EPBD article 11a IEQ requirements

Common proposal by REHVA, NVG & EUROVENT for implementation

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How to set national requirements in line with revised EPBD

- EPBD 2002-2010-2018-2023 has developed to be a comprehensive and technically complex document – technical guidance is needed for harmonised national implementation
- Healthy indoor environment, healthy indoor climate, comfort, indoor environmental quality (IEQ) and ventilation are addressed in many places in EPBD, but explicit requirements are left on the responsibility of MS
- EPBD proposal March 14, 2023 sets new requirements for measuring, control and monitoring of IEQ

https://www.europarl.europa.eu/doceo/document/TA-9-2023-0068_EN.html

Article 11 Technical building systems



*3. Member States shall require the installation of measuring and control devices for the monitoring and regulation of **indoor** environmental quality at relevant unit level and, where technically and economically feasible, in the following buildings:*

(a) zero emission buildings;

(b) new buildings;

(c) existing buildings undergoing a major renovation;

(d) non-residential buildings with an effective rated output for heating systems, cooling systems or systems for combined space heating and cooling over 70kW;

(e) public buildings and buildings providing social services of general interest, such as education, health and social assistance.

Article 11a
Indoor environmental quality

- New article
- Requires to implement of adequate IEQ standards in national level in buildings in order to maintain a healthy indoor climate
- Requirements according to measurable indicators based on to those of the LEVELs framework to be set within 24 months after entry into force
- Indoor environmental quality indicators shall be measured inside the building – list of parameters to be monitored provided

Article 11a with proposed minor changes

1. Member States shall set requirements for the implementation of adequate indoor environmental quality standards in buildings in order to maintain a healthy indoor climate.

2. By ... [24 months after the date of entry into force of this Directive], Member States shall set requirements according to measurable indicators based on to those of the LEVELs framework.

Indoor environmental quality indicators shall be continuously measured inside the building and shall at least include:

(a) the level of carbon dioxide;

(b) the room temperature ~~and thermal comfort~~;

(c) the relative humidity;

(d) the particulate matter;

The following indicators shall be measured and reported in the commissioning phase:

~~(d) the level of daylight illumination or adequate daylight levels;~~

(e) the ventilation rate in air changes per hour or supply and extract airflow rates;

(f) acoustic indoor comfort, such as the control of the reverberation time and background noise level and speech intelligibility.

Article 11a with proposed minor changes

The level of daylight illumination or adequate daylight levels shall be verified and reported.

~~Particulate matter of~~ Eemissions of indoor sources and target pollutant limits from indoor sources, on volatile organic compounds, classified as carcinogenic, mutagenic, or toxic for reproduction according to Regulation (EC) No 1272/20081, including formaldehyde, shall be reported on the basis of the available data at product level, or direct measurement where available.~~ ~~, of the relevant sources in relation to the indoor environment of the building.~~

3. The Commission is empowered to adopt delegated acts in accordance with Article 29 to supplement this Directive by establishing a methodology framework for calculating the indoor environmental quality standards.

4. Member States shall ensure that new buildings and buildings undergoing major renovation comply with adequate indoor environmental quality standards.

Guidelines for implementation of Article 11a

- Prepared as common proposal by REHVA, Nordic Ventilation Group and EUROVENT
- REHVA draft version circulated to TRC May 10, 2023
- Expected to be published in June 2023 with a reference to EPBD proposal March 14, 2023
- Will be updated when approved EPBD will be available

EPBD definitions

57g. 'indoor environmental quality' means a set of parameters relating to a building, including indoor air quality, thermal comfort, lighting, and acoustic affecting the health and wellbeing of its occupants;

57h. 'healthy indoor climate' means the indoor environment of a building, which optimises the health, comfort and well-being of occupants in line with specific performance levels, including those related to daylight, indoor air quality and thermal comfort, such as mitigating overheating and enhancing acoustic quality.

- → minimum requirements in these four IEQ domains are to be set in the regulation or building code for new buildings and major renovations
- EPBD makes reference to LEVEL(s) framework which refers to EN 16798-1:2019
- This guideline focuses to IAQ and thermal comfort requirements specification – parameters which are continuously controlled by HVAC systems
- Acoustics' and lighting parameters may be verified by discontinuous measurements typically conducted in the commissioning phase

Indoor air quality general principles

- It is explained why direct monitoring of all indoor air pollutants is impossible in practice
- CO_2 concentration can be continuously monitored as a proxy for ventilation which is an important factor for good IAQ
- PM2.5 monitoring will ensure that outdoor air for ventilation is clean or adequately filtered and there are no significant indoor sources of particulate matter
- To control IAQ, ventilation and filtration requirements are to be set and low polluting materials used
- Fine particle filters of ePM1 or ePM2.5 recommended as specified in EN 16798-3

Monitoring

- ‘at relevant unit level’ guides to monitor these parameters in all continuously occupied spaces, such as classrooms, offices, meeting rooms, restaurants, kitchens, shops, gyms, etc.
- parameters to be monitored are CO_2, temperature, relative humidity and PM2.5
- in residential buildings, it would be meaningful to monitor CO_2, temperature and PM2.5 in living rooms and bedrooms, and relative humidity in wet rooms such as toilets and bathrooms

IAQ and ventilation in non-residential buildings

- Ventilation rates in indoor spaces with no other pollution sources than human occupancy and building materials are set in EN 16798-1:2019 (Category II):

$$q_{tot} = N q_p + A_R q_B \qquad (1)$$

q_{tot}	total outdoor air ventilation rate for the breathing zone, L/s (1 L/s = 3.6 m^3/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, m^2
q_B	ventilation rate for emissions from building, 0.7 L/(s m^2)

- Equation 1 is enough to be set as a ventilation requirement in the regulation, but the numeric values will depend on occupant density. Thus, standards or guidelines are needed where default occupant density values can be found

IAQ and ventilation in non-residential buildings

- As an alternative to ventilation airflow rates, IAQ and ventilation requirements can be set with CO_2 values, calculated with ventilation rates defined by Equation 1 and metabolic CO_2 generation from CO_2 volume balance:

$$C = C_{out} + \frac{q_{CO2}}{q_{tot}} \frac{1000}{3.6} \qquad (2)$$

C CO_2 concentration (ppm)

C_{out} outdoor air CO_2 concentration, typically 400 ppm

q_{CO2} CO_2 generation rate of 10.5 L/(h person) in day care centres, 18 L/(h person) in classrooms, 20 L/(h person) in offices, meeting rooms, and restaurants, and 80 L/(h person) in gym

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

IAQ and ventilation in non-residential buildings

- CO_2 concentration values calculated using Equation 2 depend considerably on the occupant density. Therefore, it is an option to use in the regulation the following values where occupancy is fixed (absolute values, outdoor concentration 400 ppm):
  - 900 ppm in rooms where floor area is >6 m^2 per person;
  - 1000 ppm in classrooms;
  - 1200 ppm in other rooms where floor area is <3 m^2 per person.

- The above CO_2 values may be used also in the monitoring of IAQ by continuous measurement
- In the assessment of compliance with IAQ requirements, acceptable deviation from these values shall be no more than 5% during occupancy hours

Ventilation and IAQ in residential buildings

- EN 16798-1:2019 specifies 0.42 L/s m^2 (0.6 ach) total ventilation of a whole residence and 7 L/s per person supply air flow requirements
- These general requirements are developed further in REHVA GB 25

	Supply airflow rate L/s	Extract airflow rate L/s
Living rooms[1] >15 m^2	8+0.27 L/(s·m^2)	
Bedrooms >15 m^2	14	
Living rooms and bedrooms 11-15 m^2	12	
Bedrooms <11 m^2, 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, cooker hood in operation		25
Average airflow rate of a whole residence L/(s m^2)	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

Ventilation and IAQ in residential buildings

- The ventilation supply airflows to the bedrooms and living rooms are expressed as an outdoor airflow rates which shall be supplied primarily to living rooms and bedrooms
- The ventilation air for the kitchen, bathroom and toilet has to be transfer air from the bedrooms and living rooms
- Doors or specific openings must allow transfer air flows without significant pressure loss
- From wet rooms extract airflows shall be used to remove pollutants and humidity

- In demand-controlled ventilation systems, CO_2 sensors shall be used in living rooms and bedrooms, and RH sensors in wet rooms
- Alternatively, it's possible to detect occupancy based on the CO_2 and RH sensors placed inside the ventilation unit or extract ductwork, enabling for instance to operate ventilation unit in 'at home'/'out of the home' mode

Thermal comfort

- The minimum requirements in the regulation shall include at least room temperature ranges (1.2 met)
- Table 2. Room temperature requirements, an example following Category II values

Building Category	Heating season, (1.0 clo) °C	Cooling season, (0.5 clo) °C
Non-residential buildings	20.0 - 24.0	23.0 - 26.0
Residential buildings	20.0 - 24.0	22.0 - 27.0

- May be used as design values by using the lower value in heating season for the heating system and the upper value in cooling season for the cooling system
- Heating season is defined when the outside running mean temperature is below 10ºC and cooling season when it is above 15 ºC. Between 10ºC and 15ºC running mean temperature, room temperature may lie in between the heating and cooling season values.
- Acceptable deviation from the specified range in Table 2 is maximum 5% of the occupancy time. In residential buildings, additionally 150 Kh (Kelvin hours) above 27ºC may be used as acceptable excess in heating dominated climates.

Relative humidity

- LEVEL(S) recommends RH lower limit value of 20%

- Two possible options to deal with RH requirements, either not to set at all or to set a lower limit of 20% RH
- The upper limit is not relevant as a requirement but is needed as a setpoint in control of ventilation, that is a matter of technical guidance documents
- If requirements leading to humidification will be used it should be noted that the humidifier itself can be a source of pollution (microbial and chemical) if not properly maintained

- If the lower limit requirement of 20% RH is set, the acceptable deviation is maximum 5% of the occupancy time during heating season

Conclusions

- EPBD proposal March 14, 2023 sets new ambitious requirements for installation of measuring and control devices for the monitoring and regulation of indoor environmental quality at relevant unit level
- Requires to implement of adequate IEQ standards in national level in buildings in order to maintain a healthy indoor climate
- Requirements according to measurable indicators based on to those of the LEVEL(S) framework to be set within 24 months after entry into force
- Provides a list of IEQ indicators to be monitored

- Common proposal by REHVA, Nordic Ventilation Group and EUROVENT for implementation under preparation