

# Performance-based Spanish regulations relating to indoor air quality

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## ABSTRACT

As a consequence of the sustainable politics demanding regulations that allow the use of more efficient ventilation systems, the IAQ Spanish regulations were modified and enforced in 2017. The new regulations became performance-based in order to accommodate the use of systems which are capable of adapting required ventilation rates to real needs. The new requirement is based on both CO<sub>2</sub> concentration and a minimum ventilation rate.

The new IAQ requirement is able to keep acceptable IAQ values and to reduce energy demand in relation to the previous IAQ requirement.

## KEYWORDS

Ventilation, IAQ, regulations

## 1 IAQ REQUIREMENT

IAQ level is usually characterized by a maximum level of pollutants that may affect people's health and comfort and which could be achieved by different ventilation systems.

However, common pollutants are not easy to assess, so an indicator is commonly taken to represent the state of the rest of the pollutants. Among the possible pollutants that are commonly produced indoors, CO<sub>2</sub> is the most commonplace and closest related to human activity. Despite the fact that CO<sub>2</sub> does not entail any health risk in the commonly encountered concentrations, CO<sub>2</sub> is nevertheless a reliable indicator of ventilation rate, for which reason it is the most common indicator used in regulations and guides.

The chosen indicator in the Spanish IAQ regulations is CO<sub>2</sub> concentration, which is limited in two ways:

- 900 ppm maximum yearly average;
- 500000 ppm per hour maximum yearly accumulated above 1600 ppm. This parameter shows the relationship between the CO<sub>2</sub> concentrations reached above a limit value and their duration over a year. It can be calculated as the sum of the areas (ppm·h) within the representation of the CO<sub>2</sub> concentration as a time function and the limit value.

These required concentration levels shall be achieved under certain design conditions (such as occupancy scenarios, CO<sub>2</sub> production rate, yearly average outdoor CO<sub>2</sub> concentration, etc.), that should be set in the regulation. That is, it is a “design performance” because it can only be measurable *in situ* under these conditions.

In addition to this performance-based indicator, a minimum ventilation flow has been established in order to control the concentration of pollutants not related to human activity, but to furniture, paint, etc. such as formaldehydes.

## 2 VERIFICATION METHOD

Fulfilment of the requirement can be achieved through expert methods (such as specialized software), as well as a simplified verification method. This simplified method is easy to use by non-expert practitioners and consists of a table with different ventilation rates (continuous) (See table 1) that provide fulfilment of the requirement for different dwelling types.

Table 1. Continuous ventilation rates values

Dwelling case study	Continuous ventilation rate <sup>(1)</sup> (l/s)	Total whole dwelling continuous ventilation rate (l/s)	Yearly average CO <sub>2</sub> concentration <sup>(2)</sup> (ppm)	Yearly accumulated over 1.600 ppm <sup>(2)</sup> (ppm·h)
1	6	12	816	0
2	8	24	812	145860
3	11	33	789	150020
4	11	33	848	247000
5	8	24	826	105560

(1) In kitchen and each bathroom.

(2) The highest value per room in each dwelling.

The dwelling types are classified taking into account their bedroom and bathroom counts (See Table 2).

Table 2. Dwellings types

Kind and composition of dwelling	Types
Flat: Living+Kitchen+1 Bedroom+1 Bathroom	1
Flat: Living+Kitchen+2 Bedrooms+2 Bathrooms	2
Flat: Living+Kitchen+3 Bedrooms+2 Bathrooms	3
Flat: Living+Kitchen+4 Bedrooms+2 Bathrooms	4
Terraced house: Living+Kitchen+4 Bedrooms+2 Bathrooms	5

## 3 REFERENCES

Linares, P., García, S. et al (2014). Proposed change in Spanish regulations relating to indoor air quality with the aim of reducing energy consumption of ventilation systems. PROCEEDINGS of 35th AIVC Conference, 4th TightVent Conference and 2nd venticool Conference: Ventilation and airtightness in transforming the building stock to high performance. Poznań (Poland).

*Código Técnico de la Edificación* (Building Code). *Ministerio de Fomento*. On line. <http://www.codigotecnico.org/web/recursos/documentos/> [Consulted 18/06/2015]