Eurovent Industry Recommendation / Code of Good Practice

Eurovent 6/20 - 2025

Capability of Air Handling Unit control systems to support Building Automation required by Article 13(10) of Directive 2024/1275 (EPBD)

First Edition

Published on Monday, 08 September 2025 by
Eurovent, 80 Bd A. Reyers Ln, 1030 Brussels, Belgium
secretariat@eurovent.eu

Document history

This Eurovent Industry Recommendation / Code of Good Practice supersedes all of its previous editions, which automatically become obsolete with the publication of this document.

Modifications

This Eurovent publication was modified as against previous editions in the following manner:

Modifications as against	Key changes
1st edition	Current document

Preface

In a nutshell

This document discusses the capability of available AHU control systems to foster objectives of Directive 2024/1275 (Recast EPBD) in a technically and economically feasible way. It provides recommendations on specific requirements to be implemented in the transposition of the Directive by Members States to fulfil the provisions of Article 13(10), which are intended to support national legislator in developing a clear interpretation of the term 'technically and economically feasible application'.

Authors

This document was published by Eurovent and was prepared in a joint effort by participants of the Product Group 'Air Handling Units' (PG-AHU), which represents a vast majority of manufacturers of these products active on the EMEA market. Particularly important contributions have been provided (in alphabetical order) by Andy Bijmans, Johan Bjärklev, Tianyun Gao, Emre Kandemir, Martin Lenz, Mark Mandl, Andrea Pagan, Igor Sikonczyk, Nicklas Svensson, Oliver Topf and Martin Widmer.

Copyright

Suggested citation

Eurovent AISBL / IVZW / INPA. (2025). Eurovent 6/20 - 2025 - Capability of Air Handling Unit control systems to support Building Automation required by Article 13(10) of Directive 2024/1275 (EPBD). Brussels: Eurovent.

Important remarks

Eurovent does not grant any certification based on this document. All certification-related issues are managed by the Eurovent's subunit Eurovent Certification. For more information, visit www.eurovent-certification.com.

Contents

List of abbreviations used

AHU	Air Handling Unit
BAC	Building Automation and Control

BMS	Building Management System
EHA	Exhaust Air (airflow leaving the extract air treatment system and discharged to the atmosphere). Alternatively, the term *Exhaust air outlet* is used
ETA	Extract Air (airflow leaving the treated room and entering the air treatment system). Alternatively, the term *Exhaust air inlet* is used
HRS	Heat Recovery System
IAQ	Indoor Air Quality
KPI	Key Performance Indicator
ODA	Outdoor Air (airflow entering the system from outdoors before heat recovery) Alternatively, the term *Supply air inlet* is used
SCADA	Supervisory Control and Data Acquisition
SFP	Specific Fan Power
SUP	Supply Air (airflow entering the treated room after heat recovery) Alternatively, the term *Supply air outlet* is used
TBS	Technical Building System
VAV	Variable Air Volume (device)
VU	Ventilation Unit
VOC	volatile organic compounds

1 Introduction

This document outlines the capability of commonly available mechanical ventilation systems for non-residential buildings to facilitate the implementation of provision of Article 13(10) of Directive 2024/1275 (EPBD recast). Its objective is to indicate technically and economically feasible solutions for consideration in the EPBD transposition by Member States.

1.1 New relevant and linked provisions of the Directive

Article 13(10) specifies properties of building automation and control systems in non-residential buildings, which, according to Article 13(9), should be applied where technically and economically feasible.

At the same time, in Article 13(4) the Directive obliges Member States to set requirements for the implementation of adequate indoor environmental quality standards in buildings and, in Article 13(5), it unconditionally requires non-residential zero-emission buildings - meaning in practice all new non-residential buildings from 2030 onwards, to be to be equipped with measuring and control devices for the monitoring and regulation of indoor air quality (IAQ).

Mechanical ventilation systems and combined ventilation and air-conditioning systems are essential to provide and control adequate IAQ and their employment may be necessary to meet the IAQ requirements in many new buildings.

1.2 Opportunity to exploit synergies

The key component of ventilation systems is typically the air handling unit (AHU) with integrated controls capable of regulating and monitoring IAQ by means of optimised elements comprising the system.

Integrated control system of the AHU is an important part of the building automation control system (BAC), required by Article 13. It supports energy-efficient, economical and safe operation of the AHU through automatic controls and by facilitating the manual management of the unit. This enables, particularly in the case of small and medium-sized buildings, compliance with the requirements of Article 13(5) and the provisions of Article 13(10)(d), sometimes even without the need for an additional BAC system, because in the scope of ventilation systems and combined ventilation and air conditioning systems, integrated AHU controls can cover all BAC functions required by the EPBD.

It should be noted that the commonly available integrated control systems of air handling units, in addition to their capability to support the IAQ monitoring provisions, also have the capability to support other provisions of Article 13(10) on building automation and control systems.

Even though these capabilities may not cover all technical building systems, they do cover the entire scope of ventilation and combined ventilation and air-conditioning systems which in many cases are key technical building systems. Thus, integrated control of air handling units in interoperability with other parts of the BAC system can reduce its extent and cost and thereby contribute to the economic feasibility of implementing the provision of Article 13(10).

Given that Article 13(9) states that the provisions of Article 13(10) should be applied where technically and economically feasible, this capability is very significant and creates synergies that can be exploited to facilitate the objectives of the Directive.

1.3 Capability of integrated AHU control systems to support Article 13(10)

More specifically, the integrated controls of air handling units have the following capability to support provisions of Article 13(10):

a) Continuous monitoring, logging, analysing and allowing for adjusting energy use for ventilation systems and combined ventilation and air-conditioning systems.
b) Contribution via communication and interoperability with a central BAC system to buildings energy efficiency benchmarking, detecting losses, informing the responsible person, informing about opportunities for energy efficiency improvement with regard to ventilation systems and combined ventilation and air-conditioning systems.
c) Integrated controls of AHUs commonly allow communication via available standard communication protocols with other connected technical building systems and devices, in particular such as chillers, heat pumps, duct humidifiers, variable air volume units (VAV), room controllers, fire dampers, fan-coils etc.

In the following sections, these capabilities are explained and discussed in detail in relation to relevant Directive articles.

1.4 Integrated controls and external automation systems to control AHUs

It should be noted that air handling units (ventilation units in non-residential buildings) are not always equipped with integrated control systems and are sometimes controlled by separate automation systems made by external contractors.

Integrated control systems, which, according to the Eurovent Market Intelligence statistics, were supplied in almost 70% of AHUs placed on the EU market in 2023, have many advantages over automation systems installed on site. These include:

- Integrated controls are delivered as a package from one supplier and contractor.
- Integrated controls are an optimised system solution which does not require a separate project.
- The integrated control system is optimised at the development stage and then tested and configured at the factory, which significantly facilitates installation and commissioning and reduces the associated costs and time.

Nevertheless, there are cases when contractors choose to purchase AHUs without integrated control systems and complete them with external automation systems to control the operation of the AHU and ventilation. This particularly applies to large and complex buildings (e.g. hospitals, big office buildings and hotels), which involve many technical building systems, and for which employing a central automation system integrating all TBSs may be more beneficial.

Furthermore, in contrary to large and elaborate AHUs, the implementation of all recommendations made in this document in integrated AHU controls may not be economically feasible for small ventilation units in small and noncomplex buildings. Therefore, further diversification of requirements may need to be defined by the size and complexity of the building or system. Alternatively, the recommended features could be provided jointly by an integrated AHU control system and an external automation system.

Hence, the recommendations given in the following sections apply both to the integrated AHU controls and the external automation systems that control AHU operation. They are aimed to support national legislators in developing a clear and straightforward interpretation of the term ‘technically and economically feasible’.

2 Capability to support Article 13(10)(a)

Continuous monitoring, logging, analysing and allowing for adjusting energy use

The aim of the measures required under this section is to identify and eliminate changes over time that have a negative impact on energy consumption and IAQ and that are not related to the design and commissioning phases. In mechanical ventilation systems and combined air conditioning and ventilation systems, there is mainly electricity consumption by fans and thermal energy consumption by heating and cooling coils.

Deviations in optimum energy consumption can result either from improper control logic, failing to ensure adequate adjustment to actual demand, or from malfunction of system components, which in turn may be the result of wear and tear or incorrect maintenance.

Regarding electrical energy use
The most impactful factor is the correct airflow rate in the system, which is adjusted to the actual demand to ensure IAQ, as well as being in line with the design value and not deviating from it, for example due to dirty components or leaks.

Regarding thermal energy use
Main reasons for excessive and redundant heat consumption can be eliminated by ensuring that:

- Air heating and cooling modes are not active simultaneously, except for operation in dehumidification mode,
- Air heating or cooling is not active if the heat recovery is not running at the full capacity available at the time (heat recovery capacity may be temporary reduced e.g. due to defrosting)
- Free cooling must be used for cooling in the first instance. Only when its performance is insufficient can mechanical cooling be activated.
- There is no fluid flow over the heat exchanger if no heating or cooling is required (also due to valve leakage)
- Heat exchange efficiency is not reduced due to dirty exchangers.

Relevant control system functions for monitoring, recording and analysing to identify and eliminate the above-mentioned causes of unnecessary energy consumption are available today. They are also economically viable, especially considering the amount of energy consumed and the savings they provide. Therefore, Eurovent suggests implementing the following mandatory and optional requirements for control systems of ventilation and combined ventilation and air-conditioning systems to fulfil the provisions of Article 13(10)(a).

Eurovent recommendations on mandatory requirements in relation to Article 13(10)(a)

With regard to monitoring and logging

- Each VU in non-residential buildings should be equipped with all necessary sensors and be capable of continuous monitoring and logging the following parameters:
  - Airflow and the electrical power consumption of fans.
  - Air differential pressure of the HRS and air filters.
  - ETA, ODA and SUP temperature.
  - fluid mass flow and fluid supply and return temperature of all air heat exchangers (coils).
- The frequency of energy consumption logging should be suitable for benchmarking and analysing.

With regard to analysing and allowing for adjusting energy use

- Based on the monitored and logged airflow and the electrical power of the fans, the corresponding specific fan power value (SFP) is to be calculated and serve as a KPI to indicate potential deviations in VU performance.
- Based on the monitored and logged ETA, ODA and SUP temperatures, the corresponding thermal efficiency of the HRS is to be calculated and serve as a KPI to indicate a potential malfunction of the system.

- Based on the monitored and logged fluid mass flow and supply/return temperature the power consumption and differential temperature of each heat exchanger is to be calculated.

Moreover, analysing for energy optimisation and malfunction detection should include:

- *No cooling and heating mode at the same time*
  The system shall check if the cooling coil and heating coil in the air handling unit is operating at the same time, for example, by checking the flow at the valves. The exemption could be dehumidification.
- *No heating or cooling if the HRS is not operating at full available capacity at the time*
  In cases where the heating or cooling coil is active, the HRS should operate at 100% capacity (no thermal bypass). Exemption could be the case of frost protection or defreezing
- *No mechanical air cooling if free-cooling is possible and sufficient*
  The system shall ensure that the cooling coil is not activated if the outdoor temperature is lower than a set supply air temperature corrected against the fan temperature rise. The exemption could be dehumidification.
- *Leakage of heating and cooling coil valves*
  In cases where the valves should be closed, there should also be no flow in the coils
- *Dirty or damaged components*
  Differential pressure of components should be analysed, and an alarm could be generated in cases of significant increases. For this the control systems needs the air flow pressure characteristic of the components to be checked.
- *Function of dampers*
  Analysing the position feedback to ensure that dampers open or closed when needed.
- *Pressure drop of filters*
  Comparison of current and final pressure drop of the filter, considering the actual flow rate (not only nominal flow rate). For this the control systems needs the air flow pressure characteristic of the filters.
- *Deviation of current values from set-points*
  - For the supply temperature to show that the unit provides the required capacity
  - For the airflow to show that the fan is not working as expected or the pressures are too high.

With regard to the connection with provisions of Article 13(10)(c)

- The AHU control system is able to provide the calculated power consumption and differential temperature of each heat exchanger (based on the monitored and logged fluid mass flow and fluid supply and return temperature) to the central BMS in order to optimise the operation of heat and cooling generators.

Eurovent recommendations on optional requirements in relation to Article 13(10)(a)

With regard to monitoring and logging

- continuous monitoring and logging of air differential pressure on coils and other significant components (in addition to the mandatory HRS and air filters).

With regard to analysing and allowing for adjusting energy use

- Signalling of exchanger fouling on air side
  The system should trigger an alarm if a minimum temperature difference between the inlet and return (e.g. 2 K) is measured on the water side (water-glycol mixture) or the system automatically ensures that the temperature difference does not fall below the minimum (by closing the valve).
- Adjust the speed of fans according to the position of VAV dampers to optimise energy use by fans.

3 Capability to support Article 13(10)(b)

Benchmarking the building's energy efficiency, detecting losses in efficiency of technical building systems, and informing about opportunities for energy efficiency

The functions required in this section are the capability to regularly collect energy consumption and energy efficiency key indicators data, and compare them with reference values. The purpose is to identify loss of energy efficiency, so that necessary maintenance procedures can be initiated as soon as possible. Article 13(10)(b) requires benchmarking of the energy consumption of the whole building. At the same time, subsystem information should be available in order to analyse the root cause of deviations. Integrated control of air handling units can provide energy efficiency benchmarking of the ventilation and combined ventilation and air conditioning systems, which in many cases are key technical building systems.

The reference values for benchmarking can be the energy consumption and energy efficiency key indicators of the same unit from a previous time period (self-benchmarking), a target value according to a standard (standard compliance benchmarking), or another unit operating in a similar condition (peer benchmarking). The following sections explain these three types of benchmarking in detail.

3.1 Self-benchmarking

Comparing the energy consumption and energy efficiency key indicators of the same unit to a previous time period gives an indication of whether the unit is degrading. A typical approach is to compare the monthly energy consumption with the same month of the previous year. The assumption is that the unit was commissioned properly in the beginning, and the previous energy consumption represents a healthy state of the unit.

Commissioning of the AHU is mandatory after installation or renovation. It should include the following to ensure that the AHU operates efficiently and as designed:

- Develop and execute test procedures to verify that the AHU operates according to design specifications under various conditions. This includes testing for temperature control, humidity control, air quality control, pressure and air flow control.
- Verify that there are no installation mistakes. The resistance of filters, heat exchangers, dampers, ducts, and terminal units are normal. There is no duct leakage and blockage. All dampers and valves open and close normally.
- Verify that the AHU meets all performance criteria specified in the design document. This includes ensuring energy efficiency and occupant comfort.

The energy efficiency after successful commissioning represents the benchmark of normal performance. Over time, efficiency may decrease due to the following reasons:

- Lack of maintenance: The Filter and heat exchanger get dirty and the resistance increases, which causes more fan energy consumption.
- Ageing of devices: Valves and dampers may become hard to move or stuck at certain position.

- Human mistakes: The unit may be switched to manual operation and forgotten to set back to automatic mode. Set points may be set to unreasonable values. Repair and mechanical changes to the unit and duct may leave slight damage to the system, such as leakage and blockage.

Self-benchmarking helps to identify system degradation and losses in efficiency and helps determine if and when the recommissioning is needed.

3.2 Standard compliance benchmarking

EPBD requires member states to establish minimum energy performance requirements for new buildings and existing buildings undergoing major renovations. Many countries have established energy efficiency standards which set maximum permissible values for primary energy consumption in kWh/m^2/year.

Energy consumption logs in AHU integrated control contribute significantly to building energy performance benchmarking. These logs provide detailed and accurate data on the energy usage for ventilation which is essential for effective benchmarking.

Comparing operational energy consumption with standards helps in meeting mandatory energy efficiency targets and certifications, which may be required for operating permits or building certifications. In case that gaps are identified between current performance and required standards, organizations need to work on developing and implementing an energy efficiency improvement plan to address these discrepancies.

3.3 Peer benchmarking

Once the AHU data is logged by integrated controls, one can collect data from different similar units, compare the energy consumption and energy efficiency key indicators for ventilation and identify the ones which are least energy efficient. This kind of benchmarking may be executed by an organization such as facility management and real estate company, or a specific AHU manufacturer.

Peer benchmarking is particularly useful for pinpointing the worst-performing ventilation systems and focusing improvement efforts on those systems. It’s particularly useful for the management of big number of similar buildings, such as chain stores, apartment building districts, etc. Peer benchmarking is particularly suitable for SCADA / cloud solutions.

Accordingly, Eurovent suggests implementing the following mandatory and optional requirements for control systems of ventilation and combined ventilation and air-conditioning systems to fulfil the provisions of Article 13(10)(b).

Eurovent recommendations on mandatory requirements in relation to Article 13(10)(b)

With regard to the self-benchmarking

Commissioning is required upon completion of AHU installation. The commissioning report should provide both benchmark energy efficiency key indicators under commissioning operating conditions and converted to reference design conditions.

With regard to the standard compliance benchmarking

The AHU control and monitoring system is able to calculate energy consumption for ventilation in kWh/m^2/year as specified by local regulations.

Eurovent recommendations on optional requirements in relation to Article 13(10)(b)

With regard to the self-benchmarking

- Commissioning is required upon completion of AHU installation. The commissioning report should separately provide energy efficiency key indicators. with the design supply air setpoint (temperature, pressure, air flow, humidity, etc.) for a hot summer day, cold winter day and a transition season day when heating and cooling are not needed.
- If conditions do not allow completion of the commissioning report at the time when the project is completed, follow-up commissioning should be done within one year.
- In order to reflect the actual conditions, the benchmark energy consumption should be measured when building is in real use. When the usage of building is significantly changed, the test should be repeated.
- To allow benchmarking between similar operation conditions, occupancy and weather information (e.g. outside air temperature, humidity) need to be available.
- The AHU control and monitoring system should be able to compare current energy consumption with previous energy consumption from the same period (e.g.one month) of the year.
- The AHU control and monitoring system is able to inform the operator (HVAC engineer, facility manager, or building owner) when the above-mentioned comparison shows significant discrepancy (e.g. more than double the energy consumption). The format for presenting this information should be standardised.

With regard to the peer benchmarking

- To allow benchmarking between similar operation conditions, occupancy and weather information (e.g. outside air temperature, humidity) need to be available.
- The AHU fleet management system should be able to compare normalised energy consumption and energy efficiency key indicators between different units.

4 Capability to support Article 13(10)(c)

Allowing communication with connected technical building systems and other appliances inside the building, and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers

The communication between the integrated control systems of AHUs and other technical building systems must be executed through a robust communication layer. This layer should provide maximum immunity to external disturbances while ensuring high-speed data transfer, particularly in interactions with field sensors and actuators. Various options exist for the communication layer, including wired solutions like a remote terminal unit (RTU) and Ethernet, or wireless alternatives such as Wi-Fi. The selection of the communication layer should be based on the required data flow speed and system performance needs.

Integrated control of AHUs and other technical building systems should operate within a dedicated network, and preferably, external internet connections shall be routed through the Building Management System (BMS).

Communication between AHUs and other technical systems must adhere to standardised communication protocols. These protocols and the structure of exchanged data must guarantee interoperability between devices from different manufacturers. The protocols should be open source, providing the following benefits:

- Free access and use by any entity

- Modifiability and adaptability to specific needs
- Scalability and reduced implementation costs
- Freedom to select protocols that align with both technical and financial requirements
- Flexibility in integrating products from multiple vendors
- No recurring fees or hidden costs
- Simplified migration between different suppliers.

Accordingly, Eurovent suggests implementing the following mandatory and optional requirements for control systems of ventilation and combined ventilation and air-conditioning systems to fulfil the provisions of Article 13(10)(c).

Eurovent recommendations on mandatory requirements in relation to Article 13(10)(c)

- Only protocols that have a wide range of usage in building and industrial automation systems and offer reliable and scalable solutions in automation projects with flexibility, wide communication support, open standard structure and widespread device support should be used.
- Data exchange should follow commonly recognized standards and structures.
- Any technical building system involved in communication must be designed and implemented to prevent the introduction of vulnerabilities, in full compliance with current cybersecurity regulations. Moreover, every manufacturer should ensure that registry codes for automation systems are provided in a secure and accessible manner, ensuring both confidentiality and integrity.
- The standards to consider as reference for the above recommendations are:
  ISO 16484-5, EN 50090, EN 13321, ISO 14908.

Eurovent recommendations on optional requirements in relation to Article 13(10)(c)

In relation to the standard compliance benchmarking

- The AHU control and monitoring system is able to share the real-time energy consumption data or calculated annual energy consumption to the BMS system through integration and communication.

5 Capability to support Article 13(10)(d)

Monitoring of indoor air quality

Mechanical ventilation and combined ventilation and air-conditioning systems are usually indispensable in non-residential buildings to provide IAQ. The most typical ventilation system in non-residential buildings comprises a central ventilation unit (air handling unit) that serves a number of rooms or zones of similar requirements via ductwork for supply and extract air. For large buildings, this layout is replicated in individual parts or zones of the building, meaning that serval air handling units can be installed in a building.

With today's 'system-oriented' approach, the supplier of the main component of the ventilation system - the ventilation unit - can usually also supply the other components that make up the system, including those for monitoring and regulating IAQ[1]. This existing anyway complete infrastructure of the ventilation system can easily be utilised to meet, in an economically feasible way, the provisions of Article 13(10)(d).

[1] For more information refer to Eurovent PP – 2024-06-21 'Overview of ventilation technologies supporting objectives of Directive 2024/1275 (EPBD) with respect to the provision and monitoring of IAQ'.

Therefore, Eurovent suggests implementing the following mandatory requirements for control systems of ventilation and combined ventilation and air-conditioning systems.

Eurovent recommendations on mandatory requirements in relation to Article 13(10)(d)

- The control system of the ventilation system must be capable of connecting and operating IAQ sensors in the building where IAQ is to be monitored, whereas the IAQ sensor measures singly or concurrently, at least indoor temperature, indoor relative humidity and CO_2 concentration.
- The control system of the ventilation system must be capable of connecting and operating air flow control devices in the building where the IAQ is to be controlled.
- Based on measurements (readings) from IAQ sensors, the control system of the ventilation system must be able to adjust by means of airflow control devices the ventilation rate in the building where the IAQ is to be regulated, as well as the total flow rate of the ventilation unit, so that the required IAQ is maintained at the optimised air flow rate.

About Eurovent

Eurovent is the voice of the European HVACR industry, representing over 100 companies directly and more than 1.000 indirectly through our 16 national associations. The majority are small and medium-sized companies that manufacture indoor climate, process cooling, and cold chain technologies across more than 350 manufacturing sites in Europe. They generate a combined annual turnover of more than 30 billion EUR and employ over 150.000 Europeans in good quality tech jobs.

Mission

Eurovent's mission is to bring together HVACR technology providers to collaborate with policymakers and other stakeholders towards conditions that foster fair competition, innovation, and sustainable growth for the European HVACR industry.

Vision

Eurovent's vision is an innovative and competitive European HVACR industry that enables sustainable development in Europe and globally, which works for people, businesses, and the environment.

→ For in-depth information and a list of all our members, visit www.eurovent.eu