculated for separate zones.

70. If a building is partitioned into several zones and the heat flow between the zones is taken into consideration, then also any type of heat transmission (including air movement) shall be taken into consideration and the calculation shall be performed in accordance with Annex B to Standard LVS EN ISO 13790:2009 L.

### 5.3.5. Determination of the Calculation Area

71. Floor area located within the boundaries of the building shall be a conditioned floor calculation area of the building  $A_{apr}$ . If a building is partitioned in zones, the sum of the conditioned floor calculation area of all the zones must be equal to the floor calculation area of the conditioned spaces of the whole building.

72. Calculation area  $A_{apr}$  shall include:

72.1. areas of all conditioned spaces;

72.2. areas of unconditioned spaces, if they are coupled with conditioned spaces and the indoor climate is maintained therein (for example, indoor halls, passages, corridors, staircases).

73. A calculation area shall not include spaces in which it is not intended to maintain the internal temperature (for example, non-heated cellars, attics, garages). A calculation area may be specified individually for the heating and cooling season.

## **5.4. Heating and Cooling of a Building**

### **5.4.1. Procedures for Calculating and Determining the Season Duration for Heating and Cooling**

74. Calculation for heating and cooling shall be carried out according to the following procedures:

74.1. determination of the season duration;

74.2. calculation of the required energy;

74.3. possible recurrence of calculations related to the mutual influence of the building and systems or receipt of additional information.

75. Duration of the calculation period  $t^{apk}$  for the heating season shall be determined according to LBN 003-01 “Construction Climatology”.

76. The actual duration of the heating season shall be determined according to the number of hours in the season, when the relevant system was running (for example, pumps, fans). It shall be determined on the basis of measurements obtained during at least one month.

77. The actual duration of the heating season shall be used for the model validation in accordance with Sub-chapter 6.2 of this Regulation.

78. The actual duration of the cooling season shall be determined according to the number of hours in the season, when the relevant system was running (for example, pumps, fans). It shall be determined on the basis of measurements obtained during at least one month.

79. Duration of the calculation period  $t_{apk}$  for the cooling system shall be determined by using data regarding the actual duration of the cooling season.

### **5.4.2. Calculation of Energy Required for the Heating and Cooling of a Building by Using the Steady-state Method**

80. The following formula shall be used for determining energy required for the heating of each building zone for each calculation period (month or season) (it shall be taken into consideration that  $Q_{apk} \geq 0$ ):

$$Q_{apk,n} = Q_{apk,z} - \eta_{apk,ieg} \times Q_{apk,ieg}, \text{ where} \quad (12)$$

for each building zone and each month or season:

$Q_{apk,n}$  – energy required for the building heating (Wh);

$Q_{apk,z}$  – total heat losses for heating (Wh), which shall be determined in accordance with Paragraph 81 of this Regulation;

$Q_{apk,ieg}$  – total heat gains for heating (Wh), which shall be determined in accordance with Paragraph 82 of this Regulation;

$\eta_{apk,ieg}$  – heat gain utilisation factor, which shall be determined in accordance with Sub-chapter 5.9.2 of this Regulation.

81. Energy required for additional heat (humidification) shall not be included in the calculation.

82. The following formula shall be used for determining energy required for the cooling of each building zone for each calculation period (month or season) (it shall be taken into consideration that  $Q_{dz} \geq 0$ ):

$$Q_{dz,n} = Q_{dz,ieg} - \eta_{dz,z} \times Q_{dz,z}, \text{ where} \quad (13)$$

for each building zone and each month or season:

$Q_{dz,n}$  – energy required for the building cooling (Wh);

$Q_{dz,z}$  – total heat losses for cooling (Wh), which shall be determined in accordance with Paragraph 83 of this Regulation;

$Q_{dz,ieg}$  – total heat gains for cooling (Wh), which shall be determined in accordance with Paragraph 84 of this Regulation;

$\eta_{dz,z}$  – heat loss utilisation factor, which shall be determined in accordance with Sub-chapter 5.9.3 of this Regulation.

83. The total heat losses in a building zone in the calculation period shall be:

$$83.1. \text{ for heating } Q_{apk,z} = Q_{apk,pr} + Q_{apk,ve} \quad (14)$$

$$83.2. \text{ for cooling } Q_{dz,z} = Q_{dz,pr} + Q_{dz,ve} \quad (15)$$

where for each building zone and each month or season:

$Q_{apk,z}$  – total heat losses for heating (Wh);

$Q_{dz,z}$  – total heat losses for cooling (Wh);

$Q_{apk,pr}$  – total heat losses for heating through transmission (Wh), which shall be determined in accordance with Sub-chapter 5.5 of this Regulation;

$Q_{dz,pr}$  – total heat losses for cooling through transmission (Wh), which shall be determined in accordance with Sub-chapter 5.5 of this Regulation;

$Q_{apk,ve}$  – total heat losses for heating through ventilation (Wh), which shall be determined in accordance with Sub-chapter 5.6 of this Regulation;

$Q_{dz,ve}$  – total heat losses for cooling through ventilation (Wh), which shall be determined in accordance with Sub-chapter 5.6 of this Regulation.

84. The total heat gains in a building zone in the calculation period shall be:

$$84.1. \text{ for heating } Q_{apk,ieg} = Q_{iek} + Q_{sol} \quad (16)$$

$$84.2. \text{ for cooling } Q_{dz,ieg} = Q_{iek} + Q_{sol} \quad (17)$$

where for each building zone and each month or season:

$Q_{apk,ieg}$  – total heat gains for heating (Wh);

$Q_{dz,ieg}$  – total heat gains for cooling (Wh);

$Q_{iek}$  – sum of internal heat gains in the calculation period (Wh), which shall be determined in accordance with Sub-chapter 5.7 of this Regulation;

$Q_{sol}$  – sum of solar heat gains in the calculation period (Wh), which shall be determined in accordance with Sub-chapter 5.8 of this Regulation.

## 5.5. Heat Transmission Losses

85. When using the steady-state method, the total heat losses through transmission shall be calculated for each month or season and each zone by using the following formulas:

$$85.1. \text{ for heating } Q_{apk,pr} = \sum_k \{H_{T,k} \times (T_{1,apk} - T_{2,k})\} \times t_{apk} \quad (18)$$

$$85.2. \text{ for cooling } Q_{dz,pr} = \sum_k \{H_{T,k} \times (T_{1,dz} - T_{2,k})\} \times t_{dz} \quad (19)$$

where for each building zone and each calculation period:

$Q_{apk,pr}$  – total heat transmission losses for heating (Wh);

$Q_{dz,pr}$  – total heat transmission losses for cooling (Wh);

$H_{T,k}$  – heat transmission loss coefficient of the building through the element  $k$  to the adjacent spaces, environment or zones with the temperature  $T_{2,k}$  (W/K), which shall be determined in accordance with Paragraph 86 of this Regulation;

$T_{1,apk}$  – heating temperature set for the building or building unit (°C), which shall be determined in accordance with Sub-chapter 5.10 of this Regulation;

$T_{1,dz}$  – cooling temperature set for the building or building unit (°C), which shall be determined in accordance with Sub-chapter 5.10 of this Regulation;

$T_{2,k}$  – temperature for the element  $k$  in the adjacent space, environment or zone (°C), which shall be determined in accordance with Paragraph 87 of this Regulation;

$t_{apk}$  – duration of the calculation period for heating (h);

$t_{dz}$  – duration of the calculation period for cooling (h).

86. The heat transmission loss coefficient  $H_{T,k}$  for the element  $k$  shall be determined according to the Latvian Construction Standard LBN 002-01 “Thermotechnics of Building Envelopes” approved by Cabinet Regulation No. 495 of 27 November 2001, Regulations Regarding Latvian Construction Standard LBN 002-01, Thermotechnics of Building Envelopes.

87. The value of the adjacent space, outdoor environment or zone temperature  $T_{2,k}$  shall be determined for the following situations:

87.1. for heat transmission to the outdoor environment – the value of temperature  $T_{2,k}$  shall be the value of the outdoor environment temperature;

87.2. for heat transmission to adjacent unconditioned zones – the value of temperature  $T_{2,k}$  shall be the temperature of the adjacent space or the value of the outdoor environment temperature, if the adaptation coefficient is used in the calculation that reduces the heat transmission coefficient instead of the temperature difference;

87.3. for heat transmission to an adjacent zone affected by the sun (for example, glassed-in balconies, terraces, sun gardens) – heat transmission shall be calculated the same way as for the adjacent unconditioned spaces. Influence of the solar irradiation to the temperature of a space affected by the sun shall be taken into consideration when calculating solar heat gains;

87.4. for calculation with coupled zones, for heat transmission to adjacent unconditioned areas – the value of temperature  $T_{2,k}$  shall be the value of the temperature of the adjacent area;

87.5. for calculation with uncoupled zones – heat transmission with other conditioned zones shall not be taken into consideration;

87.6. for heat transmission through the ground – the value of temperature  $T_{2,k}$  shall be the value of the outdoor environment temperature, when using in the calculation the adaptation coefficient that reduces the heat transmission coefficient instead of the temperature difference and which shall be determined according to the Standard LVS EN ISO 13789:2008 “Thermal performance of buildings - Transmission and ventilation heat transfer coefficients - Calculation method” (hereinafter – Standard LVS EN ISO 13789:2008);

87.7. heat transmission to adjacent buildings – the value of temperature  $T_{2,k}$  shall be the internal temperature of the adjacent building, on the basis of the relevant data and utilisation type of the adjacent building.

## 5.6. Heat Losses through Ventilation

88. Total heat losses through ventilation from a conditioned area shall be calculated for each month or season and each zone by using the following formulas:



$$88.1. \text{ for heating } Q_{apk,ve} = \sum_k \{H_{ve,k} (T_{1,apk} - T_{2,pieg})\} \times t_{apk} \quad (20)$$

$$88.2. \text{ for cooling } Q_{dz,ve} = \sum_k \{H_{ve,k} (T_{1,dz} - T_{2,pieg})\} \times t_{dz} \quad (21)$$

where for each building zone  $z$  and each calculation period:

$Q_{apk,ve}$  – total heat flow through ventilation in the heating season (Wh);

$Q_{dz,ve}$  – total heat flow through ventilation in the cooling season (Wh);

$H_{ve,k}$  – heat transmission coefficient through air flow ventilation, element  $k$  flowing into the zone with the supply temperature  $T_{2,pieg,k}$  (W/K), which shall be determined in accordance with Paragraph 89 of this Regulation;

$T_{1,apk}$  – heating temperature set for the building or building zone ( $^{\circ}\text{C}$ ), which shall be determined in accordance with Sub-chapter 5.10 of this Regulation;

$T_{1,dz}$  – cooling temperature set for the building or building zone ( $^{\circ}\text{C}$ ), which shall be determined in accordance with Sub-chapter 5.10 of this Regulation;

$T_{2,pieg}$  – element  $k$  air flow supply temperature ( $^{\circ}\text{C}$ ), including buildings or building zones with ventilation or infiltration, which shall be determined in accordance with Paragraph 89 of this Regulation;

$t_{apk}$  – calculation period duration for heating (h);

$t_{dz}$  – calculation period duration for cooling (h).

89. Values of the total ventilation heat loss coefficient  $H_{ve,k}$  with air flow ventilation for element  $k$  or flow values  $q_{ve,k}$  shall conform to the relevant ventilation system standards LVS EN 15242:2009 L “Ventilation for buildings - Calculation methods for the determination of air flow rates in buildings including infiltration” (hereinafter – Standard LVS EN 15242:2009 L) and LVS EN 15241:2009 L “Ventilation for buildings - Calculation methods for energy losses due to ventilation and infiltration in commercial buildings” (hereinafter – Standard LVS EN 15241:2009 L). The value of an individual air flow  $k$  supply temperature  $T_{2,pieg,k}$  shall be accepted in the following way:

89.1. for ventilation containing air infiltration from the outdoor environment the value of supply temperature  $T_{2,pieg,k}$  shall be the value of outdoor environment temperature;

89.2. for ventilation containing air infiltration from the adjacent unconditioned areas or verandas the value of supply temperature  $T_{2,pieg,k}$  shall be the value of the outdoor environment temperature. The influence of the solar irradiation in addition to the temperature of the sun influence shall be taken into consideration when calculating solar heat gains;

89.3. in calculations with coupled zones for ventilation containing air infiltration from the adjacent conditioned areas the value of supply temperature  $T_{2,pieg,k}$  shall be the value of the temperature of the adjacent areas;

89.4. for mechanical ventilation the value of supply temperature  $T_{2,pieg,k}$  shall be the value of the air supply temperature, when air leaves the central air movement installations and flows into the building or building zones, which shall be determined according to the relevant standards LVS EN 15242:2009 L and LVS EN 15241:2009 L;

89.5. if a district pre-heating or pre-cooling is used and the energy use for pre-heating or pre-cooling is calculated separately, the value of supply temperature shall be the temperature after the district pre-heating or pre-cooling;

89.6. in the calculation of heat recovery the external temperature  $T_2$  shall be substituted with the incoming air temperature that shall be obtained according to the relevant standards LVS EN 15241:2009 L and LVS EN 15242:2009 L.

90. The total ventilation heat loss coefficient for each month or season and each heating or cooling zone shall be calculated by using the following formula:

$$H_{ve,k} = \rho_a c_a q_{ve,k,vid}, \text{ where} \quad (22)$$

$H_{ve,k}$  – heat transmission coefficient with air flow ventilation, when the element  $k$  flows into the zone with the supply temperature  $T_{2,pieg,k}$  (W/K), which shall be determined in accordance with Paragraph 89 of this Regulation;

$q_{ve,k,vid}$  – air flow element  $k$  time average flow level (m<sup>3</sup>/h), which shall be determined in accordance with Paragraph 91 of this Regulation;  
 $\rho_a c_a$  – air heat capacity per volume = 0.34 (Wh/(m<sup>3</sup> × °C));  
 $k$  – each of the relevant air flow elements (for example, mechanical ventilation, natural ventilation, infiltration).

91. The time average flow level of the air flow element  $k$  shall be calculated by using the following formula:

$$q_{ve,k,vid} = f_{ve,t,k} q_{ve,k}, \text{ where} \quad (23)$$

$q_{ve,k}$  – air flow element  $k$  time average flow level (m<sup>3</sup>/h), which shall be determined according to the relevant standards LVS EN 15241:2009 L and LVS EN 15242:2009 L;  
 $f_{ve,t,k}$  – air flow element  $k$  running time part, which shall be determined according to the same standard as  $q_{ve,k}$ .

## 5.7. Internal Heat Gains

### 5.7.1. Procedure for Calculating Internal Heat Gains

92. Internal heat gains shall be heat gains from internal heat sources, including negative heat gains (from a space to sources of coldness). Internal heat gains shall be any heat that is generated by internal sources and is used for space heating, space cooling or preparation of hot water.

93. Internal heat gains include:

- 93.1. metabolic heat from occupants and dissipated heat from appliances;
- 93.2. dissipated heat from lighting equipment;
- 93.3. heat that is dissipated from a domestic hot water system or that is absorbed by a hot water system;
- 93.4. heat that is dissipated from air-conditioning or ventilation system or that is absorbed by heating, air-conditioning and ventilation systems;
- 93.5. heat from processes and objects or to them.

### 5.7.2. Overall Internal Heat Gains According to the Steady-state and Dynamic Method

94. According to the steady-state method heat gains from internal sources in a definite building zone in a definite month or season shall be calculated by using the following formula:

$$Q_{iek} = \left\{ \sum_k \Phi_{iek,k} \right\} \times t + \left\{ \sum_l (1 - b_l) \Phi_{iek,nek,l} \right\} \times t \quad (24)$$

, where

$Q_{iek}$  – sum of internal heat gains in a definite month or season (Wh) (shall be determined for heating and cooling separately);

$b_l$  – reduction coefficient for an adjacent unconditioned space with an internal heat source  $l$ , which shall be determined according to the Standard LVS EN ISO 13789:2008 (if the heat source  $l$  capacity does not affect the calculation result,  $b_l = 1$ );

$\Phi_{iek,k}$  – average heat flow from the internal heat source  $k$  in the calculation period (month or season) (W), which shall be determined in accordance with Paragraph 97 of this Regulation;

$\Phi_{iek,nek,l}$  – average heat flow from the internal heat source  $l$  for an adjacent unconditioned space in the calculation period (month or season) (W), which shall be determined in accordance with Paragraph 97 of this Regulation;

t – duration of a definite month or season (h), which shall be determined in accordance with Sub-paragraph 5.4.1 of this Regulation.

95. An adjacent unconditioned space shall be an unconditioned space over the boundaries of the heating and cooling energy consumption calculation zone. If more than one conditioned zone is located next to an unconditioned space, the heat flow indicator with the internal heat source l in the unconditioned space  $\Phi_{iek,nek,l}$  must be divided per conditioned zones according to the floor areas of the conditioned zone in accordance with Sub-paragraph 5.3.5 of this Regulation.

96. When using the dynamic method, the heat flow from internal heat sources for a definite building zone shall be calculated for each hour by using the following formula:

$$\Phi_{iek} = \sum_k \Phi_{iek,k} + \sum_l (1 - b_l) \Phi_{iek,nek,l} \quad (25)$$

, where

$\Phi_{iek}$  – sum of the heat flows of the internal heat gains (W);

$b_l$  – reduction coefficient for an adjacent unconditioned space with an internal heat source l according to the Standard LVS EN ISO 13789:2008;

$\Phi_{iek,k}$  – one hour heat flow from the internal heat source k (W), which shall be determined in accordance with Sub-chapter 5.7.3 of this Regulation;

$\Phi_{iek,nek,l}$  – one hour heat flow from the internal heat source l in an adjacent unconditioned space (W), which shall be determined in accordance with Paragraph 97 of this Regulation.

### 5.7.3. Elements of Internal Heat Gains

97. Heat gains from internal heat sources in a definite building or building zone shall be calculated for each hour by using the following formula:

$$\Phi_{iek} = \Phi_{iek,iedz} + \Phi_{iek,ier} + \Phi_{iek,apg} + \Phi_{iek,\bar{u}} + \Phi_{iek,ADzV} + \Phi_{iek,proc}, \text{ where} \quad (26)$$

$\Phi_{iek}$  – heat gain ( $\Phi_{iek,k}$  or  $\Phi_{iek,nek,l}$ ) sum from the internal heat source flow (W);

$\Phi_{iek,iedz}$  – heat flow from occupants (W), which shall be determined in accordance with Paragraph 99 of this Regulation;

$\Phi_{iek,ier}$  – heat flow from appliances (W), which shall be determined in accordance with Paragraph 100 of this Regulation;

$\Phi_{iek,apg}$  – heat flow from lighting (W), which shall be determined in accordance with Paragraph 101 of this Regulation;

$\Phi_{iek,\bar{u}}$  – heat flow from the domestic hot water system (W), which shall be determined in accordance with Paragraph 103 of this Regulation;

$\Phi_{iek,ADzV}$  – heat flow from heating, air-conditioning or ventilation systems (W), which shall be determined in accordance with Paragraph 105 of this Regulation;

$\Phi_{iek,proc}$  – heat flow from processes and objects (W), which shall be determined in accordance with Paragraph 109 of this Regulation.

98. A source of cold that releases heat from a building shall be a heat source with a negative sign.

99. Metabolic heat from occupants  $\Phi_{iek,iedz}$  for each building zone and each calculation period shall be determined in accordance with Annex 4 to this Regulation or calculated by using the following formula:

$$\Phi_{iek,iedz} = f_{iedz} q_{iedz} A_{apr}, \text{ where} \quad (27)$$

$f_{iedz}$  – part of time when occupants are in the building;

$q_{iedz}$  – specific heat output from occupants per calculated building area (W/m<sup>2</sup>);

$A_{apr}$  – calculation area ( $m^2$ ), which shall be determined in accordance with Sub-chapter 5.3.5 of this Regulation.

100. Dissipated heat from appliances  $\Phi_{iek,ier}$  for each building zone and each calculation period shall be determined in accordance with Annex 4 to this Regulation or calculated by using the following formula:

$$\Phi_{iek,ier} = f_{ier} q_{ier} A_{apr}, \text{ where} \quad (28)$$

$f_{ier}$  – part of time when appliances run;

$q_{ier}$  – specific heat output from appliances per calculated building area ( $W/m^2$ );

$A_{apr}$  – calculation area ( $m^2$ ), which shall be determined in accordance with Sub-chapter 5.3.5 of this Regulation.

101. Heat flow values from lighting equipment  $\Phi_{iek,apg}$  shall be the sum of the following values:

101.1. heat flow value from luminaires that shall be calculated as part of the energy consumed in the lighting systems. Part of consumed energy that is smaller than 1 shall be allowed, if the suction ventilation releases heat right from the luminaires;

101.2. heat flow value from other lighting elements (for example, decorative lighting, special lighting, lighting related to processes).

102. Heat flow from luminaires in lighting systems shall be calculated according to the Standard LVS EN 15193:2009 L. Heat flow from other lighting elements shall be calculated taking into consideration the function of the building, utilisation of lighting and purpose of the calculation.

103. Heat flow value from domestic hot water system  $\Phi_{iek,\bar{u}}$  shall be the sum of the following values:

$$\Phi_{iek,\bar{u}k} = \Phi_{iek,\bar{u}k,cirk} + \Phi_{iek,\bar{u}k,cita}, \text{ where} \quad (29)$$

$\Phi_{iek,\bar{u}}$  – heat flow from the domestic hot water system (W);

$\Phi_{iek,\bar{u},cirk}$  – heat flow from the circulation of hot water in domestic hot water systems (W), which shall be determined in accordance with Paragraph 104 of this Regulation;

$\Phi_{iek,\bar{u},cita}$  – heat flow from the domestic hot water system (except for the circulation of hot water) (W), which shall be determined according to the Standard LVS EN 15316-3-2:2008.

104. Heat flow from the circulation of water in domestic hot water supply systems shall be determined by using the following formula:

$$\Phi_{iek,\bar{u},cirk} = q_{iek,\bar{u},cirk} L_{\bar{u},cirk}, \text{ where} \quad (30)$$

$\Phi_{iek,\bar{u},cirk}$  – heat flow from the constant water circulation in domestic hot water systems (W);

$q_{iek,\bar{u},cirk}$  – heat flow from the hot water circulation system per meter of length (W/m), which shall be determined according to the standard LVS EN 15316-3-2:2008;

$L_{\bar{u},cirk}$  – length of water circulation pipes of the water supply system in a definite building zone (m).

105. Heat flow value to heating, air-conditioning and ventilation systems or from them (due to dissipation)  $\Phi_{iek,ADzV}$  shall be the sum of the following values:

$$\Phi_{iek,ADzV} = \Phi_{iek,A} + \Phi_{iek,Dz} + \Phi_{iek,V}, \text{ where} \quad (31)$$

$\Phi_{iek,ADzV}$  – heat flow from space heating, air-conditioning and ventilation systems (W);

$\Phi_{iek,A}$  – heat flow from the space heating systems (W), which shall be determined in accordance with Paragraph 106 of this Regulation;

$\Phi_{iek,Dz}$  – heat flow from the space air-conditioning systems (W), which shall be determined in accordance with Paragraph 107 of this Regulation;

$\Phi_{iek,V}$  – heat flow from the ventilation systems (W), which shall be determined in accordance with Paragraph 108 of this Regulation.

106. Heat flow value from a space heating system  $\Phi_{iek,A}$  consists of heat dissipated in the building zone from auxiliary energy sources (for example, a pump, fan, electronic device) and heat that is dissipated from the emission, circulation, division, accumulation and energy generation of heating systems. The value shall be obtained according to the Standard LVS EN 15316-2-1:2009 L “Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 2-1: Space heating emission systems” (hereinafter – Standard LVS EN 15316-2-1:2009 L) and Standard LVS EN 15316-2-3:2009 L “Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 2-3: Space heating distribution systems” (hereinafter – Standard LVS EN 15316-2-3:2009 L).

107. Heat flow value from an air-conditioning system or to it  $\Phi_{iek,Dz}$  shall consist of heat from auxiliary energy sources (for example, a pump, fan, electronic device), which is dissipated in the cold emission circulation, division, accumulation and energy generation parts of an air-conditioning system. Heat flow value from an air-conditioning system or to it shall be obtained according to the Standard LVS EN 15243:2009 L “Ventilation for buildings - Calculation of room temperatures and of load and energy for buildings with room conditioning systems” (hereinafter – Standard LVS EN 15243:2009 L).

108. Heat flow value from a ventilation system in a definite building zone  $\Phi_{iek,V}$  shall be heat from the ventilation system dissipated in the relevant building zone. Heat flow value shall be determined according to the Standard LVS EN 15243:2009 L. Dissipated heat of the incoming air shall comprise the raising of the incoming temperature, which shall be determined according to the relevant air flow and ventilation system Standard LVS EN 15241:2009 L or Standard LVS EN 15242:2009 L and which is not considered to be an internal heat source. Internal heat from a ventilation system, which is not taken into consideration when determining an incoming temperature, may comprise dissipated heat from fan motors.

109. Heat from processes and objects or to them  $\Phi_{iek,proc}$  shall consist of heat from definite processes in the relevant building zone or to them and (or) from objects that are located in the building zone. If the surface temperature of a heat source is close to the internal temperature of spaces, the actual transferred heat amount shall depend on the temperature difference of the heat source and external air temperature. Such heat need not to be added to internal heat gains, while heat transfer must be added to heat transmission losses in accordance with Subchapter 5.5 of this Regulation.

## **5.8. Solar Heat Gains**

### **5.8.1. Conditions for Calculating Solar Heat Gains**

110. Only energy delivered by solar energy installations and auxiliary energy, which is required for heat delivery to a building from an energy source, shall be taken into consideration in the energy balance.

111. Heat gains from solar heat sources (elements of building constructions and unconditioned spaces irradiated by the sun) generate from solar irradiation existing at the location of a building, as well as orientation of collecting surfaces and areas, constant shading, solar irradiation transmittance and absorption, and thermal heat transfer. A coefficient that

comprises characteristics of collecting areas and an area of collecting surfaces (including effects from shading) shall be the actual collecting area of solar heat.

### 5.8.2. Overall Solar Heat Gains

112. Solar heat gains in a building zone for a definite month or season shall be calculated by using the following formula:

$$Q_{sol} = \left\{ \sum_k \Phi_{sol,k} \right\} \times t + \left\{ \sum_l (1 - b_l) \Phi_{sol,l} \right\} \times t, \text{ where} \quad (32)$$

$Q_{sol}$  – sum of solar heat gains in a definite months or season (Wh);

$b_l$  – reduction coefficient for an adjacent unconditioned space with an internal heat source  $l$ , which shall be determined according to the Standard LVS EN ISO 13790:2009 L;

$\Phi_{sol,k}$  – average heat flow from a solar heat source  $k$  in a definite month or season (W), which shall be determined in accordance with Sub-chapter 5.8.3 of this Regulation;

$\Phi_{sol,l}$  – average heat flow from a solar heat source  $l$  to an adjacent unconditioned space in a definite month or season (W), which shall be determined according to the Standard LVS EN ISO 13790:2009 L;

$t$  – duration of a definite month or season in hours, which shall be determined in accordance with Sub-chapter 5.4.1 of this Regulation.

113. When using the dynamic method, the heat flow from solar heat sources in a definite building zone shall be calculated for each hour by using the following formula:

$$\Phi_{sol} = \sum_k \Phi_{sol,k} + \sum_l (1 - b_l) \Phi_{sol,l} \quad (33)$$

, where

$\Phi_{sol}$  – sum of heat flows generated by heat gains (W);

$b_l$  – reduction coefficient for an adjacent unconditioned space with a solar heat source  $l$ , which shall be determined according to the Standard LVS EN ISO 13790:2009 L;

$\Phi_{sol,k}$  – one hour heat flow from a solar heat source  $k$  (W), which shall be determined in accordance with Sub-chapter 5.8.3 of this Regulation;

$\Phi_{sol,l}$  – one hour heat flow from a solar heat source  $l$  in an adjacent unconditioned space (W), which shall be determined according to the Standard LVS EN ISO 13790:2009 L.

### 5.8.3. Elements of Solar Heat Gains

114. Solar heat collecting areas shall be glazing, external nontransparent elements, internal walls and floors of verandas, as well as walls behind transparent cover or transparent insulation. In general, characteristics depend on the climate, time and position (for example, from the sun position, ratio between the direct and dissipated irradiation).

115. Taking into consideration that in general characteristics change both per hour and during a year, the appropriate average and constant values must be chosen, which conform to, for example, heating, cooling or summer comfort calculations.

116. Heat flow from solar heat gains shall be calculated by using the following formula:

$$\Phi_{sol,k} = F_{en} A_{s,k} E_{s,k}, \text{ where} \quad (34)$$

$\Phi_{sol,k}$  – solar heat gains through the building elements  $k$  (W);

$F_{en}$  – reduction coefficient of the external obstacle shading for surface  $k$  sun effective collecting area, which shall be determined in accordance with Paragraphs 121 and 122 of this Regulation;

$A_{s,k}$  – surface  $k$  (with a definite orientation and slope angle) effective collecting area in the relevant zone ( $m^2$ ), which shall be determined in accordance with Paragraphs 117 (glazing) and 118 (nontransparent building elements) of this Regulation;

$E_{s,k}$  – solar irradiation received in the calculation period per square meter of a collecting surface area ( $W/m^2$ ), which shall be determined by using statistical data of meteorological information.

117. An effective collecting area of the elements of glazed building envelopes (for example, windows) shall be calculated by using the following formula:

$$A_{s,k} = F_{\bar{e}n,g} g_g (1 - F_F) A_{l,p}, \text{ where} \quad (35)$$

$A_{s,k}$  – effective collecting area of a glazed element ( $m^2$ ). Also building envelopes made of polymers and other translucent materials that serve as glazed elements shall be considered to be glazed elements;

$F_{\bar{e}n,g}$  – shading reduction coefficient for movable shading, which shall be determined in accordance with Paragraph 119 of this Regulation;

$g_g$  – total solar energy transmittance of a transparent part of the element, which shall be determined in accordance with Table 2 of Annex 5 to this Regulation. A transparent part of the element may consist of glazing or constant solar light dissipating or shading layers;

$F_F$  – part of the frame area, ratio of the frame area to the total projected area of the glazed element, which shall be determined in accordance with Paragraph 123 of this Regulation;

$A_{l,p}$  – overall projected area of the glazed element (for example, a window) ( $m^2$ ).

118. An effective solar heat collecting area of the nontransparent part of building envelopes shall be calculated by using the following formula:

$$A_{s,k} = \alpha_{s,c} R_{se} U_c A_c, \text{ where} \quad (36)$$

$A_{s,k}$  – effective collecting area of the nontransparent part ( $m^2$ );

$\alpha_{s,c}$  – absorption coefficient for solar irradiation of nontransparent part, which shall be determined according to the Standard LVS EN ISO 6946:2009 L “Building components and building elements - Thermal resistance and thermal transmittance - Calculation method” (hereinafter – Standard LVS EN ISO 6946:2009 L);

$R_{se}$  – thermal resistance of the external surface of a nontransparent part ( $m^2 K/W$ ), which shall be determined according to the Standard LVS EN ISO 6946:2009 L;

$U_c$  – thermal transmittance coefficient of a nontransparent part ( $W/(m^2 \times ^\circ C)$ ), which shall be determined according to the Standard LVS EN ISO 6946:2009 L;

$A_c$  – projected area of a nontransparent part ( $m^2$ ).

119. A shading reduction coefficient for movable shading  $F_{\bar{e}n,g}$  shall be calculated by using the following formula:

$$F_{\bar{e}n,g} = \frac{[(1 - f_{l,int}) g_g + f_{l,int} g_{g+\bar{e}n}]}{g_g} \quad (37)$$

or

$$F_{\bar{e}n,g} = 1 - f_{l,int} (1 - g_{\bar{e}n}) \quad (38)$$

where:

$g_g$  – total solar energy transmittance through a window, if solar shading is not used, which shall be determined in accordance with Table 1 of Annex 5 to this Regulation;

$g_{g+\bar{e}n}$  – total solar energy transmittance through a window, if solar shading is used, which shall be determined in accordance with Tables 1 and 2 of Annex 5 to this Regulation;

$f_{i,int}$  – time factor assessed part, using solar shading (for example, as solar irradiation intensity function, which depends on the season and window orientation), which shall be determined in accordance with Table 3 of Annex 5 to this Regulation;

$g_{en}$  – solar energy reduction factor, which shall be determined in accordance with Table 2 of Annex 5 to this Regulation.

120. The following solar shading regulation types shall be distinguished for the solar shading control:

120.1. no control (included in the window g value);

120.2. manual operation;

120.3. motorised operation;

120.4. automated control.

121. External shading reduction coefficient  $F_{en}$ , the amplitude of which is from 0 (reduces completely) to 1 (no reduction), shall reflect solar irradiation intensity reduction, in order to determine the constant surface shading from:

121.1. other buildings;

121.2. outdoor environment terrain and land cover;

121.3. sheds, overhangs and similar constructions;

121.4. other elements of the same building;

121.5. external parts of walls, where glazed elements are fitted.

122. The shading correction coefficient shall be calculated by using the following formula:

$$F_{en} = F_h F_p F_l, \text{ where} \quad (39)$$

$F_h$  – shading correction coefficient for the influence of the horizon in accordance with Table 1 of Annex 6 to this Regulation;

$F_p$  – shading correction coefficient for the influence of the overhang and shed in accordance with Table 2 of Annex 6 to this Regulation;

$F_l$  – shading correction coefficient for the influence of the window position in accordance with Table 2 of Annex 6 to this Regulation.

123. A part of the frame area of each window shall be determined according to the Standard LVS EN ISO 10077-1:2009 L “Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General” or a fixed  $F_F$  value = 0.3 shall be used in calculations.

## 5.9. Dynamic Parameters

### 5.9.1. Calculation Procedure

124. When using the dynamic method, thermal resistance, thermal capacity (output) and heat gains from solar and internal thermal resources in the building or building zone shall be taken into consideration.

125. The dynamic effect shall be taken into consideration in calculations when introducing the gain utilisation factor for heating and the loss utilisation factor for cooling.

126. If heating is irregular or switched off, the influence of the building thermal inertia shall be taken into consideration separately.



### 5.9.2. Gain Utilisation Factor for Heating

127. The gain utilisation factor for heating  $\eta_{apk,ieg}$  shall be the function of the heat balance value  $\gamma_{apk}$  and the numeric parameter  $a_{apk}$  (which depends on the thermal inertia of the building). The gain utilisation factor for heating shall be determined by using the following formulas:

$$127.1. \text{ if } \gamma_{apk} > 0 \text{ and } \gamma_{apk} \neq 1, \quad \eta_{apk,ieg} = \frac{1 - \gamma_{apk}^{a_{apk}}}{1 - \gamma_{apk}^{a_{apk}+1}} \quad (40)$$

$$127.2. \text{ if } \gamma_{apk} = 1, \quad \eta_{apk,ieg} = \frac{a_{apk}}{a_{apk} + 1} \quad (41)$$

$$127.3. \text{ if } \gamma_{apk} < 0, \quad \eta_{apk,ieg} = \frac{1}{\gamma_{apk}} \quad (42)$$

$$127.4. \quad \gamma_{apk} = \frac{Q_{apk,ieg}}{Q_{apk,z}} \quad (43)$$

where for each month or season and each building zone:

$\eta_{apk,ieg}$  – gain utilisation factor for heating;

$\gamma_{apk}$  – heat balance coefficient for the heating unit;

$Q_{apk,z}$  – total heat losses for a heating part (Wh), which shall be determined in accordance with Sub-paragraph 83.1 of this Regulation;

$Q_{apk,ieg}$  – total heat gains for a heating part (Wh), which shall be determined in accordance with Sub-paragraph 84.1 of this Regulation;

$a_{apk}$  – numeric parameter that depends on the time constant  $t_{Apk}$ , which shall be determined by using the following formula:

$$a_{apk} = a_{apk,0} + \frac{\tau_{apk}}{\tau_{apk,0}}, \text{ where} \quad (44)$$

$a_{apk,0}$  – dimensionless numeric parameter. For continuously heated (more than 12 hours per day) buildings (for example, residential buildings, hotels) for calculation per month  $a_{apk,0} = 1$ , calculation per season  $a_{apk,0} = 0,8$ ;

$\tau_{apk}$  – time constant of a building or building zone (h), which shall be determined in accordance with Paragraph 132 of this Regulation;

$\tau_{apk,0}$  – indicated time constant. For continuously heated (more than 12 hours per day) buildings (for example, residential buildings, hotels) for calculation per month  $\tau_{apk,0} = 15$  h, calculation per season  $\tau_{apk,0} = 30$  h.

128. The gain utilisation factor shall be determined regardless of the heating system features, assuming that the temperature is fully controlled and is limitlessly flexible.

### 5.9.3. Loss Utilisation Factor for Cooling

129. The loss utilisation factor for cooling  $\eta_{dz,z}$  shall be the function of the heat balance values for cooling  $\gamma_{dz}$  and the numeric parameter  $a_{dz}$  (which depends on the thermal inertia of the building). The loss utilisation factor for cooling shall be determined by using the following formulas:

$$129.1. \text{ if } y_{dz} > 0 \text{ and } y_{dz} \neq 1, \quad \eta_{dz,z} = \frac{1 - \gamma_{dz}^{-a_{dz}}}{1 - \gamma_{dz}^{-(a_{dz}+1)}} \quad (45)$$

$$129.2. \text{ if } y_{dz} = 1, \quad \eta_{dz,z} = \frac{a_{dz}}{a_{dz} + 1} \quad (46)$$

$$129.3. \text{ if } y_{dz} < 0, \quad \eta_{dz} = 1 \quad (47)$$

$$129.4. \quad \gamma_{dz} = \frac{Q_{dz,ieg}}{Q_{dz,z}} \quad (48)$$

where for each month or season and each building zone:

$\eta_{dz,z}$  – loss utilisation factor for cooling;

$\gamma_{dz}$  – heat balance part of the cooling part;

$Q_{dz,z}$  – total heat losses of the cooling part through transmission and ventilation (Wh), which shall be determined in accordance with Sub-paragraph 83.2 of this Regulation;

$Q_{dz,z}$  – total heat gains of the cooling part (Wh), which shall be determined in accordance with Sub-paragraph 84.2 of this Regulation;

$a_{dz}$  – numeric parameter that depends on the time constant  $\tau_{dz}$ , which shall be determined by using the following formula:

$$a_{dz} = a_{dz,0} + \frac{\tau_{dz}}{\tau_{dz,0}}, \text{ where} \quad (49)$$

$a_{dz,0}$  – dimensionless numeric parameter. For continuously cooled (more than 12 hours per day) buildings (for example, residential buildings, hotels) for calculation per month  $a_{dz,0} = 1$ , calculation per season  $a_{dz,0} = 0,8$ ;

$\tau_{dz}$  – time constant of a building or building zone (h), which shall be determined in accordance with Paragraph 132 of this Regulation;

$\tau_{dz,0}$  – indicated time constant. For continuously cooled (more than 12 hours per day) buildings (for example, residential buildings, hotels) for calculation per month  $\tau_{dz,0} = 15$  h, calculation per season  $\tau_{dz,0} = 30$  h.

130. The loss utilisation factor shall be determined regardless of the cooling system features, assuming that the temperature is fully controlled and is flexible.

#### **5.9.4. Time Constant, Thermal Mass Coefficient and Internal Thermal Capacity of a Building**

131. Dynamic parameter values of the time constant, thermal mass coefficient and internal thermal capacity of a building shall be calculated in accordance with the procedures laid down in this Sub-chapter or accepted in accordance with Annex 7 to this Regulation.

132. The time constant  $t$  of a building or building zone characterises the internal thermal inertia of a conditioned zone in the heating and cooling period respectively. It shall be calculated by using the following formula:

$$\tau = \frac{C_m}{H_K}, \text{ where} \quad (50)$$

$\tau$  – time constant of the building or building zone for heating  $t_{apk}$  or cooling  $t_{dz}$  part (h);

$C_m$  – adjusted internal thermal capacity of the building, which shall be calculated in accordance with Paragraph 134 of this Regulation (Wh/K);

$H_K$  – total heat loss coefficient of the building, which shall be calculated in accordance with Paragraph 133 of this Regulation (W/K).

133. The total heat loss coefficient of a building or building zone shall be calculated by using the following formula:

$$H_K = (H_{T,k} + H_{ve,k}), \text{ where} \quad (51)$$

$H_{T,k}$  – heat transmission loss coefficient of the building (W/K), which shall be determined in accordance with Sub-chapter 5.5 of this Regulation;

$H_{ve,k}$  – ventilation heat loss coefficient (W/K), which shall be determined in accordance with Sub-chapter 5.6 of this Regulation.

134. The adjusted internal thermal capacity of a building or building zone  $C_m$  shall be calculated by adding up the adjusted thermal capacities of all the building elements, which are in direct thermal contact with the internal air of the zone:

$$C_m = \sum X_j A_j, \text{ where} \quad (52)$$

$C_m$  – adjusted internal thermal capacity (Wh/K);

$X_j$  – adjusted internal thermal capacity per building element  $j$  area (Wh/(m<sup>2</sup> × K)), which shall be determined according to the Standard LVS EN ISO 13786:2009 L “Thermal performance of building components - Dynamic thermal characteristics - Calculation methods (ISO 13786:2007)”;

$A_j$  – element  $j$  area (m<sup>2</sup>).

## 5.10. Provisions for an Operating Mode of Internal Spaces

### 5.10.1. Space Operating Modes and Continuous or Partly Continuous Heating and Cooling

135. The following operating modes shall be used for heating and cooling:

135.1. continuous heating and (or) cooling at the constant set-point temperature;

135.2. lowered or switched off temperature set for the night time and (or) week;

135.3. “holiday” heating or cooling (for example, time periods when there are no people in the spaces);

135.4. maximum heating or cooling load (time periods when increase of the relevant indicators is chosen).

136. The set-point temperature  $T_{uzst,apk}$  shall be used for a building or building zone for continuous heating in a full heating period.

137. The set-point temperature  $T_{uzst,dz}$  shall be used for a building or building zone for continuous cooling in a full cooling period.

138. The actual average temperature in a heating period may be higher and this causes overheating, and it shall be taken into consideration as regards the gain utilisation factor. The actual average internal temperature for a cooling part may be lower and this causes a greater energy consumption (losses).

139. Irregular (partly continuous) heating and cooling shall be determined as continuous (heating or cooling) with an adjusted set-point temperature, if one or several of the following conditions are met:

139.1. average space temperature is used for calculations as the set-point temperature:

139.1.1. if the difference of the set-point temperature between the continuous heating or cooling and the reduced heating or cooling is smaller than 3 oC;

139.1.2. if the building time constant, which has been determined in accordance with Paragraph 132 of this Regulation, is at least five times smaller than the shortest reduced heating period (for heating) or cooling period (for cooling);

139.2. temperature set for continuous heating part is used as the set-point temperature for calculations for all periods, if the time constant, which has been determined in accordance with Paragraph 132 of this Regulation, is threefold bigger than the longest reduced heating period.

140. The set-point temperature for a continuous cooling period shall be used for all periods, if the building time constant, which has been determined in accordance with Paragraph 132 of this Regulation, is threefold bigger than the longest reduced cooling period.

### 5.10.2. Adjustments of Unoccupied Heating Periods

141. If there are unoccupied heating periods and the provisions referred to in Sub-chapter 5.10.1 of this Regulation are not met, the energy required for heating shall be calculated by using the following formula:

$$Q_{apk,n} = a_{samz,apk} \times Q_{apk,n,N}, \text{ where} \quad (53)$$

$Q_{apk,n}$  – energy required for heating, taking into consideration unoccupied periods (Wh);

$Q_{apk,n,N}$  – energy required for heating in a continuous heating period assuming that the set-point temperature is controlled on all days of the month (Wh);

$a_{samz,apk}$  – reduction factor in the unoccupied heating period, which shall be determined in accordance with Paragraph 142 of this Regulation.

142. The reduction factor for heating with unoccupied periods  $a_{samz,apk}$  shall be calculated by using the following formula:

$$a_{samz,apk} = 1 - b_{samz,apk} (\tau_{apk,0} / \tau) \times \gamma_{apk} \times (1 - f_{N,apk}) \quad (54)$$

where (with the minimum value  $a_{samz,apk} = f_{N,apk}$  and the maximum value  $a_{samz,apk} = 1$ ):

$a_{samz,apk}$  – reduction factor for heating with unoccupied periods;

$f_{N,apk}$  – part of the number of hours per week with continuous heating (set-point temperature is not reduced or heating is not switched off), for example,  $(5 \times 14) / (7 \times 24) = 0,42$ ;

$b_{samz,apk}$  – empirical correlation factor (value  $b_{samz,apk} = 3$ );

$\tau$  – time constant of a building or building zone (h), which shall be determined in accordance with Paragraph 132 of this Regulation;

$\tau_{apk,0}$  – recommended time constant for the heating part (h), which shall be determined in accordance with Sub-chapter 5.9.2 of this Regulation;

$\gamma_{apk}$  – heat balance proportion for the heating part, which shall be determined in accordance with Sub-chapter 5.9.2 of this Regulation.

143. If there are unoccupied cooling periods and the provisions referred to in Sub-chapter 5.10.1 of this Regulation are not met, the energy required for cooling shall be calculated by using the following formula:

$$Q_{dz,n} = a_{samz,dz} \times Q_{dz,n,N}, \text{ where} \quad (55)$$

$Q_{dz,n}$  – energy required for cooling, taking into consideration unoccupied periods (Wh);

$Q_{dz,n,N}$  – energy required for cooling in a continuous cooling period, assuming that the set-point temperature is controlled on all days of the month (Wh);

$a_{samz,dz}$  – reduction factor in the unoccupied cooling period, which shall be determined in accordance with Paragraph 144 of this Regulation.

144. The reduction factor for cooling with unoccupied periods  $a_{samz,dz}$  shall be calculated by using the following formula:

$$a_{samz,dz} = 1 - b_{samz,dz} (\tau_{dz,0} / \tau) \times \gamma_{dz} \times (1 - f_{N,dz}) \quad (56)$$

where (with the minimum value  $a_{samz,dz} = f_{N,dz}$  and the maximum value  $a_{samz,dz} = 1$ ):

$a_{samz,dz}$  – reduction factor for cooling with unoccupied periods;

$f_{N,dz}$  – part of the number of days per week with the temperature for cooling set at least for the day time (temperature is not reduced or the installation is not switched off), for example, 5/7;

$b_{samz,dz}$  – empirical correlation factor (value  $b_{samz,dz} = 3$ );

$\tau$  – time constant of a building or building zone (h), which shall be determined in accordance with Paragraph 132 of this Regulation;

$\tau_{dz,0}$  – indicated time constant for the cooling part (h), which shall be determined in accordance with Sub-chapter 5.9.3 of this Regulation;

$\gamma_{dz}$  – heat balance proportion for the cooling part, which shall be determined in accordance with Sub-chapter 5.9.3 of this Regulation.

### 5.10.3 Adjustment of the “Holiday” Period

145. Individual buildings (for example, schools) substantially reduce the energy required for heating or cooling during the “holiday” heating or cooling period.

146. For months containing “holiday” periods the energy required for heating and cooling shall be calculated separately for a continuous period and “holiday” period, and the results shall be interpolated linearly according to the ratio between “holiday” and occupied period time parts by using the following formulas:

$$146.1. Q_{apk,n} = f_{apk,N} \times Q_{apk,n,N} + (1 - f_{apk,N}) \times Q_{apk,uzt} \quad (57)$$

$$146.2. Q_{dz,n} = f_{dz,N} \times Q_{dz,n,N} + (1 - f_{dz,N}) \times Q_{dz,uzt} \quad (58)$$

where:

$Q_{apk,n}$  – energy required for heating, taking into consideration “holiday” periods (Wh);

$Q_{dz,n}$  – energy required for cooling, taking into consideration “holiday” periods (Wh);

$Q_{apk,n,N}$  – energy required for heating in a continuous heating period, assuming that the set-point temperature is controlled on all days of the month (Wh);

$Q_{dz,n,N}$  – energy required for cooling in a continuous cooling period, assuming that the set-point temperature is controlled on all days of the month (Wh);

$Q_{apk,n,uzt}$  – energy required for heating in a “holiday” period, assuming that the set-point temperature is controlled on all days of the month (Wh);

$Q_{dz,n,uzt}$  – energy required for cooling in a “holiday” period, assuming that the set-point temperature is controlled on all days of the month (Wh);

$f_{apk,N}$  – time part of the “holiday” period per month in the heating period (for example, 10/31);

$f_{dz,N}$  – time part of the “holiday” period per month in the cooling period (for example, 10/31).

## 5.11. Energy Use for Heating and Cooling

### 5.11.1. Total Energy Required for the Heating and Cooling of a Building Zone

147. Total energy required for heating and cooling for the definite building zone shall be calculated by adding up the energy calculated for the period in accordance with Paragraphs 141 and 142 of this Regulation, taking into consideration a possible load for different heating or cooling parts:

$$147.1. \quad Q_{apk,n,kopa} = \sum_i Q_{apk,n,i} \quad (59)$$

$$147.2. \quad Q_{dz,n,kopa} = \sum_j Q_{dz,n,j} \quad (60)$$

where:

$Q_{apk,n,kopa}$  – total energy required for heating in the definite zone (Wh);

$Q_{apk,n,i}$  – energy required for heating in the definite zone in the calculation period  $i$  (per hour or month) (Wh), which shall be determined in accordance with Sub-chapter 5.4.2 of this Regulation;

$Q_{dz,n,kopa}$  – total energy required in the definite zone (Wh);

$Q_{dz,n,j}$  – energy required for cooling in the definite zone in the calculation period  $j$  (per hour or month) (Wh), which shall be calculated in accordance with Sub-paragraph 5.4.2 of this Regulation.

148. Duration of a heating and cooling season according to the running periods of the relevant system components shall be determined in accordance with Sub-chapter 5.4.1 of this Regulation.

149. As a result of calculations of several zones (with thermal influence between the zones or without it), the total energy required for heating and cooling for combining operation of definite heating, cooling and ventilation systems in different zones shall be the required energy sum in the zones  $zs$ , for which a combination of different systems is used:

$$149.1. \quad Q_{apk,n,kopa,zs} = \sum_z Q_{apk,n,kopa,z} \quad (61)$$

$$149.2. \quad Q_{dz,n,kopa,zs} = \sum_z Q_{dz,n,kopa,z} \quad (62)$$

where:

$Q_{apk,n,kopa,zs}$  – total energy required for the heating of all building zones  $zs$ , when using a combination of definite systems (Wh);

$Q_{apk,n,kopa,z}$  – total energy required for the heating of the building zone  $z$ , when using a combination of definite systems (Wh), which shall be determined in accordance with Paragraph 147 of this Regulation;

$Q_{dz,n,kopa,zs}$  – total energy required for the cooling of all building zones  $zs$ , when using a combination of definite systems (Wh);

$Q_{dz,n,kopa,z}$  – total energy required for the cooling of the building zone  $z$ , when using a combination of definite systems (Wh), which shall be determined in accordance with Paragraph 147 of this Regulation.

### 5.11.2. Total System Energy Use for Heating, Cooling and Ventilation

150. If heating, cooling and ventilation systems are combined, the total energy use for heating  $Q_{apk,sist}$  and the total energy use for cooling  $Q_{dz,sist}$  (including system losses) shall be determined as the required energy function for heating and cooling according to the relevant standards for heating and cooling systems LVS EN 15316-2-1:2009 L, LVS EN 15316-2-3:2009 L, LVS EN 15241:2009 L and LVS EN 15243:2009 L.

151. The total system energy for heating, cooling and ventilation systems shall be calculated according to the following combinations:

151.1. total energy used by the systems  $Q_{apk,sist,i}$  and  $Q_{dz,sist,i}$  per energy carrier  $i$ , which includes or separates the use of auxiliary energy (Wh);

151.2. sum of energy required for heating  $Q_{apk,n,i}$ , heating system losses  $Q_{apk,sist,zud,i}$  and auxiliary energy of the heating systems  $Q_{apk,sist,pap,i}$  per energy carrier  $i$  (Wh). Losses and auxiliary energy comprise energy generation, transport, control, distribution, storage and emission. This Sub-paragraph shall also be applicable to cooling systems  $Q_{dz,n,i}$ ,  $Q_{dz,sist,i}$  and  $Q_{dz,sist,pap,i}$ ;

151.3. system heat losses shall be determined taking into consideration the overall system efficiency. In such a case, a calculation shall be carried out by using the following formulas:

$$151.3.1. \quad Q_{apk,sist} = \frac{Q_{apk,n}}{\eta_{apk,sist}} \quad (63)$$

$$151.3.2. \quad Q_{dz,sist} = \frac{Q_{dz,n}}{\eta_{dz,sist}} \quad (64)$$

where:

$Q_{apk/dz,sist}$  – energy use in heating or cooling systems, including system losses (Wh);

$Q_{apk/dz,n}$  – energy required for heating and cooling, when using a definite heating system (Wh), which shall be determined in accordance with Paragraph 149 of this Regulation;

$\eta_{apk/dz,sist}$  – overall system efficiency for heating or cooling systems, including energy generation, electronics, transport, storage, distribution and emission losses, except for the case if it has been determined as auxiliary energy.

152. Energy system losses shall be determined as total losses, adding the system losses recovered from the system.

153. Energy system losses shall include additional losses of the building heat due to uneven distribution of the room temperature and insufficient temperature control.

154. The total auxiliary energy required for ventilation systems shall be determined according to the Standard LVS EN 15241:2009 L, and it shall include the following energy use types:

154.1. for fans;

154.2. for heat recovery from freezing;

154.3. for centralised distribution of air;

154.4. for centralised air cooling.

## 6. Validation of a Building Calculation Model

### 6.1. Utilisation of the Validation of a Building Calculation Model

155. Validation (verification) of a building calculation model shall be carried out, in order to ascertain that the energy performance indicators obtained in the calculations conform to the actually obtained ones. Such a comparison of the calculated and actually obtained energy performance indicators shall be necessary for a precise assessment of the advantages of the identified energy performance measures (calculated planned energy consumption after the implementation of the measures).

156. A validated building calculation model shall be used for the energy performance assessment (certification) of the buildings in operation and for the calculation of the efficiency indicators of the identified energy performance improvement measures. A validated building data set shall be used for this purpose, which is the output data of the building calculation model, in which one or several output data are adapted on the basis of the actual data, in order for the calculation results, when using the model, not to differ from the data of actual

measurements. The quality of a validated data set shall be the balance between the costs for the data obtaining (collection) and the appropriate accuracy.

## **6.2. Procedure of the Validation of a Building Calculation Model**

157. Validation (verification) of a building calculation model shall be carried out according to the following procedures:

157.1. indicators of the measured energy performance shall be obtained in accordance with Chapter 4 of this Regulation;

157.2. data and indicators required for the energy performance calculations (for example, actual climatic data, actual indoor conditions, building occupancy data, information regarding uneven heating) shall be collected;

157.3. energy performance indicators shall be verified.

158. Data required for energy performance calculations shall be obtained from the building technical documentation, performing surveys and measurements.

159. Confidence intervals shall be assessed for all the data used. Data that cannot be obtained directly shall be obtained by using a calculation or the values specified in laws and regulations and standards.

160. Energy consumption and calculation initial data collected in the assessment period must relate to the equal time periods.

## **6.3. Verification of Energy Performance Indicators**

161. During the course of the verification of energy performance indicators the results of the measured and calculated energy rating shall be compared for all energy carriers.

162. If the comparison of the results of the measured and calculated energy rating at equal internal temperature conditions is acceptable (differs for less than ten per cent and no more than 10 kWh/m<sup>2</sup> per year), it shall be considered that the building calculation model, including the calculated initial data, is reliable and the energy performance assessment may be continued.

163. If a comparison of the energy rating results is unavailable, a further survey shall be carried out, in order to verify data or introduce such influencing factors that have not been taken into consideration before. The verification shall be repeated with a new initial data set.

164. If necessary, initial data shall be adjusted, in order for a comparison of the energy performance results to be acceptable.

## **6.4. Assessment of an Indoor Climate and Outdoor Climatic Conditions**

165. Climatic data shall be determined according to LBN 003-01 “Construction Climatology”, using statistical data of meteorological information.

166. When surveying a building, the actual internal temperature of the building shall be assessed, since in practice it often differs from the designed temperature, and it substantially affects the consumption indicators of the energy used for cooling and heating. The following methods shall be used for assessing (measuring) the internal temperature:



166.1. in buildings with mechanical ventilation the air temperature shall be measured in the education channel up against the air flow direction from the fan. The average temperature of a ventilated zone shall be assessed when the exhaust fan is switched on;

166.2. by carrying out measurements of the internal temperature and other parameters of spaces in several building places, using the automated control equipment of the building, which insures a computerised accounting of the measurements;

166.3. with a small one-channel data recorder the temperature shall be measured or accounted in several most characteristic places of the building under the most characteristic conditions – on days that characterise the indicators of the meteorological conditions of the month or season;

166.4. set-point temperature indicators shall be used, if heating or cooling systems are controlled by thermostats and the calibration of the thermostats is verified;

166.5. with pyrometers or manual air temperature meters the air temperature shall be determined in several measurement points simultaneously.

167. As regards air infiltration and natural ventilation, the following methods shall be used for the actual assessment of the external air flow:

167.1. determination of the air flow velocity of the air treatment equipment;

167.2. gaseous solution tracing according to the Standard LVS EN ISO 12569:2009 L “Thermal insulation in buildings - Determination of air change in buildings - Tracer gas dilution method”.

168. Such internal heat sources like the number of people and duration of their presence in the building shall be assessed by surveying the building, or obtained from the building owner or manager.

169. Such internal heat sources like artificial lighting and electric appliances shall be assessed by using the accounting data of the consumed electricity, unless heating or cooling systems are also connected to the meter. If data regarding lighting are unavailable, calculations shall be carried out according to the Standard LVS EN 15193:2009 L. When assessing internal heat sources, it shall be taken into consideration that not all the energy used for lighting is an internal heat source (for example, if lighting is located outside the building or the heat is partially released).

170. Hot water consumption data for buildings for which an individual meter has been installed shall be obtained from the difference between two readings at the beginning and at the end of the assessment period. If hot water is not metered, the consumption thereof shall be assessed according to the number of occupants, building utilisation type and average hot water consumption data, using the data referred to in standards LVS EN 15316-3-1:2009 L, LVS EN 15316-3-2:2008 and LVS EN 15316-3-3:2009 L.

171. Consumed electricity bills shall be used for assessing the consumption of energy used for artificial lighting, unless other systems are also connected to the meter (for example, cooking, heating, cooling systems). If the meter data cannot be used, energy consumption shall be calculated according to the Standard LVS EN 15193:2009 L.

## **7. Calculation of Total Energy Performance Indicators of a Building**

172. Total energy performance indicators of a building shall be determined following the calculation of the required (calculated) and used (measured) energy carriers.

173. Total energy performance indicators of a building shall be calculated:

173.1. for energy consumption – kilowatt-hours per square metre of the calculation area per year:

173.1.1. total for heating, cooling, mechanical ventilation, preparation of hot water, as well as lighting (if applicable in accordance with Paragraph 13 of this Regulation);

173.1.2. for heating;

173.2. for primary energy consumption – kilowatt-hours per square metre of the calculation area per year, and also as a part from the total energy consumption in the building in per cent; and

173.3. for assessment of carbon dioxide emission – kilograms of carbon dioxide per square metre of the calculation area per year.

174. The primary energy consumption indicator shall be calculated from the delivered and exported energy for each energy carrier (primary energy factors for non-renewable part of energy resources shall be accepted in accordance with Clause 3 of Annex 1 to this Regulation) by using the following formula:

$$E_P = \sum(E_{pieg,i} f_{P,pieg,i}) - \sum(E_{ex,i} f_{P,ex,i}), \text{ where} \quad (65)$$

$E_P$  – primary energy consumption (kg);

$E_{pieg,i}$  – energy (Wh) delivered by the energy carrier  $i$  ;

$E_{ex,i}$  – energy (Wh) exported by the energy carrier  $i$  ;

$f_{P,pieg,i}$  – primary energy factor for delivered energy for the energy carrier  $i$  (kg/Wh);

$f_{P,ex,i}$  – primary energy factor for exported energy for the energy carrier  $i$  (kg/Wh).

175. When assessing the carbon dioxide emission, the emitted carbon dioxide (CO<sub>2</sub>) mass shall be calculated from the delivered and exported energy for each energy carrier (carbon dioxide (CO<sub>2</sub>) emission factors shall be determined in accordance with Clause 4 of Annex 1 to this Regulation) by using the following formula:

$$m_{CO_2} = \sum(E_{pieg,i} K_{pieg,i}) - \sum(E_{ex,i} K_{ex,i}), \text{ where} \quad (66)$$

$m_{CO_2}$  – carbon dioxide (CO<sub>2</sub>) emitted mass (kg);

$E_{pieg,i}$  – energy (Wh) delivered by the energy carrier  $i$  ;

$E_{ex,i}$  – energy (Wh) exported by the energy carrier  $i$  ;

$K_{pieg,i}$  – carbon dioxide (CO<sub>2</sub>) emission factor for the energy supplier  $i$  (kg/Wh);

$K_{ex,i}$  – carbon dioxide (CO<sub>2</sub>) emission factor for the energy exporter  $i$  (kg/Wh).

## 8. Assessment of the Energy Saving of Planned Energy Performance Improvement Measures

176. In order to assess the energy saving obtained from planned energy performance improvement measures, the same building calculation model that has been used when assessing the calculated energy performance shall be used.

177. If a measured energy assessment is used for validation of a building calculation model and initial data, the values obtained by means of calculations shall be compared with the measured values and the accuracy of the building calculation model shall be verified. This increases the reliability that the energy saving calculation obtained through the planned energy performance improvement measures is accurate and that the planned energy performance improvement measures will provide the anticipated results in practice.

178. If it is intended to use a building the same way as before, the particular climatic and occupancy data shall be used for assessing the advantages of planned energy performance measures. This allows for assessing also the influence of the building management practice and changes of the occupants' behaviour.

179. When identifying necessary energy performance improvement measures, one or several scenarios of the building energy performance improvement shall be prepared, in which definite and mutually coordinated energy performance measures shall be specified. Taking into consideration that separate measures can correlate (for example, an increased thermal insulation or passive solar heat gains can lower the efficiency of a boiler), the effects obtained in the course of each individual measure may not be added. Combined measures must be calculated taking into consideration the correlation thereof.

180. For each proposed scenario (contains particular energy performance improvement measures) the initial data shall be changed according to the planned energy performance improvement measures and the calculation shall be carried out anew. The difference between an assessment that has been obtained prior to energy performance improvement measures and an assessment that has been obtained after them shall be the effect of the relevant measures on energy consumption.

181. Following the identification of required energy performance improvement measures the standard energy rating shall be calculated for a modernised building. The building calculation model with an output (initial) data set shall be used for this purpose, taking into consideration the influence of the energy performance improvement measures on the initial data set determined by the standard. The actual efficiency of planned energy performance improvement measures shall depend on the actual utilisation of a building.

182. An economic evaluation of heating and other energy delivering or consuming systems shall be performed according to Standard LVS EN 15459:2008 "Energy performance of buildings - Economic evaluation procedure for energy systems in buildings".

### **Informative Reference to the European Union Directive**

This Regulation contains legal norms arising from Directive 2010/31/EC of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings.

Prime Minister

Valdis Dombrovskis

Minister for Economics

Daniels Pavļuts

## **Calorific Values of Fuel, Primary Energy Factors and Carbon Dioxide (CO<sub>2</sub>) Emission Factors**

1. Net calorific values of fuel shall be determined in accordance with Annex VI to Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

2. Gross calorific values of fuel shall be determined by using the net calorific coefficients of fuel, multiplying them by the conversion coefficients, which are specified in Table 1 of this Annex.

Table 1

No.	Fuel	Conversion coefficient from net calorific value to gross calorific value
1.	Diesel fuel	1.06
2.	Natural gas	1.11
3.	Liquefied petroleum gas	1.09
4.	Coal (anthracite)	1.04
5.	Brown coal (lignite)	1.07
6.	Wood	1.08

3. Primary energy factors for the part of non-renewable energy resources are specified in Table 2 of this Annex.

Table 2

No	Energy carrier or energy source		Primary energy factor for the part of non-renewable energy resources $f_p$
1.	Fuel	diesel fuel	1.1
2.		natural gas	1.1
3.		liquefied petroleum gas	1.1
4.		coal (anthracite)	1.1
5.		brown coal (lignite)	1.2
6.		biogas	0.5
7.		wood	0.2
8.	Thermal energy from boiler rooms, produced in cogeneration*	fossil fuel	0.7
9.		renewable fuel	0.0
10.	Thermal energy from boiler rooms (without cogeneration)	fossil fuel	1.3
11.		renewable fuel	0.1
12.	Electricity	from electrical power networks	1.5
13.		from fossil resources	2.0
14.		from renewable energy sources, which is produced within the boundaries of the technical building systems	0.0
15.	Wind, solar, aerothermal, hydrothermal and sea energy, hydraulic energy		0.0

Note. \* The value corresponds to a heat supply system with 70% output from cogeneration.

4. Carbon dioxide (CO<sub>2</sub>) emission factors are specified in Table 3 of this Annex.

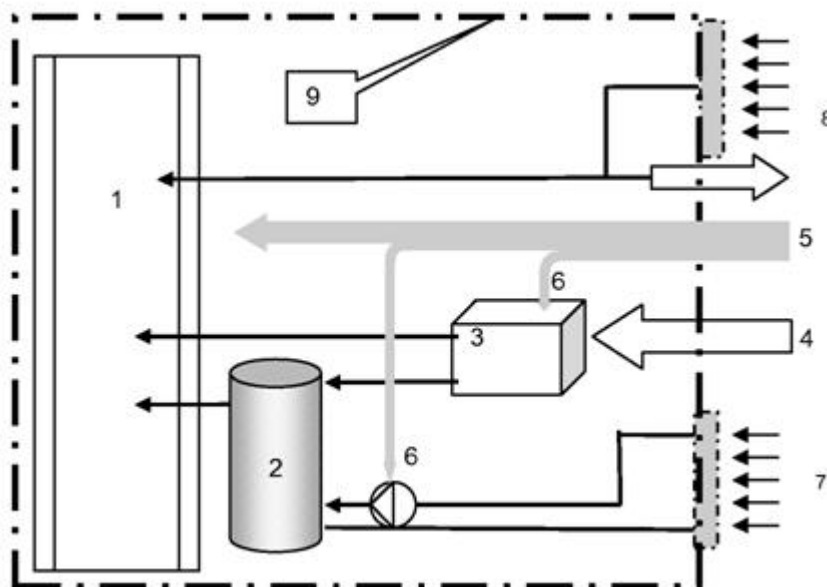
Table 3

No.	Energy carrier or energy source	Carbon dioxide (CO <sub>2</sub> ) emission factor, 10 <sup>-6</sup> kg/Wh
1.	Fuel	In accordance with Annex VI to Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council
2.	Electricity	from electrical power networks
3.	Electricity	from fossil resources
4.	Electricity	from renewable energy resources
5.	Thermal energy from boiler rooms	

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## Boundaries of an Energy Rating and Depiction of Energy Flows



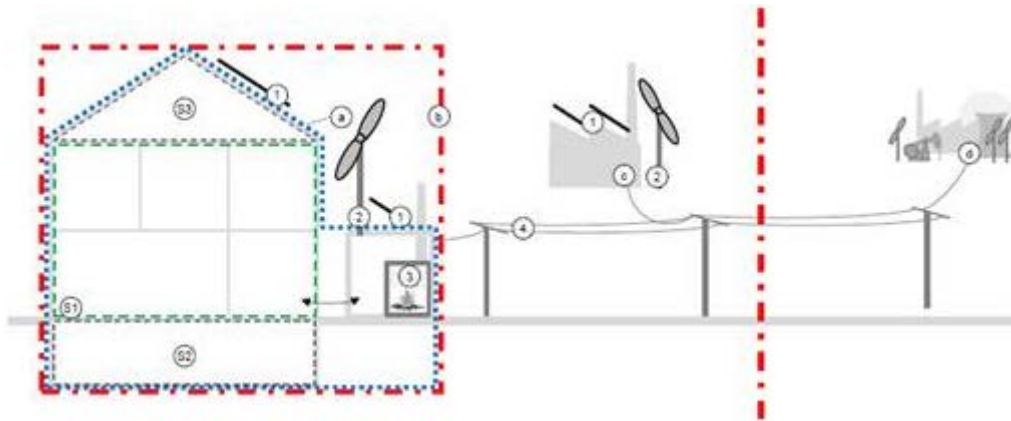
Designations:

- 1 – consumer;
- 2 – accumulator;
- 3 – boiler;
- 4 – fuel;
- 5 – electricity;
- 6 – auxiliary energy;
- 7 – solar collectors;
- 8 – photovoltaic panels;
- 9 – boundary.

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### Depiction of System Boundaries for Calculation of Primary Energy Consumption Indicators



Designations of boundaries for application of primary energy coefficients:

- a – building boundary;
- b – building place boundary;
- c – area boundary;
- d – remote (electrical power network).

Designations of building zones:

- S1 – conditioned zone;
- S2, S3 – unconditioned zone;

Designations of energy types:

- 1 – photoelectric elements;
- 2 – wind generators;
- 3 – biomass heating boiler or installation;
- 4 – electrical power network.

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## Internal Heat Gains

1. Internal heat gains – heat flow part from the occupants and appliances in residential buildings

Table 1

No.	Day of the week	Hours of the day	Living room + kitchen ( $\Phi_{iek,iedz} + \Phi_{iek,ier}$ )/ $A_{apr}$ (W/m <sup>2</sup> )	Other conditioned areas (for example, bedroom) ( $\Phi_{iek,iedz} + \Phi_{iek,ier}$ )/ $A_{apr}$ (W/m <sup>2</sup> )
1.	Monday– Friday	07.00– 17.00	8.0	1.0
		17.00– 23.00	20.0	1.0
		23.00– 07.00	2.0	6.0
		On average	9.0	2.67
2.	Saturday and Sunday	07.00– 17.00	8.0	2.0
		17.00– 23.00	20.0	4.0
		23.00– 07.00	2.0	6.0
		On average	9.0	3.83
3.	On average	24 h	9.0	3.0

2. Internal heat gains – heat flow part from the occupants and appliances in office buildings

Table 2

No.	Day of the week	Hours of the day	Office spaces (60 % of useful floor area) $(\Phi_{iek,iedz} + \Phi_{iek,ier})/A_{apr}$ (W/m <sup>2</sup> )	Other spaces (for example, foyer, entrance-hall, corridors) (40 % from useful floor area) $(\Phi_{iek,iedz} + \Phi_{iek,ier})/A_{apr}$ (W/m <sup>2</sup> )
1.	Monday–Friday	07.00–17.00	20.0	8.0
		17.00–23.00	2.0	1.0
		23.00–07.00	2.0	1.0
		On average	9.50	3.92
2.	Saturday and Sunday	07.00–17.00	2.0	1.0
		17.00–23.00	2.0	1.0
		23.00–07.00	2.0	1.0
		On average	2.0	1.0
3.	On average	24 h	7.4	3.1

### 3. Heat flow part from occupants in non-residential buildings

Table 3

No.	Occupants' density level	Useful area per person (m <sup>2</sup> )	Heat flow part from occupants $\Phi_{iek,iedz}/A_{apr}$ (W/m <sup>2</sup> )
1.	I	1.0	15
2.	II	2.5	10
3.	III	5.5	5
4.	IV	14	3
5.	V	20	2

### 4. Heat flow part from appliances in non-residential buildings

Table 4

No.	Type of the building utilisation	Generated heat during the installation running $\Phi_{iek,ier}/A_{apr}$ (W/m <sup>2</sup> )	Running time part $f_{iek}$	Average heat flow from the installation $\Phi_{iek,ier}/A_{apr}$ (W/m <sup>2</sup> )
1.	Office	15	0.20	3
2.	Training	5	0.15	1
3.	Health care (inpatient)	8	0.50	4
4.	Health Care (outpatient)	15	0.20	3
5.	Public catering	10	0.25	3
6.	Trade	10	0.25	3
7.	Public meetings and events	5	0.20	1
8.	Accommodation	4	0.50	2
9.	Place of imprisonment	4	0.50	2
10.	Sport activities and events	4	0.25	1

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## Values of the Total Solar Energy Transmittance of a Transparent Part of the Element and Reduction Factors

### 1. Values of the solar energy transmittance

Table 1

No.	Glazing type	Total solar energy transmittance of a transparent part of the element $g_g$
1.	Single layer glazing	0.85
2.	Double layer glazing	0.75
3.	Double layer glazing with selective coating	0.67
4.	Triple layer glazing	0.7
5.	Triple layer glazing with two selective coatings	0.5
6.	Double window	0.75

2. The value of the solar energy transmittance of a transparent part is affected by a screen (curtains and blinds), which substantially reduces the solar energy transmittance. Reduction factors for several screen types are specified in Table 2 of this Annex. Screen (curtains and blinds) influence coefficients must be multiplied by the value of the total solar energy transmittance of a transparent part of the element ( $g_{g+\bar{e}n} = g_g \times g_{\bar{e}n}$ ).

Table 2

No.	Screen type	Optical properties of the screen		Reduction factors $g_{\bar{e}n}$ with	
		absorption	transmission	internal screens	external screens
1.	White Venetian blinds	0.1	0.05	0.25	0.10
			0.1	0.30	0.15
			0.3	0.45	0.35
2.	White curtains	0.1	0.5	0.65	0.55
			0.7	0.80	0.75
			0.9	0.95	0.95
3.	Coloured fabric curtains	0.3	0.1	0.42	0.17
			0.3	0.57	0.37
			0.5	0.77	0.57
4.	Screens with aluminised coating	0.2	0.05	0.20	0.08

3. Mobile sun shading reduction coefficient  $f_{i,int}$  depending on the month and orientation of the glazed surface

Table 3

Time period	North	East	South	West
January	0.0	0.1	0.6	0.0
February	0.0	0.3	0.6	0.2
March	0.0	0.5	0.8	0.5
April	0.0	0.5	0.7	0.4
May	0.0	0.5	0.6	0.4
June	0.0	0.6	0.6	0.5
July	0.0	0.6	0.6	0.5
August	0.0	0.5	0.6	0.4
September	0.0	0.4	0.6	0.3
October	0.0	0.3	0.6	0.2
November	0.0	0.1	0.5	0.0
December	0.0	0.0	0.5	0.0
Heating season	0.0	0.3	0.6	0.2

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## Shading Reduction Coefficients for the Heating Season

### 1. Shading correction coefficient part for the influence of the horizon ( $F_h$ )

Table 1

No.	Horizon angle $\alpha$	56° (in latitudes)			57° (in latitudes)			58° (in latitudes)		
		S	W/E	N	S	W/E	N	S	W/E	N
1.	0°	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2.	10°	0.93	0.92	0.99	0.92	0.91	0.99	0.92	0.91	0.98
3.	20°	0.67	0.74	0.95	0.66	0.73	0.95	0.65	0.73	0.94
4.	30°	0.48	0.61	0.92	0.47	0.60	0.92	0.46	0.59	0.91
5.	40°	0.39	0.55	0.89	0.38	0.54	0.88	0.37	0.54	0.88

Designations:

S – south;

W/E – west/east;

N – north

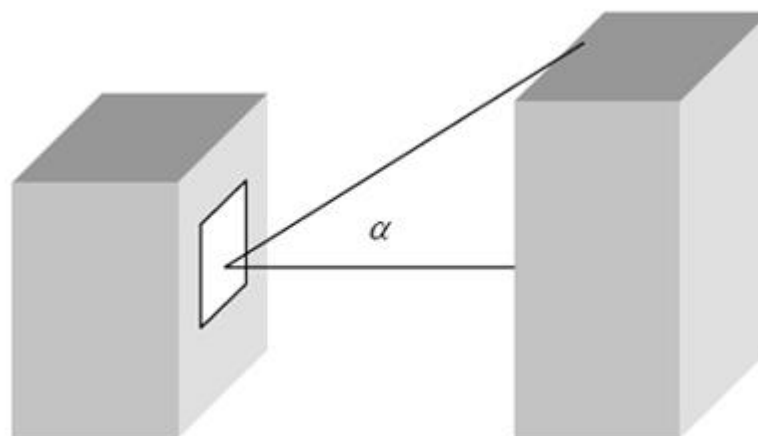


Figure 1. Horizon angle  $\alpha$

### 2. Shading correction coefficient part for the influence of the overhang and shed ( $F_p$ )

Table 2

No	Overhang angle $\alpha$	56°–57° (in latitudes)			58° (in latitudes)		
		S	W/E	N	S	W/E	N
1.	0°	1.00	1.00	1.00	1.00	1.00	1.00
2.	30°	0.93	0.91	0.91	0.94	0.91	0.91
3.	45°	0.81	0.79	0.80	0.82	0.80	0.80
4.	60°	0.61	0.61	0.65	0.62	0.62	0.65

3. Shading correction coefficient part for the influence of elements (barriers) directed vertically and outwards ( $F_1$ )

Table 3

No	Barrier angle $\beta$	56°–58° (in latitudes)		
		S	W/E	N
1.	0°	1.00	1.00	1.00
2.	30°	0.94	0.91	0.99
3.	45°	0.86	0.83	0.99
4.	60°	0.74	0.75	0.99

Note. The values indicated in Table 3 of this Annex are validated for barriers on the south side. As concerns windows facing south barriers on both sides, two shading coefficients must be multiplied. As concerns windows on the east and west side for barriers at the north end, the shading correction shall not be required.

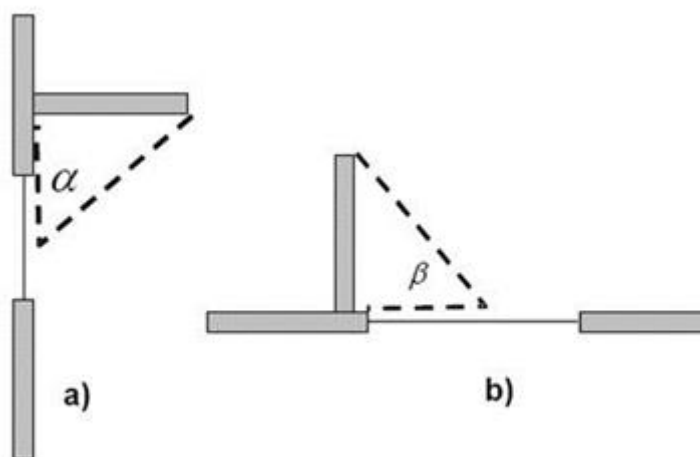


Figure 2. Sheds and barriers:  
a) vertical split for the overhang angle  $\alpha$ ;  
b) horizontal split for the barrier angle  $\beta$ .

### Values of Dynamic Parameters

No.	Classification of building constructions	Main material of the constructions*	$C_m$ (Wh/K)
1.	Very light	Glass, mineral wool, polystyrene foam	16,7 $A_{apr}$
2.	Light	Wood and wood building materials	23,1 $A_{apr}$
3.	Medium	Aerated concrete, cored ceramic brick, ceramsite concrete, wood concrete	34,4 $A_{apr}$
4.	Heavy	Solid brick, cored reinforced concrete panel	54,2 $A_{apr}$
5.	Very heavy	Concrete, reinforced concrete, stone wall	77,2 $A_{apr}$

Note. \*Forms at least 80% of the building envelope.

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