New standard ISO 16484-4 2025: How to achieve “Class A” BACS with hydronic balancing

Upgrading thermal BACS:
A smart investment for energy savings

Optimizing heating and cooling through Building Automation and Control Systems (BACS) is one of the most cost-effective ways to cut energy use and costs. Upgrading the performance of heating and cooling controls alone can deliver 15% to 38% energy savings, often paying back the investment in just 1 to 3 years. This should always be the first step before considering other measures.

A key element of this optimization is hydronic balancing– the process of ensuring that hot or chilled water flows evenly throughout the system. When the flow is balanced, every terminal unit (radiator, fan coil, air conditioning unit) receives exactly the amount of energy it needs. This allows the system to operate at partial load, reducing energy production and pump power dramatically.

Why balancing energy flows matters:

Without balancing – a state that is still common in many EU buildings – distant rooms often remain underheated or undercooled. To compensate, systems are oversized, pumps run at full speed, and energy is wasted—while occupant comfort still suffers.

Think of your heating or cooling system like a road network. If traffic (water flow) is uneven, some roads are jammed while others are empty. Balancing ensures smooth traffic everywhere, so energy reaches where it's needed without waste.

Once you decide to balance your system, you need to choose the right technology. This can be challenging, as plenty of options on the market. Here, ISO standards help:

→ ISO 52120

defines which control functions improve energy performance.

→ ISO 16484-4

specifies and explains how to implement them effectively.

Both standards classify hydronic balancing solutions and assign them to energy efficiency classes, making it easier to select high-performance products.

Dynamic balancing: achieving "Class A" BACS

Standard ISO 52120-1 defines four different BACS energy efficiency classes to classify building automation systems, both in the residential and non-residential sectors.

Class A

"High energy performance":

corresponds to systems with levels of precision as to guarantee high energy performance to the power generator. Room control devices must be able to manage HVAC systems taking into account various factors (for example, preset values based on occupancy detection, air quality, etc.) and include integrated additional functions for multidisciplinary reports between HVAC and various building services (for example, electricity, lighting, solar shading, etc.).

Class B

"Advanced":

includes systems capable of centralized and coordinated management of the individual plants in the building. Room control devices must be able to communicate with the building automation system.

Class C

"Standard" (reference):

corresponds to solutions equipped with traditional building automation and control systems, possibly equipped with communication, in any case at minimum performance levels.

Class D

"Non energy efficient":

includes traditional and non-energy-efficient technical systems automation and control.

The standard specifies that only systems balanced dynamically per emitter are compatible with Class A "HIGH ENERGY PERFORMANCE". This is particularly relevant for tertiary buildings or high-end large residential buildings.

See the table below for more details.*

Cooling Control

			Definition of classes							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
Automatic control										
3	Cooling control									
3.4a	Hydronic balancing cooling distribution (including contribution to the balancing to the emission side)									
	Hydronic balancing is applied to a group of cooling emitters (cooling panel, fan-coil unit or indoor unit) greater than 10, in addition to static balancing at individual cooling emitters.									
	0	No balancing	■				■			
	1	**Balanced** statically per emitter, without group balance	■	■			■			
	2	**Balanced** statically per emitter, and a static group balance (e.g. with balancing valve)	■	■			■			
	3	**Balanced** statically per emitter and **dynamic** group balance	■	■	■		■	■		
	4	**Balanced dynamically** per emitter	■	■	■	■	■	■	■	■

↑ Table 1

Heating control

			Definition of classes							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
Automatic control										
1	Heating control									
1.1	Emission control									
	The control function is applied to the heat emitter (radiators, underfloor heating, fan-coil unit, indoor unit) at room level; for type 1 one function can control several rooms.									
	0	No automatic control	■				■			
	1	Central automatic control	■				■			
	2	Individual room control	■	■			■	■		
	3	Individual modulating room control with communication	■	■	■	■	■	■	■	■
	4	Individual modulating room control with communication and occupancy detection (not applied to slow reacting heating emission systems, e.g. floor heating)	■	■	■	■	■	■	■	■

* In case of slow reacting heat and cool emission systems, for example, floor heating, wall heating, etc., functions 1.1.3 and 3.1.3 are allocated to BAC class A.

↑ Table 2

It is therefore important to understand which technologies provide "true" dynamic balancing and the associated benefits.

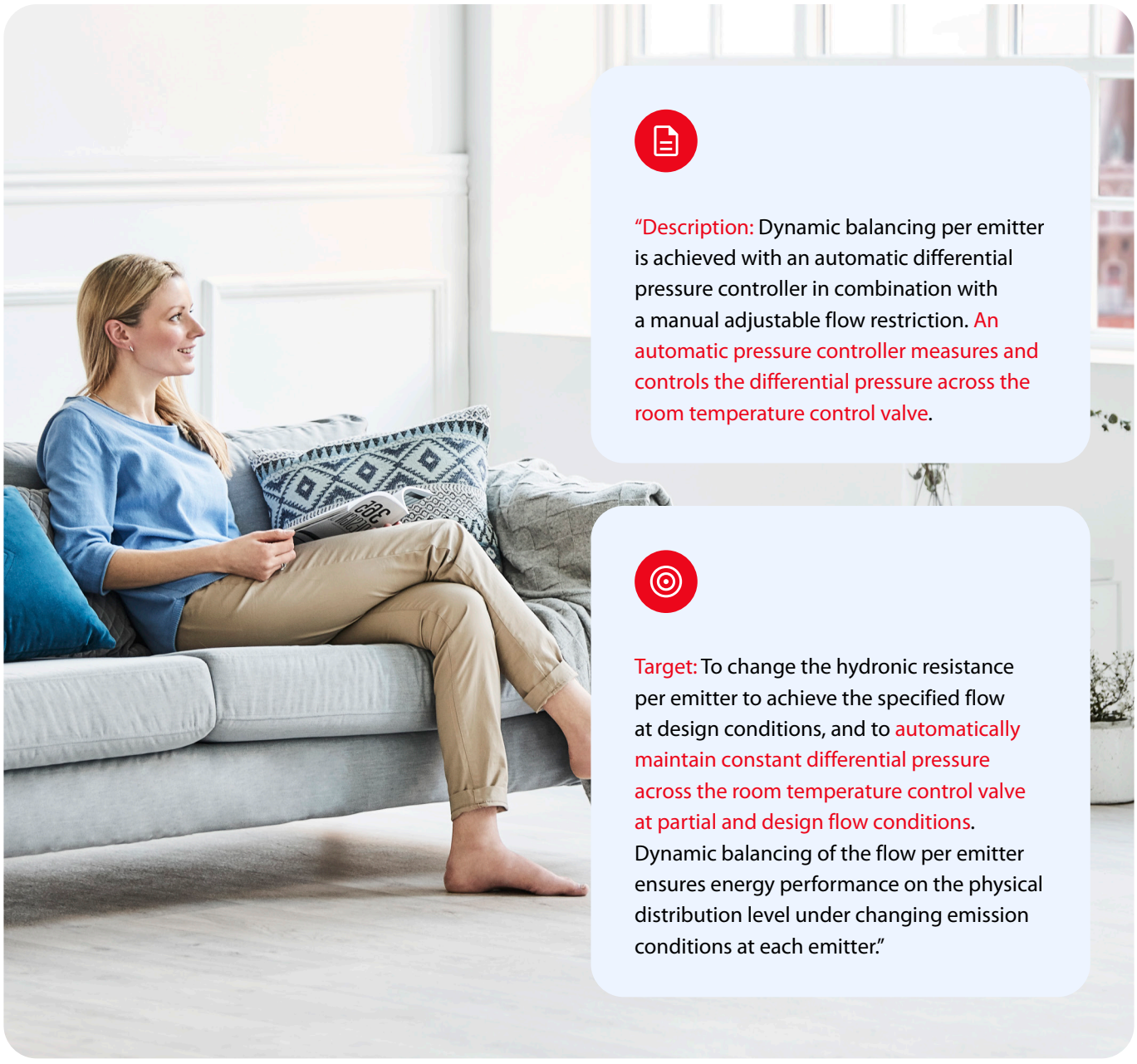
*Withdraw from the tables 3.1 and 1.1 from the Iso 52120-1 standard. Complete Version of the Standard can be found at: ISO 52120-1:2021 – Energy performance of buildings — Contribution of building automation, controls and building management — Part 1: General framework and procedures (https://www.iso.org/standard/65883.html)

Requirements for "Class A" dynamic balancing

As described, ISO 52120 tells you *what* building automation functions are needed to save energy, while the new ISO 16484-4 standard explains *how* to implement those functions in detail.

In fact, the newly published standard ISO 16484-4:2025 provides precise definitions and logic blocks for all functions and serves as a requirements specification for building control applications, including hydronic balancing of heating and cooling systems.

See the excerpts below on Dynamic Balancing. ↓



"Description: Dynamic balancing per emitter is achieved with an automatic differential pressure controller in combination with a manual adjustable flow restriction. An automatic pressure controller measures and controls the differential pressure across the room temperature control valve.

Target: To change the hydronic resistance per emitter to achieve the specified flow at design conditions, and to automatically maintain constant differential pressure across the room temperature control valve at partial and design flow conditions. Dynamic balancing of the flow per emitter ensures energy performance on the physical distribution level under changing emission conditions at each emitter."

Dynamic balancing per emitter means each radiator or cooling unit gets the right water flow automatically, even when conditions change. This is done by combining:

→ An automatic differential pressure controller

(keeps pressure stable across the control valve),

+

→ A manual flow restriction

(sets the maximum flow at design conditions).

The goal is:

- At full load: to ensure each emitter gets its designed flow.
- At partial load: to keep pressure constant so the control valve works properly.

Why is this important? Because it prevents some units from getting too much or too little water, which saves energy and keeps comfort levels stable. In short, it makes the system smart enough to adapt to changing demand without wasting energy.

Pressure-independent control valves that combine a valve seat with pre-setting meet the requirements for "Class A" BACS. According to the standard, they maintain stable operation at both design and partial flow conditions.

Whereas valves relying on a flow limiter can only be effective at design flow conditions and meet the requirements for the less efficient "Class C" BACS.

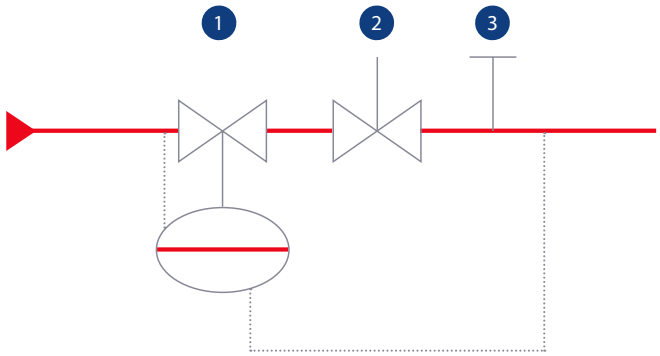
True dynamic (PICV)

Both valve seat + pre-setting are pressure independent

BAC efficiency Class A

Balanced dynamically per emitter

Automatically maintain constant differential pressure across the room temperature control valve at partial and design flow conditions.



1 Pressure controller 2 Control Valve 3 Pre-setting

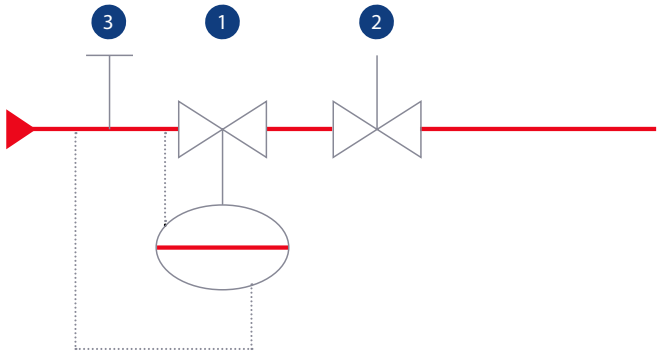
Flow limiter

Only pre-setting is pressure independent

BAC efficiency Class C

Balanced statically per emitter

Only automatically maintain constant differential pressure across the room temperature control valve at design flow conditions.



A worthwhile investment

The economic benefits of investing in high performance balancing technologies are striking. Upgrading from non-performing systems to class "A" or "B" improves – on average – the Energy Performance Certificate by 1.0 class for residential buildings and by 1.3 classes for non-residential buildings, thereby increasing the building's commercial value, improving occupants' health and comfort and reducing energy bills.

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Our portfolio can help you achieve the best energy performance with heating and cooling controls

	Hydronic balancing				1.4.a Heating		3.4.a Cooling	
	Valve at emitter				Residential	Non residential	Residential	Non residential
	Danfoss RA-DV	Dynamic valve			A	A	/	/
	Danfoss VHS-DV	Dynamic valve			A	A	/	/
	Danfoss AB-QM	PICV			A	A	A	A
	Emitter and group balance							
	Valve at emitter		Group valve		Residential	Non residential	Residential	Non residential
	Danfoss RA-IN	Pre-setting valve	Danfoss ASV-PV 	Dynamic balancing valve	B	C	/	/
	Danfoss RA-N				B	C	/	/
	Danfoss RA-U / -UN				B	C	/	/
	Danfoss RA-UR				B	C	/	/
	Danfoss RA-N (BIV)				B	C	/	/
	Danfoss RA-IN	Pre-setting valve	Danfoss AB-PM 	Dynamic balancing valve	B	C	/	/
	Danfoss RA-N				B	C	/	/
	Danfoss RA-U / -UN				B	C	/	/
	Danfoss RA-UR				B	C	/	/
	Danfoss RA-N (BIV)				B	C	/	/

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