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REHVA proposals for implementing IEQ according to the EPBD guidance principles

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EPBD guidance documents published by European Commission

- On 30 June 2025, the Commission published a support package of 13 guidance documents offering practical guidance to help EU countries implementing and transposing the EPBD into national law by 29 May 2026
- https://energy.ec.europa.eu/topics/energy-efficiency/energy-performance-buildings/energy-performance-buildings-directive_en

- Two most technical documents cover relevant **Indoor Environmental Quality (IEQ) parameters** and **Zero Emission Building (ZEB) requirements** calculations, the topics where REHVA Technical Guidance for EPBD Implementation Task Force has intensively worked during last years

Guidance document for TBS and IEQ

Important principles and parameters:

- Minimum requirements for indoor air quality and thermal comfort are to be set in the regulation for new buildings and major renovations, if not yet available
- EN 16798-1 **Category II** recommended
- IAQ monitoring and regulation: link with **demand-controlled ventilation**
- **CO_2** concentration can be continuously monitored as a proxy for ventilation which is an important factor for good IAQ
- **PM2.5** monitoring may be needed if there are no outdoor air filters in the ventilation system

EUROPEAN COMMISSION

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ANNEX 10

ANNEX

to the

COMMUNICATION TO THE COMMISSION

Approval of the content of the draft Commission Notice providing guidance on new or substantially modified provisions of the recast Energy Performance of Buildings Directive (EU) 2024/1275

Technical building systems, indoor environmental quality and inspections (Articles 13, 23 and 24)

REHVA Model IEQ Regulation provides an example how these can be implemented

REHVA Model IEQ Regulation: example of evidence based IEQ implementation

- To help to implement new IEQ provisions in national regulation, REHVA and Nordic Ventilation Group experts have developed a model IEQ regulatory text
- Proposed text is expected to serve as an example of evidence based IEQ useful minimum implementation
- 100% compliant with the Commission guidance document

		Design	Commissioning	Monitoring	Inspections
Thermal Comfort	Operative temperature	X		(X)	
	Air temperature	X	X	X	X
	Air velocity	X			
	Relative humidity	X		X	
Indoor air quality	Ventilation Rate	X	X		X
	Carbon dioxide	X		X	
	PM2.5	X*		X*	
	Formaldehyde	X^+			
	Nitrogen dioxide	X^+			
	Radon	X^+			
	Carbon Monoxide	X^+			
Daylighting	Daylight provision	X			
	Illuminance	X	X		
	Glare probability	X			
Acoustics	Sound pressure level	X	X		
	Sound reverberation time	X	X		optional

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https://www.rehva.eu/fileadmin/user_upload/2024/IEQ_Guidance_2025.pdf

2024 EPBD recast introduced clear definition for IEQ

Article 2(66) - 'indoor environmental quality'
means the result of an assessment of the conditions inside a building that **influence the health and wellbeing of its occupants**, based upon parameters such as those relating to the:

a) temperature,
b) humidity,
c) ventilation rate,
d) and presence of contaminants.

at least, **thermal comfort + IAQ**

- Member States will retain the competence for regulating indoor environmental quality, and they will need to define the indoor conditions (following the definition) to be maintained in buildings
- Member States can go beyond this definition and include other aspects in the transposition of the definition of IEQ, such as daylighting and acoustics (also in line with LEVEL(s))

New IEQ provisions

Addressing optimal IEQ in the design phase

Article 5(1) - Minimum energy performance requirements shall take account of **optimal indoor environmental quality**, in order to avoid possible negative effects such as inadequate ventilation, as well as local conditions and the designated function and the age of the building.

Article 7(6) - Member States shall address, in relation to new buildings, the issues of **optimal indoor environmental quality** […]

Article 8(3) - Member States shall address, in relation to buildings undergoing major renovation, the issues of **indoor environmental quality** […]

Measuring and Control devices for IAQ Article 13(5)

5. Member States shall require non-residential zero-emission buildings to be equipped with measuring and control devices for the monitoring and regulation of indoor air quality. In existing non-residential buildings, the installation of such devices shall be required, where technically and economically feasible, when a building undergoes a major renovation.
Member States may require the installation of such devices in residential buildings.

Table 10 – Examples of relevant parameters for indoor environmental quality

	Indicator	D	C	M(a)	I(a)	Description and references
Thermal Comfort	Operative temperature	X		(X)		Possible alternative to air temperature in the monitoring stage. Uniform temperature of an imaginary black enclosure in which an occupant would exchange the same amount of heat by radiation plus convection as in the actual non-uniform environment. Ranges are provided as a function of building type, season, and dependent on the cooling system (with or without) by the predicted mean vote (PMV) and adaptive comfort models. (EN ISO 7730, EN ISO 7726).
	Air temperature	X	X	X	X	Required in the assessment of other indicators. Air temperature can be used in long-term measurements if corrected for large hot or cold surfaces to determine the operative temperature. Indoor temperatures above 18 °C during the heating season will have significant health benefits. (EN ISO 7730, EN ISO 7726).
	Air velocity	X				It influences general thermal comfort and local thermal discomfort due to draught. Comfortable air velocity generally below 0.2 m/s. In buildings with mechanical cooling artificially increased air velocity under personal control (e.g. fans) can be used to compensate for increased air temperature under summer comfort conditions (operative temperature >25 °C). (EN 16798-1, EN ISO 7726). A comfort area for increased air velocity (<0.8 m/s) without personal control for temperatures above 25.5 °C is defined in ASHRAE 55(b).
	Relative humidity	X		X		Composition of the air in terms of water vapour in relation to the maximum amount it can hold at a given temperature. It also influences air quality. Very low RH (<20%) can cause irritation of eyes, nose, and throat and increase sensitiveness to infections. Persistent dampness, condensation, and excess moisture (RH > 70%) can cause building damage and microbial growth. It is recommended to limit absolute humidity to 12 g/kg (EN 16798-1, EN ISO 7726).
Indoor air quality	Ventilation rate	X	X		X	To be addressed as part of system inspections pursuant to Article 23. Supply or removed air from space for the purpose of controlling air contaminant levels, humidity, perceived air quality or temperature within the space (EN 16798-1). If critical sources for health are identified, it must be checked that they remain below the health threshold values. Minimum 4 l/s per person is prescribed during occupied hours; 0.15 l/s per m^2 during unoccupied hours. Typically measured from supply and extract terminals.
	Carbon dioxide	X		X		Proxy for ventilation effectiveness in spaces where people are the main source of pollution. Indoor CO_2 concentration should be adjusted according to the outdoor CO_2 concentration. It should not exceed 1350 ppm above outdoor concentration. Typically measured in extract terminals. (EN 16798).
	$PM_{2.5}$	X(c)		X(d)		Particulate matter where particles have an aerodynamic diameter equal to or less than 2.5 µm. It can be generated indoors from combustion appliances or outdoors and has harmful effects on human health. Air filtration is required to control particulate matter from outdoor sources. Indoor particulate matter is controlled by reducing emission sources (e.g. electric instead of gas stoves) and adequate ventilation. Preferably below an annual mean of 10 µg/m^3. Incremental steps are proposed for $PM_{2.5}$ limits (35, 25, 15, 10, 5 µg/m^3) (EN 16798-1, WHO).
	Formaldehyde (e)	X(f)				Major sources are building materials and consumer products (e.g. furniture, cleaning). It can cause sensory irritation and respiratory health risks. Use of labelled low-emitting building and finishing materials and products can reduce exposure Measured near potential sources such as furniture and flooring (EN 16798-1, WHO).
	Nitrogen dioxide	X(f)				Originating from combustion. Indoor contamination may be possible from attached garages and indoor combustion sources, in which cases sensors and/or measuring requirements would be recommended. It poses health risks related to the respiratory system. Measured near potential sources such as kitchens and garages. A 1 h mean limit of 200 µg/m^3 and annual mean of 40 µg/m^3 are proposed (EN 16798-1, WHO).
	Radon	X(f)				Human carcinogen, originating from decay of radium in soil and rocks. Reference level of 100 Bq/m^3 (or 300 Bq/m^3 based on prevailing country-specific conditions). Measured in the lowest occupied level of the building (EN 16798-1, WHO).
	Carbon monoxide	X(f)				Originating from combustion. Acute exposure-related reduction of exercise tolerance and increase in symptoms of ischaemic heart disease. A 24-hour mean limit of 4 mg/m^3 is proposed with an interim target of 7 mg/m^3 (EN 16798-1, WHO).

Model IEQ regulation: assumptions

- All numeric values included serve as examples, following the Commission guidance recommendation to use Category II specified in EN 16798-1:2019 (medium occupant expectation), whose values ensure avoiding adverse health effects and comfort and well-being of occupants
- Limited to thermal comfort and IAQ, and noise of building services
- It is expected that a weather file for indoor climate and energy simulations already exist (for long term assessment of IEQ that is needed because of optimal IEQ and IAQ regulation)

- The following presentation is limited to IAQ

IAQ&ventilation

IAQ forms a main part of the document:

- **Non-residential vs. residential**
- **Ventilation system (includes natural ventilation) – technology neutral**
- **Operation for optimal IAQ**
- **IAQ monitoring and regulation**

IAQ&ventilation

- **IAQ = source control + ventilation + filtration of outdoor air where relevant**
- **Minimum outdoor air ventilation requirements in residential/non-residential buildings**
- **Addresses PM2.5 so that ventilation with outdoor air filters is enough**
- **In zones where outdoor air intake is without filters, WHO PM2.5 limit value is required (when exceeded, openings must be closed or other measures applied)**

4. Design values and requirements for indoor air quality

4.1 General

4.1.1 Indoor air quality shall be controlled by source control (pollutant sources), ventilation, and filtration of outdoor air where relevant.

4.1.2 Source control must be applied for pollutants emitted from building materials and interior design through the use of low polluting building materials[14], and with the use of local exhausts where relevant.

4.1.3 To maintain an acceptable level of pollutants in the indoor environment, minimum outdoor air ventilation requirements given in 4.2 and 4.3 shall be used to dimension the ventilation system.

4.1.4 To control the entry of outdoor particulate matter, outdoor air filters[15] in the ventilation system may be used. In zones where outdoor air intake without outdoor air filters is used, the particulate matter PM2.5 cannot be higher[16] than 10 μg/m^3.

[14] Low polluting building materials are defined in EN 16798-1:2019. Values for very low-polluting materials can be used only in the case of labelled/certified materials.

[15] For non-residential buildings filters are specified in EN 16798-3. Adequate filters protect both the occupants and the ventilation equipment.

[16] At a higher concentration, outdoor openings must be closed and IAQ maintained with other ventilation or air cleaning measures. WHO Global Air Quality Guidelines 2021 specify PM2.5 thresholds as an annual mean of 5-10 μg/m^3 and a 24-hour mean of 15-25 μg/m^3.

Minimum ventilation requirements

- Refers to EN 16798-1:2019 Category II values
- In non-res. ventilation depends on number of people and floor area, i.e. dilutes emissions from people and building
- If other sources, more ventilation may be needed

- For residential buildings proposes room based values derived from Category II with common occupancy and room size assumptions
- Compliance with airflow rates may be assessed through CO_2 (and RH in residential)

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4.2 Ventilation in non-residential buildings

4.2.1 In indoor spaces where the criteria for indoor environments are set by human occupancy and where the production or process does not have a significant impact on the indoor environment, the required outdoor air ventilation rate shall be calculated as follows:

$$q_s = Nq_p + A_R q_B \quad (1)$$

where[17]

- q_s design outdoor air ventilation rate, L/s (1 L/s = 3.6 m³/h)
- N design value for the number of persons in the room,
- q_p ventilation rate for occupancy per person, 7 L/(s person)
- A_R room floor area, m²
- q_B ventilation rate for emissions from building, default value 0.7 L/(s m²) assuming low polluting materials. When very low-polluting building materials (certified by national material emission control/labelling systems) are used, q_B = 0.35 L/(s m²).

4.2.2 In indoor spaces with other pollution sources, in addition to human occupancy and emissions from building, the sufficiency of ventilation rates provided by Equation 1 shall be checked and ventilation rates increased where relevant.

4.3 Ventilation in residential buildings

4.3.1 In residential buildings the total ventilation of a whole residence shall be at least 0.42 L/(s m²) [18]. Room specific minimum ventilation requirements are given in Table 2.

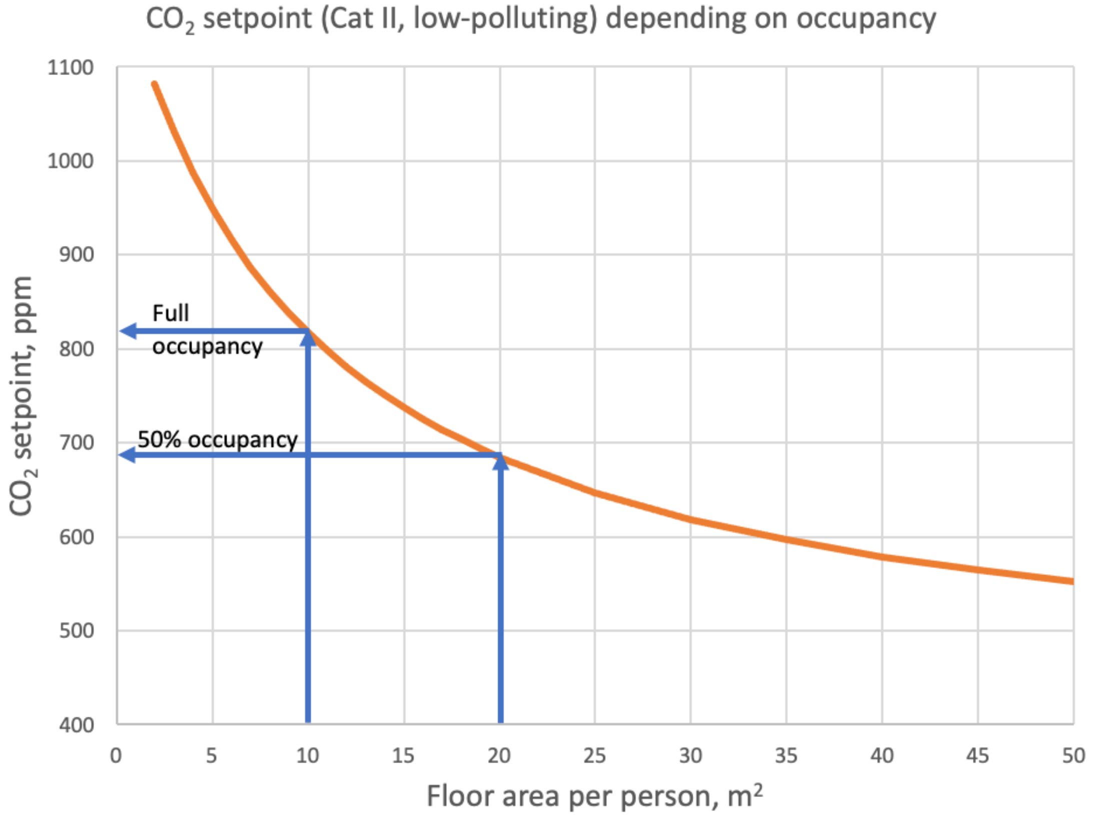
Table 2. Minimum design airflow rates in residences[19].

	Supply airflow rate L/s	Extract airflow rate L/s
Living rooms[1] >15 m²	8+0.27 L/(s·m²)	
Master bedroom and bedrooms >15 m²	14	
Living rooms and bedrooms 11-15 m²	12	
Bedrooms <11 m², 3rd and successive bedrooms in large apartments	8	
WC		10
Bathroom		15
Bathroom in one room apartment		10
Utility room		8
Wardrobe and storage room		6
Kitchen[2]		8
Kitchen[2], one room apartment		6
Kitchen[3], cooker hood in operation		25
Average airflow rate of a whole residence L/(s m²)	0.42	
Staircase of an apartment building, ACH	0.5	

[1] Transfer air from bedrooms can be used as a part of supply air but 12 L/s is minimum outdoor air rate
[2] Airflow rate in the kitchen when cooker hood is not in operation
[3] Fire regulations are to be followed

Operation for optimal IAQ

- Accepts CO_2 as a parameter to control IAQ
- Typical occupancy to calculate CO_2 setpoint (results in lower value than that at full load)
- Acceptable deviation in long term assessment <= 5% of occupied hours



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5.2 Operation for optimal indoor air quality in non-residential buildings

5.2.1 Ventilation systems in non-residential buildings shall be controlled according to occupancy. Concentration of CO_2 can be used as a proxy for ventilation to operate ventilation system in between design and minimum ventilation rate.

5.2.2 Minimum ventilation rate shall be calculated with Equation 1 with no occupancy (*n*=0).

5.2.3 For CO_2 concentration setpoint[21] the total ventilation rate per person shall be calculated:

$$q_{sp} = \frac{q_s}{n} \tag{2}$$

where

q_{sp} total ventilation rate per person (L/(s person))

q_s design ventilation rate supplied by actual air distribution system, (L/s)

n number of the persons in the room corresponding to typical occupancy[22] (-)

5.2.4 CO_2 concentration setpoint above the outdoor CO_2 concentration shall be calculated from metabolic CO_2 generation and CO_2 volume balance:

$$C = \frac{q_{CO2}}{q_{sp}} \frac{1000}{3.6} \tag{3}$$

where

C CO_2 concentration setpoint value above the outdoor CO_2 concentration (ppm)

q_{CO2} CO_2 generation rate (L/(h person))

$\frac{1000}{3.6}$ 3600 and 10^6 are unit conversions from hour to second and litre to ppm

5.2.6 If ventilation is shut off for unoccupied periods, the system shall be switched on so that ventilation airflow volume corresponding to at least one volume of rooms will be delivered within 2 hours prior to occupation.

5.2.7 CO_2 setpoint values shall be used in the long-term assessment of CO_2 concentration with IAQ simulations. Acceptable deviation from these values shall be no more than 5% during occupancy hours.

IAQ regulation and monitoring

- **Requires DCV and BACS:**
  - Demand controlled ventilation system in new non-residential buildings (airflow rate control according to occupancy) in rooms for 3 or more persons
  - BACS that provide monitoring of IAQ and temperature
  - In major renovations to be followed as applicable
- **In DCV with outdoor air filters, CO_2 may be used as a parameter for IAQ monitoring and regulation**
- In zones where outdoor air intake without outdoor air filters is used, additionally the particulate matter PM2.5 shall be used for IAQ monitoring and regulation

6 IAQ monitoring and regulation equipment[24] in non-residential buildings

6.1 New non-residential buildings shall be equipped with measuring and control devices as a part of a demand-controlled ventilation (DCV) system for the monitoring and regulation of IAQ.

6.2 New non-residential buildings shall be equipped with building automation and control systems[25] which provide monitoring of IAQ and temperature in continuously occupied spaces.

6.3 In major renovations 6.1 and 6.2 shall be followed as applicable.

6.4 IAQ regulation shall be applied at least in spaces that are intended for three or more persons.

6.5 IAQ regulation is not needed in spaces where ventilation requirements are determined predominately by extract air flow rates.

6.6 DCV systems should use sensors that can reliably measure parameters that are used for IAQ monitoring and regulation.

6.7 In DCV systems equipped with adequate outdoor air filters, CO_2 may be used as a parameter for IAQ monitoring and regulation. In zones where outdoor air intake without outdoor air filters is used, additionally the particulate matter PM2.5 shall be used for IAQ monitoring and regulation[26].

6.8 Monitored IAQ parameters shall be made visible in rooms for users, provided both by readings and traffic light colour type of indicators. They should also be available at least with hourly resolution for last 12 months in building automation and control systems for long term performance assessment and maintenance support purposes.

[24] EPBD Article 13(5)

[25] EPBD Article 13(10). Note that article 13(9–12) provide other building automation and control requirements for systems performance and automatic lighting controls which can be addressed in energy regulation.

[26] When PM2.5 is reaching the setpoint, measures to control PM2.5 should be applied. These may include closing the outdoor openings, activating mechanical ventilation and/or air cleaning.

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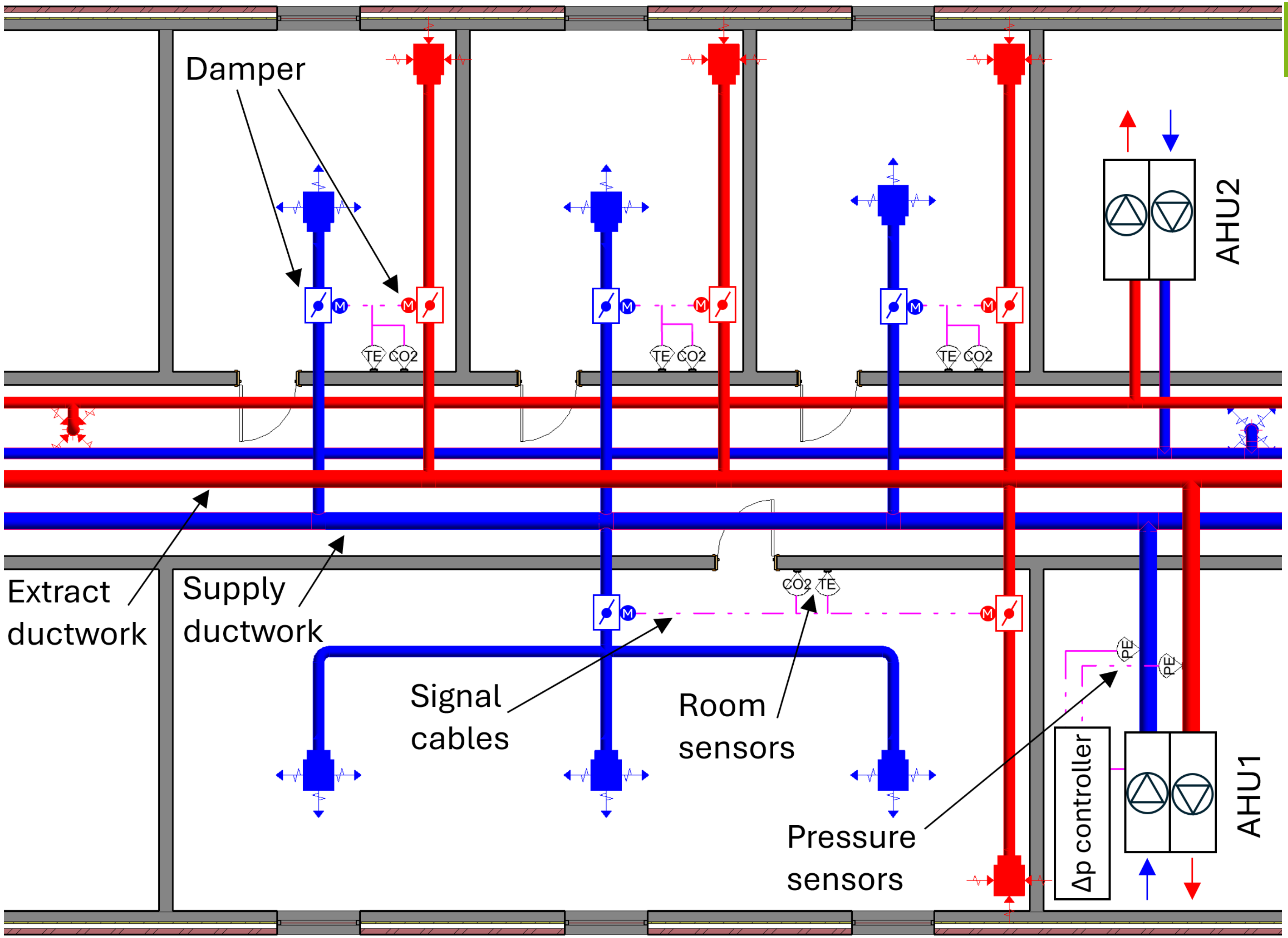
Explanatory report

- Example of pressure independent DCV system (AHU1) = solution to comply with EPBD in non-residential
- Fan speed is controlled to keep constant static pressure in the main duct
- Dampers adjust the air flow rates based on the room sensors CO_2 (and temperature) readings
- AHU2 (CAV) with time control but not DCV serves toilets and corridors



Capacity to react to external signals

8 Capacity to react to external signals and adapt energy use, generation or storage[28]

8.1 A capacity to react to external signals shall be implemented so that thermal comfort and IAQ are not compromised. Acceptable deviations may be assessed as specified in 3.6, 5.2.7 and 5.3.2.

- Assumes that the capacity to react to external signals is addressed in energy regulation
- IAQ and thermal comfort shall not compromised
- **Long term assessment needed to show that IAQ and thermal comfort will stay within accpetable range**

Conclusions

- EU countries are implementing and transposing the Energy Performance of Buildings Directive into national law by 29 May 2026
- On 30 June 2025, the Commission adopted a support package offering practical guidance to help EU countries
- The most technical guidance documents are supported with recent REHVA documents
- REHVA Primary Energy and Operational CO_2 Indicator document explains ZEB requirements calculation principles and assessment boundary options
- REHVA Model Indoor Environmental Quality Regulation takes a step forward by proposing regulatory texts serving as examples of evidence based IEQ useful minimum implementation