SOC1.1

Thermal comfort

Objective

Our objective is to guarantee thermal comfort that is appropriate for the intended use of the building throughout the year regardless of season, and to ensure user comfort.

Benefits

Measures that give building users the greatest possible control over indoor climate conditions improve their individual well-being. Improved well-being results in better satisfaction with the facilities and therefore also increases the productivity of building users.

Contribution to overriding sustainability goals

	CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS (SDGS) OF UNITED NATIONS (UN)	CONTRIBUTION TO GERMAN SUSTAINABILITY STRATEGY
Low	3.4 Reduce mortality from non-communicable diseases and promote mental health	

Outlook

Thanks to digital solutions, technology is becoming ever more sophisticated and tailored more closely to individual needs. It is not necessary to specify concrete solutions to achieve points. Instead, designers are encouraged to concentrate more closely on addressing the objectives of the criterion in the context of their project. In order to ensure that desired parameters regarding thermal comfort of a building can continue to be achieved in future, it is recommended that designers familiarise themselves with future climate data predictions. This measure for climate adaptation and increased building resilience is currently addressed as a bonus, but will become increasingly important in these times of ongoing climate change. There are currently no plans to focus more heavily on this objective.

Share of total score

	SHARE	WEIGHTING FACTOR
Office **Assembly buildings**	**4.1%**	**4**
Education	**3.6%**	**4**
Residential **Logistics** **Production**	**4.3%**	**4**
Hotel	**3.9%**	**4**
Consumer market **Shopping centre** **Department stores**	**4.5%**	**4**

EVALUATION

Thermal comfort for the heating period and cooling period is evaluated depending on the intended use based on different aspects such as operative temperature, drafts, radiant temperature asymmetry and relative humidity. A total of 100 points can be achieved for this criterion or a maximum of 105 points including bonuses. In the area of **Education,** 120 points could be achieved. Nevertheless only a maximum of 100 points can actually be awarded.

NO.	INDICATOR	POINTS
1	**Operative temperature/indoor air temperature/heating period**	
1.1	**Operative temperature (heating period)** (Area-weighted interpolation is possible) **Office** **Education** **Residential** **Consumer market** **Hotel** **Assembly buildings**	**Max. 30**
	■ Compliance with requirements in compliance with the criteria in accordance with DIN EN 15251 Category III, see Appendix 2, or minimum national criteria – whichever is stricter – and supporting documentation. 5% deviation frequency of occupancy time is permitted	10 **Consumer market** 15
	■ Compliance with requirements in compliance with the criteria in accordance with DIN EN 15251 Category II, see Appendix 2 5% deviation frequency of occupancy time is permitted*	20 **Consumer market** 25
	■ Compliance with requirements in compliance with the criteria in accordance with DIN EN 15251 Category I, see Appendix 2 3% deviation frequency of occupancy time is permitted **Hotel** Note: Evaluation of this indicator can be carried out by means of different classification of office and hotel rooms into the categories mentioned above (max. 30 points). **Consumer market**	30
	■ Compliance with requirements in compliance with the criteria in accordance with DIN EN 15251 Category II, see Appendix 2 5% deviation frequency is permitted* In addition: Local heating system at checkout workstations (e.g. radiator, floor heating system)	30
	Logistics **Production**	**Max. 30**
	Portion of industrial work**	**Max. 30**
	■ Documentation of compliance with workplace regulation (ASR) A3.5 in workstation areas. see Appendix 2	15
	■ Implementation of additional measures for increasing thermal comfort with regard to the temperature across at least 95% of workstations, e.g. solutions enabling users to change the local temperature themselves, over-fulfilment of the values from Table 1 of workplace regulation A3.5 by at least 1 K	30

* The specified % figures of the acceptable deviation frequency refer to the sum of exceeding and underachieving frequencies (deviation time according to DIN EN 15251, Annex G). Regardless of the classification, the acceptable upper limit of category III can generally be used for the analysis of exceeding temperatures in the heating season. The rating can be done using area-weighted interpolation.

(+) Max.30

Portion of office spaces**

- Compliance with requirements in accordance with the workplace regulation and compliance with the criteria in accordance with DIN EN 15251 Category III, see Appendix 2
  5% deviation frequency of occupancy time is permitted — 10
- Compliance with requirements in accordance with the workplace regulation and compliance with the criteria in accordance with DIN EN 15251 Category II, see Appendix 2
  5% deviation frequency of occupancy time is permitted — 20
- Compliance with requirements in accordance with the workplace regulation and compliance with the criteria in accordance with DIN EN 15251 Category I, see Appendix 2
  3% deviation frequency of occupancy time is permitted — 30

Not applicable for **Shopping centre** , **Department stores**

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2 Drafts/heating period

2.1 Drafts (heating period)

Office **Education** **Residential** **Hotel** **Consumer market** — **7,5**

Consumer market — **15**

- The air velocity at the workstations or in the open space does not rise above the maximum permitted value in accordance with Category B of DIN EN ISO 7730.
  For buildings without indoor air ventilation (HVAC) systems, this requirement is considered to have been complied with.

Shopping centre — **20**

- In all relevant drafts areas in malls (e.g. building entrances, air outlets, cold air downdrafts at façades), necessary measures are implemented to prevent drafts.

Logistics **Production** — **Max. 12**

Portion of industrial work** — Max. 12

- The air velocity at the workstations or in the open space does not rise above the maximum permitted value in accordance with Category B of DIN EN ISO 7730. For buildings without indoor air ventilation (HVAC) systems, this requirement is considered to have been complied with. — 8
- In addition, a concept for evaluating the risk of drafts due to open doors must be created. The structural, technical or organisational measures required based on the concept, such as air curtain systems, double door systems, automated door systems, high-speed doors, etc., are implemented. — +4

Portion of office spaces** — **(+) 12**

- The air velocity at the workstations or in the open space does not rise above the maximum permitted value in accordance with Category B of DIN EN ISO 7730. For buildings without indoor air ventilation (HVAC) systems, this requirement is considered to have been complied with.

Assembly buildings **7.5**

- Intermediate level for buildings, such as exhibition halls, where the large number of functional gates is required:
  In all areas, in which drafts can impair comfort, the certain measures have been implemented to avoid drafts (e.g. at building entrances, air outlets, air inlet openings for natural ventilation). 3
- The air speed at the workplaces or in the occupied area does not rise above the maximum permissible value according to Category B of the DIN EN ISO 7730. For buildings without air conditioning systems, the requirement is considered to be fulfilled. 7.5

Not applicable for **Department stores**

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3 Radiant temperature asymmetry and floor temperature/heating period

3.1 Radiant temperature asymmetry and floor temperature (heating period)

Office **Education** **Residential** **Hotel** **Assembly buildings** **7.5**
Logistics **Production** **2**

- The interior surface temperatures largely comply with the following limit values:

Ceiling maximum	35 °C
Glass surfaces of the façade/wall minimum	18 °C
Glass surfaces of the façade/wall maximum	35 °C
Floor maximum	29 °C

Additionally for **Logistics** **Production** **+ 4,5**

- Documentation of sufficient structural/technical measures for preventing radiant temperature asymmetry

Note: for certain types of the scheme **Assembly buildings** this indicator is **variable**
(for more detailed information refer to the chapter: “IV. Usage-specific description”)

Not applicable for **Shopping centre** **Department stores** **Consumer market**

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4 Relative humidity/heating period (quantitative)

4.1 Relative humidity (heating period)

Office **Education** **Residential** **Logistics** **Production** **Consumer market** **5**
Assembly buildings
Shopping centre **10**

- The indoor air does not become too dry during the heating period (even in the event of low exterior temperatures or dry exterior air), i.e. the indoor humidity meets the following requirement:

$$\varphi \geq 25\%$$

This requirement is met over at least 95% of the operating hours.

Hotel **5**

- The indoor air does not become too dry during the heating period (even in the event of low exterior temperatures or dry exterior air), i.e. the indoor humidity meets the following requirement:

$$75\% \geq \varphi \geq 25\%$$

This requirement is met over at least 95% of the operating hours.

Not applicable for **Department stores**

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5 Operative temperature/indoor air temperature/cooling period

5.1 Operative temperature (cooling period)

(Area-weighted interpolation is possible)

Office **Education** **Residential** **Hotel** **Assembly buildings** **Max. 35**

Consumer market **Max. 30**

- Compliance with minimum national criteria to avoid overheating in summer, or with MIN_FAC*, whichever is stricter, see Appendix 3 — 10
- compliance with the criteria in accordance with DIN EN 15251 Category III, see Appendix 3.5% deviation frequency of occupancy time is permitted — 20
- Compliance with the criteria in accordance with DIN 4108-2 and compliance with the criteria in accordance with DIN EN 15251 Category II, see Appendix 3, 5% deviation frequency of occupancy time is permitted — 30
- Compliance with the criteria in accordance with DIN EN 15251 Category I, see Appendix 3, 3% deviation frequency of occupancy time is permitted. — 35

(not applicable for **Consumer market**)

Education **20**

- Kindergarten: Shaded exterior areas are always accessible.

Class: Compliance with the criteria in accordance with DIN EN 15251 Category III, see Appendix 3
5% deviation frequency is permitted*

Hotel Note: Evaluation of this indicator can be carried out by means of different classification of office and hotel rooms into the categories mentioned above (max. 35 points).

Shopping centre **Max. 40**

Please note: Evaluation of this indicator can be carried out by means of different classification of the mall/shopping street and the rental spaces (max. 40 points)

Temperature/cooling period of mall/shopping street **Max. 15**

- Compliance with minimum national criteria to avoid overheating in summer, or with MIN_FAC*, whichever is stricter, see Appendix 3 — 6
- Compliance with the criteria in accordance with DIN EN 15251 Category III, upper temperature limit
  qi = 0.33 θ_{rm} + 18.8 °C + 4 K
  5% frequency of exceeding is permitted — 9
- Compliance with the criteria in accordance with DIN EN 15251 Category II, upper temperature limit
  qi = 0.33 θ_{rm} + 18.8 °C + 3 K
  5% frequency of exceeding is permitted — 12
- Compliance with the criteria in accordance with DIN EN 15251 Category I, upper temperature limit — 15

qi = 0.33 θ_{rm} + 18.8 °C + 2 K
3% frequency of exceeding is permitted

* The specified % figures of the permissible deviation frequency refer to the sum of exceeding and underachieving frequencies (deviation time according to DIN EN 15251, Annex G). Regardless of the classification, the permissible upper limit of category III can generally be used for the analysis of exceeding temperatures in the heating period. The rating can be interpolated area-weighted.

** The thermal comfort requirements for office and industrial work to be evaluated according to evaluation guide (see method)

Temperature/cooling period/rental space	**+ Max. 25**
■ Compliance with minimum national criteria to avoid overheating in summer, or with MIN_FAC*, whichever is stricter, see Appendix 3	10
■ 40 W/m²	15
■ 60 W/m²	20
■ 80 W/m²	25
Alternative documentation	
■ Compliance with minimum national criteria to avoid overheating in summer, or with MIN_FAC*, whichever is stricter, see Appendix 3	10
■ Compliance with the criteria in accordance with DIN EN 15251 Category III, see Appendix 3	15
5% deviation frequency is permitted	
■ Compliance with the criteria in accordance with DIN EN 15251 Category II, see Appendix 3	20
5% deviation frequency is permitted	
■ Compliance with the criteria in accordance with DIN EN 15251 Category I, see Appendix 3	25
3% deviation frequency is permitted	

Department stores	**Max. 100**
■ Compliance with the criteria in accordance with DIN 4108-2, see Appendix 3	10
■ 40 W/m²	25
■ 60 W/m²	75
■ 80 W/m²	100
Alternative documentation	
■ Compliance with minimum national criteria to avoid overheating in summer, or with MIN_FAC*, whichever is stricter, see Appendix 3	10
■ Compliance with the criteria in accordance with DIN EN 15251 Category III, see Appendix 3	25
5% deviation frequency is permitted	
■ Compliance with the criteria in accordance with DIN EN 15251 Category II, see Appendix 3	75
5% deviation frequency is permitted	
■ Compliance with the criteria in accordance with DIN EN 15251 Category I, see Appendix 3	100
3% deviation frequency is permitted	

Logistics **Production**	**Max. 30**
Portion of industrial work**	**Max. 30**
■ Compliance with workplace regulation A3.5 see Appendix 3.	10

- If the air temperature in the workstation area exceeds 26 °C, structural and technical measures are implemented — 15
- Limiting the air temperature in the workstation area to a maximum of 30 °C — 20
- Limiting the air temperature in the workstation area to a maximum of 26 °C. — 30

Portion of office spaces** — **(+) Max. 30**

- Compliance with minimum national criteria to avoid overheating in summer, or with MIN_FAC*, whichever is stricter, see Appendix 3 — 10
- Compliance with DIN 4108-2 and compliance with the criteria in accordance with DIN EN 15251 Category III, see Appendix 3 (5% deviation frequency is permitted) — **15**
- Compliance with DIN 4108-2 and compliance with the criteria in accordance with DIN EN 15251 Category II, see Appendix 3 (5% deviation frequency is permitted) — **20**
- Compliance with DIN 4108-2 and compliance with the criteria in accordance with DIN EN 15251 Category I, see Appendix 3 (3% deviation frequency is permitted) — 30

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6 Drafts/cooling period

6.1 Drafts (cooling period)

Office **Education** **Residential** **Hotel** **Logistics** **Production** **Assembly buildings** — **5**

Consumer market — **15**

- Compliance with Cat. B in accordance with DIN EN ISO 7730, Annex A, Figure A2. For buildings without indoor air ventilation (HVAC) systems, this requirement is considered to have been complied with.

Shopping centre

- In all relevant drafts areas in malls (e.g. building entrances, air outlets, air vent openings for natural ventilation), necessary measures are implemented to prevent drafts. — **20**

Not applicable for **Department stores**

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7 Radiant temperature asymmetry and floor temperature/cooling period

7.1 Radiant temperature asymmetry and floor temperature (cooling period)

Office **Education** **Residential** **Hotel** **Assembly buildings** — **5**

Logistics **Production** — **2**

The interior surface temperatures largely comply with the following limit values:

Ceiling minimum	16 °C	
Ceiling maximum	35 °C	
Glass surfaces of the façade/wall minimum		18 °C
Glass surfaces of the façade/wall maximum		35 °C
Floor minimum	19 °C	
Floor maximum	29 °C	

Additionally for **Logistics** **Production** 4,5

- Documentation of sufficient structural/technical measures for preventing radiant temperature asymmetry.

Not applicable for **Shopping centre** **Department stores** **Consumer market**

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8 Indoor humidity/cooling period

8.1 **Indoor humidity (cooling period)**

Office **Education** **Residential** **Hotel** **Logistics** **Production** **Consumer market** **5**
Assembly buildings

Shopping centre **10**

The indoor air does not become too humid during the cooling period (even in the event of high exterior temperatures), i.e. the indoor humidity meets the following requirements:

- Absolute humidity < 12 g/kg

The requirements for indoor humidity must be complied with, regardless of whether the interior spaces are ventilated through windows or a ventilation system.

Not applicable for **Department stores**

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9 AGENDA 2030 BONUS – CLIMATE ADAPTATION **+5**

Resilient thermal comfort: The frequency of exceeding during the heating and cooling period is determined for buildings using climate data predictions for 2030 and 2050. The results are used in the decision-making process at the planning stage.

** The thermal comfort requirements for office and industrial work to be evaluated according to evaluation guide(see method)

SUSTAINABILITY REPORTING AND SYNERGIES

Sustainability reporting

Appropriate key performance indicators (KPIs) include communicating the values for operative temperature, air velocities, surfaces and indoor humidity. Basic data and the results of a thermal simulation can be used for reporting purposes in accordance with the "Level(s) – Common EU framework of core environmental indicators".

NO.	KEY PERFORMANCE INDICATORS (KPIS)	UNIT
KPI 1	Frequency of deviation of the operative temperature (heating and cooling period), corresponds to Level(s) indicator 4.2: Time out of range	[%]
KPI 2	Number or proportion of workstations where the specified frequency of deviation of the operative temperature (heating and cooling period) is applicable	[%]
KPI 3	Upper and lower temperature limits for the operative temperature (heating and cooling period), corresponds to Level(s) indicator 4.2: Performance Assessment results	[°C]
KPI 4	Maximum air velocities at the workstations (heating and cooling period)	[%]
KPI 5	Number of workstations where the specified air velocities is applicable	[%]
KPI 6	Maximum and minimum interior surface temperatures	[°C]
KPI 7	Indoor humidity (maximum and minimum) corresponds to elements of Level(s) indicator 4.1.1 for 95% of the operating time	[%]
KPI 8	Climate zone, and heating and cooling days also correspond to Level(s) basic data regarding the building	[zone] [number]
KPI 9	Number of exceeding temperature hours in 2030 and 2050 corresponds to Level(s) indicator 5.1: Time outside of thermal comfort range – Time out of range 2030/2050	[kh/a]

Synergies with DGNB System applications

- **DGNB OPERATION:** Achieving a high level of thermal comfort for buildings in use (BIU) is indirectly assessed positively for the evaluation of the user satisfaction in criterion SOC9.1.
- **DGNB RENOVATED BUILDINGS:** Large similarities with criterion SOC1.1 in the REN scheme.
- **DGNB INTERIORS:** Criterion PRO1.1 establishes an incentive for taking sustainability aspects of thermal comfort into account when choosing rental spaces.

APPENDIX A – DETAILED DESCRIPTION

I. Relevance

Thermal comfort in buildings significantly contributes to ensuring an efficient and productive working and living environment, and to achieving high levels of user satisfaction.

A room is thermally comfortable if it is neither too cold nor too warm, the air is neither too dry nor too humid and that no draft is present.

II. Additional explanation

The acceptability of the indoor climate depends on the indoor air temperature, the temperature of the surfaces surrounding the user, the air velocity in the room and the relative humidity, throughout both the cooling period and the heating period. This should take into account not only the overall level of comfort, but also the possibility of local phenomena occurring that could negatively impact thermal comfort. This means that a person could be overall thermally comfortable, but still experience discomfort on a part of their body due to local drafts.

III. Method

Thermal comfort in the heating and cooling period is evaluated via several individual indicators. The specifications of DIN EN 15251, DIN EN ISO 7730, DIN EN ISO 13786, DIN EN ISO 10211, together with the DIN EN ISO 13370, (or) DIN EN ISO 13789, DIN EN 12831 and the workplace regulation (from German Employers' Liability Insurance Association) form the basis of the evaluation.

The following indicators are assessed as part of the evaluation:

(1) Operative temperature/indoor air temperature/heating period (quantitative)
(2) Drafts/heating period (qualitative)
(3) Radiant temperature asymmetry and floor temperature/heating period (qualitative)
(4) Relative humidity/heating period (quantitative)
(5) Operative temperature/indoor air temperature/cooling period (quantitative)
(6) Drafts/cooling period (qualitative)
(7) Radiant temperature asymmetry and floor temperature/cooling period (qualitative)
(8) Relative humidity/cooling period (quantitative)
(9) Agenda 2030 bonus: Thermal comfort climate adaptation

The vertical temperature gradient is an indicator that cannot yet be assessed and is therefore left out of the evaluation.

For the analysis of the operative temperature in the cooling period, it is important to differentiate between rooms with cooling and rooms without cooling.

The following criteria are used to determine whether the building in question is without cooling and therefore whether the adaptive comfort model from DIN EN 15251 should be applied:

- The rooms must have windows or openings that allow exterior air to enter and that can be easily opened and adjusted by users.
- There must not be any mechanical cooling used in the room. Radiant cooling or surface cooling (e.g. cooling ceilings or concrete core cooling/component activation) must be categorised as mechanical cooling for the purposes of this criterion.
- Mechanical ventilation with uncooled air (in the cooling period) may be used, but priority must be given to being able to open and close windows as a means of regulating the indoor climate.
- In addition, other low-energy options for personal regulation of the interior temperature may be used, such as shutters, night time ventilation, etc.
- Appendix 2: Permissible upper and lower temperature limits of the comfort categories in the heating period
- Appendix 3: Permissible upper and lower temperature limits of the comfort categories in the cooling period

Room or area reference
Indicators 1 and 5:
Verification of indicators 1 and 5 "Operative temperature" must be carried out via area-weighted averaging.

It is generally not necessary to simulate the entire building. A representative sample of rooms must instead be analysed (clustering). The representative rooms must be selected so that 95% of the areas described in Appendix 1 correspond to the evaluated quality level. In order to ensure that the results can be applied to the other rooms, the usage zones must be arranged in such a way that different boundary conditions (e.g. specific internal and external loads) and building technology concepts are taken into account. Critical rooms such as corner rooms, rooms with large glass surfaces, etc. must be included in the documentation. In general, it can be assumed that a functioning room concept for a critical room can also ensure thermal comfort for non-critical rooms with otherwise identical conditioning.

Indicators 2, 3, 4, 6, 7, 8:
The other indicators for thermal comfort have a low importance in comparison to indicators 1 and 5, meaning that these indicators are only considered as examples for representative rooms for each scheme. The room under consideration is listed in **bold** in Appendix 1.
The representative room must be selected so that 80% of the usable area under consideration corresponds to the evaluated quality level.

Indicator 9: Agenda 2030 bonus: Thermal comfort climate adaptation
The frequency of exceeding during the heating and cooling period is determined for buildings using climate data predictions for 2030 and 2050. The results are used in the decision-making process at the planning stage. The climate data used should be based on the UN IPCC "Mitigation" (SRES E1) emissions scenario. The "Medium-high" (SRES A1B) emissions scenario can be used as a second "worst-case scenario". Information regarding the assessment methodology and the possible areas of focus in the planning process can be found in the "Level(s) framework" published by the European Commission (Source: "Level(s) – A common EU framework of core sustainability indicators for office and residential buildings", Draft Beta v1.0, Brussels, August 2017).

IV. Usage-specific description

For indicators 1 and 5, all listed rooms are analysed. For the remaining indicators, the rooms that are to be analysed can be found in Appendix 1 (rooms listed in bold).

Office

The room and area reference is shown in Appendix 1: Rooms to be verified, for usage group 2 – Office work.

Education

The room and area reference is shown in Appendix 1: Rooms to be verified, for usage group 5 – Education, teaching and culture.

Indicators 1 and 5: Operative temperature

For the day nurseries building use in the New Education Facilities (NEF) scheme, the required operative room temperature is different than other education-specific building uses.

Residential

The room and area reference is shown in Appendix 1: Rooms to be verified, for usage group 1 – Residential and recreation.

Hotel

The room and area reference is shown in Appendix 1: Rooms to be verified, for usage groups 1 – Residential and recreation and 2 – Office work.

Shopping centre

Contrary to Appendix 1, the following rooms or areas are analysed for evaluation in the scheme NSC15 Shopping centres:

For the following indicators, only the areas within the mall or shopping street are analysed:
2. Drafts/heating period
6. Drafts/cooling period
8. Relative humidity/cooling period
4. Relative humidity/heating period
In indicator 5: Operative temperature/indoor air temperature/cooling period
Indicator 5.1: Mall or shopping street
Indicator 5.2: Tenant areas

The following indicators are not included in this scheme:
1. Operative temperature/indoor air temperature/heating period
3. Radiant temperature asymmetry and floor temperature/heating period
7. Radiant temperature asymmetry and floor temperature/cooling period

Department stores

The room and area reference is shown in Appendix 1: Rooms to be verified, for usage group 4 – Distribution and sales.
Contrary to Appendix 1, only the sales areas are analysed in the scheme Department stores.

The following indicators are not included in this scheme:
1. Operative temperature/indoor air temperature/heating period
2. Drafts/heating period
3. Radiant temperature asymmetry and floor temperature/heating period
4. Relative humidity/heating period
6. Drafts/cooling period
7. Radiant temperature asymmetry and floor temperature/cooling period
8. Relative humidity/cooling period

Logistics **Production**

Evaluation guide:
The requirements for thermal comfort vary for office and industrial work.
For offices with a usable area of ≥ 400 m² or ≥ 20 permanent workstations, the thermal comfort for both office and industrial areas must be analysed.

- Case I: Number of office workstations ≥ 15% of the total workstations or ≥ 20 permanent office workstations:

  Evaluation by proportion of office area and proportion of industrial area

  The room and area reference for usable office area are shown in Appendix 1: Rooms to be verified, for usage groups 2 – Office work and 3 – Production, manual and machine work.

  For the evaluation, the proportion of office area and the proportion of industrial area must be analysed in the individual indicators.

$$\text{Total points} = \text{points for proportion of office area} \times \frac{\text{number of office workstations}}{\text{total number of workstations}} +$$

$$\text{points for proportion of industrial work} \times \frac{\text{number of industrial workstations}}{\text{total number of workstations}}$$

- Case II: Number of office workstations < 15% of the total workstations and < 20 permanent office workstations: Evaluation by proportion of industrial area

  For the evaluation, the proportion of industrial area must be analysed in the individual indicators.
  Total points = points for proportion of industrial work

An evaluation tool has been created to simplify the documentation process.

Indicators 1 and 5:
The following points must be noted for verification of compliance with workplace regulation A3.5:
It is necessary to check whether there are operational requirements at the workstations that could lead to loss of comfort. These include issues regarding air temperature, air humidity, air velocity, thermal radiant, work intensity or clothing. If this is the case, the risk assessment process must involve checking which technical, organisational or personal measures, if any, are necessary, and whether work is to be carried out in hot environments.

Heating period
In addition, the workstations must be categorised based on work intensity in accordance with Table 2 of workplace regulation A3.5. Room heating must be designed such that the minimum values for indoor air temperature, in

accordance with Table 1 of workplace regulation A3.5, are complied with. Local temperature differences and temperature stratification must be taken into account in a suitable form as part of this.

If it is not possible to reach the minimum values in accordance with Table 1 of workplace regulation A3.5 in workspaces, even after exhausting all technical options, additional measures from the following categories, in this order of priority, must be implemented to prevent temperatures from falling too low:

- Technical measures relating to workstations (e.g. thermal radiant heaters, heating mats)
- Organisational measures (e.g. heating periods)
- Personal measures (e.g. suitable clothing).

Documentation that the measures specified above are sufficient can be compiled, for example, using a PMV evaluation in accordance with DIN EN ISO 7730.

Cooling period
In particular cases, working at temperatures above +26 °C can lead to health risks, if, for example:

- Work involves heavy physical labour,
- Special protective clothing must be worn that significantly reduces heat dissipation.

In such cases, additional measures must be chosen for implementation via a risk assessment tailored to the specific circumstances.

Definition
Automated door systems are motorised doors with manual (e.g. radio, pull-cord or push-button) or automatic (e.g. induction loop, radar, laser, light barrier) initiating mechanisms.

High-speed doors are doors with an average opening and closing speed above 0.5 m/s. Suitable organisational measures may include preventing opposite doors opening.

Assembly buildings
The spatial and area reference can be found in Appendix 1: Rooms for use group 2 - office work, 3 - production, manual and machine work, experiment, 4 - storage, distribution, selling, 5 - education, teaching and culture as well as additional information on other areas, such as corridors, foyer areas etc. are to be considered if they are approved to assign the scheme “Assembly Buildings”.

For the assessment of the buildings, which do not operate all year round, the adoption of the usage and operating times e.g. according to the scheme specific EPC / energy simulation / calculation is desirable. In the case of trade fairs, for example, only the event times (when the exhibition is open) are relevant to the assessment and not the time when the hall is closed (the space is vacant), during when the temperature may be reduced.

2. Drafts / heating period
In some building types such as trade fairs, for the proper operation a large number of functional doors are necessary, thus, certain measures to avoid the drafts will be evaluated positively. For all other “Assembly building” types, compliance with the DIN EN ISO 7730 category B, (Appendix A, Figure A2) is a necessary requirement.

3. Radiation temperature asymmetry and floor temperature / heating period (variable). In buildings, such as trade fairs, the indicator 3.1 (variable) can be set to "not relevant" if no areas for permanent residence is in the direct vicinity of ceiling-high glazed elements, or ceilings and/or floors are not used as a source for cooling or heating.

APPENDIX B – DOCUMENTATION

I. Required documentation

Office **Education** **Residential** **Hotel** **Consumer market** **Shopping centre** **Logistics** **Production** **Assembly buildings**

Examples of possible documentation include the following items. The documentation submitted for the evaluation of individual indicators should comprehensively and clearly demonstrate compliance with the relevant requirements Some forms of documentation apply to all schemes. Depending on the scheme, different documentation may also be relevant – in such cases, the relevant documentation will be explicitly stated.

In accordance with Appendix 4: "Permitted documentation processes"

Indicator 1: Operative temperature/indoor air temperature/heating period

Office **Education** **Residential** **Hotel** **Consumer market** **Logistics** **Production** **Assembly buildings**

Basis and results of the completed thermal building simulation
Measurement report for the completed measurements for documenting the thermal comfort
Calculation of the heating load in accordance with DIN EN 12831 or local standard

Indicator 2: Drafts/heating period

Office **Education** **Residential** **Hotel** **Consumer market** **Logistics** **Production** **Assembly buildings**

Characteristics of the air outlets, e.g. in the form of manufacturer data sheets
Basis and results of the completed flow simulations
Measurement reports

Shopping centre **Logistics** **Production buildings** **Assembly buildings**

Representation and documentation of the relevant drafts areas in the mall/shopping street areas
Representation and documentation of the implementation of the required measures to prevent the possibility of drafts

Indicator 3: Radiant temperature asymmetry and floor temperature/heating period

Office **Education** **Residential** **Hotel** **Logistics** **Production** **Assembly buildings** [1]

The permitted documentation process depends on the type of component:

Heated components:
Verification is carried out via documentation of the design.
Non-heated, opaque components:
If the U-values in accordance with criterion TEC1.3 are complied with, it is assumed that the criteria for minimum temperatures are also met.
Non-heated, transparent components:
Zonal thermal simulation
One-dimensional heat flow calculation
Simplified table method

Indicator 4: Indoor humidity/heating period

Office **Education** **Residential** **Logistics** **Production** **Consumer market** **Assembly buildings** **Shopping centre** **Hotel**

[1] Variable Indicator

The permitted verification processes depend on whether the room is equipped with a ventilation system with humidification function:

Mechanical ventilation system with humidification and dehumidification function:
–Verification is carried out via documentation of the design of ventilation system
Rooms without humidification via the mechanical ventilation system, without humidification and dehumidification function, or without window ventilation:
–The requirement is considered to have been met if the indoor humidity can be changed via a device/system.
Zonal moisture simulation or expansion of the thermal simulation to include moisture balances that represent the chronological progression of air humidity in the room

Indicator 5: Operative temperature/indoor air temperature/cooling period
Basis and results of the completed thermal building simulation
Measurement report for the completed measurements for documenting the thermal comfort
Cooling load calculations in accordance with EN 16798-11 (Module 3 and 4 from ISO 52000-1) or local standard

Indicator 6: Drafts/cooling period
Characteristics of the air outlets, e.g. in the form of manufacturer data sheets
Basis and results of the completed flow simulations
Office **Education** **Residential** **Hotel** **Logistics** **Production** **Assembly buildings**
Measurement reports
Intermediate level **Assembly buildings**
Presentation of the measures to avoid drafts

Indicator 7: Radiant temperature asymmetry and floor temperature/cooling period
Office **Education** **Residential** **Hotel** **Logistics** **Production** **Assembly buildings**
Documentation of the design of the cooled components

Office **Education** **Hotel** **Consumer market**
Representation of the overall concept for the façade/solar radiation protection/cooling system
Zonal room simulations
CFD flow simulations or spectral calculations

Indicator 8: Indoor humidity/cooling period
The permitted verification processes depend on whether the room is equipped with a ventilation system with a humidification function:
Mechanical ventilation system with humidification and dehumidification function:
–Verification is carried out via documentation of the design of the ventilation system
Rooms without humidification via the mechanical ventilation system, without humidification and dehumidification function, or without window ventilation:
–Expansion of the thermal simulation to include moisture balances that represent the chronological progression of air humidity in the room

Office **Education** **Residential** **Hotel** **Logistics** **Production** **Shopping centre** **Assembly buildings**
Zonal moisture simulation
The permitted verification processes depend on whether the room is equipped with a ventilation system with a humidification function:

Mechanical ventilation system with humidification and dehumidification function:
Verification is carried out via documentation of the design of the ventilation system
Rooms without humidification via the mechanical ventilation system, without humidification and dehumidification function, or without window ventilation:
Zonal moisture simulation or expansion of the thermal simulation to include moisture balances that represent the chronological progression of air humidity in the room Zonal moisture simulation

Indicator 9: Agenda 2030 bonus: Thermal comfort climate adaptation

- Results of the thermal simulation/calculation which are done using the climate data predictions for 2030 and 2050

APPENDIX C – LITERATURE

I. Version

Change log based on version 2018

PAGE	EXPLANATION	DATE
all	Genral, Evaluation and Usage-specific description: scheme “Assembly buildings” has been added	16.09.2021
	Appendix 1: areas for the scheme “Assembly buildings” have been added	16.09.2021
	Indicator 9: Agenda 2030 bonus: type-error correction, instead of A!B is now A1B	16.09.2021

II. Literature

- DIN 277-1:2016-01: Areas and volumes of buildings – Part 1: Building construction, Berlin, January 2016
- DIN 33403-02. Climate at the workplace and in its environments – Part 2: Effect of the climate on the heat balance of human beings. Berlin: Beuth Verlag. August 2000
- DIN EN 4108-2. Thermal protection and energy economy in buildings – Part 2: Minimum requirements to thermal insulation. Berlin: Beuth Verlag. February 2013
- DIN EN 12831. Heating systems in buildings – Method for calculation of the design heat load. Berlin: Beuth Verlag. August 2003
- DIN EN 13363. Solar protection devices combined with glazing – Calculation of total solar energy transmittance and light transmittance – Part 2: Detailed calculation method. Berlin: Beuth Verlag. June 2005
- DIN EN 15251. Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics. Berlin: Beuth Verlag. December 2012
- DIN EN ISO 7726. Ergonomics of the thermal environment – Instruments for measuring physical quantities. Berlin: Beuth Verlag. April 2002
- DIN EN ISO 7730. Ergonomics of the thermal environment – Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria. Berlin: Beuth Verlag. May 2006
- ISO 15099. Thermal performance of windows, doors and shading devices – detailed calculations. Berlin: Beuth Verlag. March 2011
- VDI guideline VDI 2078. Calculation of cooling load and room temperatures of rooms and buildings (VDI Cooling Load Code of Practice). Düsseldorf: Verein Deutscher Ingenieure e.V. June 2015
- VDI guideline VDI 3804. Air-conditioning – Office buildings (VDI ventilation code of practice). Düsseldorf: Verein Deutscher Ingenieure e.V. March 2009
- VDI guideline VDI 6020: Requirements on methods of calculation to thermal and energy simulation of buildings and plants. Verein Deutscher Ingenieure e.V.
- Workplace regulation A3.5 Raumtemperatur [Room temperature]. German Federal Institute for Occupational Safety and Health (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin). June 2010

APPENDIX 1

Rooms to be verified

ROOMS TO BE VERIFIED

PLEASE NOTE: DIFFERENT USES WITHIN A BUILDING MUST BE REPRESENTED THROUGH AREA-WEIGHTAGE IN ACCORDANCE WITH THE AREAS DESCRIBED BELOW. A REPRESENTATIVE SAMPLE OF ROOMS MUST BE ANALYSED (CLUSTERING). THE REPRESENTATIVE ROOMS MUST BE SELECTED SO THAT 95% OF THE AREAS CORRESPOND TO THE EVALUATED QUALITY LEVEL.

SCHEME	TYPE OF USABLE AREA (UA) IN ACCORDANCE WITH DIN 277-1 BEING VERIFIED (Area definitions under the doc. Evaluation and structure of the DGNB system, chapter 4 "T&D")	
	TABLE 1: NO. – USE GROUP	TABLE 2: NO. – AREAS AND VOLUMES
Office	2 – Office work (UA 2)	**Office rooms** **Open-plan offices** Meeting rooms (these are also considered to include conference rooms) Design rooms Ticket office Control rooms Surveillance rooms
Consumer markets **Shopping centre**	2 – Office work (UA 2)	**Office rooms** **Open-plan offices** Meeting rooms Design rooms Ticket office Control rooms Surveillance rooms
Department stores	4 – Distribution and sales (excl. storage) (UA 3 and 4)	Reception and distribution areas (where these are permanent working areas) **Sales rooms** Showrooms Workshops (where these are permanent working areas)

	2 – Office work (portion of administrative work) (UA 2)	**Office rooms** **Open-plan offices** Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms
Logistics buildings **Production buildings**	3 – Production, manual and machine work, experiment (portion of industrial work) (UA 3)	**Factory halls** **(where these are permanent working areas)** **Workshops** **(where these are permanent working areas)** Technological laboratories Physics, engineering physics and electrical engineering laboratories Chemistry, bacteriology and morphology laboratories
	4 – Storage, distribution, sales(only the designated work zones) (UA 4)	Warehouses Archives, collection rooms **Reception and distribution areas (these are also considered to include order picking areas)**
Residential	1 – Residential and recreation (UA 1)	**Living spaces** Common rooms Break rooms Waiting rooms Dining rooms
Hotel	1 – Residential and recreation (portion of hotel rooms) (UA 1)	**Living spaces** Common rooms Break rooms Waiting rooms Dining rooms
	2 – Office work (portion of offices) (UA 2)	**Office rooms**
Education	5 – Education, teaching and culture (UA 5)	**Classrooms with fixed seating** **General classrooms and practice rooms without fixed seating** Dedicated classrooms and practice rooms without fixed seating Library rooms Assembly rooms or areas Stages, studios Exhibition rooms

	2 – office work (UA 2)	**Office rooms** **Open-plan offices** Meeting rooms (these are also considered to include conference rooms) Design rooms Ticket office Control rooms Surveillance rooms Office equipment rooms
	3 – Production, manual and machine work, experiment (only the designated work areas) (UA 3)	**Factory halls** **(where these are permanent working areas)** **Workshops** **(where these are permanent working areas)** Technological laboratories Physics, engineering physics and electrical engineering laboratories Rooms for keeping animals rooms for plant cultivation Commercial kitchens (including dispensing and returning) Special workrooms (for housekeeping, laundry care, etc.)
Assembly buildings	4 – Storage, distribution, sales, in particular (only the designated work zones) (UA 4)	Warehouses Archives, collection rooms **Reception and distribution areas (these are also considered to include order picking areas, sales rooms, exhibition rooms)**
	5 – Education, teaching and culture (UA 5)	**Classrooms with fixed seating** **General classrooms and practice rooms without fixed seating** Dedicated classrooms and practice rooms without fixed seating Library rooms Assembly rooms or areas Stages, studios Exhibition rooms
	Remarks regarding variable area usage: ▪ Floor areas with variable usage (e.g. entrance halls to the traffic area despite simultaneous use for information, breaks, exhibitions, etc.) are to be allocated to the above-mentioned areas according to the predominant use. ▪ Circulation areas within rooms (e.g. between the furnishings in open-plan offices or between machines in factory halls or visitor aisles in exhibitions) do not belong to the circulation area (CS), but to the usable area (UA).	

APPENDIX 2

Permitted lower temperature limits during the heating period (in accordance with DIN EN 15251 and DIN EN ISO 7730)

	LEVEL OF ACTIVITY	CATEGORY IN ACCORDANCE WITH DIN EN 15251	PMV INDEX/OPERATIVE TEMPERATURE FOR HEATING PERIOD LOWER LIMIT CLOTHING ≈ 1.0 CLO	PMV INDEX/OPERATIVE TEMPERATURE FOR HEATING PERIOD UPPER LIMIT CLOTHING ≈ 1.0 CLO
Office work	Sitting ~ 1.2 met	Category I	-0.2 / +21.0 °C	
		Category II	-0.5 / +20.0 °C	
		Category III	-0.7 / +19.0 °C	+0.7 / +25.0 °C
Distribution and sales – I	Standing, walking ~ 1.6 met	Category I	-0.2 / +17.5 °C	
		Category II	-0.5 / +16.0 °C	
		Category III	-0.7 / +15.0 °C	+0.7 / +23.0 °C
Distribution and sales – II	Working ~ 2.0 met	Category I	-0.2 / +14.0 °C*	
		Category II	-0.5 / +12.0 °C*	
		Category III	-0.7 / +11.0 °C*	+0.7 / +21.0 °C*
Production, manual and machine work, experiment – I	Working ~ 1.6 met	Category I	-0.2 / +17.5 °C	
		Category II	-0.5 / +16.0 °C	
		Category III	-0.7 / +15.0 °C	+0.7 / +23.0 °C
Production, manual and machine work, experiment – II	Working ~ 2.0 met	Category I	-0.2 / +14.0 °C*	
		Category II	-0.5 / +12.0 °C*	
		Category III	-0.7 / +11.0 °C*	+0.7 / +21.0 °C*

Residential and recreation	Sitting ~ 1.2 met	Category I	-0.2 / +21.0 °C	
		Category II	-0.5 / +20.0 °C	
		Category III	-0.7 / +18.0 °C	+0.7 / +25.0 °C
Education, teaching and culture	Sitting ~ 1.2 met	Category I	-0.2 / +21.0 °C	
		Category II	-0.5 / +20.0 °C	
		Category III	-0.7 / +19.0 °C	+0.7 / +25.0 °C
Kindergarten	Standing, walking ~ 1.4 met	Category I	-0.2 / +19.0 °C	
		Category II	-0.5 / +17.5 °C	
		Category III	-0.7 / +16.5 °C	+0.7 / +23.5 °C

* Values determined in accordance with DIN EN ISO 7730

For analysis of temperatures exceeding limit values during the heating period, the permitted upper limit from **Category III** can generally be used regardless of the classification.

If the levels of activity or the clothing factors do not correspond to those in the actual use conditions, the PMV can also be verified as an alternative to the operative temperature. The selected boundary conditions must be verified. The clothing factor must be applied consistently for the heating period.

Permitted minimum values for the indoor air temperature in work areas in accordance with workplace regulation A3.5

PRIMARY POSTURE	WORK INTENSITY: LIGHT	WORK INTENSITY: MEDIUM	WORK INTENSITY: HEAVY
Sitting	+ 20 °C	+ 19 °C	-
Standing, walking	+ 19 °C	+ 17 °C	+ 12 °C

WORK INTENSITY	EXAMPLES
Light	Light manual/arm work while sitting or standing still, combined with occasional walking
Medium	Medium-intensity manual/arm or leg work while sitting, walking or standing
Heavy	Heavy manual/arm or leg work while sitting, walking or standing

APPENDIX 3

Permitted upper temperature limits during the cooling period (in accordance with DIN EN 15251 and DIN EN ISO 7730)

	LEVEL OF ACTIVITY	CATEGORY IN ACCORDANCE WITH DIN EN 15251	PMV INDEX/OPERATIVE TEMPERATURE FOR BUILDINGS WITH MECHANICAL COOLING CLOTHING ≈ 0.5 CLO		PMV INDEX/OPERATIVE TEMPERATURE FOR BUILDINGS WITH NO COOLING: ADAPTIVE COMFORT MODEL CLOTHING ≈ 0.5 CLO	
			LOWER LIMIT FOR COOLING PERIOD	UPPER LIMIT FOR COOLING PERIOD	LOWER LIMIT FOR COOLING PERIOD	UPPER LIMIT FOR COOLING PERIOD
Office work	Sitting ~ 1.2 met	Category I		+0.2 / +25.5 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 2\ K$
		Category II		+0.5 / +26.0 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 3\ K$
		Category III	-0.7 / +22.0 °C	+0.7 / +27.0 °C	$\theta_i = 0.33\theta_{rm} + 18.8\ °C - 4\ K$	$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 4\ K$
Distribution and sales – I	Standing, walking ~ 1.6 met	Category I		+0.2 / +24.0 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 2\ K$
		Category II		+0.5 / +25.0 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 3\ K$
		Category III	-0.7 / +20.0 °C	+0.7 / +26.0 °C	$\theta_i = 0.33\theta_{rm} + 18.8\ °C - 6\ K$	$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 4\ K$

Distribution and sales – II	Working ~ 2.0 met	Category I		+0.2 / +25.5 °C*		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 2\ K$
		Category II		+0.5 / +26.0 °C*		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 3\ K$
		Category III	-0.7 / +17.0 °C*	+0.7 / +27.0 °C*	$\theta_i = 0.33\theta_{rm} + 18.8\ °C - 9\ K$	$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 4\ K$
Production, manual and machine work, experiment – I	Working ~ 1.6 met	Category I		+0.2 / +24.0 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 2\ K$
		Category II		+0.5 / +25.0 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 3\ K$
		Category III	-0.7 / +20.0 °C	+0.7 / +26.0 °C	$\theta_i = 0.33\theta_{rm} + 18.8\ °C - 6\ K$	$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 4\ K$
Production, manual and machine work, experiment – II	Working ~ 2.0 met	Category I		+0.2 / +22.0 °C*		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 2\ K$
		Category II		+0.5 / +23.0 °C*		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 3\ K$
		Category III	-0.7 / +17.0 °C*	+0.7 / +24.0 °C*	$\theta_i = 0.33\theta_{rm} + 18.8\ °C - 9\ K$	$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 4\ K$
Residential and recreation	Sitting ~ 1.2 met	Category I		+0.2 / +25.5 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 2\ K$
		Category II		+0.5 / +26.0 °C		$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 3\ K$
		Category III	-0.7 / +22.0 °C	+0.7 / +27.0 °C	$\theta_i = 0.33\theta_{rm} + 18.8\ °C - 4\ K$	$\theta_i = 0.33\theta_{rm} + 18.8\ °C + 4\ K$

Education, teaching and culture	Sitting ~ 1.2 met	Category I		+0.2 / +25.5 °C		θ_i = 0.33θ_{rm} + 18.8 °C + 2 K
		Category II		+0.5 / +26.0 °C		θ_i = 0.33θ_{rm} + 18.8 °C + 3 K
		Category III	-0.7 / +22.0 °C	+0.7 / +27.0 °C	θ_i = 0.33θ_{rm} + 18.8 °C - 4 K	θ_i = 0.33θ_{rm} + 18.8 °C + 4 K
Kindergarten	Standing, walking ~ 1.4 met	Category I		+0.2 / +24.5 °C		θ_i = 0.33θ_{rm} + 18.8 °C + 2 K
		Category II		+0.5 / +25.5 °C		θ_i = 0.33θ_{rm} + 18.8 °C + 3 K
		Category III	-0.7 / +21.0 °C	+0.7 / +26.0 °C	θ_i = 0.33θ_{rm} + 18.8 °C - 5 K	θ_i = 0.33θ_{rm} + 18.8 °C + 4 K

* Values determined in accordance with DIN EN I

For analysis of temperatures falling below limit values in the cooling period, the permitted lower limit from **Category III** can generally be used regardless of the classification.

If the levels of activity or the clothing factors do not correspond to the actual use conditions, the PMV can be verified as an alternative to the operative temperature. The selected boundary conditions must be verified. The clothing factor must be applied consistently for the cooling period.

As per DIN 15251, the adaptive comfort model only applies to sitting tasks with a level of activity between 1.0 and 1.3 met. In accordance with DIN EN 15251, an adaptive comfort model is permitted here as a conversion table, even for uses with a high level of activities. The upper limit is set similarly for sitting activities. The lower limit is shifted downwards in accordance with the level of activity. In the table shown above, the upper and lower limits for each scheme are specified.

Permitted maximum values for the indoor air temperature in work areas in accordance with workplace regulation A3.5, portion of industrial work
For the cooling period, a maximum indoor air temperature in accordance with workplace regulation A3.5 of 26 °C is initially assumed. However, changes to the limit are permitted, but a maximum limit value of 30 °C is set for the verification of industrial workstations.

Requirements for summer heat protection (MIN_FAC)

Table 1: Definition of **MIN_FAC**

	MECHANICALLY HEATED BUILDING (OFFICES AND SIMILARLY USED SPACES)	BUILDING WITHOUT ACTIVE COOLING OR WITHOUT AIR CONDITIONING
MIN_FAC	$S_{HP,} = W_{WR} \cdot g_t \leq 0.16 = S\ hp,_{max}$	$SHP = W_{WR} \cdot g_t \leq 0.16 = S\ hp,_{max}$

where:

W_{WR} is the window to wall ratio = window area / wall area
window area = sum of all windows (including window frames and mullions)
wall area = area of the exterior wall (width * floor to ceiling height) including all transparent and opaque parts of the wall

g_t is the combined total shading coefficient of window system, glazing and sun protection.

S_{HP} (Solar Heat Protection) is the factor to avoid overheating for office rooms according to DIN EN 13363
Alternative: Thermal, solar and daylight properties of building components and elements according to either detailed calculation method ISO 52022-3:2017 or Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing ISO 52022-1:2017.

APPENDIX 4

Permitted verification processes

The methods listed below are accepted for the verification of the indicators listed in the criterion or fulfilment of the relevant requirements.

Indicators 1 and 5: Operative temperature

1. Zonal thermal room simulation

Thermal room simulation carried out on a zonal basis (= thermal building simulation) must be performed by an expert, for more details refer to the criterion ENV1.1 Appendix 2.1 – “Basic principles and relevant standards for the dynamic building simulation. The software used for the simulation must be validated in accordance with DIN EN 15265 and/or DIN EN 15255, or ASHRAE 140: 2011 (or latest) standards, for more options refer to the ENV1.1 Appendix 2 and 4.
The simulation results regarding thermal comfort during the heating period must only be evaluated for this time frame (in accordance with DIN EN 15251, the heating period is defined as the time over which the building must be heated). This means that only the heating period may be used for the assessment of the permitted frequency of falling below and exceeding the limits (not the entire year).
If more precise data regarding the heating period is not available, for the purposes of simplification, the period from 1st November to 30th April can be assumed as the heating period.
The simulation results regarding thermal comfort in the cooling period must only be evaluated for the cooling period (in accordance with DIN EN 15251, the cooling period is defined as the time over which the building does not need to be heated). This means that only the cooling period may be used for the assessment of the permitted frequencies of exceeding and falling below the limits (not the entire year).
If more precise data regarding the cooling period (= non-heating period) is not available, for the purposes of simplification, the period from 1st May to 31st October can be assumed.

The simulations regarding thermal comfort must be based on the current weather data provided by local Meteorological Services for the relevant site (= test reference year for the region). Assessment have to be performed using the microclimate of the building site location (e.g. "urban heat island" for inner city locations), using typical meteorological climate data in hourly values for the location (test reference year), adopted to the local climate known from the past 30 years.
If suspended ceilings and/or sound-absorbing panels are planned in order to ensure that the acoustic conditions of the room are good, the acoustic elements evaluated in criterion SOC1.3 Acoustic comfort must be taken into account during the thermal simulations.

Information:
The zonal thermal room simulation can be used to document the following indicators:

- Operative temperature (= average value in the room)
- Radiant temperature asymmetry and floor temperature (= average value for the surface temperature in the room)
- Relative air humidity (= average value in the room).

2. Measurement in accordance with DIN EN 15251

The measurements for verification of the thermal comfort in the heating and cooling period must meet the requirements for comfort measurements in accordance with DIN EN 15251:

- The measurements must be carried out in representative rooms in typical operating phases.
- The measurements must be carried out under typical weather conditions for the cold or warm season as applicable. This means that the measurements in the heating period must be carried out at or below the statistically average exterior temperature for the three coldest months of the year. In the cooling period, the measurements must be carried out at or above the statistically average exterior temperature for the three warmest months of the year.
- The duration of the temperature measurements should be selected such that it is representative.
- The measuring device used for evaluation of the thermal indoor climate must meet the requirements for measuring accuracy specified in DIN EN ISO 7726.

Information:
The thermal comfort measurements can be used to document the following indicators:

- Operative temperature (= at selected, representative workstations)
- Drafts (= at selected, representative workstations)
- Radiant temperature asymmetry and floor temperature (= interior surface temperatures)
- Relative humidity (= at selected, representative workstations).

3. Calculation of the heating load in accordance with DIN EN 12831 or calculation of the cooling load in accordance with EN 16798 (Module M4 from the modular structure of the EN ISO 52000-1)

As an alternative, documentation can be carried out on the basis of the room using the calculation of the heating load in accordance with DIN EN 12831 or the calculation of the cooling load in accordance with EN 16798, if the following conditions have been met for the room being verified:

Definition of the window area proportion: The reference area is the façade area visible from the inside.

For the heating period:

Window area proportion of f < 40%

- The room being verified has a window area proportion of f < 40%.
- The lower limits for the operative temperature specified in Appendix 2 are determined via calculation of the heating load in accordance with DIN EN 12831 for the sizing of the heating system.

Window area proportion of f ≥ 40%

Documentation can be carried out via the calculation of the heating load in accordance with DIN EN 12831 if the room is heated via a rapid regulating heating system (e.g. heating sail, radiator, convection heater) with single-room regulation. The following conditions must also be met:

- The room being verified has a window area proportion of f between 40% and 70% with a U_w value of ≤ 1.3 W/m²K.
- The room being verified has a window area proportion with reference to the façade of f > 70% with a U_w value of ≤ 1.0 W/m²K.
- Heating systems integrated into components (e.g. underfloor heating, capillary tube mats) are not rapid regulating heating systems. This means that documentation of the calculation of the heating load in accordance with DIN EN 12831 is not permitted in such cases.
- In order to compensate for the difference between the operative temperature and the air temperature caused by the higher window area proportion (f ≥ 40%), the air temperature as per the calculation of the heating load in accordance with DIN EN 12831 (= design temperature) must be 1 K above the temperatures specified for Categories I, II and III in Appendix 2, in order to achieve the same number of checklist points.

Sales rooms or showrooms (AG > 100 m²)

- For large sales rooms or showrooms (AG > 100 m²), documentation via the calculation of the heating load in accordance with DIN EN 12831 is generally permitted.

As the static calculation of the heating load in accordance with DIN EN 12831 cannot provide information regarding instances where the temperature falls below or exceeds the design temperature, documentation of the frequency of falling below and exceeding the temperature is not required for this verification process, for the purposes of simplification.

For the cooling period:

Window area proportion of f < 40%

- The room being verified has a window area proportion of f < 40%.
- The room has active cooling (air-based cooling or radiant cooling).
- The façade has external solar radiation protection.
- The upper limits for the operative temperature specified in Appendix 3 for cooled buildings are determined via calculation of the cooling load for the sizing of the cooling system.

Window area proportion of f ≥ 40%

- The room being verified has a window area proportion of f ≥ 40%.
- The façade has external solar radiation protection.
- A quickly regulating cooling system with single-room regulation is used.
- The cooling system uses both convection cooling and radiant cooling (e.g. cooling sail, chilled ceiling). For purely convective systems (e.g. underfloor convector, fan coils), documentation via calculation of the cooling load is not permitted at higher window area proportions (f ≥ 40%).
- Cooling systems integrated into components (e.g. underfloor cooling, structural component tempering, capillary tube mats) are not rapid regulating cooling systems. This means that documentation of the calculation of the cooling load in accordance is not permitted in such cases.
- A mechanical ventilation system with dehumidification ensures that the cooling system can be continually operated without power losses-. If the only available ventilation is via window ventilation or

a ventilation system without dehumidification, this requirement is not met.
- The upper limits for the operative temperature specified in Appendix 3 for cooled buildings are determined via calculation of the cooling load for the sizing of the cooling system.

As the static calculation of the cooling load cannot provide information regarding instances where the temperature falls below or exceeds the design temperature, documentation of the frequency of falling below and exceeding the temperature is not required for this documentation process, for the purposes of simplification.

For rooms that are not cooled or rooms that are categorised as being without cooling, this simplified method is not permitted in principle.

4. Other methods

For verification of the thermal comfort in the heating and cooling periods, methods other than those listed above are generally not permitted.

Information regarding documentation of summer heat protection in accordance with DIN 4108-2:

- Documentation of summer heat protection must be carried out in accordance with the version of DIN 4108-2 applicable for certification under public law (EnEV certification [T&D_03]). Alternatively, documentation in accordance with a newer version of DIN 4108-2 is permitted.
- For documentation of summer heat protection in accordance with DIN 4108-2, the estimated total energy transmittance g_{tot} must be verified in addition to compliance with the maximum permitted solar transmittance parameter $S_{max,per}$. In addition, the components of this value, the estimated total energy transmittance of the glazing g and the reduction level of the sun protection F_c used must be verified, justified and supplied together with a list of references.

Indicators 2 and 6: Drafts

The input parameters required by the drafts model in DIN EN ISO 7730 are the indoor air temperature, the average airspeed and the standard deviation of the air velocity (or degree of turbulence; a degree of turbulence of 40 to 50% must be assumed for mixing ventilation, while a degree of turbulence of 20 to 25% must be assumed for displacement ventilation [EN 16798]).
The method in accordance with DIN EN ISO 7730, Annex A, Figure A.2 can be used in temperature ranges of 20 °C to 26 °C. This model is used to provide an ideal point of reference for evaluation of the drafts indicator.
For buildings without indoor air ventilation (HVAC) systems, this requirement is generally considered to have been complied with. Drafts are known to form as a result of opened windows. However, users can stop drafts themselves by closing the windows.
Regardless of the documentation process, documentation must generally be compiled for all types of air outlets and ventilator-driven air flows, (e.g. ventilation systems, circulation heaters, convection heaters with blowers, etc.).

The following methods are acceptable for documenting drafts:

- Characteristics of the air outlets – Manufacturer specifications
- The characteristics of the air outlets as provided by the manufacturers can be used to determine the air velocity relative to the distance from the air outlet. The air velocity must not exceed the maximum permitted value in the open space closest to the air outlet.
- Flow simulations

- Alternatively, the airflow in the room can also be determined using high-resolution CFD flow simulations. When doing so, the air velocity in the open space must not exceed the maximum permitted value.
- Measurements
- Alternatively, the air velocity can also be determined using measurements for representative open spaces. When doing so, the airspeed in the open space must not exceed the maximum permitted value.

Indicators 3 and 7: Radiant temperature asymmetry and floor temperature

The permitted documentation processes depend on the type of component:

- Heated/cooled components
- Verification is carried out via documentation of the design.

For the heating period only:

- Non-heated, opaque components
- If the U-values in accordance with criterion TEC1.3 are complied with, it is to be assumed that the criteria for minimum temperatures are also met.
- Non-heated, transparent components
- Only the following documentation processes are permitted:

a) Zonal thermal simulation

Compliance with the permitted interior surface temperatures is verified via an additional evaluation of the zonal thermal room simulation. Here, the temperatures may, in the same way as for indicator 1, exceed or fall below the permitted limit values for no more than 3% or 5% (depending on the category that is to be complied with) of the winter usage period in total (time reference as in indicator 1: Winter heating period, not the entire year).

b) One-dimensional heat flow calculation

If compliance with the permitted interior surface temperatures is verified using one-dimensional heat flow calculations, the following boundary conditions must be applied:

Exterior temperature: -5 °C
Interior temperature: 20 °C
Heat transfer resistance in accordance with DIN EN ISO 6946:
External: R_a = 0.04 m²K/W
Internal: Heat flow
Upwards: R_i = 0.10 m²K/W
Horizontal: R_i = 0.13 m²K/W
Downwards: R_i = 0.17 m²K/W

c) Simplified table method

If no simulations or one-dimensional heat flow calculations have been carried out, documentation can be compiled via a simplified method using the table below.

WINDOW AREA PROPORTION WITH REFERENCE TO THE FAÇADE BY ROOM	REQUIREMENT OR DOCUMENTATION
f ≤ 40 %	The requirement is considered to be met.
40% < f ≤ 70%	At a heat transfer coefficient for the windows of U_w ≤ 1.3 W/(m²K) [1] and a radiator positioned under the glazing, this requirement is considered to be met.
f > 70%	The heat transfer coefficient of the windows is equal to or less than U_w ≤ 1.0 W/(m²K)[2].

1. for the projects in various climatic zones: compliance with minimum national requirements for the Heat transfer coefficients or Optional U - Values (minimum requirement) for the various climatic zones according to the Appendix 1 of criteria TEC1.3

2. for the projects in various climatic zones: 25% Overachievement of the minimum national requirements for the Heat transfer coefficients or Optional U - Values (minimum requirement) for the various climatic zones according to the Appendix 1 of criteria TEC1.3

For cooling period only:

For non-cooled components (particularly glass façade(s)), the following applies:

d) No documentation required for small windows (f < 40%)

Documentation of the maximum inner surface temperatures of the glass façade is not required for rooms with a window area proportion of f < 40%. The window area proportion f relates to the internal façade surface(s) or the façade surface(s) visible from the inside.

e) Documentation for external solar radiation protection:

Documentation for external solar radiation protection can be carried out via a representation of the overall concept for the façade/solar radiation protection/cooling system. When doing so, the thermal qualities of the components, the position and type of solar radiation protection, and the arrangement and operation of the ventilation and cooling systems must be shown and specified.

f) Larger windows (f ≥ 40%) without external solar radiation protection:

If larger windows (f ≥ 40%) are used without external solar radiation protection, the maximum interior surface temperatures must additionally be verified via suitable simulation calculations. Only zonal room simulations, CFD flow simulations or spectral calculations in accordance with DIN EN 13363-2 or ISO 15099 are permitted for this purpose.

I. Zonal room simulation
Compliance with the permitted interior surface temperatures is verified via an additional evaluation of the zonal thermal room simulation. Here, the temperatures may, in the same way as for indicator 5, exceed or fall below the permitted limit values for no more than 3% or 5% (depending on the category that is to be complied with) of the summer usage period in total (time reference as in indicator 5: Summer cooling period, not the entire year).

II. CFD flow simulation
Compliance with the permitted interior surface temperatures is verified via a high-resolution CFD flow simulation for a typical summer situation.

III. Spectral calculation in accordance with DIN EN 13363-2 or ISO 15099
If documentation is carried out via spectral calculations in accordance with DIN EN 13363-2 or ISO 15099, a maximum exterior temperature of +32 °C, a vertical global solar transmittance of 600 W/m² for south-facing façades or 720 W/m² for east-facing or west-facing façades (EN 16798-11), and an indoor air temperature of 26 °C must be attained.

Indicators 4 and 8: Indoor humidity

The permitted documentation processes depend on whether the room is equipped with a ventilation system with a humidification function:

(1) Mechanical ventilation system with humidification and dehumidification function

Verification is carried out via documentation of the design of the ventilation system

(2) Rooms without humidification or dehumidification via the mechanical ventilation system, or without window ventilation

For the heating period:

Zonal moisture simulation
Thermal simulation is expanded to include moisture balances that represent the chronological progression of air humidity in the room. For thermal simulations including moisture balances, the high variation in window ventilation intensity depending on time must be represented via zonal ventilation simulation (air node network).
Here, the temperatures may fall below or exceed the permitted limit value for no more than 5% of the winter usage period in total (time reference as in indicator 1: Winter heating period, not the entire year).

For the cooling period:

Zonal moisture simulation
Thermal simulation is expanded to include moisture balances that represent the chronological progression of air humidity in the room. For thermal simulations including moisture balances, the high variation in window ventilation intensity depending on time must be represented via zonal ventilation simulation (air node network).
The limit values for air humidity (see above) in accordance with DIN EN 15251 are considered to have been complied with if they have been achieved for at least 95% of the summer usage period (time reference as in indicator 5: Non-heating period, not the entire year); this means that temperatures exceeding or falling below the limit values are permitted for no more than 5% of the summer usage period.