Future requirements for the energy efficient indoor environment (2)

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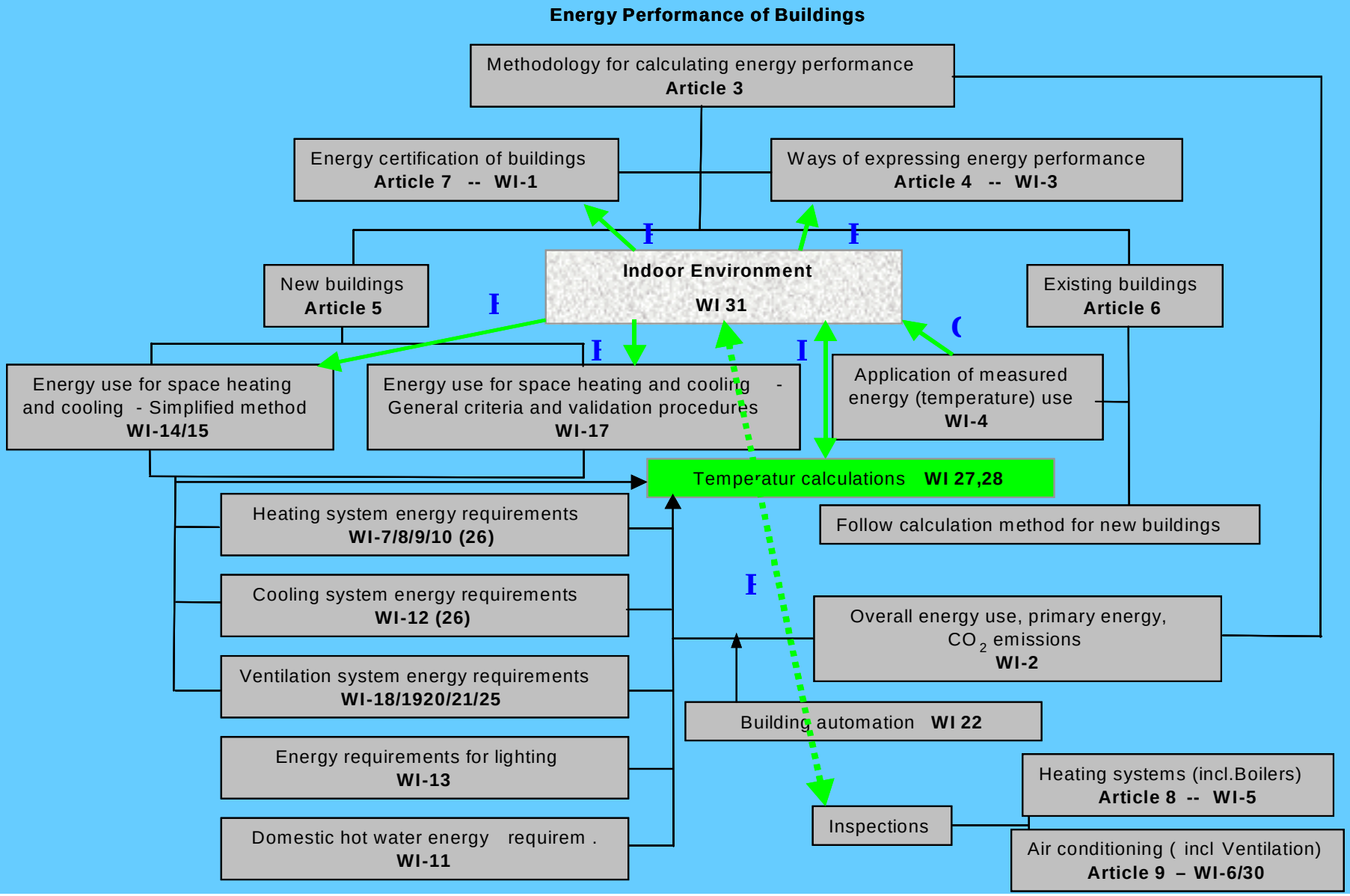
Indoor environmental input parameters for design and assessment of energy performance of buildings- addressing indoor air quality, thermal environment, lighting and acoustics

prEN 15251:2006

Relations between indoor environment standard and other CEN EPBD standards



Contents of the standard

- Standard sets the requirement which parameters have to be specified and gives examples of numeric values in **four quality categories**
  - Design criteria
  - Indoor environment parameters for energy calculations
  - Evaluation of indoor environment and long term indicators
  - Inspections and measurements in existing buildings
  - Classification and certification criteria of indoor environment

Cat	Explanation
I	High level of expectation and is recommended for spaces occupied by very sensitive and fragile persons with special requirements like handicapped, sick, very young children and elderly persons
II	Normal level of expectation and should be used for new buildings and renovations
III	An acceptable, moderate level of expectation and may be used for existing buildings
IV	Values outside the criteria for the above categories. This category should only be accepted for a limited part of the year

Scope of the standard

- Thermal environment
  - temperature (air and operative temperature)
- Ventilation rates
- Air quality (only CO_2)
- Noise level
- Humidity (only for specific cases)
- Lighting

Design temperatures for dimensioning the mechanical systems

(based on CEN report CR 1752)

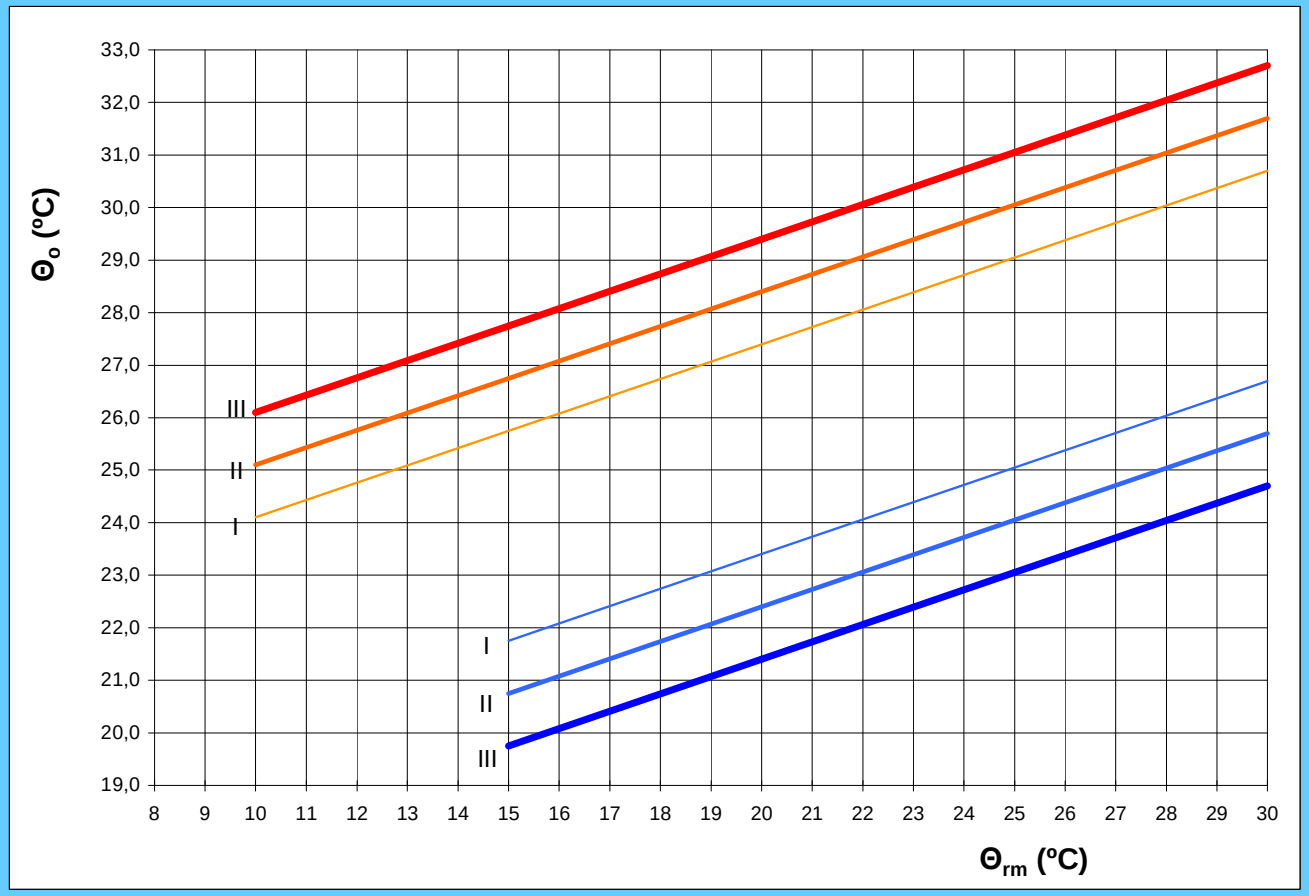
Type of building/ space	Category	Operative temperature °C	
		Heating (winter season), ~ 1,0 clo	Cooling (summer season), ~ 0,5 clo
Single office (cellular office) Sedentary ~ 1,2 met	I	21,0	25,5
	II	20,0	26,0
	III	19,0	27,0

Indoor temperature range for energy calculations

(based on CEN report CR 1752)

Category	Temperature range for heating, °C Clothing ~ 1,0 clo	Temperature range for cooling, °C Clothing ~ 0,5 clo
I	21,0 – 23,0	23,5 - 25,5
II	20,0 – 24,0	23,0 - 26,0
III	19,0 – 25,0	22,0 - 27,0

Design values for the indoor operative temperature for buildings without mechanical cooling systems as a function of the exponentially-weighted running mean of the outdoor temperature



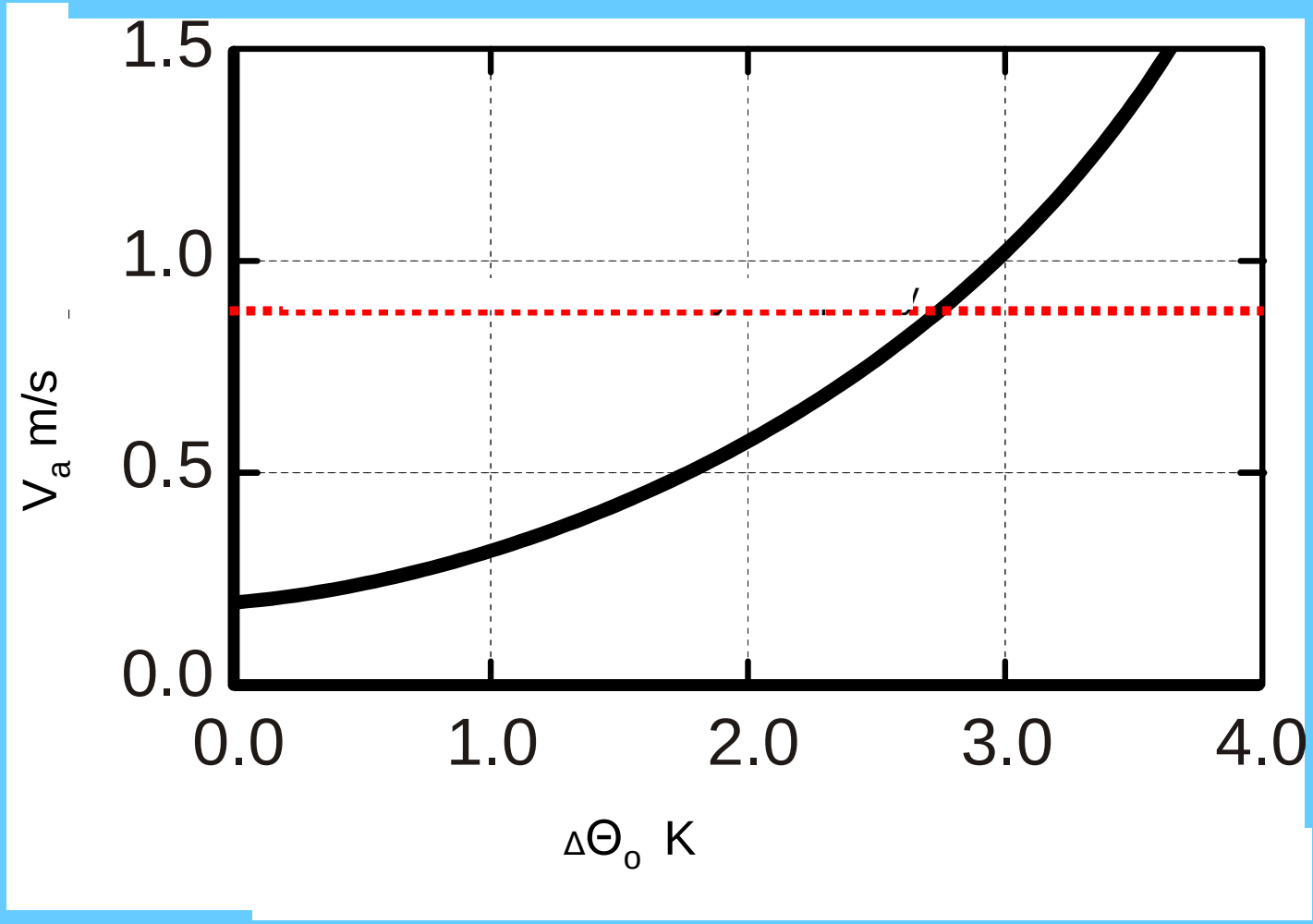
Running mean outdoor temperature

Running mean outdoor temperature

- $\Theta_{rm} = (\Theta_{ed\ -1} + 0{,}8\ \Theta_{ed\ -2} + 0{,}6\ \Theta_{ed\ -3} + 0{,}5\ \Theta_{ed\ -4} + 0{,}4\ \Theta_{ed\ -5} + 0{,}3\ \Theta_{ed\ -6} + 0{,}2\ \Theta_{ed\ -7})/3{,}8$

- $\Theta_{ed\ -1}$ = daily mean temperature one day before
- $\Theta_{ed\ -2}$ = daily mean temperature two days before

Air speed required to offset increased temperature (EN ISO 7730). The air speed increases by the amount necessary to maintain the same total heat transfer from the skin. Acceptance of the increased air speed will require occupant control of device creating the local air speed.



Ventilation rates are based on pollution load from occupants and materials,

the purpose is to encourage the use of low polluting materials

$$q_{tot} = n \times q_p + A \times q_B$$

q_p *is*

A: 10 l/s,pers B: 7 l/s,pers C: 4 l/s,pers

q_B *is for*

	Low polluting building	Non low-polluting building
Category I:	1,0 l/s, m^2	2,0 l/s, m^2
Category II:	0,7 l/s, m^2	1,4 l/s, m^2
Category III:	0,4 l/s, m^2	0,8 l/s, m^2

Ventilation rates for single offices

Type of building or space	Cat e-gor y	Floor area m^2/per-son	l/s, m^2 for oc-cupan cy	q_B l/s,m^2 for low polluted building	q_A l/s,m^2 for non-low polluted building	q_{tot} l/s,m^2 total for low poll buildi ng	q_{tot} l/s,m^2 total for non-low poll building	Add when smoki ng allowe d l/s,m^2
Single office	I	10	1,0	1,0	2,0	2,0	3,0	0,7
	II	10	0,7	0,7	1,4	1,4	2,1	0,5
	III	10	0,4	0,4	0,8	0,8	1,2	0,3

Example of ventilation rates for the residences. Continuous operation of ventilation during occupied hours. Complete mixing.

Category	Air change rate [1)]		Living room and bedrooms, mainly outdoor air flow		Exhaust air flow, l/s		
	l/s,m^2 (1)	ach	l/s, pers[2)] **A.1 (2)**	l/s/m^2 (3)	Kitchen (4a)	Bathrooms (4b)	Toilets (4)
I	0,49	0,7	10	1,4	28	20	14
II	0,42	0,6	7	1,0	20	15	10
III	0,35	0,5	4	0,6	14	10	7

Design values for relative humidity

(humidification and dehumidification is not recommended but if used values are given not to over humidify or dehumidify)

Category	Design relative humidity , %	
	dehumidification	humidification
I	50	30
II	60	25
III	70	20

Guidelinevalues for CO2 - concentrations

Category	Corresponding CO2 above outdoors in PPM for energy calculations
I	350
II	500
III	800
IV	< 800

Lighting
(from CEN 12464)

Type of building	Space	Maintained illuminance, $\hat{E}_m$, at working areas, lx	UGR	Ra	Remarks
Office buildings	Single offices	500	19	80	at 0,8 m
	Open plan offices	500	19	80	at 0,8 m
	Conference rooms	500	19	80	at 0,8 m

Evaluation of indoor environment has to be included in the energy certificate

- Evaluation of indoor environment can be based on
  - Design
  - Simulation & Calculation
  - Measured indoor environment
- Energy certificate without declaration of indoor environment makes no sense

Example of classification by “foot-print” of thermal environment and indoor air quality/ventilation. The distribution in the different categories is weighted by the floor area of the different spaces in the building.

Quality of indoor environment in % of time in four categories				
Percentage	5	7	68	20
Thermal Environment	IV	III	II	I
Percentage	7	7	76	10
Indoor Air Quality	IV	III	II	I

A.1

Standard is in the voting process for through national standardisation organisations

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Good papers are still welcome