
Železniške naprave - Klimatske naprave v železniških vozilih za mestni, primestni in regionalni promet - Parametri za določanje udobja in preskusi tipa

Railway applications - Air conditioning for urban, suburban and regional rolling stock - Comfort parameters and type tests

Bahnanwendungen - Luftbehandlung in Schienenfahrzeugen des städtischen-, Vorort- und Regionalverkehrs - Behaglichkeitsparameter und Typprüfungen

Applications ferroviaires - Conditionnement de l'air pour matériel roulant urbain, banlieue et régionaux - Paramètres de bien-être et essais de type

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**Railway applications - Air conditioning for urban,
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and type tests**

Applications ferroviaires - Conditionnement de l'air
pour matériel roulant urbain, banlieue et régionaux -
Paramètres de bien-être et essais de type

Bahnanwendungen - Luftbehandlung in
Schienenfahrzeugen des städtischen-, Vorort- und
Regionalverkehrs - Behaglichkeitsparameter und
Typprüfungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

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European foreword

This document (prEN 14750:2022) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 14750-1:2006 and EN 14750-2:2006.

In comparison with the previous edition, the following technical modifications have been made:

- Creation of 3 categories of vehicle (Urban, Suburban and Regional) to define the corresponding performances.
- Definition of normal and extreme range of exterior temperature with corresponding performances.
- Usage of an index (Comfort Level) to provide a global view of the climatic comfort.
- Improvement of the validation process with new regulation tests. The purpose is to check the regulation of the system.
- Introduction of the process of validation of the climatic comfort parameters thanks simulations.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

1 Scope

This document establishes thermal comfort parameters for passenger compartments or saloons of railway vehicles. These comfort parameters apply in a similar way to the areas reserved for train staff.

This document also specifies conditions, performance values and the comfort parameter validation methods for compartments or saloons.

This document is applicable to urban (metro, tramway), suburban and/or regional vehicles equipped with cooling and/or heating/ventilation systems. It does not apply to main line vehicles and driver's cabs which are considered in separate European Standards.

2 Normative references

The following documents are referred to in the text in such a way that some or all their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 7726:2001, *Ergonomics of the thermal environment - Instruments for measuring physical quantities (ISO 7726:1998)*

ISO 19659-1:2017, *Railway applications — Heating, ventilation and air conditioning systems for rolling stock — Part 1: Terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19659-1:2017 and the following apply.

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

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

NOTE Refer to informative Annex R for abbreviations.

3.1

air conditioning installation

all equipment of HVAC system involved to reach the thermal comfort

Note 1 to entry: Refer to ISO 19659-1:2017.

3.2

interior temperature setting

T_{ic}

target value for interior air temperature

3.3

normal interior temperature setting

$T_{ic,0}$

target value for interior air temperature according to regulation curve

Note 1 to entry: Refer to 10.2 and normative Annex B.

prEN 14750:2022 (E)**3.4****interior temperature setting offset** $T_{ic,off}$

adjustment of the interior temperature setting

Note 1 to entry: Refer to 10.2.

3.5**mean interior temperature** T_{im}

arithmetic mean of the interior temperatures of one comfort zone and measured 1,10 m above the floor as specified in the procedure described in normative Annex K

3.6**mean exterior temperature** T_{em}

arithmetic mean of the exterior temperatures measured according to the procedure described in normative Annex M

3.7**comfort envelope**

areas designed for occupation by passengers. Local annexes are excluded from the comfort envelope

Note 1 to entry: If a gangway is designed for passengers to dwell inside, it is part of comfort envelope.

3.8**comfort zone**

subset of the comfort envelope on one car limited by partition wall, vestibule, interior door, steps, or gangway with a total floor height difference of at least 0,3m

Note 1 to entry: Tram is considered as one comfort zone.

Note 2 to entry: The comfort zone is divided in subzones to define the position of the measuring points (refer to normative Annex K).

3.9**local annexes**

places where passengers stay briefly or pass through

Note 1 to entry: If a gangway is closed by two doors it is not considered as a local annex and no comfort criterion is applied.

Note 2 to entry: Examples of local annexes: toilet compartment (WC), baby change area, aisles, vestibule.

Note 3 to entry: For multi-purpose areas, the classification as comfort zone or local annex have to be agreed.

3.10**heat transfer coefficient (k)**

ratio between the heat flow rate per unit of surface area and the prevailing difference in temperature (T_{im}) and (T_{em}) across the relevant walls of the vehicles

Note 1 to entry: The coefficient k takes account of the efficiency of the insulation of the exterior walls and the effect of the infiltration of air caused by the non-airtightness of the vehicle in motion (doors, windows, various openings) and is applicable to all or part of the vehicle.

Note 2 to entry: This value is expressed in $W/(m^2K)$.

3.11**equivalent solar load**

total heat received by 1 m^2 surface perpendicular to the radiation emitted by a luminous source (solar equivalent) and this, when inclined at an angle of 30° to the horizontal

3.12**stand by operation**

mode under which a predetermined interior temperature range is maintained during non-operational activity of the vehicle

3.13**design passenger load**

number of passengers used to size the air conditioning installation

3.14**free cooling**

provision of cooling using fresh air

3.15**vestibule**

area with at least one exterior door separated from the comfort envelope by interior door(s), full partition wall(s), step(s), or ramp with a total floor height difference of at least 0,3 m and without permanent seats

3.16**vehicle CO₂ concentration**

C_{im}

arithmetic mean of the interior CO₂ concentration measured at the centre of each subzone of each comfort zone and at the height of 1,7 m

Note 1 to entry: Refer to normative Annex K.

3.17**climatic zone**

climatic conditions used to size the HVAC system

Note 1 to entry: Refer to 8.1, 8.2 and 8.3 for the definition of design and the extreme conditions.

3.18**absolute interior humidity**

X_{im}

arithmetic mean of the absolute humidity calculated with the local relative humidity and corresponding temperature of the comfort zone measured at 1,10 m above the floor as specified in normative Annex K

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3.19

relative interior humidity RH_{im}

relative interior humidity calculated with the interior mean temperature (T_{im}) and absolute interior humidity (x_{im}) per comfort zone

3.20

absolute exterior humidity x_{em}

arithmetic mean of the absolute humidity calculated with the local relative humidity and corresponding temperature as specified in normative Annex M

3.21

relative exterior humidity RH_{em}

relative exterior humidity calculated with the exterior mean temperature (T_{em}) and absolute exterior humidity (x_{em})

3.22

subzone

portion of the comfort zone used for the location of the test sensors

3.23

mean air speed of vehicle surrounding flow

arithmetic mean of the air speed measured at 6 points (see normative Annex M) outside the vehicle at the distance of 0,1m from the wall of the vehicle. The mean air speed of vehicle surrounding flow is used for measurements at standstill

3.24

mean air speed of interior flow

arithmetic mean of the air speed measured at 6 points inside the vehicle at the distance of 0,1m from the wall of the vehicle

Note 1 to entry: See normative Annex M.

3.25

mean vehicle interior temperature T_{iv}

arithmetic mean of the all interior temperatures of all different comfort zones of the vehicle and measured 1,10 m above the floor as specified in the procedure described in normative Annex K

3.26

absolute vehicle interior humidity x_{iv}

arithmetic mean of the absolute humidity calculated with the local relative humidity in all different comfort zones of the vehicle and corresponding temperature measured at 1,10 m above the floor as specified in normative Annex K

3.27

relative vehicle interior humidity RH_{iv}

relative interior humidity calculated with the interior mean temperature (T_{iv}) and absolute interior humidity (x_{iv})

3.28**control settling time** t_{cs}

maximum allowed time for achieving stabilized condition after a change of T_{ic}

4 Parameter selection

Table A.1 shall be completed to define all parameters needed to apply this document.

5 Vehicle categories

The contractual specification shall detail the operational scenario and vehicle category (refer to normative Annex A).

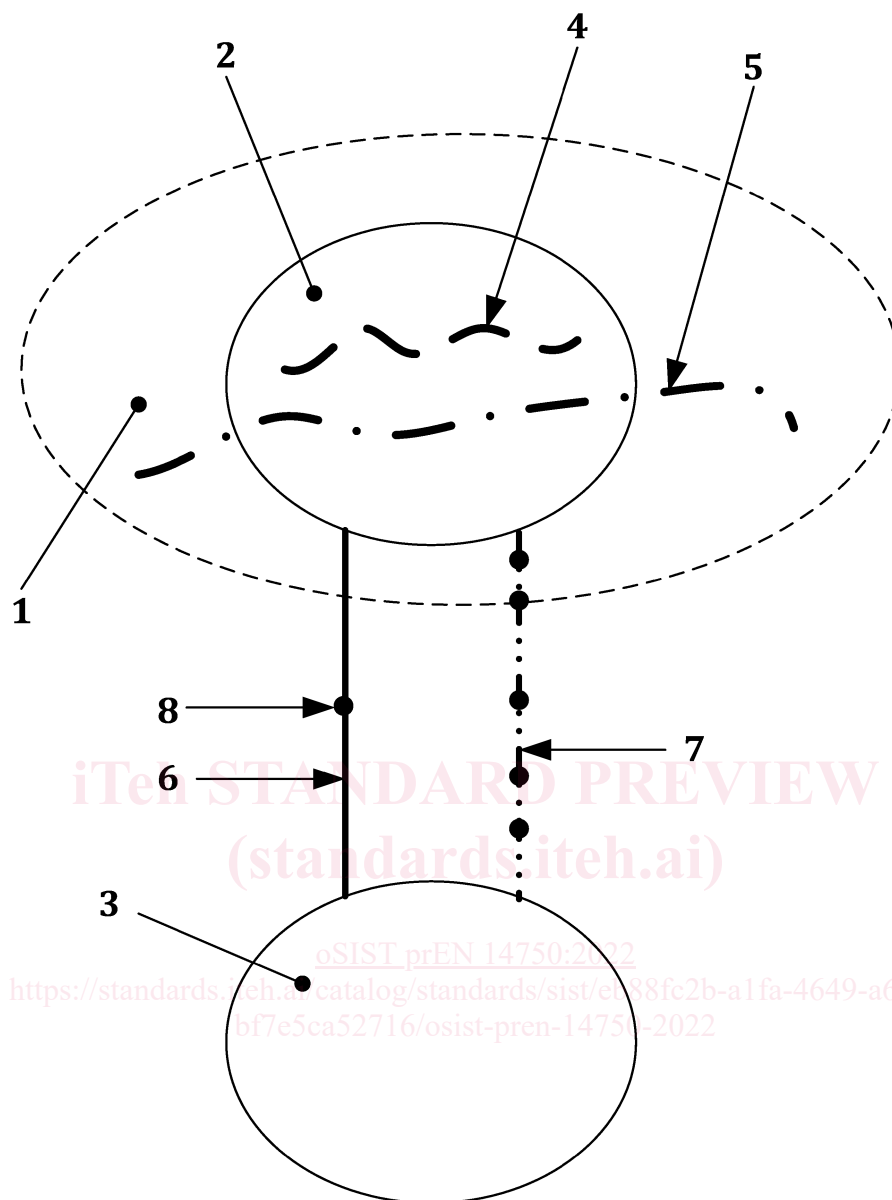
For guidance, the criteria to classify a vehicle for thermal comfort are given in Figure 1 and in Table 1. The limits of relevant comfort parameters vary with the applicable category.

- Urban (category U): Trains which operate inside the city (e.g. tram, metro).
- Suburban (category S): Trains which operate inside and in the surrounding of the city.
- Regional (category R): Trains which operate between cities with intermediate stops.
- Main line: Trains which operate between cities usually without intermediate stops.

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**Key**

1	Suburbs
2	City 1
3	City 2
4	Urban
5	Suburban
6	Regional
7	Main line
8	Stops

Figure 1 — Typical operating areas of trains

Table 1 — Vehicle categories for passenger area

Average or typical values	Urban	Suburban	Regional	Main Line
Standard	EN 14750 Category U	EN 14750 Category S	EN 14750 Category R	EN 13129
Typical time between stops	< 3min	< 10min	5 – 30min	> 30min
Typical design passenger load	Seated + 2p/m ²	Seated + 2p/m ²	Seated	Seated
Typical probability of removing clothing to suit thermal conditions	Low	Low	Medium	High

If the vehicle's operation is foreseen to be in more than one category, it is recommended to select the most appropriate thermal comfort category.

The ability to achieve thermal comfort is influenced by the type of train. It should be recognized that it may not be practicable to take a level of thermal comfort from one vehicle category and apply it to a different vehicle category. For example, it would unlikely be practicable to provide a main line train level of thermal comfort within a metro train.

6 Comfort parameters

During normal passenger service, comfort is assessed based on the following interior climate parameters:

- air temperature,
- air speed,
- relative humidity,
- surface temperatures.

as a function of thermal exchange between the interior climate and a seated or standing person dressed normally in accordance with Figure E.1 as a function of the exterior climatic conditions which have an indirect effect.

The minimum comfort level for each single test and for each car to be applied should be defined in the contractual specification. In the absence of such a definition, 85 % shall be reached at least.

7 Quality limits

The evaluation of the comfort parameters shall be done by quality limits q_1 and q_2 .

NOTE These quality limits are defined for normal and extended ranges based on mean exterior temperature.

The quality limits (normal or extended) are defined as a function of the mean exterior temperature (T_{em}) in accordance with Table 2 and Table 3.