

3RD EDITION

TECHNICAL NOTEBOOK

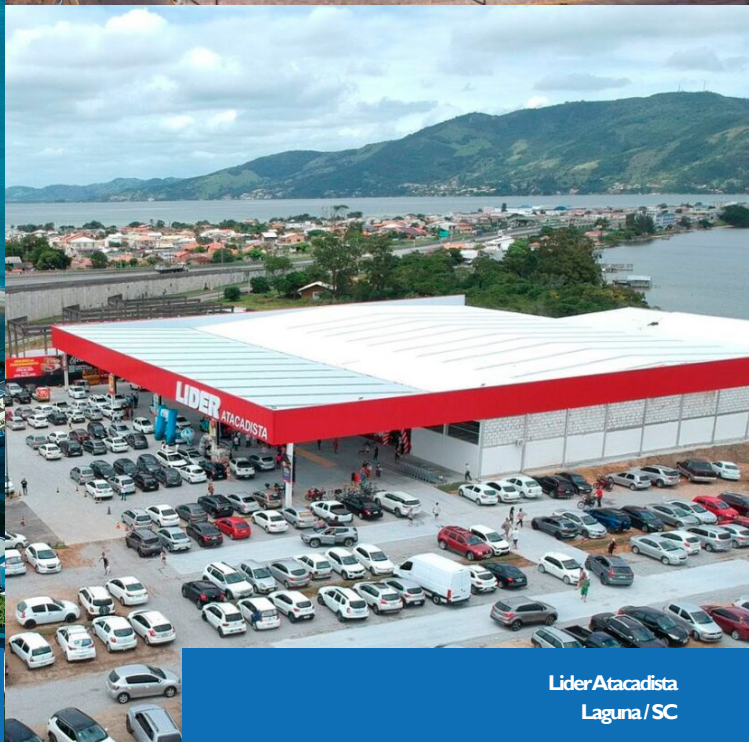




Yachthouse by Pininfarina
Pasqualotto & GT / Balneario camboriu / SC



Moinho de Massas e Biscoitos Isabela
M.Dias Branco / Bento Gonçalves / RS



Lider Atacadista
Laguna / SC



Metropolitan Business Center
Metropolitan Empreendimentos Imobiliários / Criciúma / SC

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Celucon was founded in 1998 and has since been producing Autoclaved Aerated Concrete (AAC), which can be applied in various segments of the construction industry. One of the company's main characteristics is its efficiency in quality control and its compliance with the standards set by the Brazilian Association of Technical Standards (ABNT).

MISSION

To provide innovative construction solutions, offering economy, agility, and comfort in buildings.

VISION

To be recognized as the best option for innovative solutions in the construction industry.

VALUES

- **Vision and Ownership Mindset**
- **Trust, Ethics, and Transparency**
- **Commitment to Customer Satisfaction**
- **Innovative Spirit**
- **Belief in People's Capabilities**

AUTOCLAVED AERATED CONCRETE

Autoclaved Aerated Concrete (AAC), referred to here as the Celucon Module, is an ecological pre-cast building material that has been on the global market for over 100 years. It is widely used in residential, commercial, and industrial construction due to its superior features.

It is produced by mixing water, sand, lime, cement, gypsum, and aluminum, thus creating a durable yet lightweight concrete. Its strength comes from the crystallization of Tobermorite, a molecule that, once formed, does not physically degrade through heat, decay, corrosion, or other chemical processes.

The autoclaving process uses high-pressure and high-temperature steam to enhance its strength and rigidity, ensuring the superior quality of the Celucon Module compared to non-autoclaved products.

CELUCON MODULE

WATER
+
SAND
+
LIME
+
CEMENT
+
GYPSUM
+
ALUMINUM

ADVANTAGES AND BENEFITS



HIGH PRODUCTIVITY

Due to its lightweight nature, larger dimensions, and excellent adhesion, AAC significantly increases laying speed, ensuring high productivity, reducing execution time, and lowering labor costs.



THERMAL INSULATION

With low thermal conductivity and closed air cells, the Celucon Module ensures excellent thermal insulation, providing comfortable and balanced environments throughout the year while reducing heating and cooling costs.



SUSTAINABLE

All material waste is ground and reused in production. Additionally, the manufacturing process does not generate any contaminating waste.



ACOUSTIC INSULATION

The uniform distribution of air cells reduces sound propagation in all directions, offering a simple solution for acoustic comfort



WATERPROOF

The evenly distributed closed-cell structure makes the Celucon Module highly resistant to moisture absorption.



FIREPROOF

As it is a superior thermal insulator, as well as non-combustible, non-flammable, and smoke-tight, the Celucon Module is an excellent and straightforward fireproofing solution.



LIGHTWEIGHT

With low density, the Celucon Module is easy to handle, significantly reducing transportation, structural, and foundation costs.



STANDARDIZED

Complies with ABNT standards: NBR-13438, NBR-13440, NBR-14956-1, NBR-14956-2, and NBR-15575.



VERSATILE

The Celucon Module can be used in various applications. Additionally, all cut pieces are reusable.



UNIFORMITY

The production process guarantees precise dimensions, reducing costs for laying mortars and coatings.



DURABLE

The Celucon Module is immune to attacks by pests and insects. It does not degrade or lose its properties over time.



RESILIENT

It boasts high resistance to compression, tension, impacts, and suspended loads.

PRODUCTS

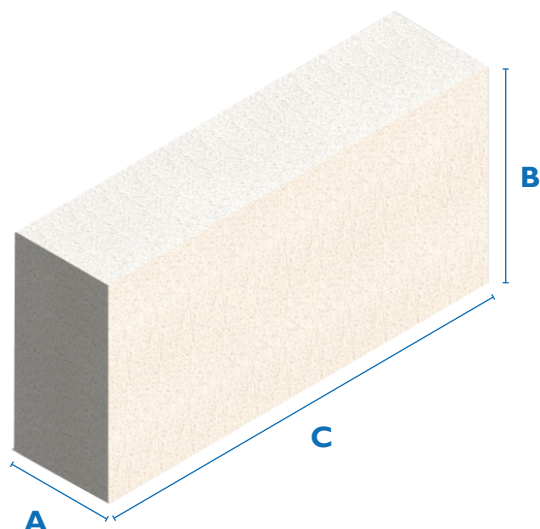


SPECIFIC REQUIREMENTS ACCORDING TO ABNT NBR-13438

Class	Dry Compression Strength		Dry Apparent Density
	Minimum Average Value (MPa ¹)	Minimum Isolated Value (MPa ¹)	Average (kg/m ³)
C 12	1,2	1,0	< 450
C 15	1,5	1,2	< 500
C 25	2,5	2,0	< 550
C 35	3,5	3,0	< 600
C 45	4,5	4,0	< 650

¹ CONSIDER: 1 MPa = 1N/MM² = 10 KGF/CM²

Celucon offers classes C25 and C45:
 Dimensional Tolerance: ±3.0 mm
 Drying Shrinkage: ≤ 0.35 mm/m
 Thermal Conductivity C25: 0.15 W/mK



PARTITION BLOCK

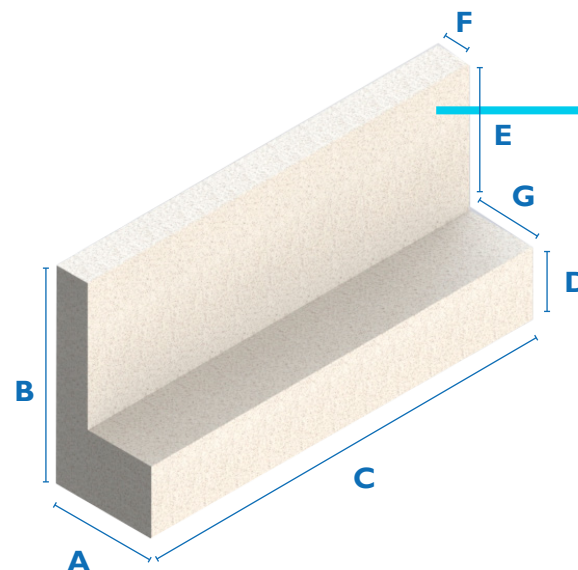
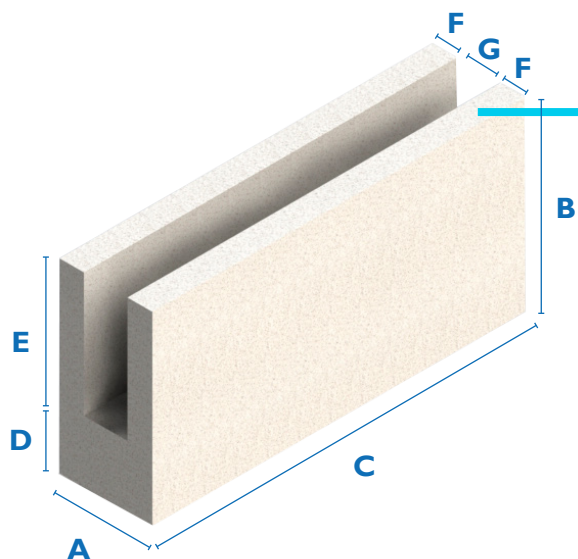
Class C25: Dry Apparent Density: 480 kg/m³ (±5%).

Class C45: Dry Apparent Density: 600 kg/m³ (±5%).

Moist Density Approximately 25% Higher

CLASS C25	Dimensions AxBxC (mm)	Pieces (m ²)	Pieces (m ³)	m ² /m ³	Weight per piece (kg)	Pieces per pallet	
						Pallet 0,90 x 1,20 m	
						Standard	Reduced
	050x300x600	5,56	111,11	19,98	4,32	x	144
	075x300x600	5,56	74,07	13,32	6,48	x	96
	100x300x600	5,56	55,56	9,99	8,64	90	72
	120x300x600	5,56	46,3	8,33	10,37	78	60
	140x300x600	5,56	39,68	7,14	12,10	66	48
	150x300x600	5,56	37,04	6,66	12,96	60	48
	175x300x600	5,56	31,75	5,71	15,12	54	36
	190x300x600	5,56	29,24	5,00	16,42	48	36
	200x300x600	5,56	27,78	5,00	17,28	48	36
	240x300x600	5,56	23,15	4,16	20,74	36	24

CLASS C45	Dimensions AxBxC (mm)	Pieces (m ²)	Pieces (m ³)	m ² /m ³	Weight per piece (kg)	Pieces per pallet	
						Pallet 0,90 x 1,20 m	
						Standard	Reduced
	120x300x600	5,56	46,30	8,33	12,96	78	60
	150x300x600	5,56	37,04	6,66	16,20	60	48
	200x300x600	5,56	27,78	5,00	21,60	48	36



SPECIAL MODULES

U MODULE

Dry Apparent Density: 600 kg/m³ (±5%).
Moist Density Approximately 25% Higher.

Dimensions AxBxC (mm)	Pieces (m ²)	Pieces (m ³)	m ² /m ³	D mm	E mm	F mm	G mm	Weight per piece (kg)	Pieces per pallet
									Pallet 1,00 x 1,20 m
140x300x600	5,56	39,68	7,14	100	200	40	60	8,64	48
150x300x600	5,56	37,04	6,66	100	200	45	60	9,5	48
175x300x600	5,56	31,75	5,71	100	200	47,5	80	10,51	40
190x300x600	5,56	29,24	5,25	100	200	55	80	11,81	40
200x300x600	5,56	27,77	4,99	100	200	60	80	12,67	40

L MODULE

Dry Apparent Density: 600 kg/m³ (±5%).
Moist Density Approximately 25% Higher.

Dimensions AxBxC (mm)	Pieces (m ²)	Pieces (m ³)	m ² /m ³	D mm	E mm	F mm	G mm	Weight per piece (kg)	Pieces per pallet
									Pallet 1,00 x 1,20 m
100x300x600	5,56	55,6	10	100	200	50	5	5,76	108
120x300x600	5,56	46,3	8,33	100	200	50	7	6,34	84
140x300x600	5,56	39,7	7,14	100	200	50	9	6,91	72
150x300x600	5,56	37	6,66	100	200	50	10	7,2	72
175x300x600	5,56	31,7	5,71	100	200	50	12,5	7,92	60
190x300x600	5,56	29,2	5,26	100	200	50	14	8,35	48
200x300x600	5,56	27,8	5	100	200	50	15	8,64	48

TOOLS



Celucon Application Paddle

Used to evenly spread mortar over Celucon Modules.



Masonry Saw

Used for manually cutting Celucon Modules with increased durability and cutting capacity.



Rasp Float

Used for leveling surfaces to improve laying and coating.



Celucon Square

Helps ensure symmetrical cutting of Celucon Modules.



Celucon Wall Groover

Designed for manually grooving walls for pipe installations.



Bosch GAC250 Professional AAC Electric Cutter

Designed to cut AAC blocks of various sizes.

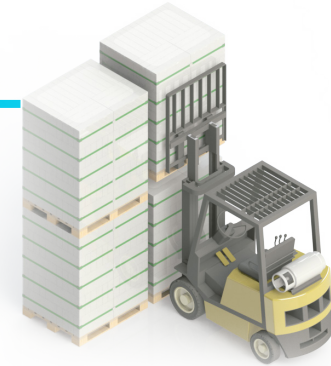
LOGISTICS AND STORAGE

All materials must be inspected upon receipt to detect any possible non-conformities. In case of any issues, please immediately contact Celucon's customer service department.

Pallets must be stored on level, firm, and dry ground according to the following guidelines.

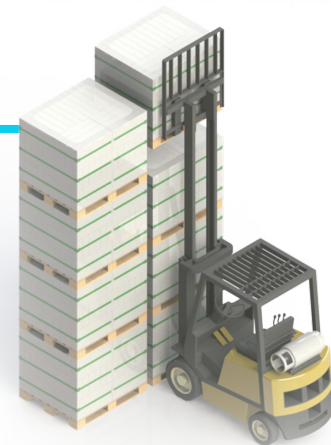
Partition Module

STANDARD PALLETS:
Maximum stacking of two pallets.



Partition Module

REDUCED PALLETS:
Maximum stacking of four pallets.



L Module
U Module

STANDARD PALLETS:
Maximum stacking of two pallets.



CONSTRUCTION RECOMMENDATIONS

This construction guide serves as a reference for the installation of the Celucon Module, providing guidance for construction workers and those gaining experience with autoclaved aerated concrete. The information herein is based on ABNT NBR 14956-1 and ABNT NBR 14956-2 standards, as well as research conducted by Celucon's technical team.

Partition walls are not designed to bear loads in their vertical plane. However, they should withstand minor deformations imposed by the structure without developing cracks that compromise their stability or cause visual discomfort.



Court of Justice - Thá Engenharia
Rio Grande / RS

WALL THICKNESS

The following tables suggest the minimum thickness required for partition walls using the Celucon Module. However, even when adhering to the suggested minimum thickness, the following points should be observed:

- Walls longer than 6 meters must have movement joints as outlined in the "MOVEMENT JOINT" section.

•**Note: The spacing of the straps and pillars should be analyzed for each case individually.**

Note: For external wall partitions, it is recommended to apply a thickness greater than 10 cm, with each case requiring approval from the responsible engineer of the project.

INTERNAL PARTITION THICKNESS (MM) – SITUATION 1

Wall height (m)	Wall length (m)					
	3,00	4,00	5,00	6,00	7,00	8,00
2,40	75	75	100	100	100	100
2,70	75	100	100	100	100	100
3,00	100	100	100	100	125	125
3,50	100	100	100	125	125	125
4,00	100	100	100	125	125	150
4,50	100	100	125	125	125	150
5,00	100	125	125	125	150	150
6,00	100	125	125	150	150	175

PARTITION FIXED AT EDGES, BASE, AND TOP (CSR-HEBEL).

INTERNAL PARTITION THICKNESS (MM) – SITUATION 2

Wall height (m)	Wall length (m)			
	3,00	4,00	5,00	6,00
2,40	100	125	150	175
2,70	100	125	150	200
3,00	100	125	150	200
3,50	100	125	150	200
4,00	100	125	150	200
4,50	100	150	175	200
5,00	150	150	175	200
6,00	150	150	175	200

PARTITION FIXED AT EDGES, BASE, AND TOP (CSR-HEBEL).

INTERNAL PARTITION THICKNESS (MM) – SITUATION 3

Sealing Thickness (mm)	100	125	150	175	200
Maximum Height (m)	2,70	3,35	4,00	4,70	5,4

PARTITION FIXED AT EDGES, BASE, AND TOP (CSR-HEBEL).

INSTALLATION

Before starting, a leveling layer must be applied to correct any irregularities on the support surface. For this leveling layer, conventional mortar with a mix ratio of 1:3 (cement and medium-washed sand by volume) is recommended. For shallow foundations, such as grade beam footing, waterproofing with asphalt sheeting and using waterproofing additives in the mortar is advised.

MORTAR FOR SETTING

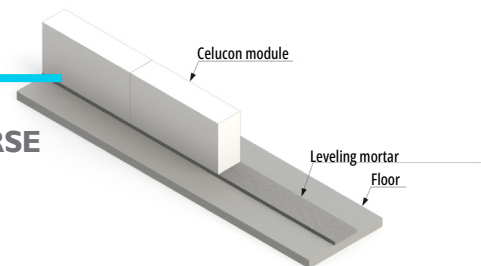
The recommended mortars for setting the Celucon Module are: Conventional mortar, industrialized mortar, and polymeric mortar.

The mix ratio recommended by ABNT NBR 14956-2 as a reference for mortar to be prepared on-site is 1:3:8 by volume of dry materials: cement, hydrated lime, and medium soft sand, respectively.

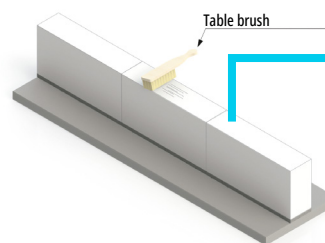
The industrialized mortars that may be used are of types AC1, AC2, AC3, ready-to-use mortar, and mortars suitable for autoclaved aerated concrete.

In the specific case of using polymeric mortars, the vertical joints do not need to be filled. The recommended joint thickness is 0.5 cm for cementitious mortars and 0.3 cm for polymeric mortar.

SETTING THE FIRST COURSE

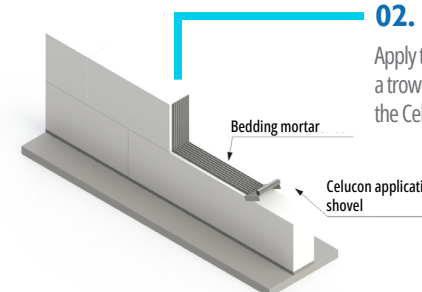


The setting of the second course onwards should always follow the sequence below:



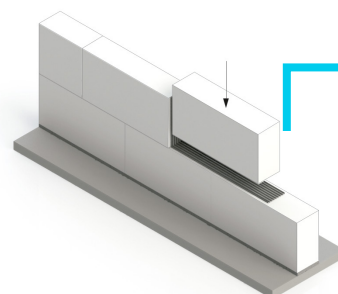
01.

For cementitious mortars, clean and moisten the surface. For polymeric mortar, just clean the surface.



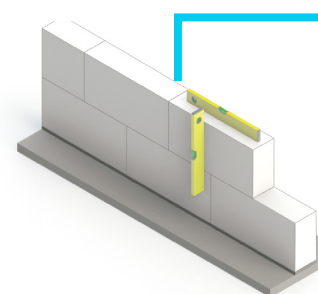
02.

Apply the setting mortar – you can use a trowel, spatula, notched trowel, or the Celucon application spatula.



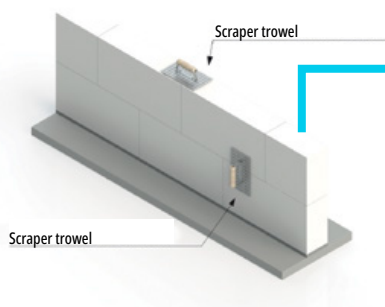
03.

Set the Celucon Module.



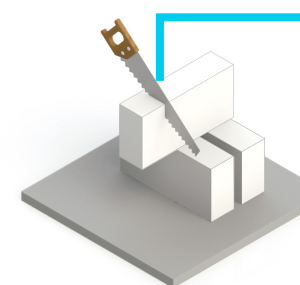
04.

Level horizontally and vertically.



05.

To correct imperfections caused by irregularities in the setting, use a rasp float.



06.

If necessary, you can easily cut the Celucon Module using a handsaw, sabre saw, or bench band saw.

MORTAR CONSUMPTION TABLE					
Module Dimensions AxBxC (cm)	Units/m ²	Adhesive Mortar AC1, AC2, or AC3 (Kg/m ²)	Polymeric Mortar (Kg/m ²)	Conventional Mortar**	
				(m ³ / m ²)	(kg / m ²)
5 x 30 x 60	5,56	1,75	0,5	0,0013	Cement: 0,23 Lime: 0,24 Sand: 2,3
7,5 x 30 x 60	5,56	2,62	1	0,0018	Cement: 0,35 Lime: 0,36 Sand: 3,4
10 x 30 x 60	5,56	3,50	1	0,0025	Cement: 0,46 Lime: 0,48 Sand: 4,6
12 x 30 x 60	5,56	4,35	1	0,0031	Cement: 0,58 Lime: 0,61 Sand: 5,7
14 x 30 x 60	5,56	4,90	1	0,0035	Cement: 0,65 Lime: 0,68 Sand: 6,4
15 x 30 x 60	5,56	5,25	1	0,0038	Cement: 0,7 CLime: 0,73 Sand: 6,8
17,5 x 30 x 60	5,56	5,90	1	0,0043	Cement: 0,81 Lime: 0,85 Sand: 7,9
19 x 30 x 60	5,56	6,60	1	0,0048	Cement: 0,88 Lime: 0,92 Sand: 8,6
20 x 30 x 60	5,56	7,00	1	0,0050	Cement: 0,93 Lime: 0,97 Sand: 9,1
24 x 30x 60	5,56	8,40	1	0,0060	Cement: 1,11 Lime: 1,16 Sand: 11,0

*SETTING WITH 0.5 CM THICKNESS.

**CONVENTIONAL MORTAR WITH A MIX RATIO OF 1:2:8 FOR CEMENT, LIME, AND SAND, RESPECTIVELY.



LINTELS AND COUNTER-LINTELS

For openings in Celucon Module masonry, lintels and counter-lintels must be used. Options include:

•Using L or U Modules;

01. Prepare and secure supports;

02. Place the L or U Module;

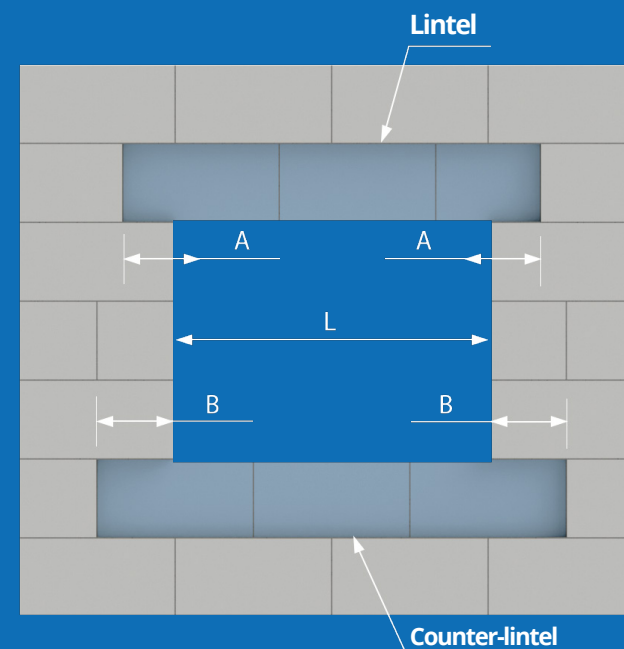
03. Position reinforcement (rebar).
*With L module, a wooden board must be put in the internal side as well;

04. Pour concrete;

05. Once cured, remove support structures.

NOTES:

1. For spans (L) up to 50 cm, reinforcements may be omitted, depending on the load type.
2. For spans (L) greater than 320 cm and wall lengths exceeding 12.0 m without movement joints, the lintel must be designed as a beam.
3. Walls longer than 12.0 m without movement joints should be analyzed individually.
4. For successive openings with distances of less than 60 cm, continuous lintels and counter-lintels must be used.



The minimum overlap length for lintels and counter-lintels must comply with the following table.

LAYOUT OF MASONRY FOR OPENINGS ACCORDING TO ABNT NBR 14956-2					
Lintel			Counter-lintel		
Span L (cm)	Minimum Overlap A (cm)	Maximum Wall Length (m)	Span L (cm)	Minimum Overlap B (cm)	Maximum Wall Length (m)
50 a 100	10	< 8,0	50 a 180	30	< 8,0
100 a 180	20	< 8,0	50 a 180	40	8,0 – 12,0
100 a 180	30	8,0 – 12,0	180 a 320	40	< 8,0
180 a 320	30	> 12,0	180 a 320	60	8,0 – 12,0
>320	See note 2.		> 320	80	< 8,0
			> 320	80	8,0 – 12,0
			> 320	See note 2.	> 12,0

The use of a galvanized flat truss is another possibility (check the manufacturer's recommendations).

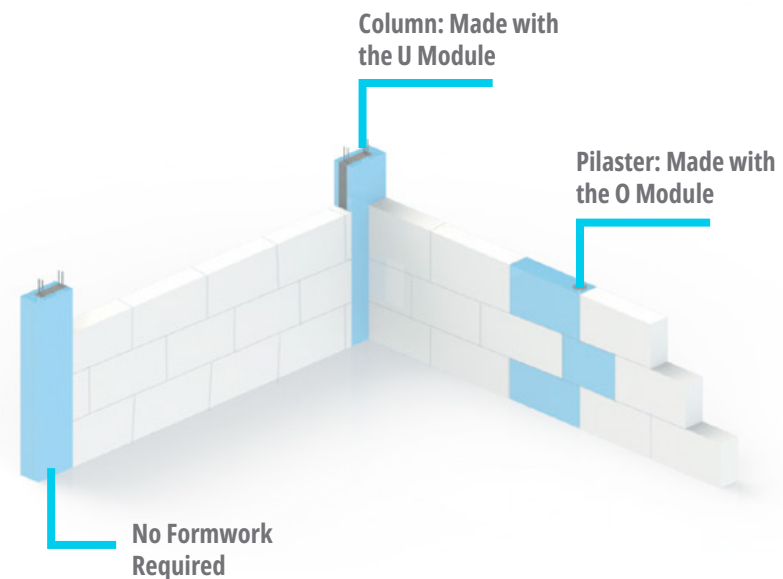
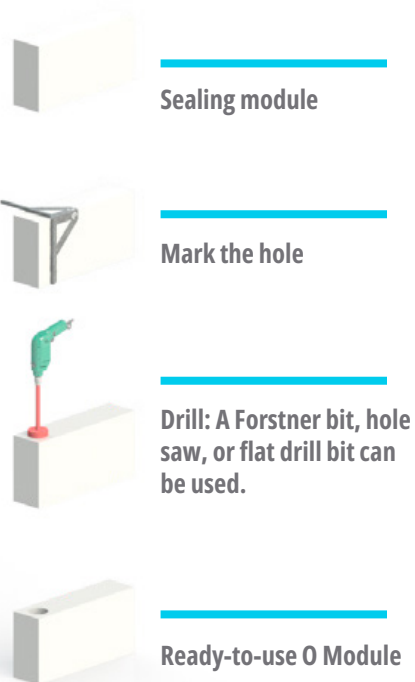
APPLICATION

STRUCTURAL REINFORCEMENTS

The O Module, fabricated on-site, can be used for columns and pilasters.

The L Module and U Module can be applied both horizontally - lintels, counter-lintels, and tie beams - and vertically - columns and pilasters.

Both modules help streamline construction, reducing labor costs, debris, and providing thermal insulation for concrete and reinforcement bars.



MASONRY ANCHORAGE TO THE COLUMN

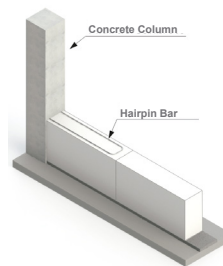
The connection between masonry and columns is usually achieved through the adhesion of the bedding mortar, with the vertical joint completely filled and the structures previously prepared with roughcast. However, in certain specific cases, as detailed below, masonry must be fixed to columns using anchorage. The characteristics of such anchorage are as follows:

- a) Walls on cantilever slabs, with or without edge beams;
- b) Walls longer than 12 meters;
- c) Walls longer than 4 meters, resting on highly deformable structural elements;
- d) Wall sections with one free end (not connected to another wall or column for at least half the wall height (H)) with a length less than $2H/3$;
- e) Walls subject to continuous vibration, such as those with suspended air conditioners or those connected to columns and walls in elevator shafts;
- f) Walls with a free upper edge, such as parapets, balcony walls, or service area walls;
- g) Walls on the first floor of buildings on stilts (pilotis);
- h) Uncommon situations that may generate significant stress at the column-masonry interface.

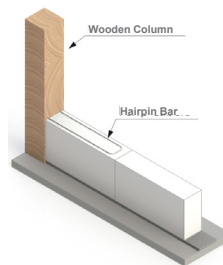
Reinforcements for Connections:
Connections can be strengthened using hairpin bars, welded mesh, or perforated strips.

ANCHORAGE WITH HAIRPIN BAR

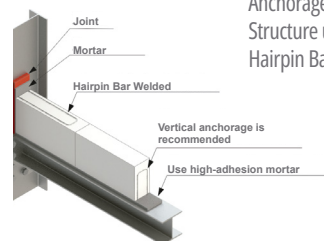
The hairpin bar should be a smooth steel wire in the shape of a U, with a diameter between 4.0 mm and 5.0 mm. In concrete columns, it can be embedded during the column casting process, with the bars bent to face the formwork internally, or later embedded into holes drilled with a bit, followed by cleaning and bonding with epoxy or polyester resin. This second option also applies to wooden columns. In metallic columns, the hairpin bar should be welded to the column.



Anchorage in Concrete Column using Hairpin Bar.



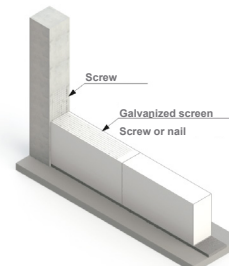
Anchorage in Wooden Column using Hairpin Bar.



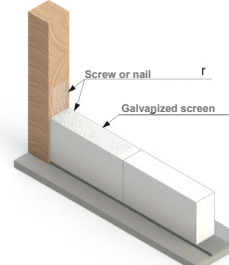
Anchorage in Metal Structure using Hairpin Bar.

ANCHORAGE WITH WELDED WIRE MESH

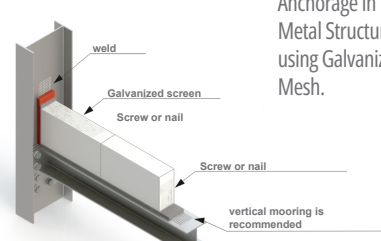
Galvanized welded wire mesh with a square grid of 15 x 15 mm or 25 x 25 mm, and a minimum wire diameter of 1.0 mm, can be used. In concrete and wooden columns, the mesh should be screwed to the column. In the case of wooden columns, it can also be nailed. In metal columns, the mesh should be welded to the column.



Anchorage in Concrete Column using Galvanized Mesh



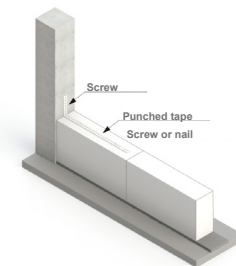
Anchorage in Wooden Column using Galvanized Mesh.



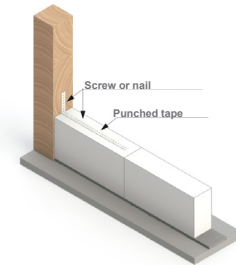
Anchorage in Metal Structure using Galvanized Mesh.

ANCHORAGE WITH PERFORATED STRAP

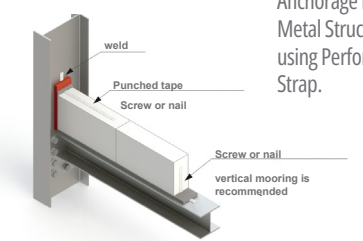
The perforated strap can also be applied following the same method as the welded wire mesh.



Anchorage in Concrete Column using Perforated Strap.



Anchorage in Wooden Column using Perforated Strap.



Anchorage in Metal Structure using Perforated Strap.

BONDING BETWEEN WALLS

Walls should be united preferably by bond joints, as this type of connection provides the best performance by allowing the redistribution of stresses acting on the masonry in a continuous and uniform manner.

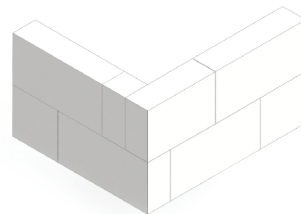
To ensure better performance of the masonry when subjected to forces, all vertical joints between intersecting modules and adjacent modules must be filled.

The modules that make up the intersection should have lengths at least equal to 1/3 of the module's length.

When a bonding joint is not possible, the connection between walls should be made by positioning welded wire mesh with a square grid of 15 x 15 mm or 25 x 25 mm, and a minimum wire diameter of 1.0 mm. The dimensions of the mesh should be:

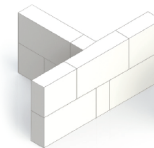
- Length: equal to twice the thickness of the thinnest wall plus the thickness of the wall.
- Width: equivalent to the thickness of the thinnest wall, minus 3 cm.

Examples of Bonding:

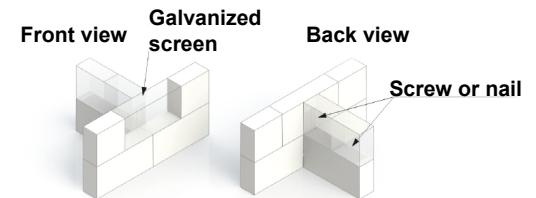
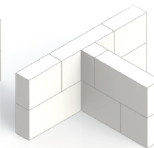


L Mooring
Module 15x30x60cm

Front view



Back view



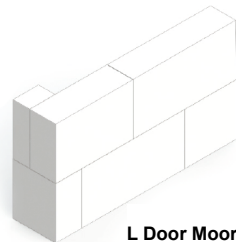
Front view Galvanized screen

Back view

Screw or nail

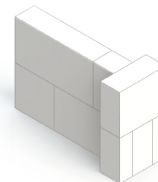
T Mooring
Module 15x30x60cm

T Mooring - meeting of walls
Module 15x30x60cm

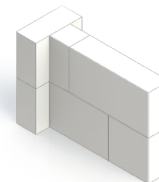


L Door Mooring
Module 15x30x60cm

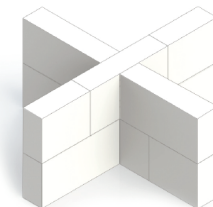
Front view



Back view



T Door Mooring
Module 15x30x60cm



X Mooring
Module 15x30x60cm

ANCHORAGE

To ensure the perfect stability of the walls, it is recommended that the anchorage be done 30 days after completing all masonry. The modules of the last row should be installed with a 2-3 cm gap between the ceiling or beam.

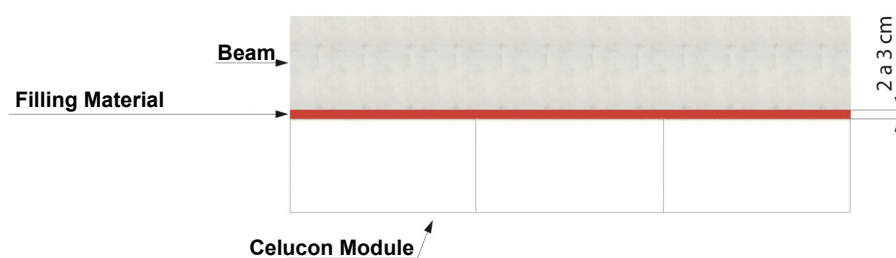
This gap for wall fixing can be filled with the following materials:

- Expansive Mortar
- Mortar with low cement consumption and high hydrated lime consumption
- Industrialized Mortar (as long as it has low

deformation modulus)

- Expansive Polyurethane

The fixation work should follow a sequence, ensuring the surface is completely clean, free from dust, oil, efflorescence, or other materials that may harm adhesion. The anchorage should be carried out from top to bottom, with a minimum interval of 24 hours between floors to allow the structure to deform.

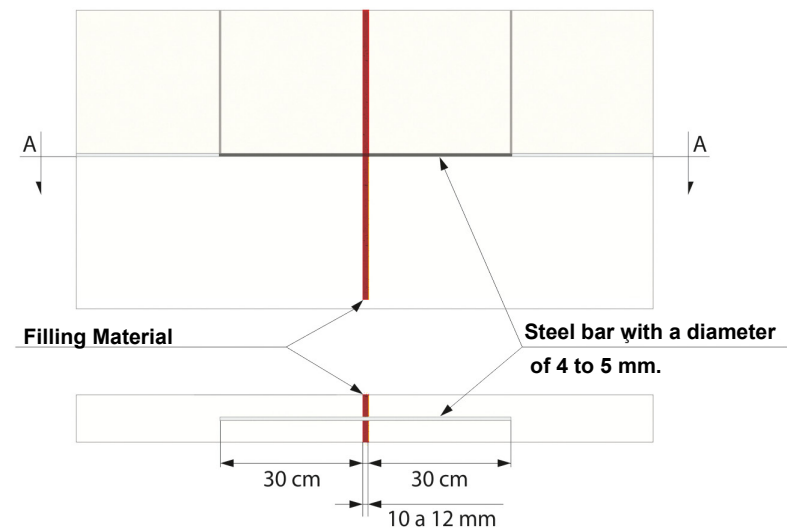


MOVEMENT JOINTS

The purpose of work or control joints is to limit the dimensions of the masonry panel to prevent excessive concentration of stresses due to intrinsic deformations, structural deformations, and foundation settling.

Walls that exceed 6 meters in length must include movement joints with a thickness of 10 to 12 mm. A steel bar with a diameter of 4 to 5 mm can be used, positioned parallel to the masonry axis, functioning as connectors to prevent shearing. These connectors should be placed in the odd horizontal joints, starting

from the third row. The gap can be filled with expansive polyurethane foam, expansive additive mortar, or even industrialized mortar (provided it has a low deformation modulus).

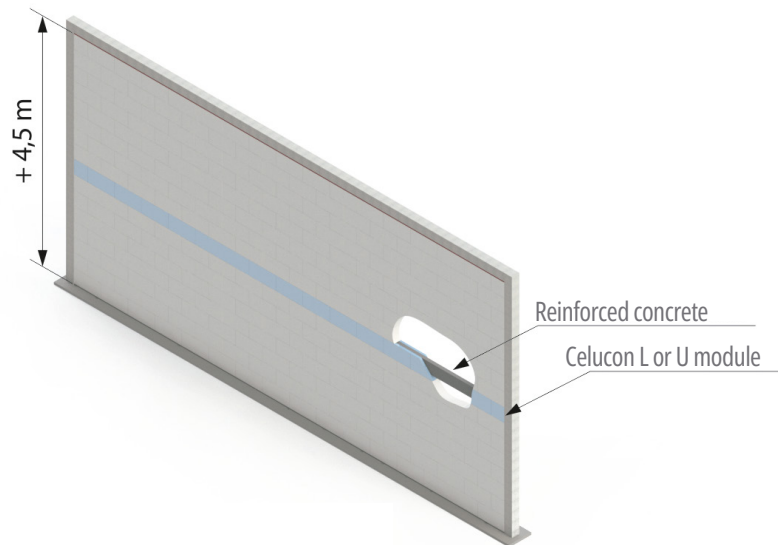


Cut A-A

SPAN DIVISION

For walls longer than 10 meters, the gap should be divided by including pilaretes. For walls taller than 4.5 meters, the gap should be divided by including tie beams.

Both should be made of reinforced concrete, using wooden forms or Celucon Module U.



Binding belt using U module

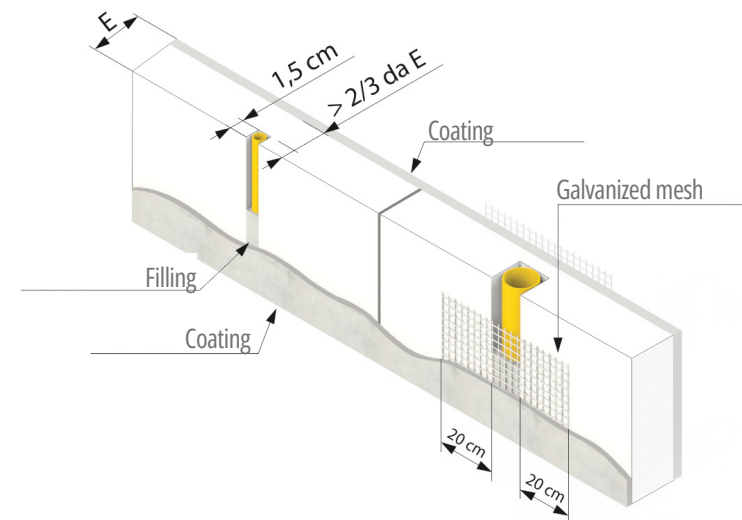
EMBEDDING INSTALLATIONS

Considering the ease of making cuts and grooves in the Celucon Module, installations in general are carried out after the masonry has been erected. The masonry can be cut using a manual cutter, electric cutter, or double-disc saw, avoiding the use of a sledgehammer and chisel.

For electrical and plumbing installations, where the diameters are smaller, it is recommended to fill with the same strong cement mortar (1:3 to 1:4). For large-diameter pipes, it is recommended to use galvanized

welded wire mesh with a square mesh of 15 x 15 mm or 25 x 25 mm, with a minimum wire diameter of 1.0 mm on both sides of the partition.

In the case of hot water pipes, if proper pipe insulation is not provided, a high temperature gradient may occur, which could compromise the coating in that area and cause heat loss from the pipe.



COATING

The Celucon Module is compatible with most types of coatings. For optimal performance, it is essential to assess the technical characteristics of each product to ensure they are compatible with the module's behavior and features. In fireproofing and special acoustic insulation applications, the installation must follow Celucon guidelines based on test reports.

EXTERNAL COATING

For external walls of residential (houses) and industrial buildings, the final finish can be applied directly onto the modules without the need for roughcast or leveling plaster.

For vertical structures (buildings), the usual technical procedures should be followed:

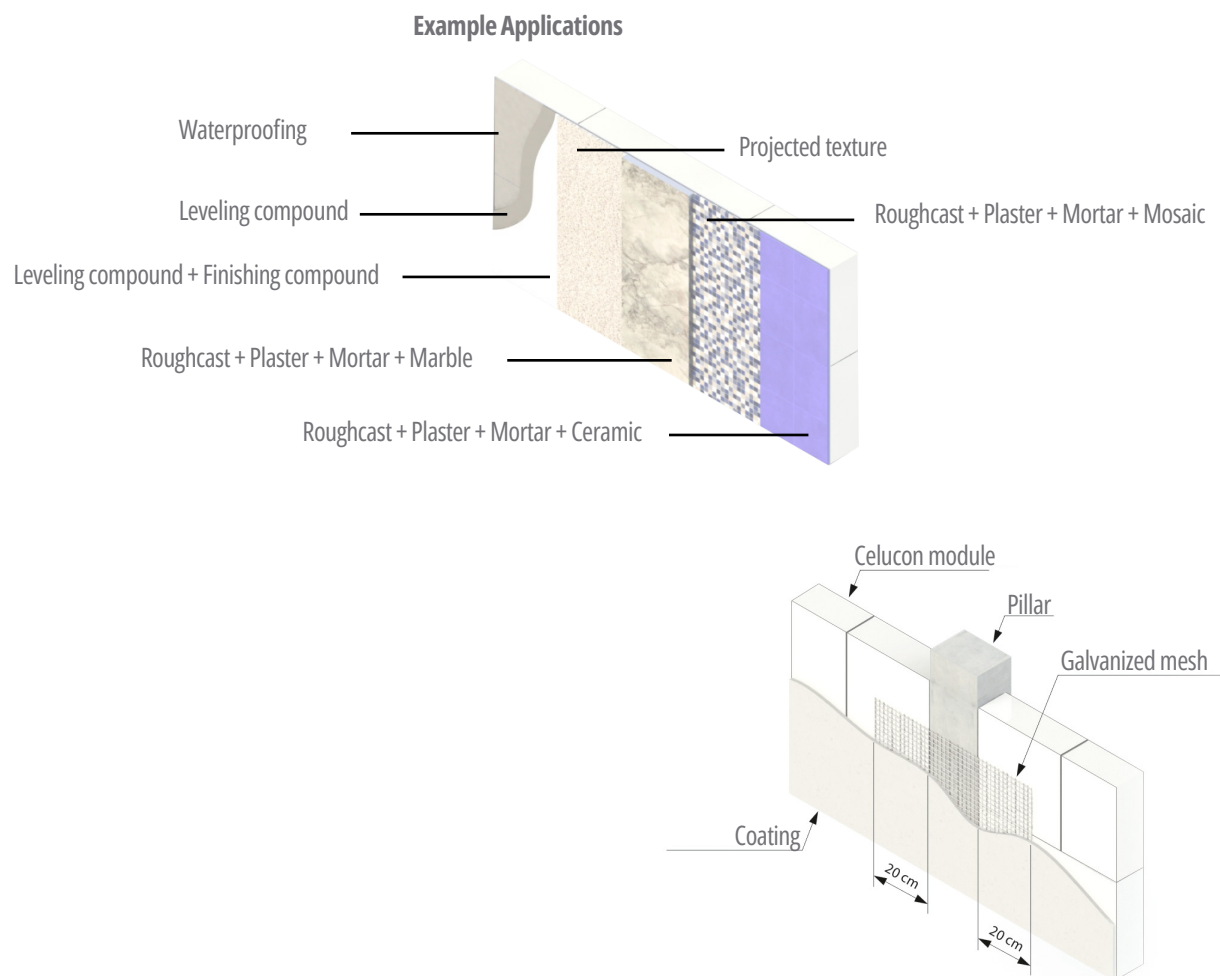
1. Prepare the surface with roughcast for better adhesion.
2. Apply leveling plaster if necessary, and finally, apply the finish.

Ensure the total thickness of the coating is a minimum of 2 cm according to ABNT NBR standards.

For marble, granite, or stone applications, the need for fasteners should be assessed based on the weight and use conditions.

When there is an interface between masonry and structure, it is recommended to use galvanized welded mesh with a square mesh of 5x15 mm or 25x25 mm and a minimum wire diameter of 1.0 mm. Tensions in these regions may not be absorbed by the coating and may require reinforcement for better performance.

It is also recommended to use waterproofing additives.



COATING

INTERNAL COATING

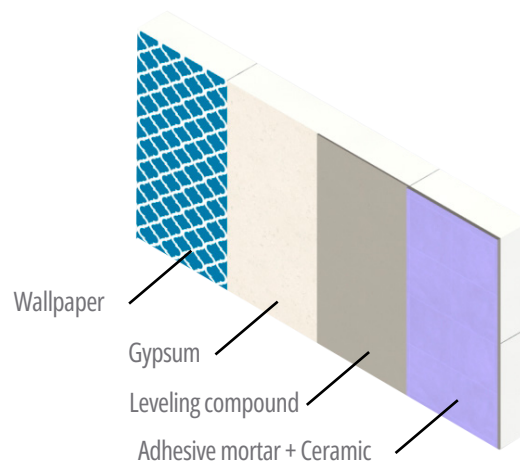
For internal walls, there is no need for roughcast or leveling plaster, and the final finish can be applied directly.

For example, plaster with thickness from 5 to 10 mm and gypsum, joint compound, leveling compound, or fine compound with a thickness of 1 to 5 mm.

For ceramic applications, there is also no need for roughcast or leveling plaster, as the adhesive mortar can be applied directly to the Celucon Module.

For phenolic laminates and wallpapers applied directly to the Celucon Module, the following steps should be followed:

1. Smooth the surface (sand it).
2. Clean all powdery material from the surface.
3. The wall moisture content should be less than 10% by weight.
4. Waterproof the surface, as these coatings may detach when there is moisture migration from inside the wall to the exterior.
5. Follow the sequence recommended by the manufacturer.

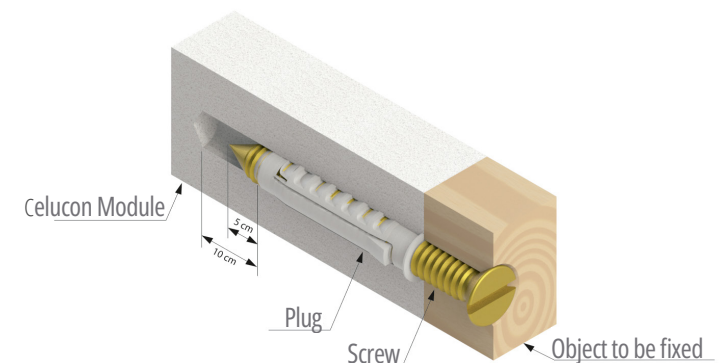


FIXINGS

It is recommended to use nylon or steel plugs specifically designed for cellular concrete, following these precautions:

1. Holes can be drilled using high-speed steel bits, concrete bits, or wood bits with a diameter slightly smaller than the plug.
2. The drill should have the impact function turned off.
3. The final length of the screw should be at least 5 mm longer than the sum of the plug length and the material to be fixed.

An alternative option is using chemical anchors according to the supplier's application guidelines.





PERFORMANCE

The NBR 15575 - Residential Buildings – Performance standard was published by the Brazilian Association of Technical Standards (ABNT) following international performance standardization models. It was developed through consensus and with the support of various organizations and sectors, including government agencies, professional associations, universities, technical institutions, and the productive sector, among others.

The Brazilian Chamber of the Construction Industry (CBIC) introduced NBR 15575, which presents a new methodology for designing and constructing safe buildings (mechanical performance, fire safety, operational safety), residential buildings (waterproofing, thermal and acoustic performance, lighting, health, hygiene, air quality, functionality, accessibility, and tactile comfort), and sustainability (durability, maintenance conditions, and environmental suitability). In general, the performance concept refers to the behavior of construction systems when subjected to real-life usage conditions during their service life, with a focus on user needs.

The level of performance refers to the building's and its systems' behavior during use, and this behavior is assessed through the requirements established to meet the basic needs of users. Performance requirements are the conditions that systems and components must meet, or in other words, they express the qualitative attributes that the building and its systems must have. To assess these requirements, performance criteria and evaluation methods are established.

Performance criteria are the parameters that define the performance levels to which each requirement must adhere, or in other words, they are the measurable quantitative specifications of performance requirements. For each criterion, three performance levels are established: Minimum (M), Intermediate (I), and Superior (S).

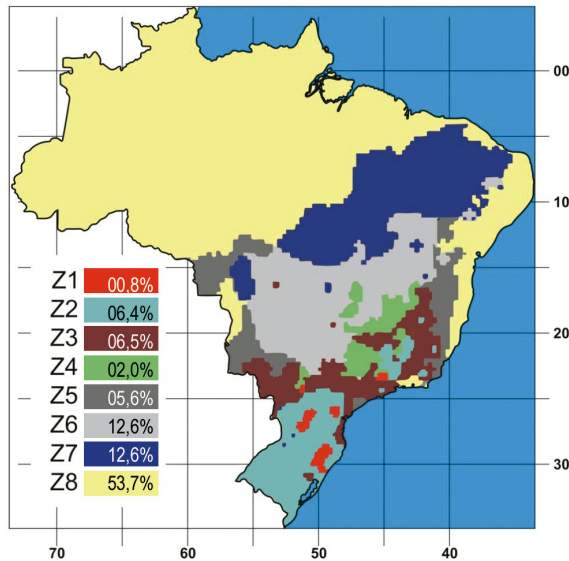
Meeting the minimum performance level (M) is mandatory for all requirements specified in ABNT NBR 15575-4 – Performance: Requirements for internal and external vertical partition systems.

The evaluation methods to measure performance can include field tests, laboratory tests, computer simulations, and even analytical calculations. Below are the results obtained from the tests conducted on the Celucon Module based on the ABNT NBR 15575 standard.



THERMAL PERFORMANCE

According to ABNT NBR 15575, the thermal performance of a building must be assessed by considering all criteria that influence its behavior, such as the materials used, the dimensions of the spaces, and the climatic properties of the location. In Brazil, regions are divided into eight bioclimatic zones based on ABNT NBR 15220.



TEST RESULTS WITH CELUCON MODULE

The thermal test followed the performance simulation method of the ABNT NBR 15575 standard. The evaluation was conducted for typical winter and summer days, comparing the internal temperature resulting from simulations with the external temperature. The difference between internal and external temperatures was compared with the maximum allowable for summer and the minimum for winter.

THERMAL PERFORMANCE EVALUATION CRITERIA (ZB 1 TO ZB 8) ADAPTED FROM ABNT NBR 15575			
Performance Level	ZB 1 A 7	ZB 8	ZB 1 A 5
	Summer	Summer	Winter
M	$T_{i,max} \leq T_{e,max}$	$T_{i,max} \leq T_{e,max}$	$T_{i,min} \geq (T_{e,min} + 3^{\circ}\text{C})$
I	$T_{i,max} \leq (T_{e,max} - 2^{\circ}\text{C})$	$T_{i,max} \leq (T_{e,max} - 1^{\circ}\text{C})$	$T_{i,min} \geq (T_{e,min} + 5^{\circ}\text{C})$
S	$T_{i,max} \leq (T_{e,max} - 4^{\circ}\text{C})$	$T_{i,max} \leq (T_{e,max} - 2^{\circ}\text{C})$	$T_{i,min} \geq (T_{e,min} + 7^{\circ}\text{C})$

The simulation was performed to assess the thermal performance of a residential building with external walls made from Celucon Module and conventional mortar, totaling a thickness of 200 mm.

The internal walls were made of the same module and mortar with a 150 mm thickness. The ceiling consisted of concrete slab and mortar, while the roof was made from 8 mm fibrocement tiles.

For the building to present the most thermally critical condition, the chosen spaces for analysis were oriented with the least favorable solar exposure. The simulation considered absorptance values of 0.3, 0.5, and 0.7 since no specific color was indicated for the building. The internal spaces were designated as 100-L, 100-O, 200-L, and 200-O.

The building met all the performance criteria set by ABNT NBR 15575

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THERMAL PERFORMANCE LEVEL CLASSIFICATION								
ZB	Absorptance	Situation	External Temperature (°C)	Internal Temperatures				Performance Level
				100-L	100-O	200-L	200-O	
1	0,3	Summer	31,75	22,77	24,35	29,40	28,14	I
		winter	1,96	10,98	11,50	8,45	8,64	I
	0,5	Summer	31,75	23,12	24,76	29,94	28,62	M
		winter	1,96	11,20	11,74	8,77	8,98	I
	0,7	Summer	31,75	23,47	25,14	30,42	29,06	M
		winter	1,96	11,21	11,97	9,08	9,30	S
2	0,3	Summer	32,10	26,28	25,04	31,22	30,14	M
		winter	10,33	14,86	15,10	14,36	14,42	M
	0,5	Summer	32,10	26,71	25,46	31,78	30,65	M
		winter	10,33	15,04	15,0	14,59	14,67	M
	0,7	Summer	32,10	26,71	25,46	31,78	30,65	M
		winter	10,33	15,04	15,30	14,59	14,67	M
3	0,3	Summer	31,80	25,57	24,05	30,27	28,96	M
		winter	6,06	13,16	13,58	10,85	10,95	M
	0,5	Summer	31,80	25,96	24,35	30,76	29,35	M
		winter	6,06	13,37	13,77	11,13	11,21	I
	0,7	Summer	31,80	26,32	34,68	31,20	29,70	M
		winter	6,06	13,56	13,96	11,39	11,45	I
4	0,3	Summer	32,11	25,44	24,40	29,05	28,12	I
		winter	11,24	18,28	16,60	17,89	17,99	I
	0,5	Summer	32,11	25,83	24,84	29,57	28,62	I
		winter	11,24	18,50	18,83	18,21	18,32	I
	0,7	Summer	32,11	26,23	25,25	30,06	29,08	I
		winter	11,24	18,71	19,04	18,50	18,62	S
5	0,3	Summer	33,29	26,65	25,76	31,47	30,50	M
		winter	10,80	16,38	16,70	15,43	15,52	M
	0,5	Summer	33,29	27,04	26,20	31,97	30,97	M
		winter	10,80	16,55	16,88	15,65	15,77	M
	0,7	Summer	33,29	27,04	26,20	31,97	30,97	M
		winter	10,80	16,71	17,03	15,87	16,00	I
6	0,3	Summer	33,66	25,74	24,75	28,68	27,92	S
	0,5			26,06	25,05	29,08	28,30	S
	0,7			26,35	25,35	29,45	28,65	S
7	0,3	Summer	37,69	29,88	28,80	24,47	33,59	I
	0,5			30,22	29,15	34,90	34,01	I
	0,7			30,53	29,51	35,30	34,40	I
8	0,3	Summer	35,15	27,93	26,71	33,18	32,17	M
	0,5			28,35	27,14	33,73	32,70	M
	0,7			28,75	27,58	34,21	33,16	M

RESULTS USING CELUCON MODULE

1

Reduction in thermal load (air conditioning system size): 53%;

2

Reduction in energy consumption by the air conditioning system: 32%;

3

Temperature reduction in summer: 26%;

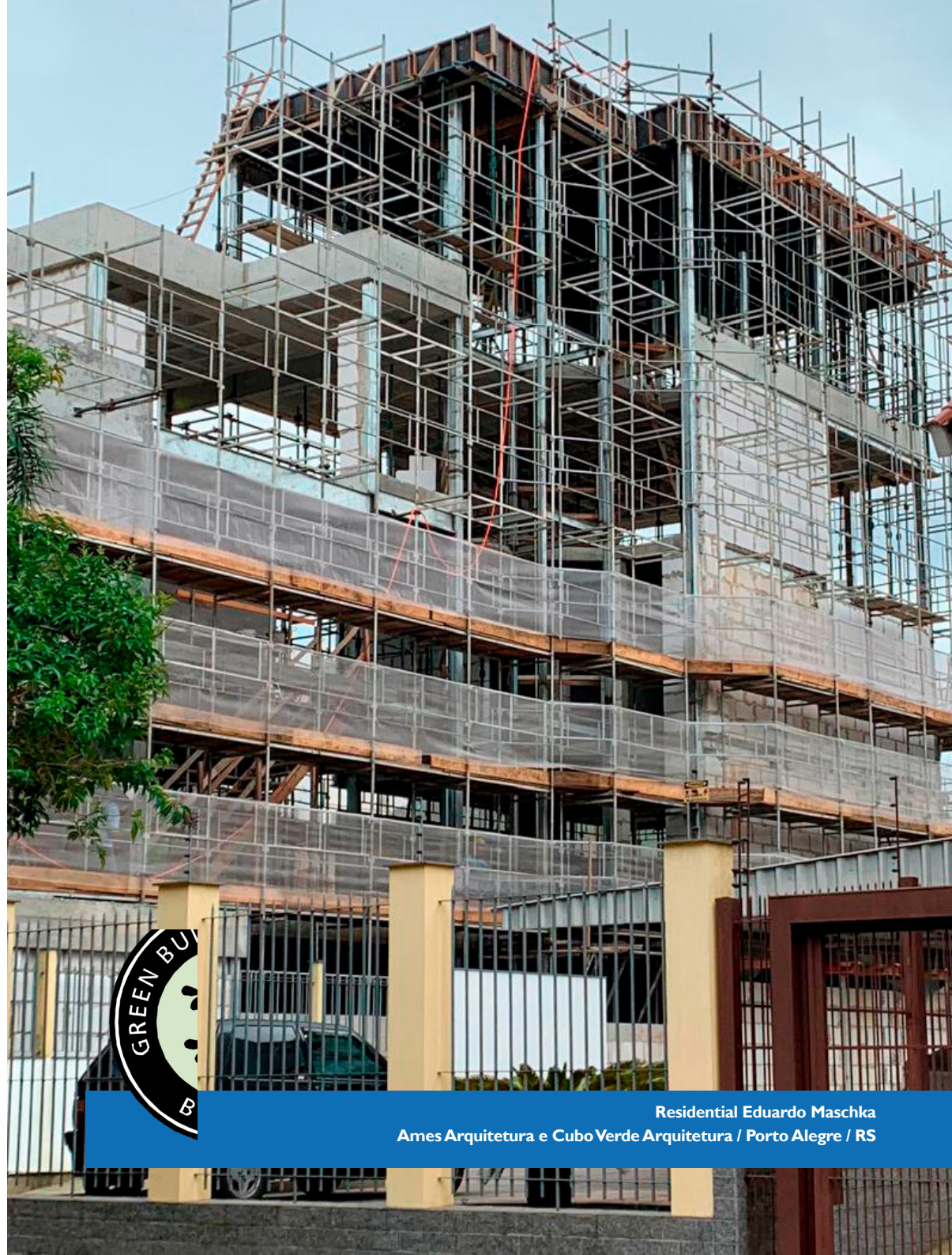
4

Energy losses in winter: Reduction of 23%;

5

Level A of Procel Edifica for winter and summer enclosures.

The project was developed by Eduardo Maschka Lucas in Porto Alegre, with consultancy by Petinelli Inc., one of Brazil's leading sustainable consulting companies, certified LEED and Procel Edifica.



Residencial Eduardo Maschka
Ames Arquitetura e Cubo Verde Arquitetura / Porto Alegre / RS



FIRE SAFETY

FIRE RESISTANCE

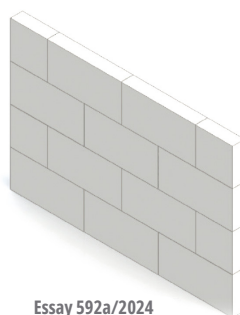
Vertical enclosures, both external and internal, must meet the minimum fire resistance requirements by evaluating the TRRF (Required Fire Resistance Time) as set forth in the standards ABNT NBR 14432, ABNT NBR 9077, ABNT NBR 10636, and ABNT NBR 16965. These standards aim to control fire propagation risks and maintain structural stability in case of fire.

The architect, engineer, or fire safety specialist responsible for the project must establish the TRRFs of the various vertical enclosures according to the ABNT NBR 14432 and ABNT NBR 9077 standards, as well as local regulations (Fire Department and municipal codes).

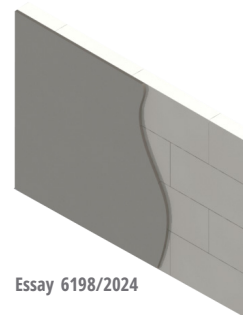
The designer should also consider the type of finish to be used and its thickness. Some finishes, such as wallpapers, fabrics, and acrylic coatings, may alter the system's performance.

FIRE PERFORMANCE RESULTS WITH CELUCON MODULE

FIRE RESISTANCE TEST					
Essays	Laboratory	Celucan CCA Dimension (cm)	Finish	Time	
				Minutes	Hours
5926a/2024	itt Performance - Unisinos	10 x 30 x 60	No coating	180	3:00
6198/2024	itt Performance - Unisinos	10 x 30 x 60	2.0 cm on the face exposed to the flame	240	4:00
5867/2024	itt Performance - Unisinos	14 x 30 x 60	No coating	360	6:00



Essay 592a/2024



Essay 6198/2024



Essay 5867/2024

STRUCTURAL PERFORMANCE

Vertical enclosures, whether structural or non-structural, must be designed and assembled to maintain stability when subjected to mechanical, gravitational, and other loads. This part of the performance standard also addresses the efforts applied to walls based on the building’s use and occupation, evaluating aspects such as suspended elements, soft body impacts, and hard body impacts.

The performance requirements in ABNT NBR 15575 specify acceptable limits for displacement, cracking, and failure, ensuring they do not adversely affect the structure of the vertical enclosure, which could lead to malfunctions in the building and compromise the safety of its occupants.

Tests for resistance to soft body and hard body impacts are conducted as per ABNT NBR 15575, with results reported as either passed or failed, without performance classifications.

EVALUATION CRITERIA FOR SUSPENDED COMPONENTS			
Load applied at each point (kN)	Load applied to the component (kN)	PerformanceCriteria	Performance Level
0,4	0,8	Occurrence of tolerable cracks. Horizontal displacement limitation: dh < h/500, dhr < h/2500	M
0,5	1,0	No cracks or detachments. Horizontal displacement limitation: dh < h/500, dhr < h/2500	I
0,6	1,2	No cracks or detachments. Horizontal displacement limitation: dh < h/500, dhr < h/2500	S

RESULTS WITH CELUCON MODULE

For the suspended component testing, a French bracket was used, fixed with a VR10 hollow brick plastic plug from the brand Vonder. The results pertain solely to this system. The system was subjected to a load of 1.0 kN, corresponding to the intermediate performance level, and remained stable over 24 hours as specified in the standard.

The structural sample for analysis consisted of an external vertical enclosure system made of Celucon Modules (125 mm thick), coated with ready-to-use stabilized mortar (25 mm thick), and set with the same mortar (1 mm thickness). The sample had dimensions of 3.5 meters in width by 2.7 meters in height.

Report – ITT Performance Unisinos – 0727/2015

SUSPENDED LOAD TEST						
Applied load per point (kN)	Applied load on the component (kN)	dh (mm)		dhr (mm)		Performance evaluation
		D1	D2	D1	D2	
0,5	1	0,040	0,1030	0,0345	0,0920	No displacement: dh > h/500, dhr > h/2500

SOFT BODY IMPACT TEST – EXTERNAL IMPACT

Impact energy of soft body (J)	Performance criteria	dh (mm)	dhr (mm)	Situation
360	No damage or penetration by the impacting body	0,2215	0,0105	Approved
240	No failure: $dh \leq h/125$, $dhr \leq h/625$	0,1745	0,0045	Approved
180	No damage or penetration by the impacting body	0,1395	0,0265	Approved
120	No failure: $dh \leq h/125$, $dhr \leq h/625$	0,052	0,0045	Approved

EHARD BODY IMPACT TEST – EXTERNAL IMPACT

Sequence	Impact energy of hard body (J)	Dimple depth (mm)	Dimple diameter (mm)	Performance criteria	Performance evaluation
1	2,5	1,18	9,79	No failures, Dimple depth ≤ 2 mm	Approved
2		1,08	9,04		
3		0,84	8,45		
4		0,78	8,90		
5		0,89	8,61		
6		0,96	8,77		
7		0,94	8,02		
8		0,83	7,59		
9		1,01	8,27		
10	10	0,73	8,48	No rupture or penetration	Approved
1		1,56	12,43		
2		2,24	15,42		
3		2,52	16,06		
4		1,56	15,64		
5		1,49	14,84		
6		1,39	14,31		
7		1,01	11,51		
8		1,17	10,70		
9		1,23	13,27		
10		0,89	11,84		





ACOUSTIC PERFORMANCE

The acoustic performance of a space is evaluated using parameters defined in ABNT NBR 15575, which describes the acoustic performance of a building's environment based on the construction system's components that delimit these spaces, such as vertical enclosures (walls, doors, and windows), floors, ceilings, and plumbing systems.

ABNT NBR 15575 establishes the need to check the level of sound insulation for masonry between external and internal environments, between autonomous units, and between unit rooms and common areas. Laboratory tests measure the weighted sound reduction index R_w (dB), or field tests provide standardized difference in level $D_{nT,w}$ (dB) and standardized difference in level at two meters $D_{2m,nT,w}$ (dB), with each test based on international standards (ISO).

Systems must meet the minimum requirements of ABNT NBR 15575. Systems are classified as light (with surface density less than 60 kg/m^2) or heavy (with surface density equal to or greater than 60 kg/m^2).

EXTERNAL WALLS

Sound insulation for vertical external enclosures – ABNT NBR 15575 (2021)

Noise class	Linc (dB)	Field performance $D_{2m,nT,w}$ (dB)						Laboratory performance R_w (dB)	
		Bedroom			Living room			Bedroom	Living room
		Minimum	Intermediary	Upper	Minimum	Intermediary	Upper	Intermediário	Upper
I	≥ 60	≥ 20	≥ 25	≥ 30	Does not apply	Does not apply	Não se aplica	25 a 29	Does not apply
II	61 a 65	≥ 25	≥ 30	≥ 35	Does not apply	Does not apply	Does not apply	30 a 34	Does not apply
III	66 a 70	≥ 30	≥ 35	≥ 40	Does not apply	≥ 30	≥ 35	35 a 39	30 a 34

INTERNAL WALLS

Sound insulation for vertical internal enclosures – ABNT NBR 15575 (2021)

Separation element	Field performance $D_{nT,w}$ (dB)			Reference values R_w for laboratory/project – minimum performance (dB)	
	Minimum	Intermediary	Upper	Heavy Systems	Lightweight Systems
Wall between autonomous units (in situations without a bedroom).	40 a 44	45 a 49	≥ 50	≥ 43	≥ 45
Wall between autonomous units (if one or more rooms is a bedroom).	45 a 49	50 a 54	≥ 55	≥ 48	≥ 50
Blind wall between a unit and common areas such as corridors and stairwells.	40 a 44	45 a 49	≥ 50	≥ 43	≥ 45
Blind wall between a unit and common areas (without a bedroom).	30 a 34	35 a 39	≥ 40	≥ 33	≥ 35
Blind wall between a unit and common areas like home theaters, gyms, event halls, and bathrooms.	45 a 49	50 a 54	≥ 55	≥ 48	≥ 50
Wall and door assemblies between separate units, separated by a hall (no bedroom).	40 a 44	45 a 49	≥ 50	≥ 43	≥ 45
Wall and door assemblies between separate units, separated by a hall (if at least one room is a bedroom).	45 a 49	50 a 54	≥ 55	≥ 48	≥ 50

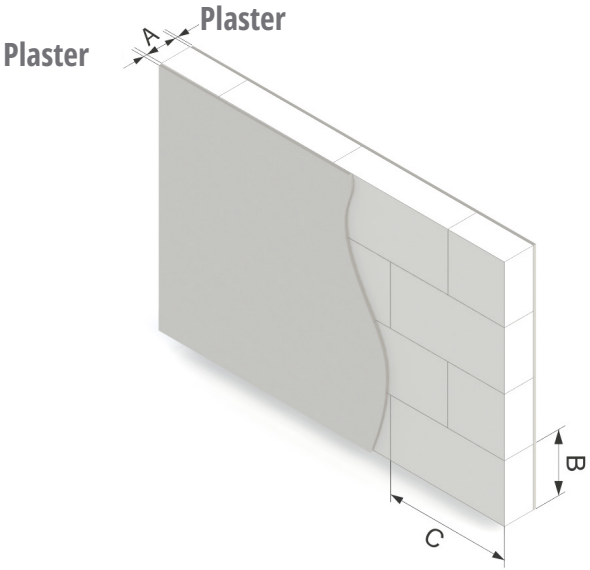
RESULTS WITH CELUCON MODULE

TESTS ACCORDING TO ISO 12354-1/2017 – 3XA ARZENO AUDIO AND ACOUSTICS – ART NO 10282100										
Dimensions AxBxC (mm)	Plaster 1,0 cm		Plaster 1,5 cm		Plaster 2,0 cm		Plaster 2,5 cm		Plaster 3,0 cm	
	Rw (dB)	kg/ m ²	Rw (dB)	kg/ m ²	Rw (dB)	kg/ m ²	Rw (dB)	kg/ m ²	Rw (dB)	kg/ m ²
50x300x600	27	68,0	31	86,0	34	104,0	36	122,0	38	140,0
75x300x600	30	84,0	33	102,0	36	120,0	38	138,0	40	156,0
100x300x600	33	100,0	36	118,0	38	136,0	40	154,0	42	172,0
125x300x600	35	116,0	38	134,0	40	152,0	42	170,0	43	188,0
140x300x600	37	125,0	39	143,0	41	161,0	42	179,0	44	197,0
150x300x600	37	132,0	40	150,0	41	168,0	43	186,0	45	204,0
175x300x600	39	148,0	41	166,0	43	184,0	44	202,0	46	220,0
190x300x600	40	157,0	42	175,0	44	193,0	45	211,0	46	229,0
200x300x600	41	164,0	43	182,0	44	200,0	46	218,0	47	236,0

*Celucion Module with Class C25

ACOUSTIC INSULATION SOLUTION: 48DB				
Dimensions AxBxC (mm)	Rw (dB)	kg / m ²	Plaster thickness (E cm)	Report
200x300x600	48	248,0	3,0	3XA Arzeno Audio and Acoustics 39,2024

*Celucion Module with Class C45



Wall with Celucion Module for sound insulation: a fast, lightweight, simple, and efficient solution.

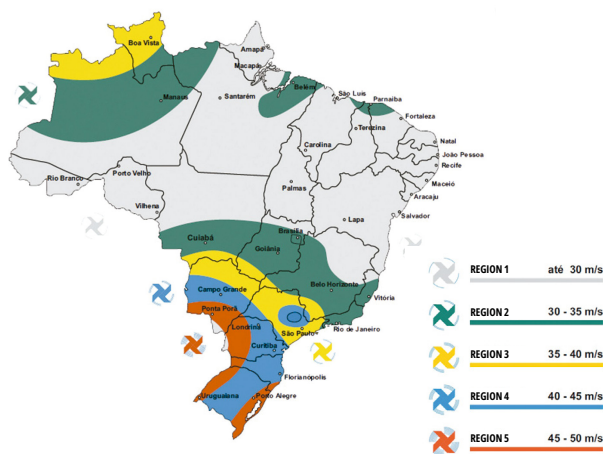


WATERPROOFING PERFORMANCE

Waterproofing is a critical factor in evaluating and ensuring the aesthetic and structural conservation of a building, as well as its hygiene and salubrity.

The standard establishes that external masonry surfaces (facades), including interfaces between windows and walls, should not show signs of infiltration that cause splashing, dripping, or water droplets on the internal face. Only small stains, depending on the type of building, are allowed.

Testing simulates rain and wind exposure on masonry for seven hours, considering the pressure in the building's wind zone as defined by ABNT NBR 6123.



RESULTS WITH CELUCON MODULE

The test was conducted with a Celucon Module of 12.5 cm thickness, with external and internal plaster thickness of 2.5 cm. No moisture stains were found on the side opposite to water exposure or pressure. The system showed no signs of infiltration causing splashes, drips, or water droplets adhering to the internal face.

Based on the results, it can be affirmed that the vertical external enclosure system tested meets the performance requirements set by ABNT NBR 15575 and has achieved a SUPERIOR performance level according to the standard.

TEST CONDITIONS		
Region	Static pressure (Pa)	Water flow rate (L/m ² .minute)
I	10	3
II	20	
III	30	
IV	40	
V	50	

WATERPROOFING PERFORMANCE CRITERIA FOR VERTICAL EXTERNAL ENCLOSURES (FACADES)			
Building	Test time (hours)	Maximum percentage of area with moisture stains on the opposite side of water exposure relative to the total area of the sample	Performance level
Ground floor	7	10	M
		No stains	I / S
More than one floor	7		M
		No stains	I / S

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ASSESSMENT OF WATERPROOFING PERFORMANCE FOR VERTICAL ENCLOSURES			
Building	Test time (hours)	Maximum percentage of the sum of moisture stain areas on the opposite side of water exposure relative to the total area of the sample exposed to water spray	Performance level
Ground floor (only the enclosure wall)	7	No stains	S
More than one floor (only the enclosure wall)	7	No stains	S



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Rod. Genésio Mazon, SC 445 – Km 12
Vila Rica – Morro da Fumaça/SC

(48) 3434 6600
celucon.com.br



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