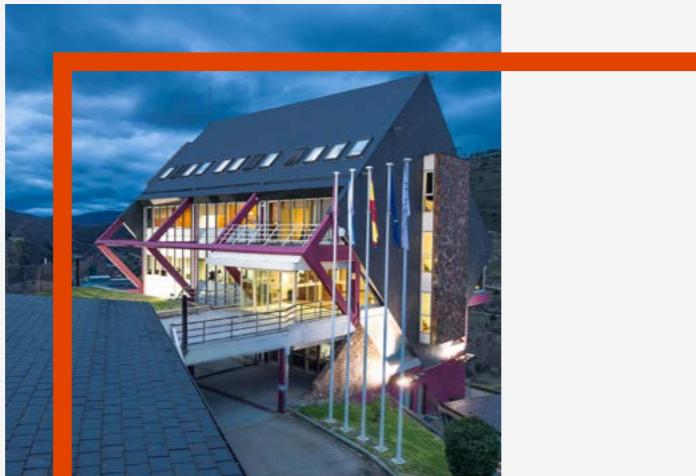




THERMOCHIP **HOUSING**



THE INDUSTRIALISED SOLUTION FOR NZEB
BUILDING DESIGN AND CONSTRUCTION



THERMOCHIP

Thermochip, a pioneer in the manufacture and commercialisation of sandwich panels in Spain, has worked for more than thirty years to consolidate its position as the leader in the light rooftop panel sector, having already installed more than six million square metres.

Backed by its history in the industrialised construction sector, Thermochip is sharing its commitment to the future of construction: efficient and sustainable industrialised buildings.

WHAT IS THERMOCHIP HOUSING?

THERMOCHIP HOUSING is the industrialised solution by Thermochip for designing and executing nearly zero-energy buildings with certainty.

ROOF
SATE
WALL
+ FLOOR

THERMOCHIP
HOUSING

NZEB

BY 31 DECEMBER 2020, ALL NEW BUILDINGS SHALL BE NEARLY ZERO-ENERGY BUILDINGS, AFTER 31 DECEMBER 2018 PUBLIC AUTHORITIES BUILDINGS TOO.

[Directive on the energy performance of buildings, 2010/31/EU.]

REGULATORY SCENARIO

Nearly zero-energy buildings are buildings with **a very high energy efficiency level** which must be designed in accordance with the following general considerations:

- Aesthetics and design.
- Energy savings as the priority.
- An easy assembly process.
- Simple and affordable maintenance.
- Less technical problems.
- Avoiding shading and condensation.
- Economically feasible solutions:
 - Technology that is available on the market at a good price.
 - Replacement of materials at a good price.



THERMOCHIP HOUSING

HIGH THERMAL
INSULATION
CONTROL

EXHAUSTIVE
THERMAL BRIDGE
CONTROL

WATER
AND AIR
TIGHTNESS



ADVANTAGES FOR SPECIFIERS

ALL-NEW CONSTRUCTION SYSTEMS

Thermochip Housing solutions for facades, interior walls, flooring, wall panelling and roofs in nearly zero-energy buildings.

BIM INTEGRATION

Support for draughtsmen starting with the project phase. Access to the BIM object library at the Thermochip website [RVT format].

CERTAINTY

Less uncertainty between the architecture project and construction. Easy execution control and quick assembly.



DESIGNING AN NZEB BUILDING

HIGH THERMAL INSULATION

Ideal transmittance values for the envelope based on the local climate.

The proper choice of insulation based on the walls to be built and the specific thermal calculation for the project location is fundamental.

ELIMINATION OF THERMAL BRIDGES

THERMOCHIP HOUSING provides a layer of continuous thermal insulation meaning the buildings created with this system have no thermal bridges which prevents temperature transfers and condensation.

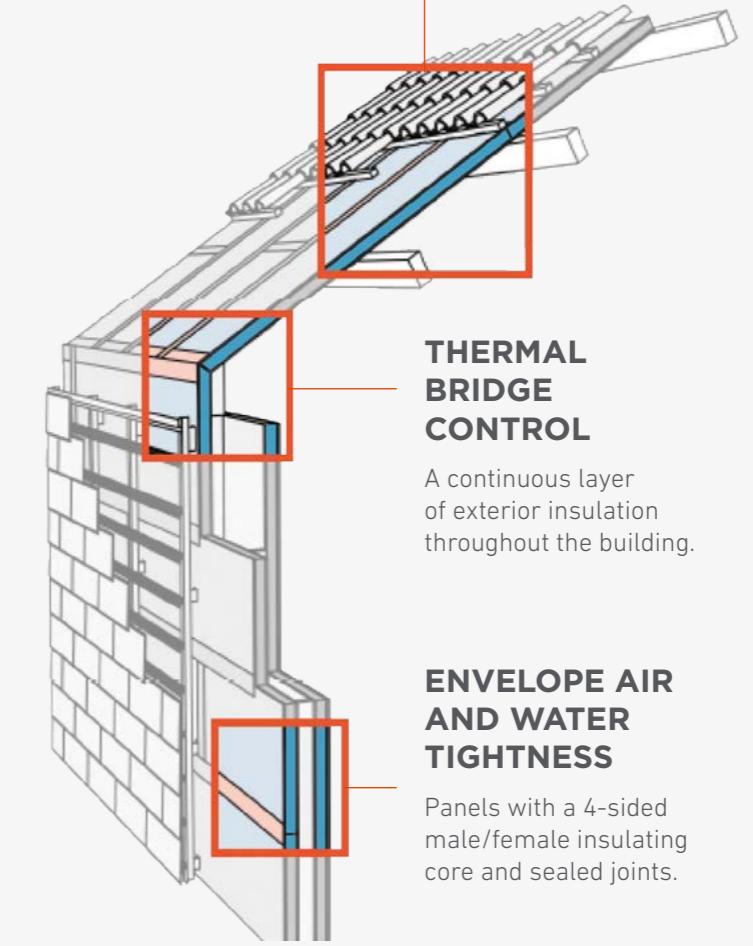
ENVELOPE AIR TIGHTNESS

The sealing treatment has a major impact on the building behaviour. The sealing layer must be continuous. The "pencil rule" is followed when designing it.

The building tightness (air and water) design must be combined with good ventilation to guarantee efficient indoor air renewal.

CONTINUOUS THERMAL INSULATION ENVELOPE

based on the specific needs of each project



THERMAL BRIDGE CONTROL

A continuous layer of exterior insulation throughout the building.

ENVELOPE AIR AND WATER TIGHTNESS

Panels with a 4-sided male/female insulating core and sealed joints.

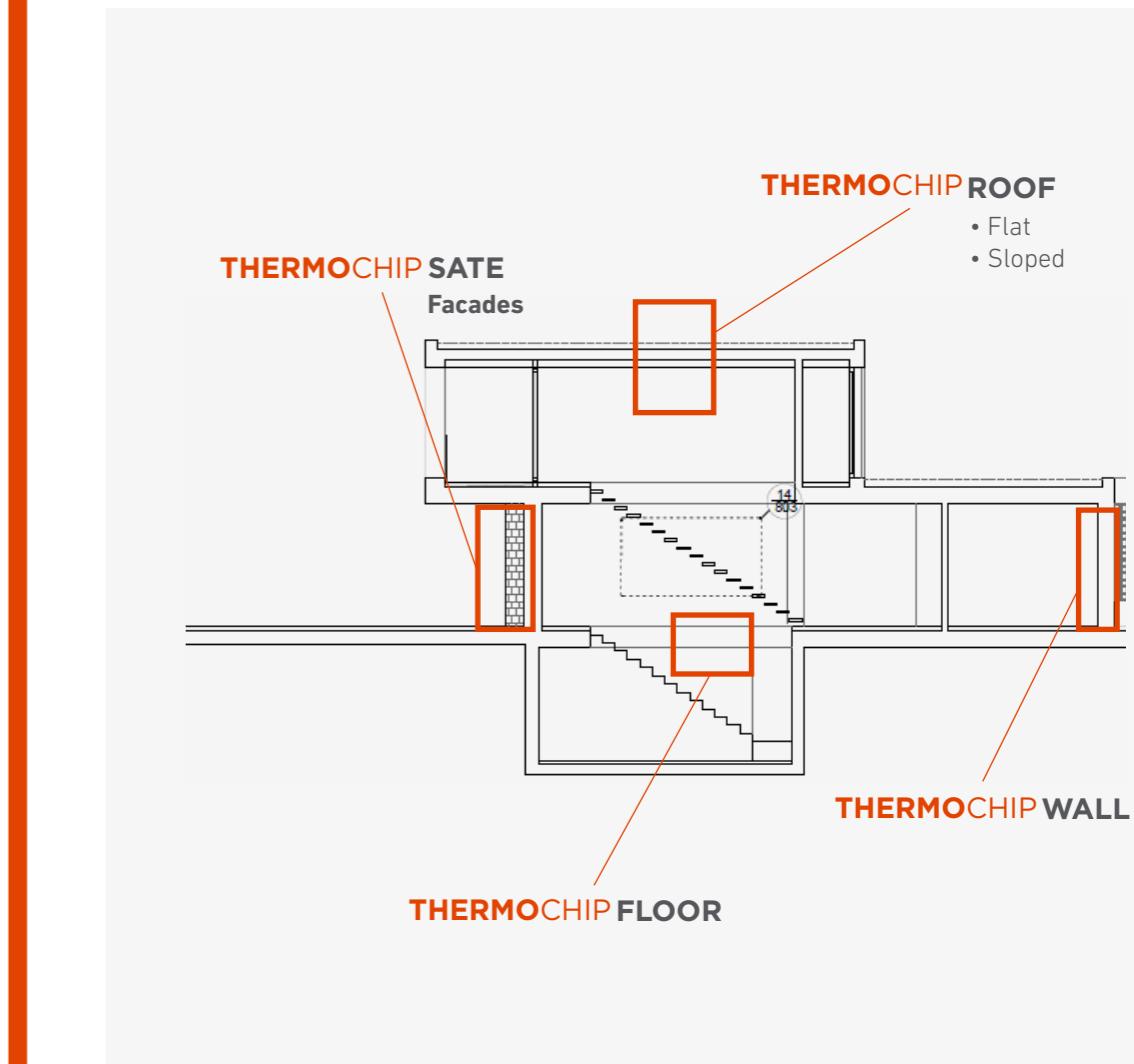


Another fundamental point is the choice and proper installation of **exterior carpentry with high thermal features**.

Along with a **building bioclimatic study** to get the most out of natural renewable energies, these aspects are the keys to designing nearly zero-energy buildings.



GUIDE TO DESIGNING NZEB BUILDINGS



This guide describes all the components, technical specifications and design tips for planning NZEB buildings using **the industrialised THERMOCHIP HOUSING system**.

Industrialisation, sustainability and design go hand in hand to create new buildings and reduce the energy consumption in existing buildings.

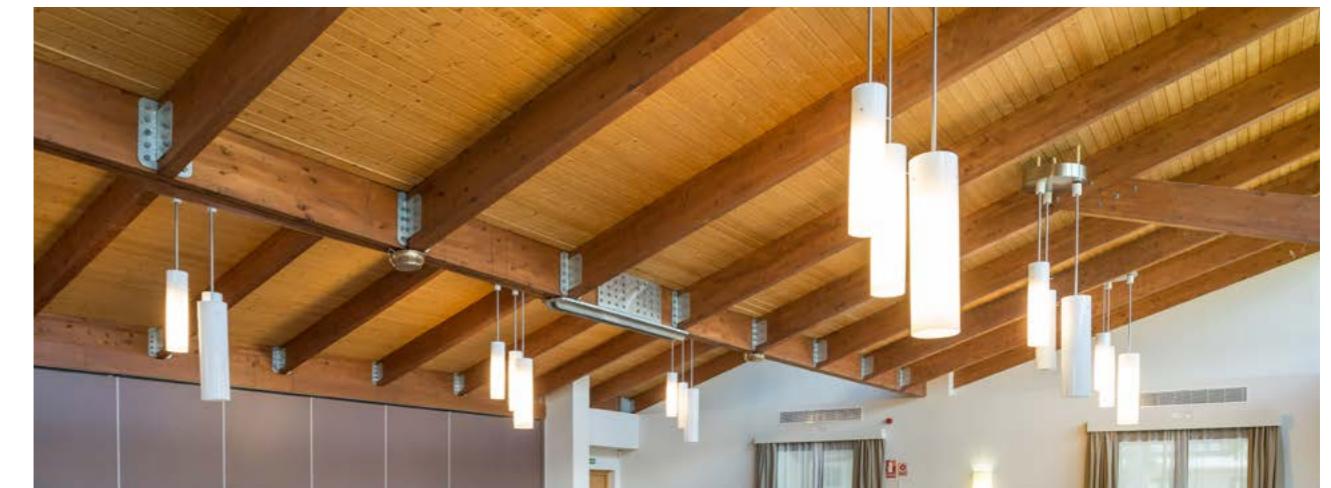


SLOPED ROOF

The same **THERMOCHIP** range as always.

The **THERMOCHIP ROOF** sloped roof panel is comprised of a layer with a very wide range of decorative finishes in contact with the load bearing structure, a continuous extruded polystyrene **male/female 4-sided insulating core** and a waterproof slab on the upper side of the formwork.

To avoid having to install waterproofing elements later on, a breathable waterproof sheet can be attached to the panel at the factory for extra water tightness (**THERMOCHIP PLUS**).



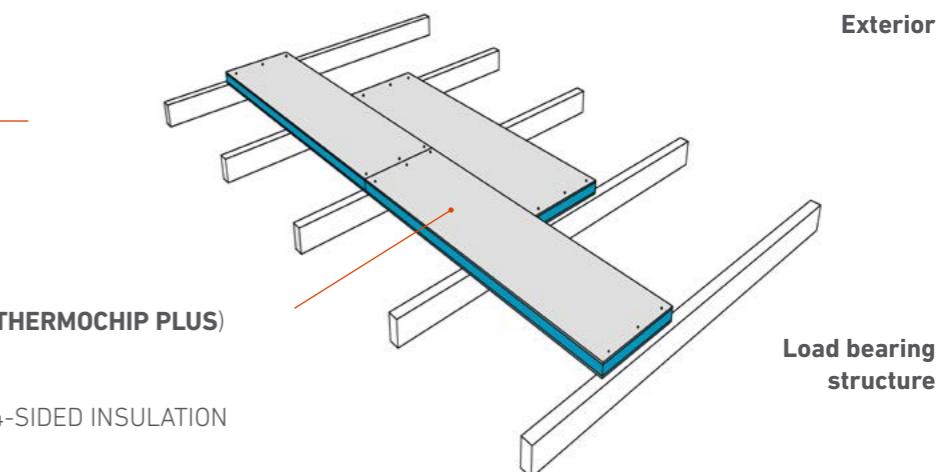
THERMOCHIP ROOF

WATERPROOFING AND INSULATION

Breathable waterproof sheet (**THERMOCHIP PLUS**)
15 mm OSB3 slab

CONTINUOUS MALE/FEMALE 4-SIDED INSULATION
12 mm fibrous plaster slab

THREE BASIC INSTALLATION PRINCIPLES



THERMOCHIP PLUS

THERMOCHIP ROOF

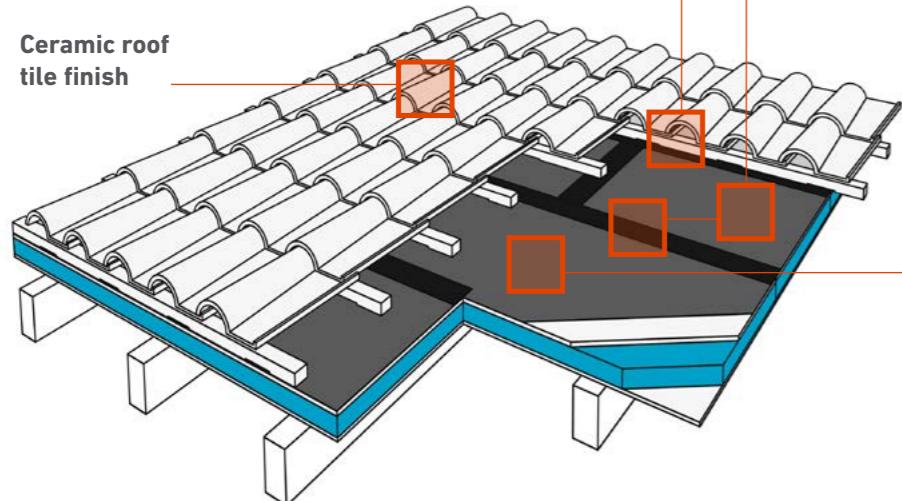
Breathable
waterproof sheet

THERMOCHIP PLUS



Battens under roof tiles

Roof evacuation and ventilation. Grooved on the bottom of the battens to evacuate water. Autoclave treated battens.



Breathable waterproof sheet (**THERMOCHIP PLUS**) with joints sealed with black adhesive tape between panels: Roof waterproofing and air tightness.

Effective roof panel **waterproofing** is essential to the proper operation of the roofing system and preventing interstitial condensation.

Installing the **PLUS** breathable waterproofing sheet to reduce execution times and guarantee roof waterproofing is recommended.

ROOF VENTILATION: The presence of a ventilated chamber between **THERMOCHIP** panels and the exterior panelling prevents the appearance of mould and condensation. Guaranteeing proper ventilation of this air chamber throughout the roof surface is recommended as per the indications in the document Spanish Technical Building Code DB HS 1 Protection against moisture.

TECHNICAL DATA SHEETS PAGES 13 & 14

REGULATORY JUSTIFICATION

[HE - Energy efficiency]
Irrespective of the type of finish, the complete roofing solution must comply with a transmittance value of Umax: 0.35 W/m²K for E climate zones (the most restrictive).

The transmittance value is U = 0.296 W/m²K for a roof panel with the following composition. The panel alone, without counting the contribution of the other materials, complies with the energy requirements for roofing in E climate zones (the most restrictive).

Panel composition:
15 mm OSB slab (exterior) + 120 mm XPS insulation + 12 mm fibrous plaster slab (interior).

[HR - Noise protection]
According to the test data, the overall weighted sound reduction index A for the roof panel is RA= 36.1 dBA.

[HS - Health standards]
The roof waterproofing level does not depend on climatic factors. Waterproofing the roof using **THERMOCHIP PLUS**

is recommended as it is a prefabricated system installed on roofs to guarantee tightness and joint sealing.

The minimum roof slope must be 30% for mixed roofs and 32% for curved roofs. [Spanish Technical Building Code DB HS, table 2.10]. The air chamber should be correctly ventilated as per Spanish Technical Building Code DB HS, section 2.4.3.5. Installing the roof tiles as per the manufacturer's instructions is recommended.

NOTE: A detailed thermal calculation is recommended for Spanish Technical Building Code DB-HE and HS condensation justification.

REGULATORY JUSTIFICATION

[HE - Energy efficiency]
Irrespective of the type of finish, the complete roofing solution must comply with a transmittance value of Umax: 0.35 W/m²K for E climate zones (the most restrictive).

The transmittance value is U = 0.301 W/m²K for a roof panel with the following composition. The panel alone, without counting the contribution of the other materials, complies with the energy requirements for

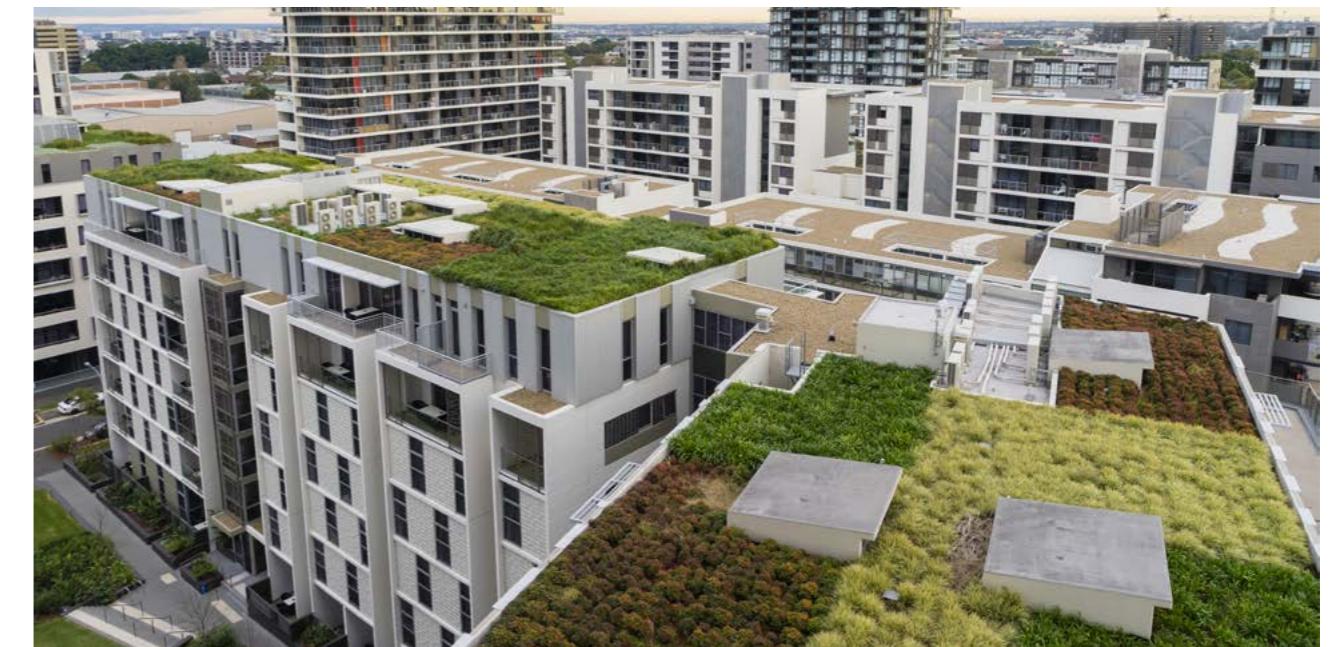
roofing in E climate zones (the most restrictive).
Panel composition:
12 mm fibrous cement slab (exterior) + 120 mm XPS insulation + 12 mm fibrous plaster slab (interior).

[HR - Noise protection]
According to data provided by the laboratory, the overall weighted sound reduction index A for the roof panel is RA= 36.1 dBA.

NOTE: Due to the extensive casuistry, a structural verification for each particular case is recommended for Spanish Technical Building Code DB-SE and SI justification. A detailed thermal calculation is recommended for Spanish Technical Building Code DB-HE and HS condensation justification.

FLAT ROOF

The **THERMOCHIP ROOF** flat roof panel is comprised of a fibrous plaster slab in contact with the load bearing structure, by means of a **continuous extruded polystyrene male/female 4-sided insulating core** and a fibrous cement slab on the upper side of the roof.

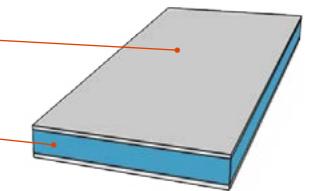


Exterior

THERMOCHIP ROOF

Breathable (**THERMOCHIP PLUS**)
12 mm fibrous cement slab

CONTINUOUS MALE/FEMALE 4-SIDED INSULATION
12 mm fibrous plaster slab

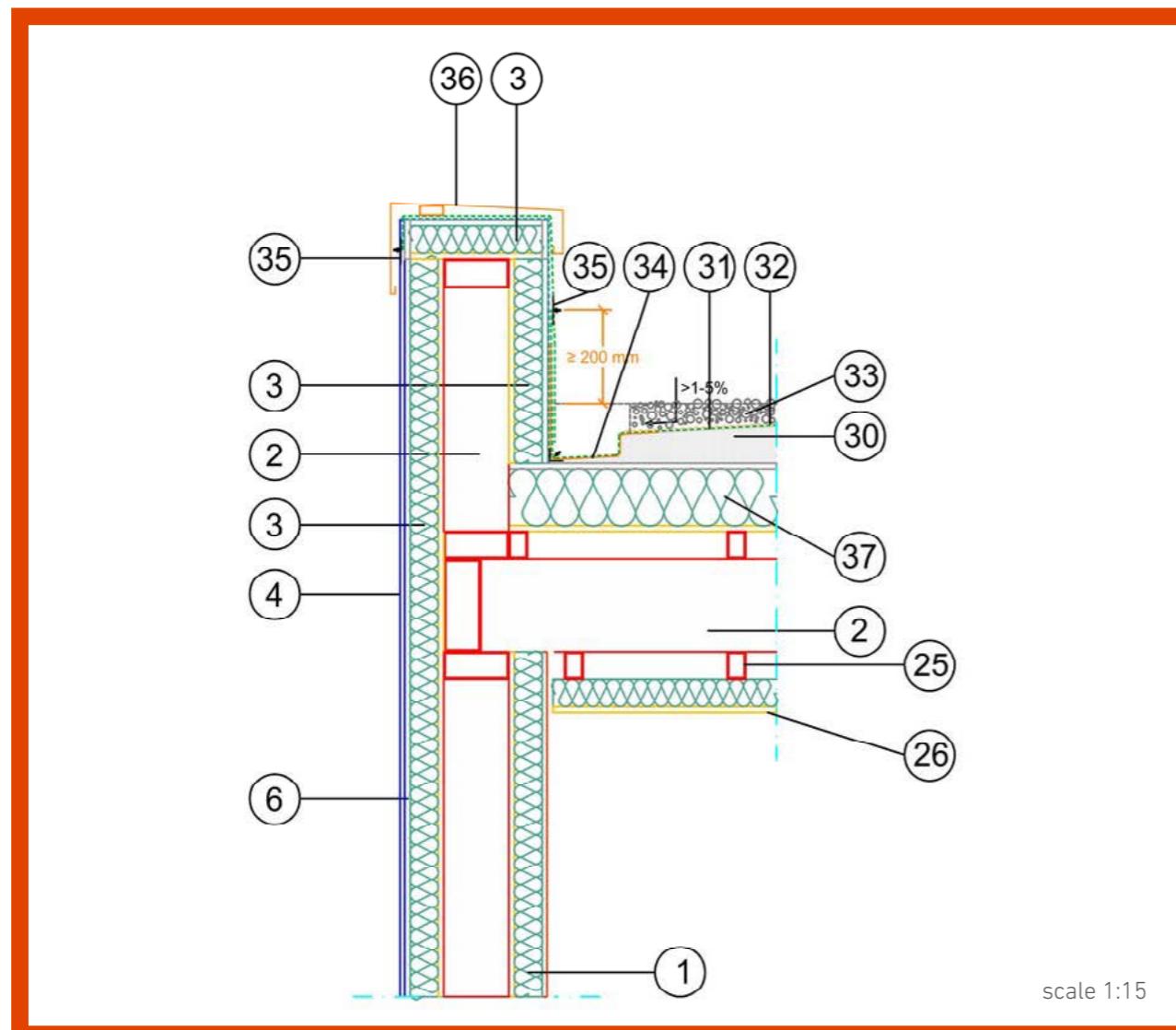


Load bearing structure

TECHNICAL DATA SHEET PAGE 12

Detail 06.a

FACADE - FLAT ROOF MEETING POINT NOT PASSABLE

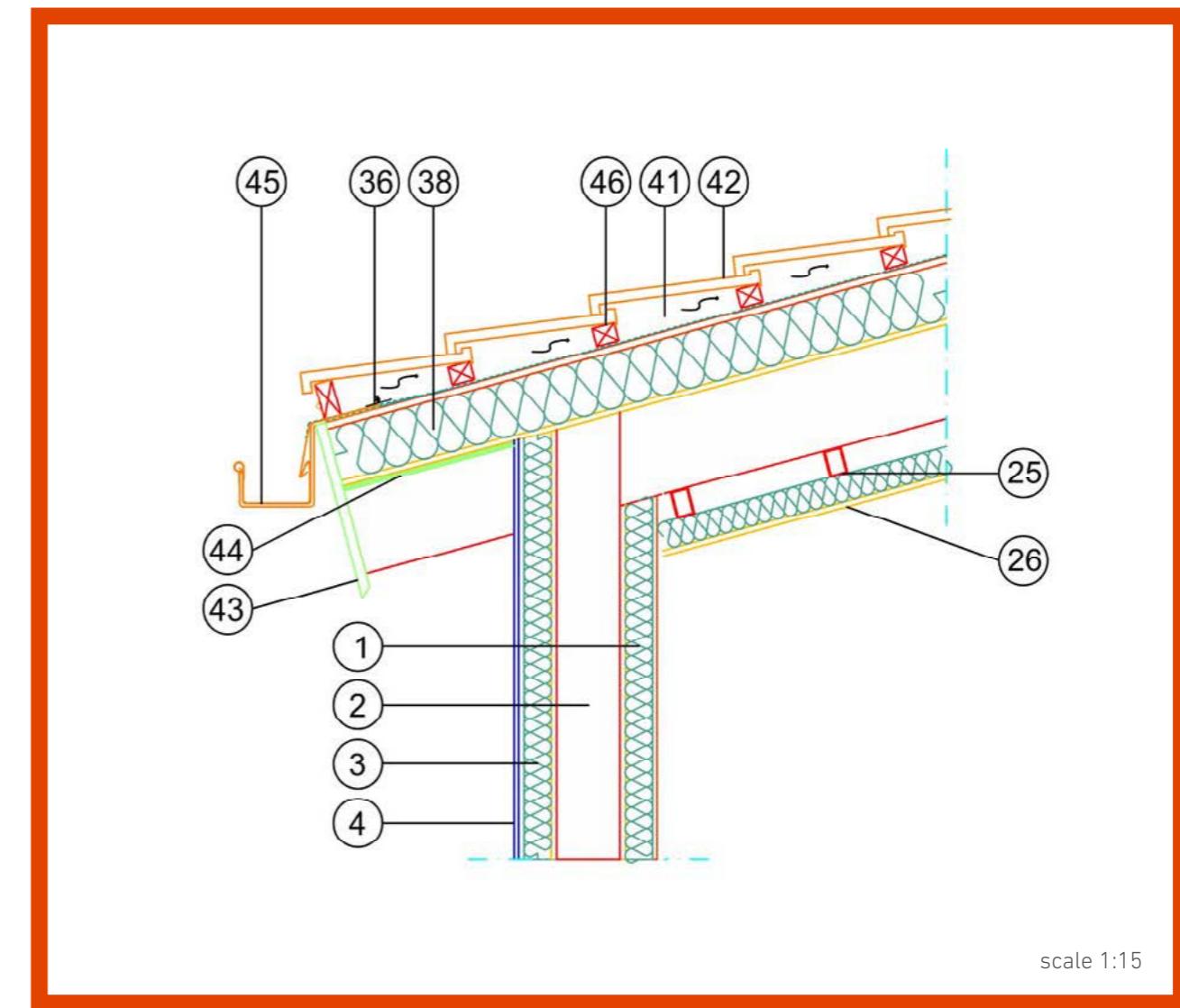


D.06.a

- 02. Structure (additional inner insulation between the structure)
- 03. THERMOCHIP SATE
- 04. Continuous elastic mortar finish on the outer layer of THERMOCHIP SATE
- 06. EPDM or bituminous waterproofing membrane
- 25. Profiles to install dropped ceilings
- 26. THERMOCHIP DECO
- 37. THERMOCHIP ROOF -flat roof- (sealed joints)
- 30. Light mortar to form the slope
- 31. EPDM or similar waterproofing sheet
- 32. Separating and protective layer, puncture resistant
- 33. Protective gravel layer (16-32 mm, emin: 5 cm)
- 34. Hidden gutter (folded sheet metal)
- 35. Sealed with tape in the joints between waterproofing membranes
- 36. Crown plate finish

Detail 06.b

FACADE - PLUS SLOPED ROOF MEETING POINT



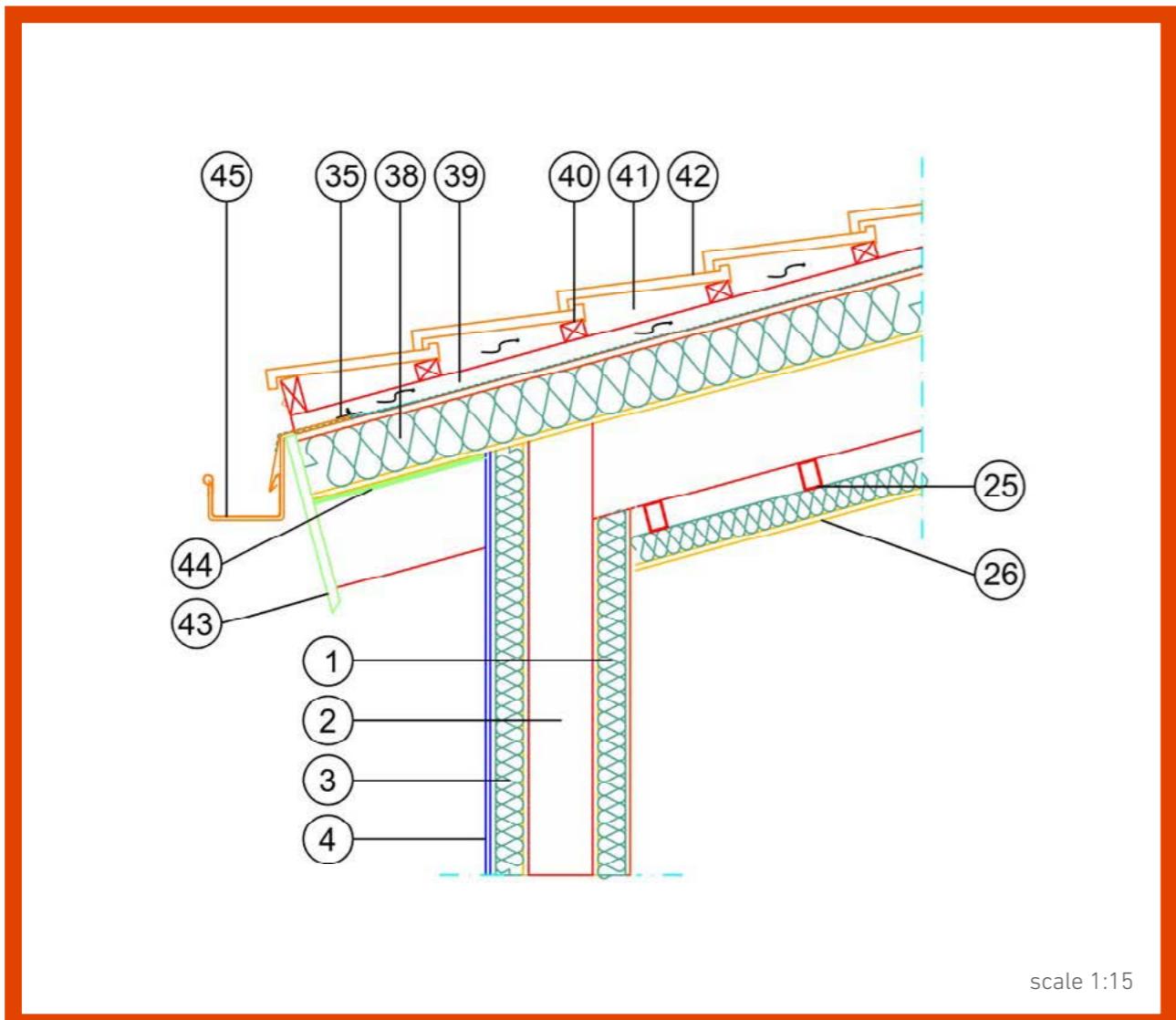
D.06.b

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

- 01. THERMOCHIP WALL (sealed joints for tightness)
- 02. Structure (additional inner insulation between the structure)
- 03. THERMOCHIP SATE
- 04. Continuous elastic mortar finish on the outer layer of THERMOCHIP SATE
- 25. Profiles to install dropped ceilings
- 26. THERMOCHIP DECO
- 38. HERMOCHIP PLUS ROOF -sloped roofs- (sealed joints) Breathable waterproof sheet attached to the panel (THERMOCHIP PLUS)
- 46. PLUS transversal batten to form a ventilated chamber (autoclave treated pine). Grooved on the bottom of the battens to evacuate water.
- 41. Ventilated chamber under tiles
- 42. Ceramic tile roof
- 43. Eave protective part (sheet metal or pine treated for class IV risk)
- 44. Decorative panel coating on eaves
- 45. Exposed gutter (folded sheet metal) mechanically fixed to the sandwich panel
- 36. Crown plate finish

Detail 06.c

FACADE - SLOPED ROOF MEETING POINT



D.06.c

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

01. THERMOCHIP WALL (sealed joints for tightness)
02. Structure (additional inner insulation between the structure)
03. THERMOCHIP SATE
04. Continuous elastic mortar finish on the outer layer of THERMOCHIP SATE
05. Profiles to install dropped ceilings
06. THERMOCHIP DECO
07. Sealed with tape in the joints between waterproofing membranes
08. Crown plate finish
09. THERMOCHIP PLUS ROOF -sloped roof- (sealed joints)
10. Breathable waterproof sheet attached
11. to the panel (THERMOCHIP PLUS)
40. Longitudinal batten to form a ventilated chamber (autoclave treated pine for class IV risks)
41. Transversal batten to form a ventilated chamber (autoclave treated pine for class IV risks)
42. Ventilated chamber under tiles
43. Ceramic tile roof
44. Eave protective part (sheet metal or pine treated for class IV risk)
45. Decorative panel coating on eaves
46. Exposed gutter (folded sheet metal) mechanically fixed to the sandwich panel



THERMOCHIP SATE

THERMOCHIP SATE is a panel for use on facades and exterior walls.

It is comprised of a fibrous plaster slab in contact with the load bearing structure, a **continuous extruded polystyrene male/female 4-sided insulating core** and a fibrous cement slab.



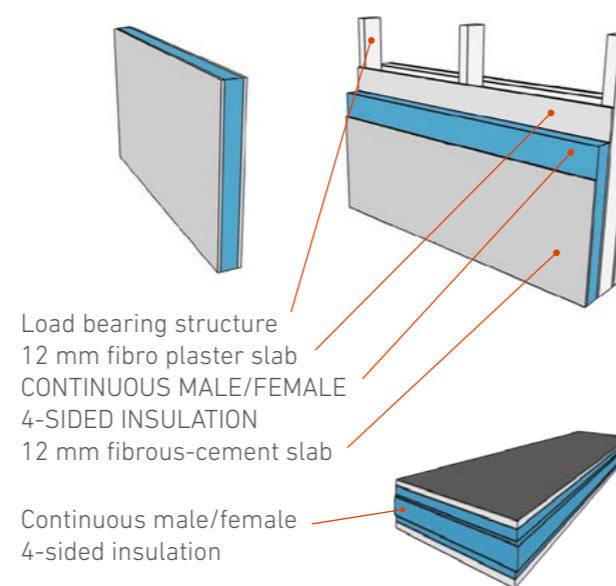
THERMOCHIP SATE

THE MOST VERSATILE EXTERIOR CONTINUOUS INSULATION SYSTEM

CONTINUOUS INSULATION SOLUTION

It is the only sandwich panel for facades on the market where the four sides of the panel feature a **tongue-free assembly method** to create more efficient facades because of the continuous insulation throughout the surface.

Unlike other products, the **THERMOCHIP** continuous insulation system helps create more stable and even enclosures as the four sides of the panels can be assembled. This system **eliminates thermal bridges**, facilitates quick panel installation and guarantees **continuous insulation**.



**AN EXTERIOR WALL SOLUTION,
MULTIPLE PANELLING SOLUTIONS.**

PANELLING SOLUTIONS **THERMOCHIP SATE + ELASTIC MORTARS**

Elastic mortar can be used as the exterior finish for **THERMOCHIP SATE** panels.

The exterior elastic mortar panelling provides sealing from the wind and rain.

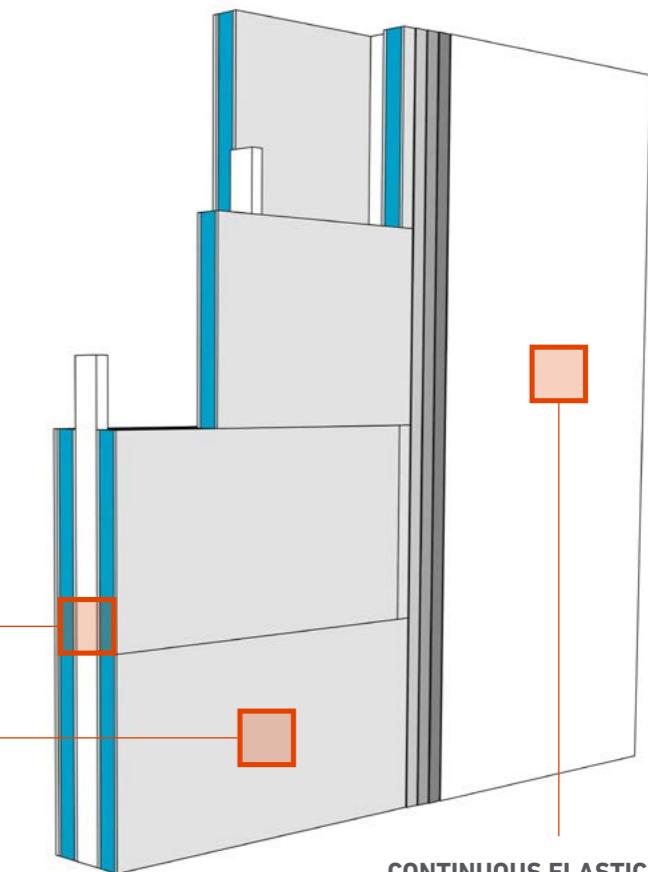
INSTALLATION

The different layers of the finishing elastic mortar are directly applied to the exterior fibrous cement layer for continuous sealing over the entire exterior **THERMOCHIP SATE** surface to increase the building air and water tightness.

Following the manufacturer's instructions when laying the mortar is recommended.

Load bearing structure

THERMOCHIP SATE. With a continuous male/female four-sided insulation core.



TECHNICAL DATA SHEET PAGE 27

REGULATORY JUSTIFICATION

[SI - Fire safety]

The basic B-s1, d0 exterior propagation requirement for dividing walls and facades applies meaning fire propagation must be limited on the outside of the building.

The reaction to fire class of the materials that occupy more than 10% of the surface of the exterior facade finish shall be at least B-s3, d2 (for facades with a base that is accessible to the public and facades with

a height of more than 18 m). The elastic mortar finish must have a minimum reaction to fire rating of B-s3-d2 in these types of buildings.

[HE - Energy efficiency]

Irrespective of the finish panelling, the complete roofing solution must comply with a transmittance value of Umax:

0.55 W/m²K for E climate zones (the most restrictive). A transmittance value of U = 0.432 W/m²K is achieved with an 80

mm insulation THERMOCHIP SATE panel, which meets the energy requirements for E zones.

[HR - Noise protection]

According to the test data, the overall weighted sound reduction index A for the facade panel is RA= 36.1 dBA.

[HS - Health standards]
Rainwater resistance: one conditioning factor for this facade solution is equal to

R3 - C1, which is valid for a waterproof level of 5, the highest level indicated in the Spanish Technical Building Code. Condensation limitations: a specific thermal calculation of the enclosure is recommended to evaluate possible condensations.

PANELLING SOLUTIONS

THERMOCHIP SATE + MORTARED CLADDING

The mortared cladding over the **THERMOCHIP SATE** facade panel gives the enclosure immense thermal inertia which, along with the continuous insulation provided by the facade panel, creates a high-performing system in terms of energy.

The mass panelling means the soundproofing capacity offers an advantage over other types of facade solutions.

Cement mortar

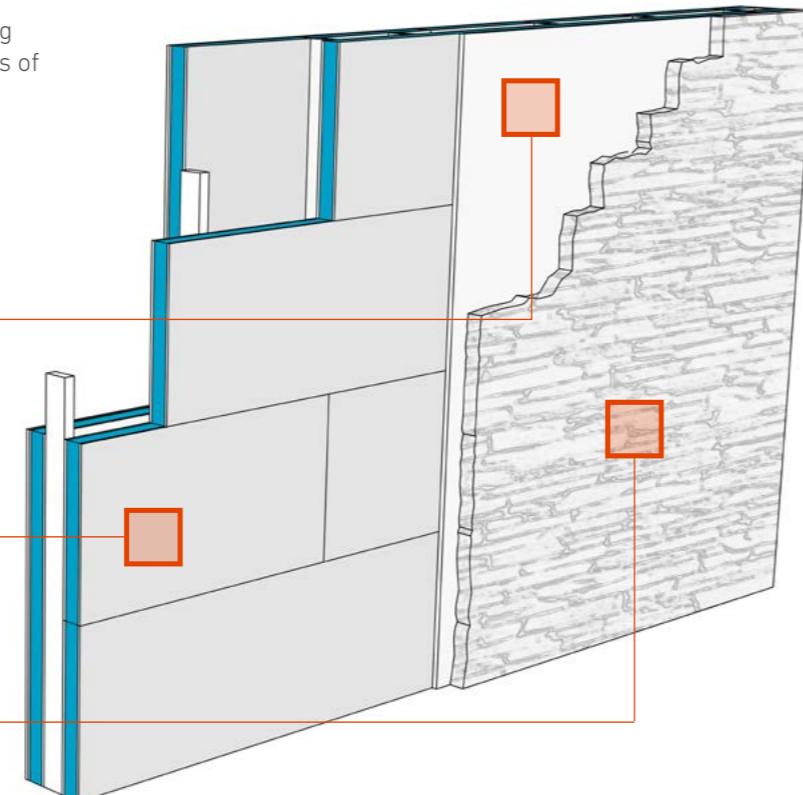
Mortar-glue to install cladding on the exterior fibrous cement panel

THERMOCHIP SATE.

With a continuous male/female four-sided insulation core

Cladding

Panelling material on the outside of the facade



TECHNICAL DATA SHEET PAGE 28

REGULATORY JUSTIFICATION

[SI - Fire safety]
The basic SI 2 exterior propagation requirement for dividing walls and facades applies meaning fire propagation must be limited on the outside of the building.

The reaction to fire class of the materials that occupy more than 10% of the surface of the exterior facade finish shall be at least B-s3, d2 (for facades with a base that is accessible to the public and facades with a height

of more than 18 m). The mortar finish must have a minimum reaction to fire rating of B-s3-d2.

[HE - Energy efficiency]
Irrespective of the finish panelling, the complete roofing solution must comply with a transmittance value of U_{max} : $0.55 \text{ W/m}^2\text{K}$ for E climate zones (the most restrictive). A transmittance value of $U = 0.432 \text{ W/m}^2\text{K}$ is achieved with an 80 mm insulation THERMOCHIP SATE panel, which meets the

energy requirements for E zones just like all the other facade panelling systems described in this document.

[HS - Health standards]
Rainwater resistance: one conditioning factor for this facade solution is equal to R3 - C1, which is valid for a waterproof level of 5, the highest level indicated in the Spanish Technical Building Code. Condensation limitations: a specific thermal calculation of

the enclosure is recommended to evaluate possible condensations.

PANELLING SOLUTIONS

THERMOCHIP SATE + VENTILATED FACADES

The ventilated facade helps cool the building in the summer and controls heat dissipation in the winter which means it is very adequate panelling for the **THERMOCHIP SATE** system.

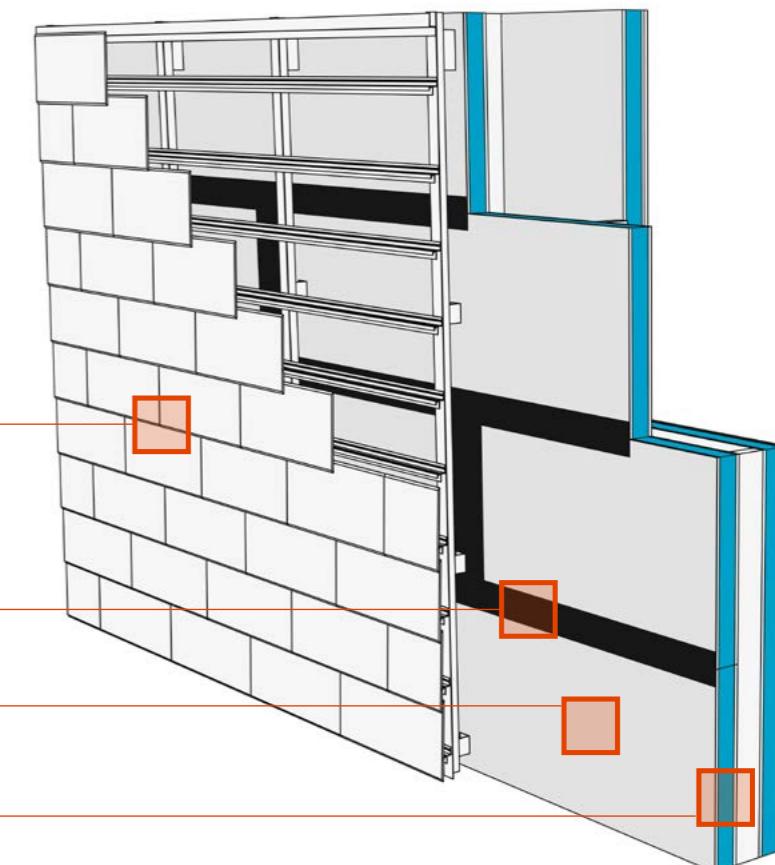
Plus, it fosters energy savings and the circulation of air in the chamber reduces the condensation and moisture found in traditional facades.

Ventilated facade system

Waterproof adhesive tape to seal joints between panels

Fibrous-cement slab
Outer layer of **THERMOCHIP SATE**

THERMOCHIP SATE with a continuous male/female four-sided insulation core



TECHNICAL DATA SHEET PAGE 29

REGULATORY JUSTIFICATION

[SI - Fire safety]
For facades accessible to the public and facades of a height of more than 18 m, the materials that occupy more than 10% of the interior surface of the ventilated chamber must have a minimum reaction to fire rating of B-s3-d0. The exterior panel, THERMOCHIP SATE fibrous cement slab, has a class A reaction to fire rating which makes it the ideal system for use on facades in direct contact with a ventilation chamber.

The panel alone, without counting the contribution of the other materials, complies with the energy requirements for

roofing in E climate zones (the most restrictive).

Panel composition:
10 mm fibrous cement slab (exterior) + 80 mm XPS insulation + 12 mm fibrous plaster slab (interior).

[HE - Energy efficiency]
Irrespective of the type of finish, the complete facade solution must comply with a transmittance U_{max} value: $0.55 \text{ W/m}^2\text{K}$ for E climate zones (the most restrictive). The transmittance value is $U = 0.432 \text{ W/m}^2\text{K}$ for a facade panel with the following composition:

Rainwater resistance: one conditioning factor for this facade solution is equal to B3 - C1, which is valid for a waterproof level of 5, the highest

level indicated in the Spanish Technical Building Code.

NOTE: A detailed thermal calculation is recommended for Spanish Technical Building Code DB-HE and HS condensation justification.

BUILDING ENERGY REHABILITATION

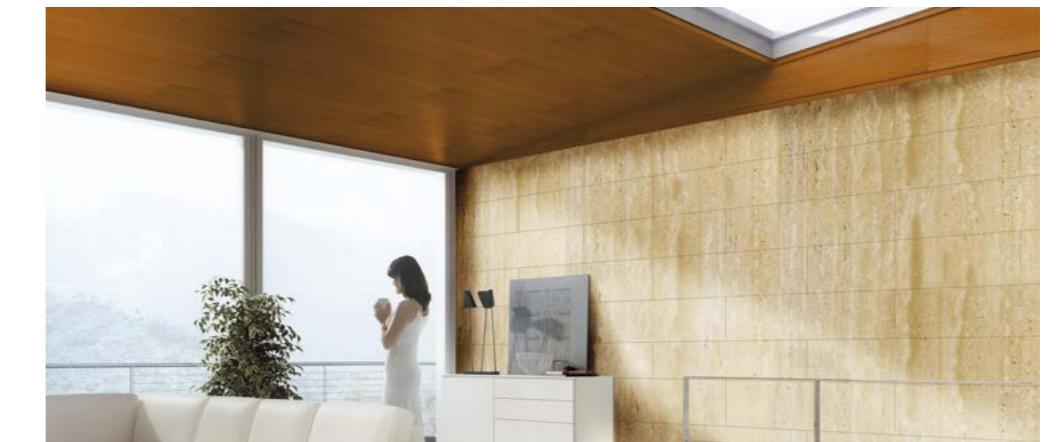


THERMOCHIP SATE is not only for use with new construction. With **THERMOCHIP SATE**, it is possible to panel the exterior of an existing building by adding a continuous layer of insulation and a firm and stable base for any type of panelling.

This way and with simple intervention, minimising the impact on occupants inside their homes, it is possible to rework thermal bridges in the buildings to ensure a drastic reduction in energy consumption.

ADVANTAGES

- Increased thermal insulation.
- Improved acoustic behaviour.
- Energy bill savings.
- Minimal impact on building occupants inside their homes.
- Does not reduce the net surface area of the inside of the home.
- Improved thermal comfort for occupants.
- Property revalorisation.
- Any type of panelling acceptable.



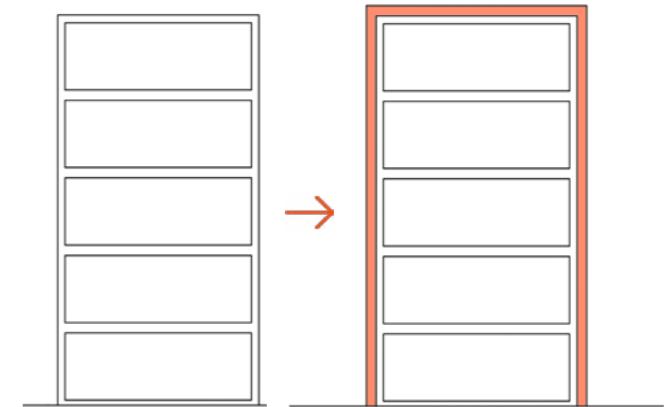
The **exterior continuous insulation (SATE)** for a facade not only halts the loss of heat in the winter but also helps regulate heat in the summer.

This leads to heating and air conditioning **energy savings** which reduces the energy bill for buildings.

The interior comfort in housing is enhanced and CO₂ emissions into the air are decreased.

SAVINGS & COMFORT

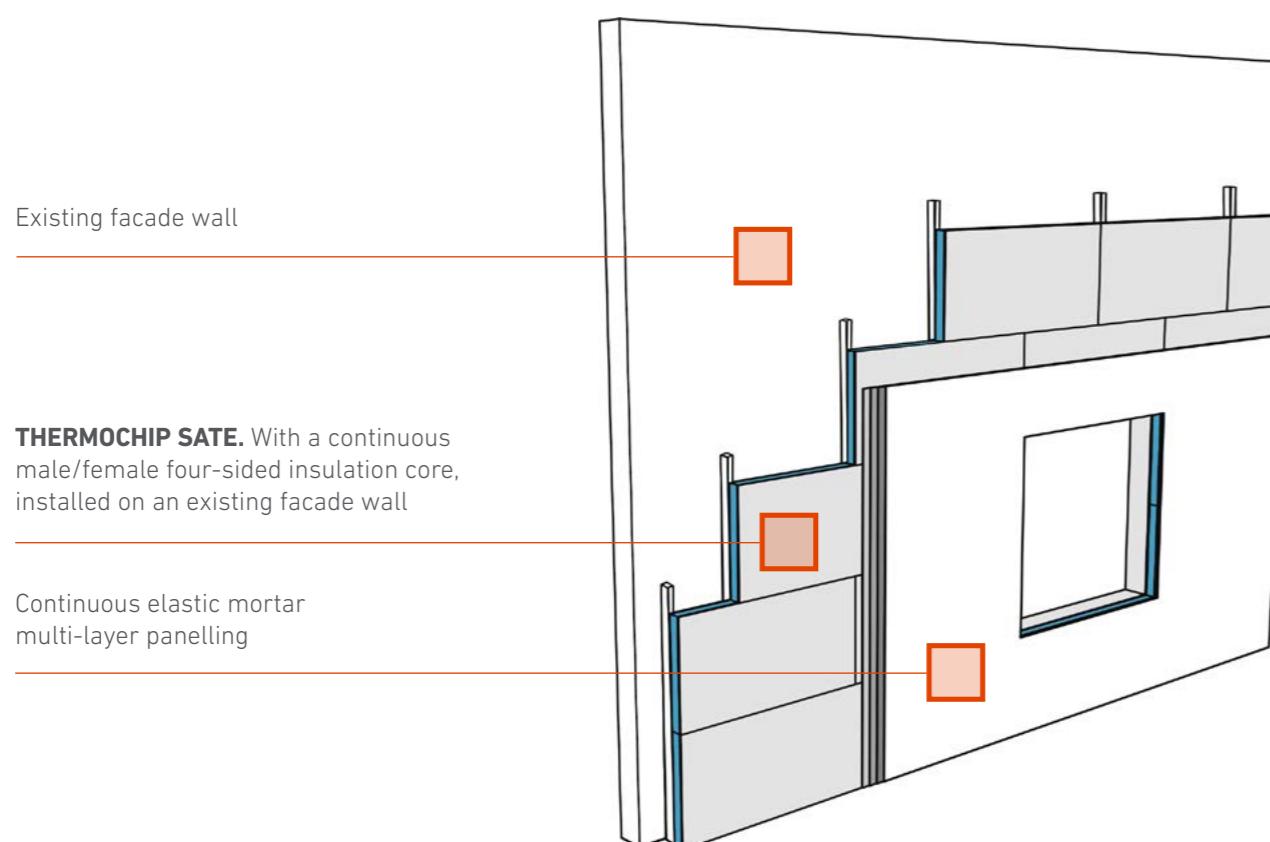
BUILDING ENERGY REHABILITATION



THERMOCHIP SATE



According to **IDAE** (Spanish Institute for Diversification and Energy Savings) data, SATE systems ensure drastic reductions in the energy dissipated to the outside with **a proven decrease in fuel consumption of nearly 30%** and an estimated return on investment for the installation of the system of five years on average.



THERMOCHIP SATE. With a continuous male/female four-sided insulation core, installed on an existing facade wall

Continuous elastic mortar multi-layer panelling

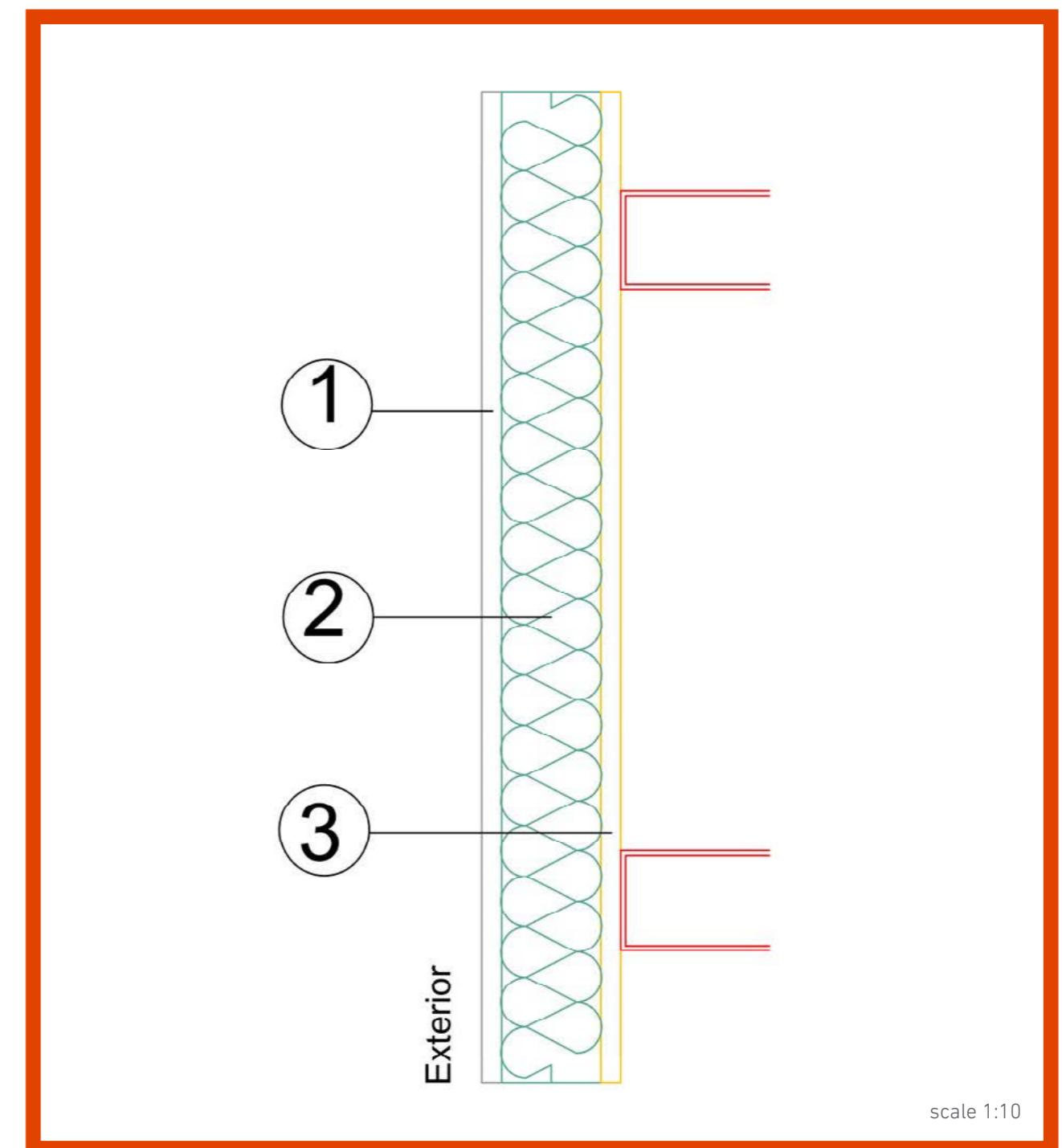
WHAT IS THE ENERGY IMPROVEMENT FOR THE ENCLOSURE?

The following table shows a comparative example of the transmittance value [U] before and after installing **THERMOCHIP SATE**.

BASE FACADE	SATE + BASE FACADE
BASE FACADE: 1/2 foot of perforated brick Cement mortar Air chamber Single brick partition Interior plaster	THERMOCHIP SATE: Elastic mortar finish Fibrous cement slab [12 mm] XPS insulation [60 mm] Fibrous plaster slab [12 mm] + FAÇADE BASE
U = 1,256 W/m² K	U = 0,412 W/m² K

Detail 01.b

THERMOCHIP SATE FACADES



scale 1:10

D.01.b

THERMOCHIP SATE

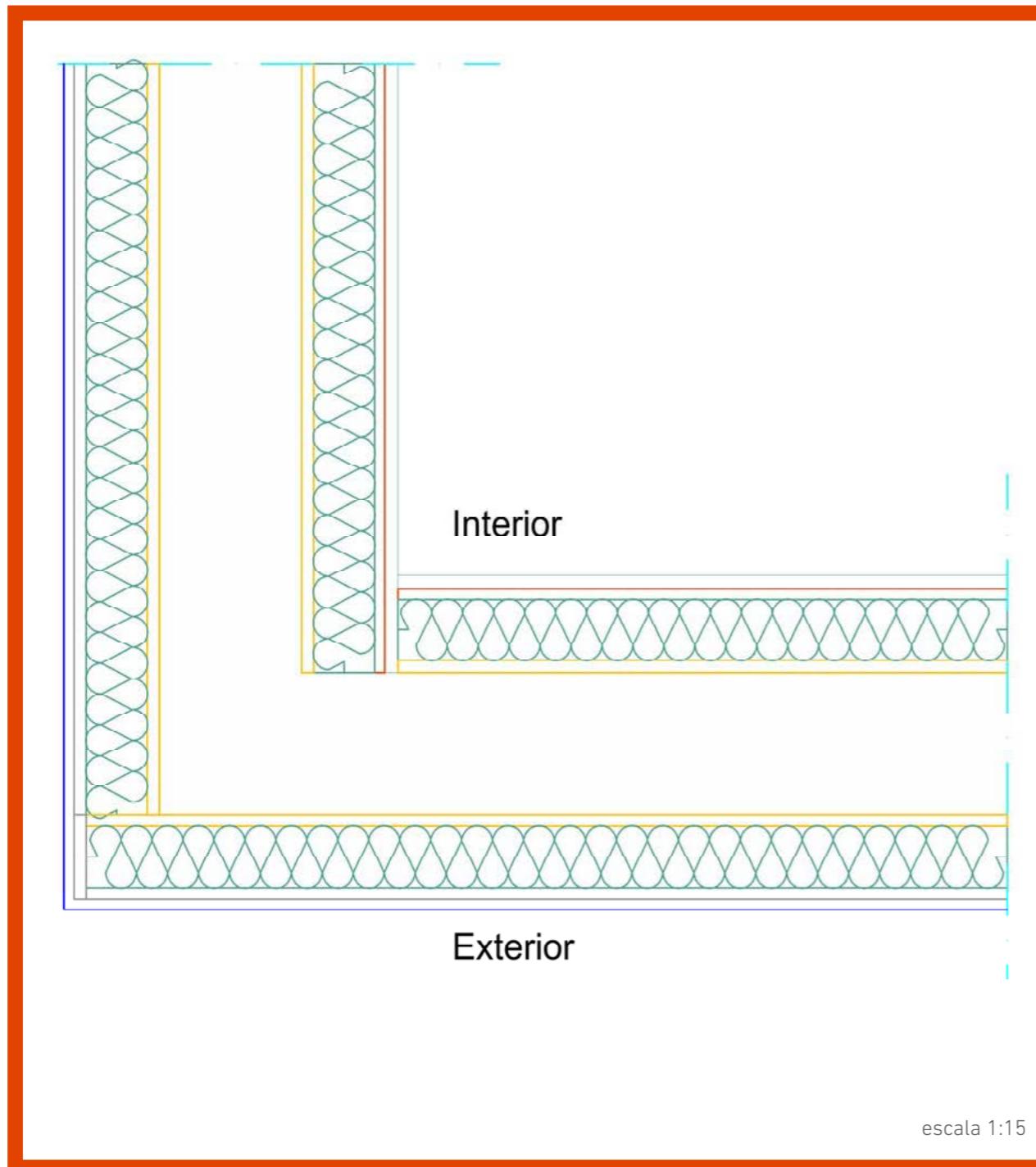
[exterior]

1. 12 mm fibrous-cement slab
2. CONTINUOUS MALE/FEMALE 4-SIDED INSULATION [XPS]
3. 12 mm fibrous plaster slab
[load bearing structure]

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

Detail 02.d

THERMOCHIP SATE AND THERMOCHIP WALL FLOOR MEETING POINT

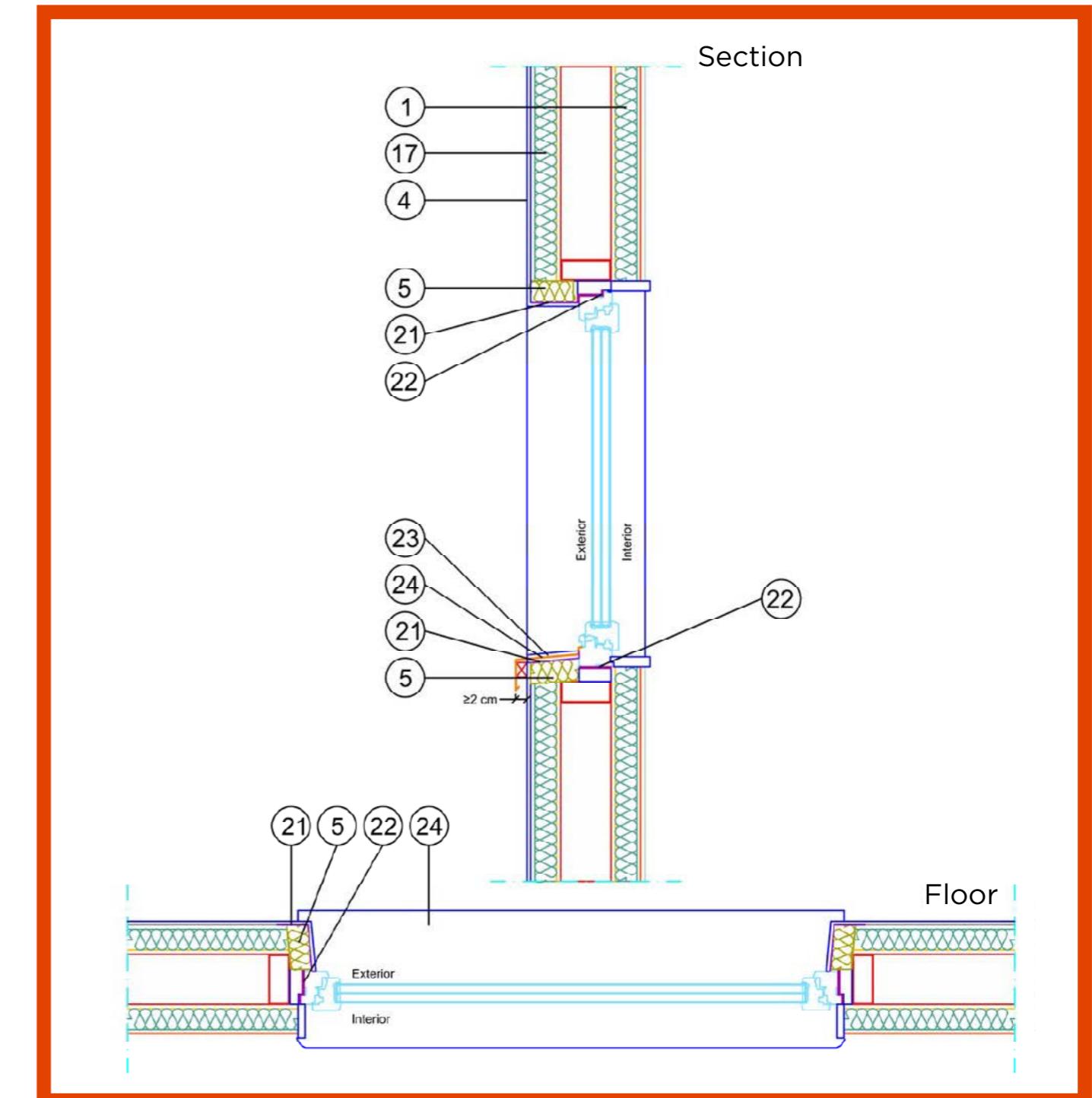


D.02.d

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

Detail 03

FACADE CARPENTRY MEETING POINT



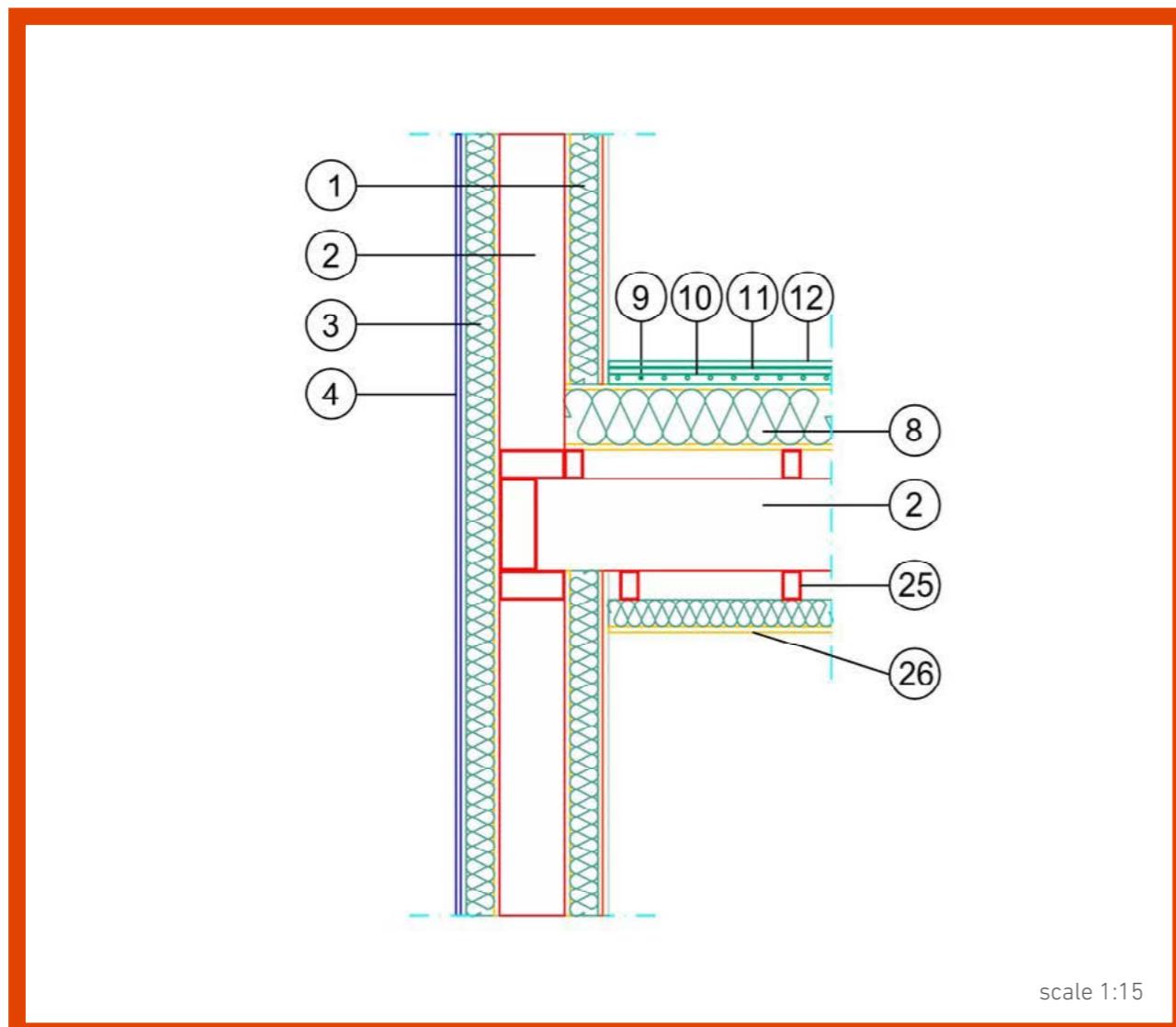
D.03

- 01. THERMOCHIP WALL (sealed joints for tightness)
- 04. Continuous elastic mortar finish on the outer layer of THERMOCHIP SATE
- 05. Extruded polystyrene (XPS) thermal insulation
- 17. THERMOCHIP SATE (waterproof adhesive tape to seal joints between panels)
- 21. Plasterable adhesive tape to seal exterior joints between the carpentry
- 22. Self-expanding sealing tape for exterior carpentry
- 23. Vertical sheet with mortared side finish at the windowsill
- 24. Windowsill horizontal sheet

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

Detail 04

FACADE - INTERMEDIATE FORMWORK MEETING POINT

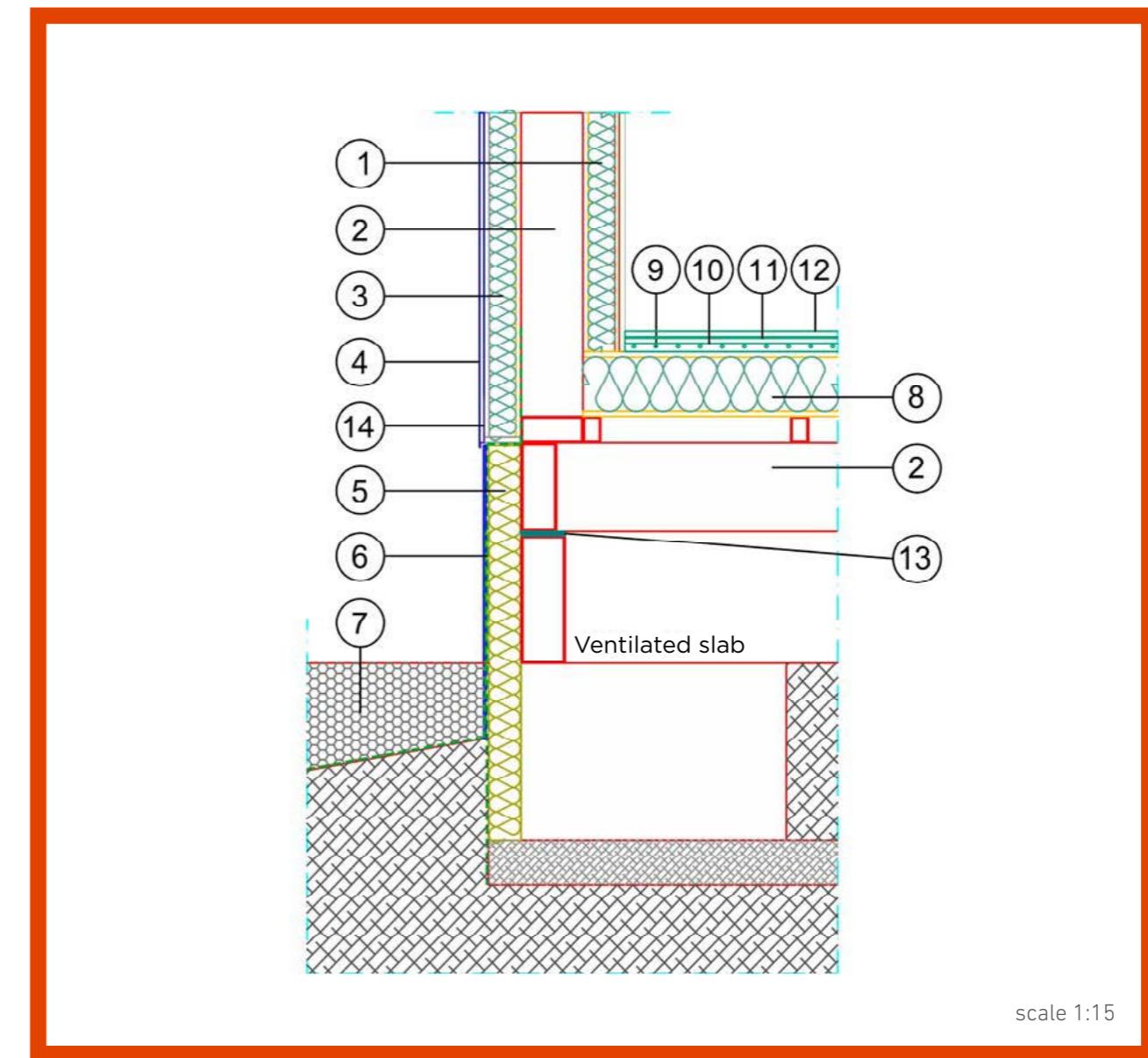


D.04

- 01. THERMOCHIP WALL (sealed joints for tightness)
- 02. Structure (additional inner insulation between the structure)
- 03. THERMOCHIP SATE
- 04. Continuous elastic mortar finish on the outer layer of THERMOCHIP SATE
- 05. Extruded polystyrene (XPS) thermal insulation
- 08. THERMOCHIP FLOOR (sealed joints)
- 09. Technical panel for underfloor heating
- (upper metal sheet)
- 10. Protective sheet metal separation membrane
- 11. Fibrous plaster slab for floor e: 12 mm
- 12. Interior flooring
- 25. Profiles to install dropped ceilings
- 26. THERMOCHIP DECO

Detail 02.a

MORTAR FACADE - GROUND MEETING POINT



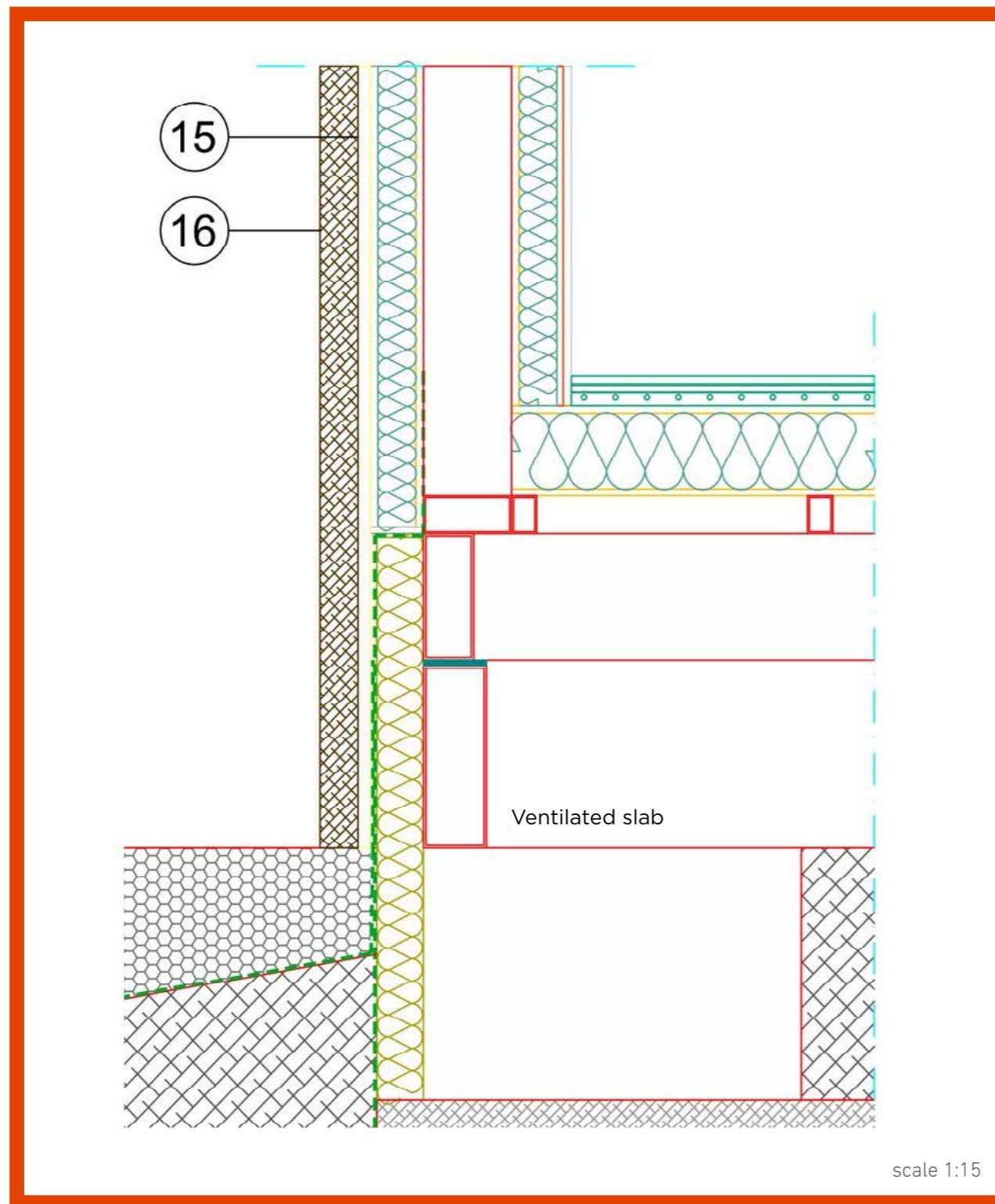
D.02.a

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

- 1. THERMOCHIP WALL (sealed joints for tightness)
- 2. Structure (additional inner insulation between the structure)
- 3. THERMOCHIP SATE
- 4. Continuous elastic mortar finish on the outer layer of THERMOCHIP SATE
- 5. Extruded polystyrene (XPS) thermal insulation
- 6. EPDM or bituminous waterproofing membrane
- 7. Perimeter layer of gravel
- 8. THERMOCHIP FLOOR (sealed joints)
- 9. Technical panel for underfloor heating (upper metal sheet)
- 10. Protective sheet metal separation membrane
- 11. Fibrous plaster slab for floor e: 12 mm
- 12. Interior flooring
- 13. EPDM type separation tape cuts capillary moisture
- 14. Continuous elastic mortar base metal profile (forms a drip)

Detail 02.b

FACADE MORTAR CLADDING - GROUND MEETING POINT

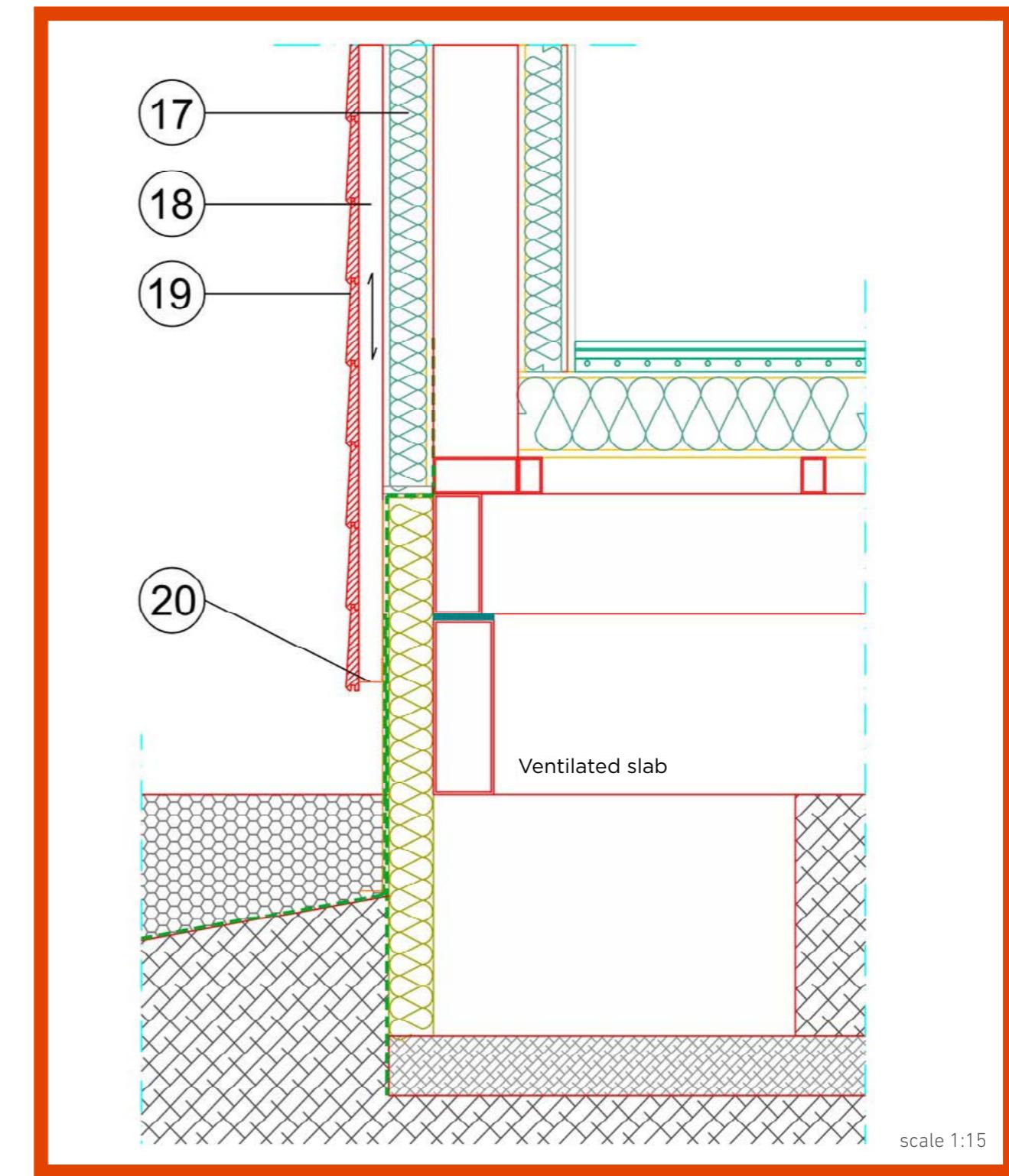


D.02.b

- 15. Cement mortar glue to install cladding
- 16. Cladding: exterior facade panelling

Detail 02.c

VENTILATED FACADE - GROUND MEETING POINT



D.02.c

- 17. THERMOCHIP SATE (waterproof adhesive tape to seal joints between panels)
- 18. Batten to form a ventilated facade fixed to the

- load bearing structure
- 19. Ventilated facade
- 20. Anti-rat screen

THERMOCHIP WALL

THERMOCHIP WALL is a panel for use on envelope interior walls.

It is comprised of a fibrous plaster slab in contact with the load bearing structure, a continuous extruded polystyrene male/female four-sided insulating core and a fireproof plaster slab as well as a second fibrous plaster slab towards the inside of the home.

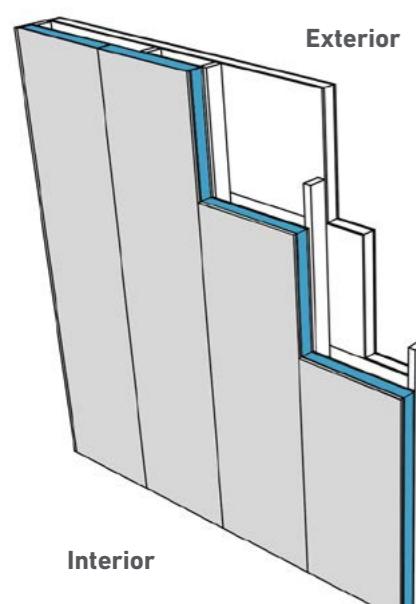


THERMOCHIP WALL

EACH PROJECT
IS UNIQUE

The **thickness of the insulating core** may vary depending on the insulation needs for each project (site, energy requirements, etc.).





AIR TIGHTNESS IN NZEB BUILDINGS

To meet the **air tightness criteria for the envelope**, one of the considerations in NZEB building construction is defining a layer of air tightness for proper and controlled mechanical ventilation with heat recovery.

This consists of a hermetic layer that wraps around the heated space in the building. This hermetic layer must be continuous and can be achieved with a layer of continuous plaster on the inner side of the panels: **THERMOCHIP WALL**.

Another solution is to create a hermetic layer with laminated plaster slabs.

[A value of q_{50} for laminated plaster slabs $0.002\text{--}0.03 \text{ m}^3/\text{m}^2/\text{h}$, which is less than the $0.06 \text{ m}^3/\text{m}^2/\text{h}$ recommended by PHI (Passive House Institute)].

Treating all joints between panels with airtight and long-lasting sealing is recommended.

DESIGN TIPS

Depending on the envelope configuration, a vapour stop or barrier may be necessary in some climate zones to limit interstitial condensation. With a continuous extruded polystyrene (XPS) insulation core, the resistance to the diffusion of water vapour $\mu = 150$ [data provided in ETA 08/0295].

The thickness of THERMOCHIP panels is higher than the minimum established in the Spanish Technical Building Code and, therefore, the insulation core is considered to be a vapour barrier. The four male/female sides and joint sealing guarantees continuity in condensation evaluation.

NOTE: According to the Spanish Technical Building Code DB HS, a vapour barrier is an element that shows resistance to vapour diffusion of more than $10 \text{ MN}\cdot\text{s}/\text{g}$ which is equivalent to $2.7 \text{ m}^2\cdot\text{h}\cdot\text{Pa}/\text{mg}$.

REGULATORY JUSTIFICATION

[SI - Fire safety]
For panels with an interior laminated plaster slab layer, the reaction to fire class corresponds to B-s1, d0 which fulfills the conditions indicated in table 4.1. [Spanish Technical Building Code DB SI 1, Interior propagation], which makes it of particular interest for communal and public buildings.

NOTE: According to ETA 08/0295 for the product, panels with fireproof plaster and fibrous plaster slabs are response to fire classified as B-s1, d0 based on specialised laboratory testing.

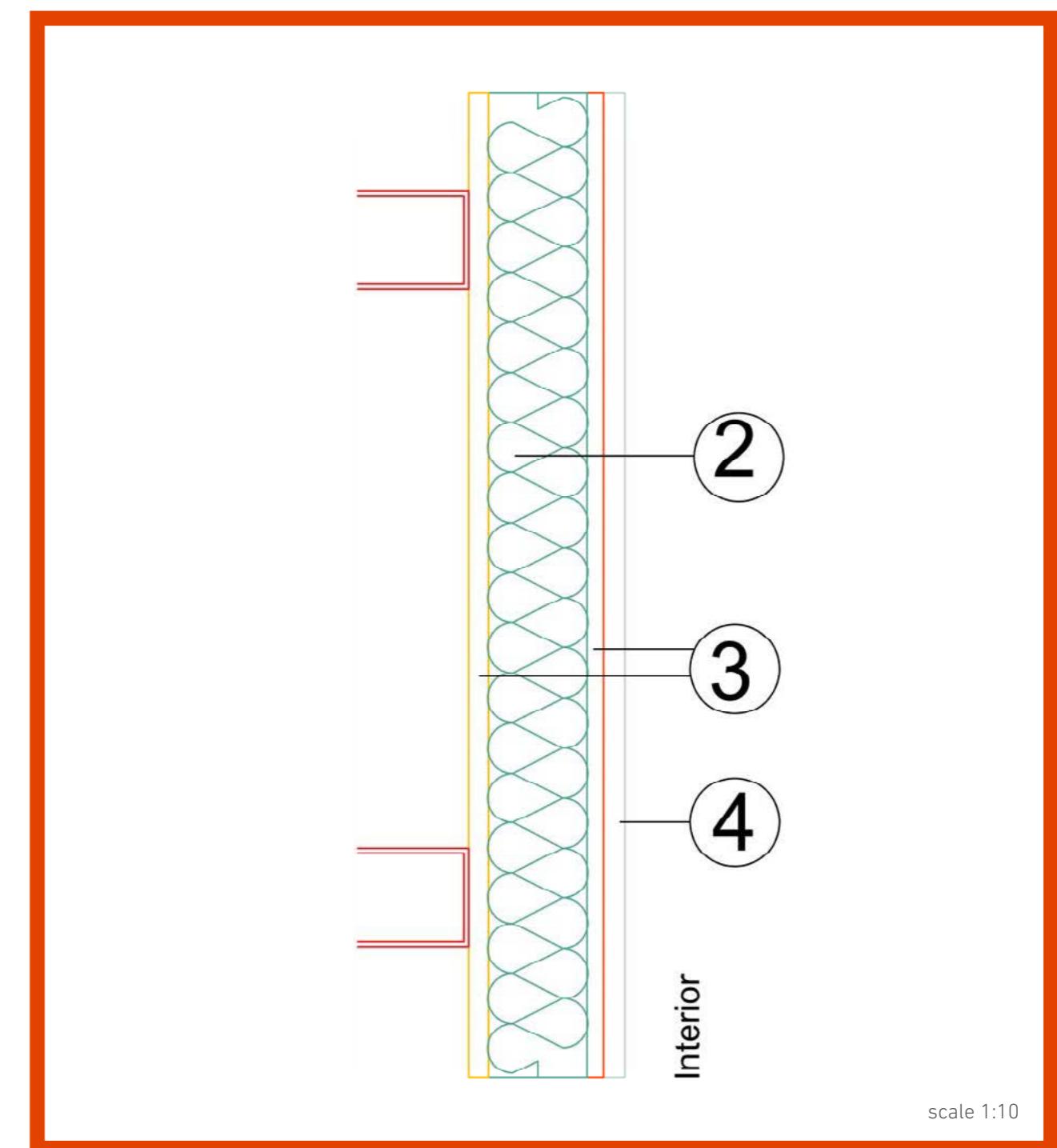
[HE - Energy efficiency]
The interior partitions must comply with a transmittance U_{max} value of: $0.70 \text{ W/m}^2\text{K}$ for E climate zones (the most restrictive).

The transmittance value is $U = 0.530 \text{ W/m}^2\text{K}$ for a facade panel with the following composition. The panel alone, without counting the contribution of the other materials, complies with the energy requirements for roofing in E climate zones (the most restrictive).

Panel composition:
12 mm fibrous cement slab (exterior) + 60 mm XPS insulation + 12 mm fibrous plaster slab - 15 mm fireproof PPF plaster slab (interior).

Detail 01.c

THERMOCHIP WALL: INTERIOR WALL



scale 1:10

D.01.c

THERMOCHIP WALL

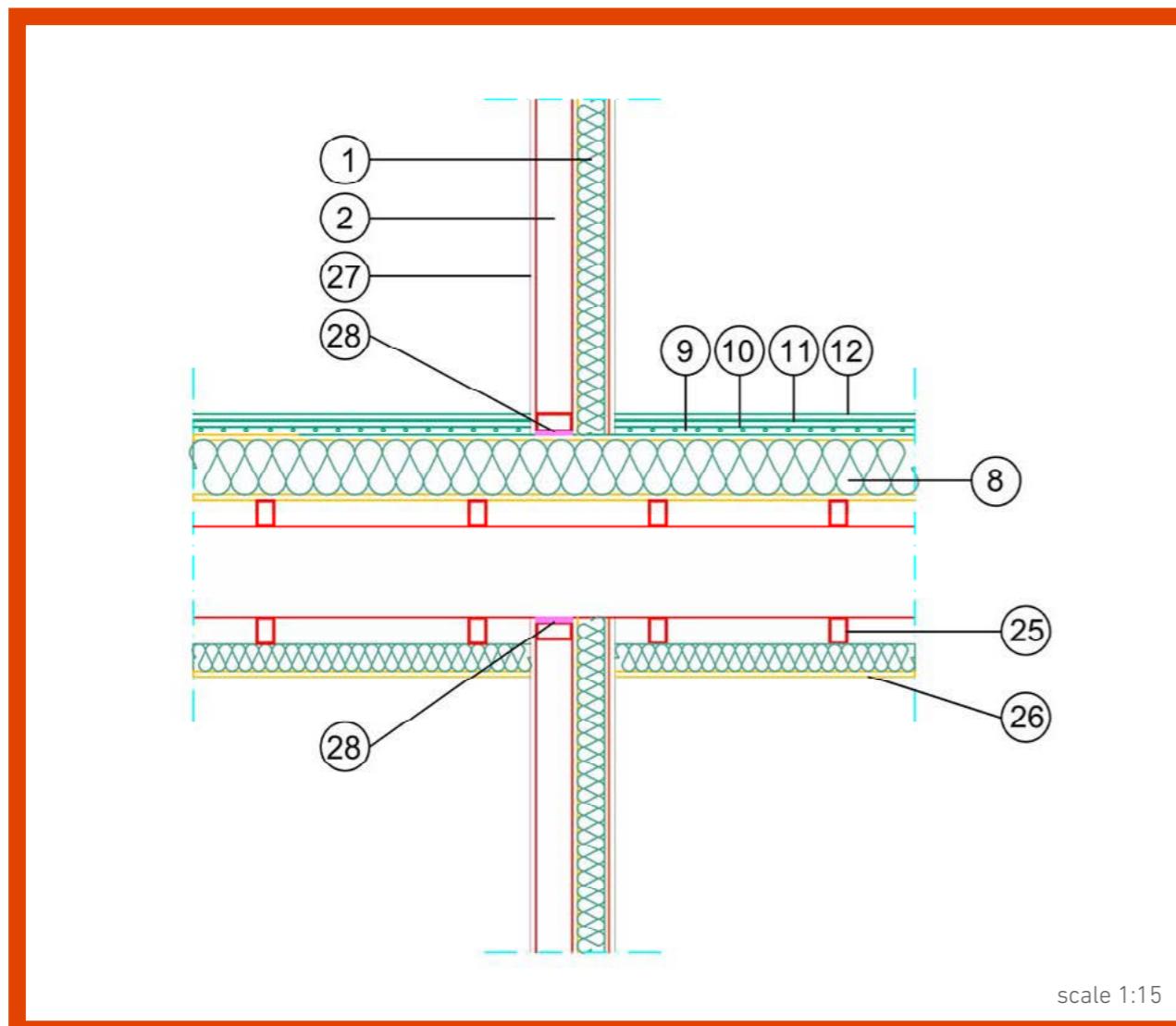
[interior]

4. 15 mm fireproof laminated plaster slab
3. 12 mm fibrous plaster slab
2. CONTIN. ALE/FEMALE 4-SIDED [XPS] INSULATION
3. 12 mm fibrous plaster slab
[load bearing structure]

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

Detail 05.a

MEETING POINT BETWEEN INTERIOR PARTITION
INTERMEDIATE LAMINATED PLASTER FORMWORK

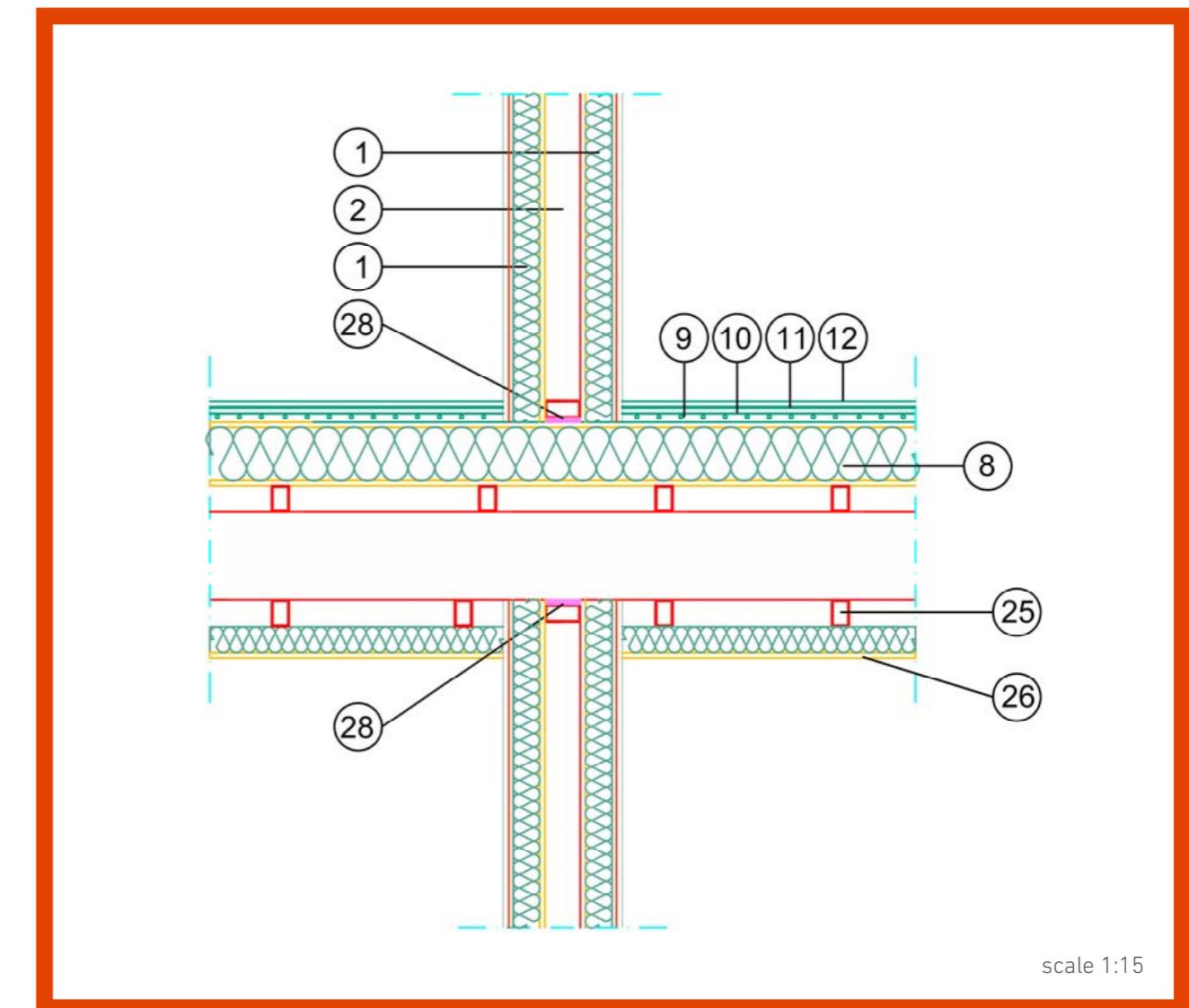


D.05.a

- 02. Structure (additional inner insulation between the structure)
- 08. THERMOCHIP FLOOR (sealed joints)
- 09. Technical panel for underfloor heating (upper metal sheet)
- 10. Protective sheet metal separation membrane
- 11. Fibrous plaster slab for floor e: 12 mm
- 12. Interior flooring
- 25. Profiles to install dropped ceilings
- 26. THERMOCHIP DECO
- 28. Acoustic insulation tape (reduced aerial and structural noise transmission)
- 27. Laminated plaster slab

Detail 05.b

MEETING POINT PARTITION WALL/WALL INTERMEDIATE FORMWORK

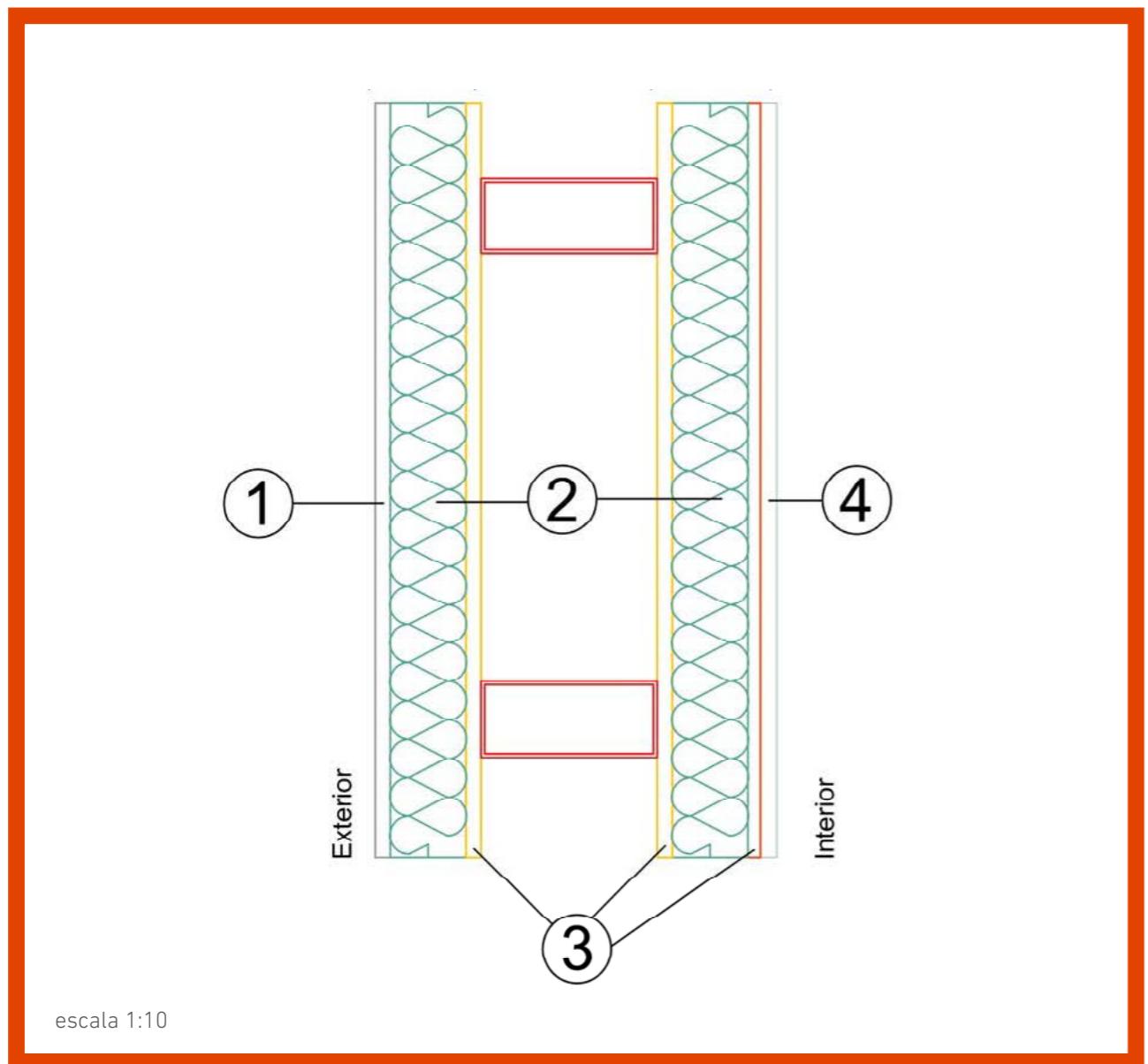


D.05.b

- 01. THERMOCHIP WALL (sealed joints for tightness)
- 02. Structure (additional inner insulation between the structure)
- 08. THERMOCHIP FLOOR (sealed joints)
- 09. Technical panel for underfloor heating (upper metal sheet)
- 10. Protective sheet metal separation membrane
- 11. Fibrous plaster slab for floor e: 12 mm
- 12. Interior flooring
- 25. Profiles to install dropped ceilings
- 26. THERMOCHIP DECO
- 28. Acoustic insulation tape (reduced aerial and structural noise transmission)

Detail 01.a

THERMOCHIP SATE - THERMOCHIP WALL



D.01.a

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. THERMOCHIP waives all liability deriving from the foregoing specifications.

THERMOCHIP SATE

[exterior]

1. 12 mm fibrous cement slab
2. CONTIN. ALE/FEMALE 4-SIDED [XPS] INSULATION
3. 12 mm fibrous plaster slab
[load bearing structure]

THERMOCHIP WALL

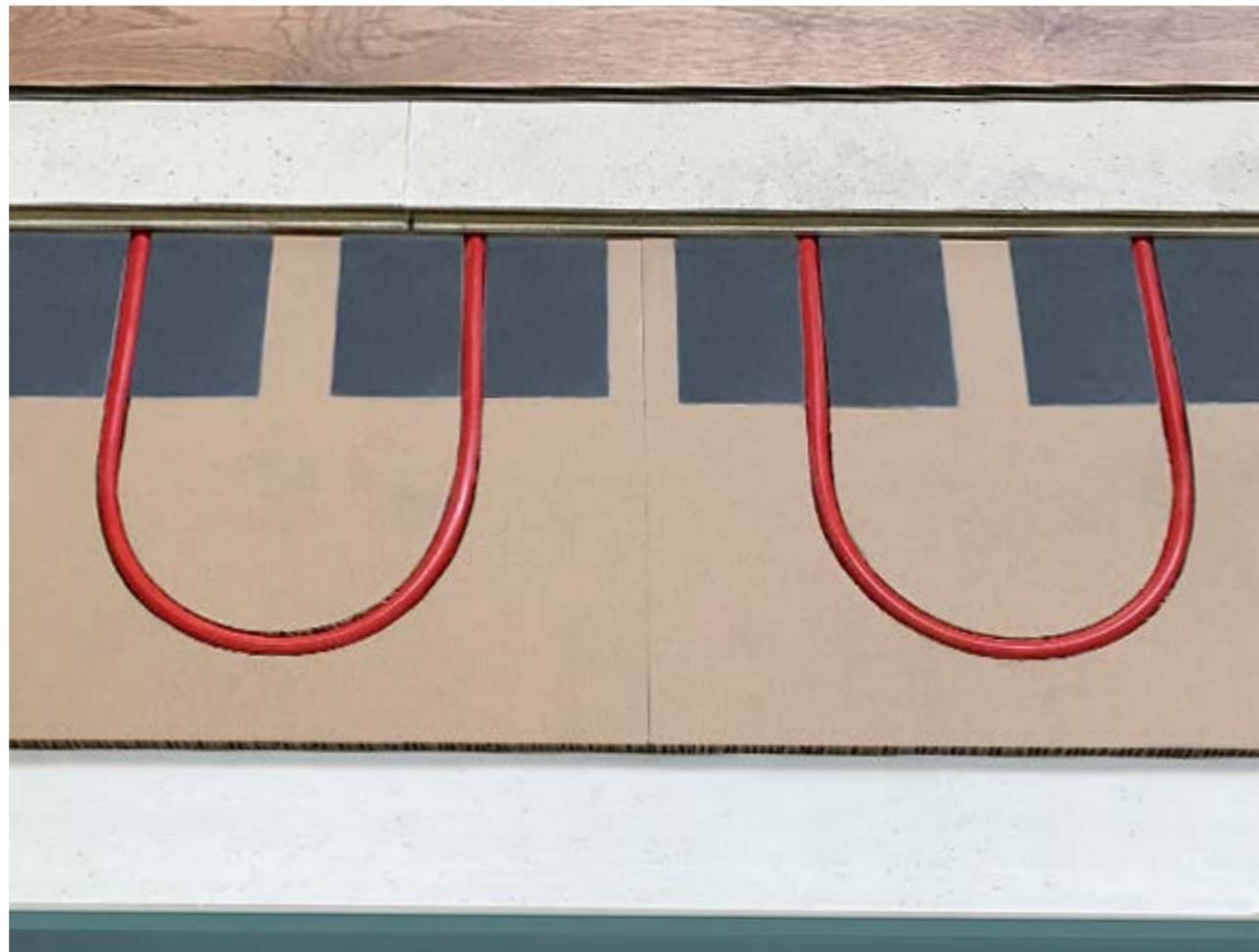
[interior]

4. 15 mm fireproof laminated plaster slab
2. CONTIN. ALE/FEMALE 4-SIDED [XPS] INSULATION
3. 12 mm fibrous plaster slab
[load bearing structure]



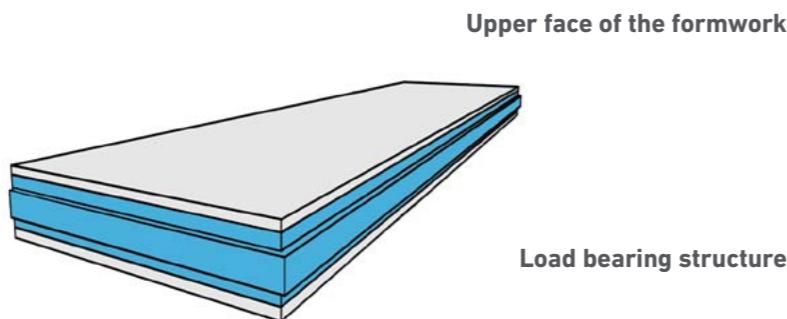
**THERMOCHIP
FLOOR**

THERMOCHIP FLOOR



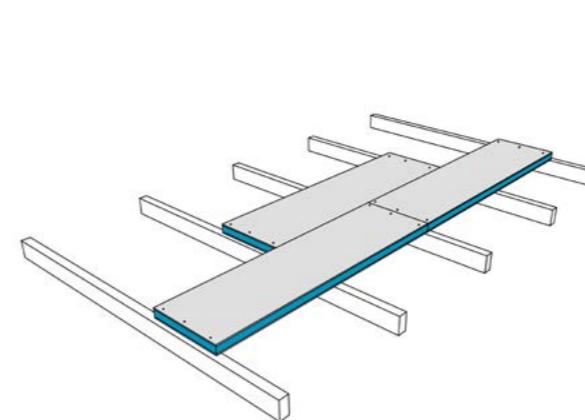
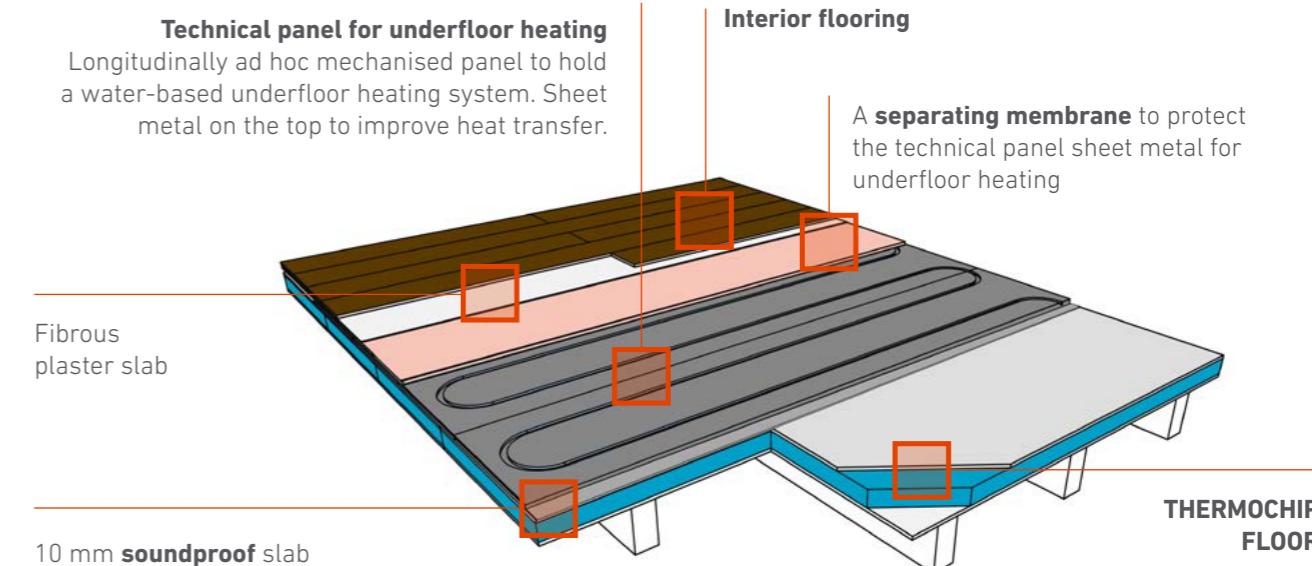
THERMOCHIP FLOOR

12 mm fibrous plaster slab
CONTINUOUS MALE/FEMALE
4-SIDED INSULATION
12 mm fibrous plaster slab



THERMOCHIP FLOOR is the **THERMOCHIP HOUSING** solution for formwork (interiors between floors and sanitary formwork). The sandwich panels are installed over the formwork load bearing structure and a strip of rubber to reduce the transfer of impact noise.

A high-density slab is placed over it for soundproofing as well as an industrialised underfloor heating technical panel which may be adjusted pursuant to the project energy demands. This panel, which is manufactured ad hoc and longitudinally mechanised, holds heating pipes covered by a fibrous plaster slab to support the final room panelling (wood, ceramic, etc.).



DESIGN TIPS INSTALLING PANELS ON THE STRUCTURE:

Installing the panels perpendicular to the supports, resting on the load bearing structure on the shorter sides is recommended. Each panel must be installed over a minimum of five supports, considering a maximum separation of 600 mm between each one.

Staggering the panels is recommended: altering transversal joints between panels so the larger sides are perpendicular to the supports.

SECURING THEM TO THE LOAD BEARING STRUCTURE: The panels shall be secured using nuts and bolts with a minimum of three screws per support. The recommendation is that all fixings and the separation from the load bearing structure shall be as indicated based on a specific structural verification for each case [as per the indications established in Spanish Technical Building Code DB SE].

REGULATORY JUSTIFICATION

[HE - Energy efficiency]

The complete flooring solution in contact with the air (sanitation formwork) must comply with a transmittance value of U_{max} : $0.35 \text{ W/m}^2\text{K}$ for E climate zones (the most restrictive as per the Spanish Building Code). Doing a detailed thermal calculation to find the actual transmittance (U) of the enclosure is recommended. The transmittance value is $U = 0.299 \text{ W/m}^2\text{K}$ for a formwork panel with the following composition.

The panel alone, without counting the contribution of the other materials, complies with the energy requirements for roofing in E climate zones (the most restrictive).

Panel composition:
12 mm fibrous plaster slab (exterior) + 120 mm XPS insulation + 12 mm fibrous plaster slab

[HR - Noise protection]
According to data provided

by the laboratory, the overall weighted sound reduction index A for the THERMOCHIP FLOOR panel is $RA= 53 \text{ dBA}$.

[HS - Health standards]

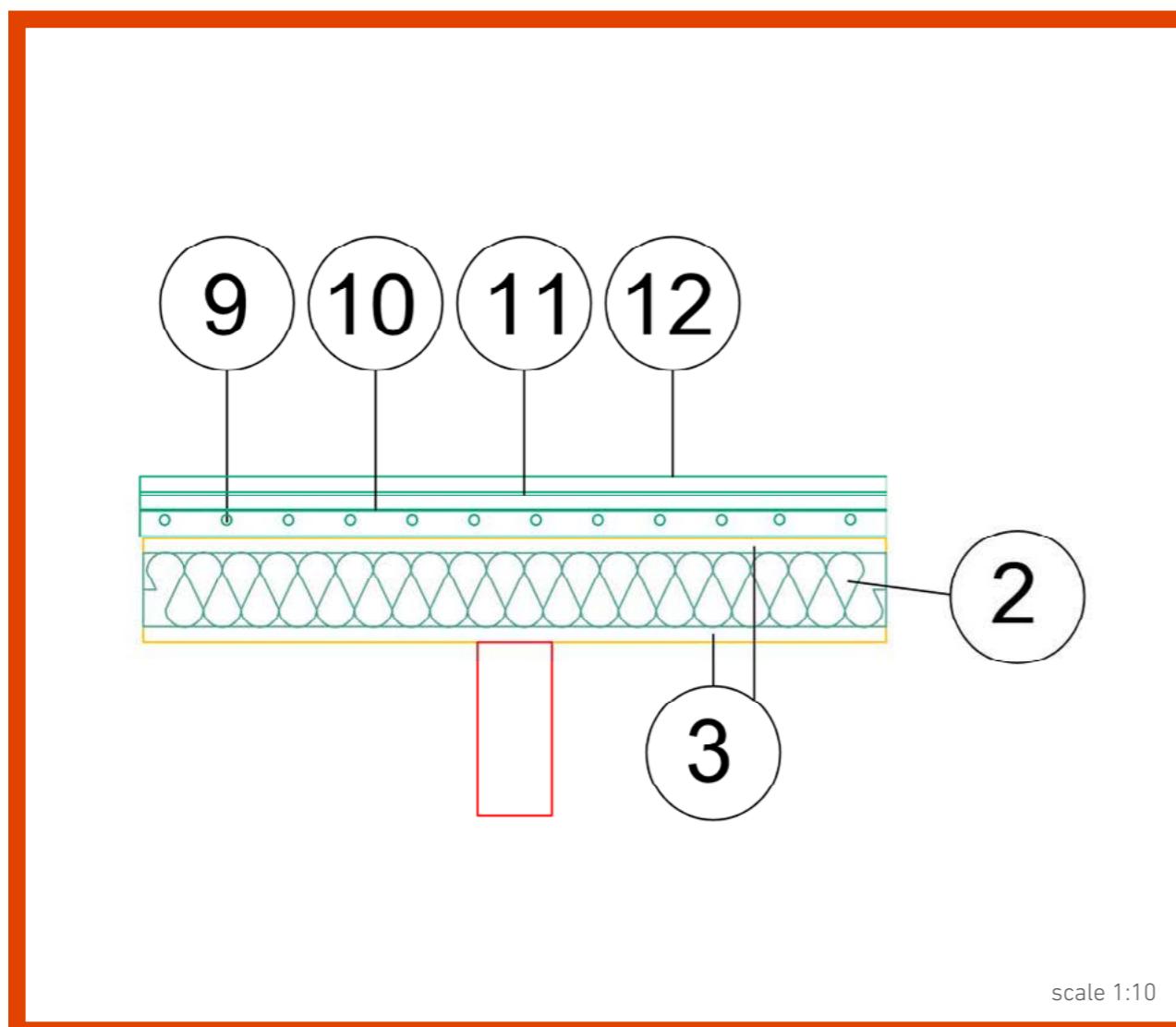
If used as sanitation formwork, as per Spanish Technical Building Code DB HS 2.2. Floors, ventilation of the space between the ground and the raised floor is necessary according to the recommendations established in the Spanish Technical Building Code for this point [Spanish

Technical Building Code DB HS 2.2.2., V]. The meeting point between the raised floor and the wall must also be sealed with a breathable waterproof sheet that is adequately overlapped to protect the connection.

NOTE: Due to the extensive casuistry, a structural verification for each particular case is recommended for Spanish Technical Building Code DB-SE and SI justification.

Detail 01.d

THERMOCHIP FLOOR + UNDERFLOOR HEATING AND FLOORING



D.01.d

THERMOCHIP FLOOR

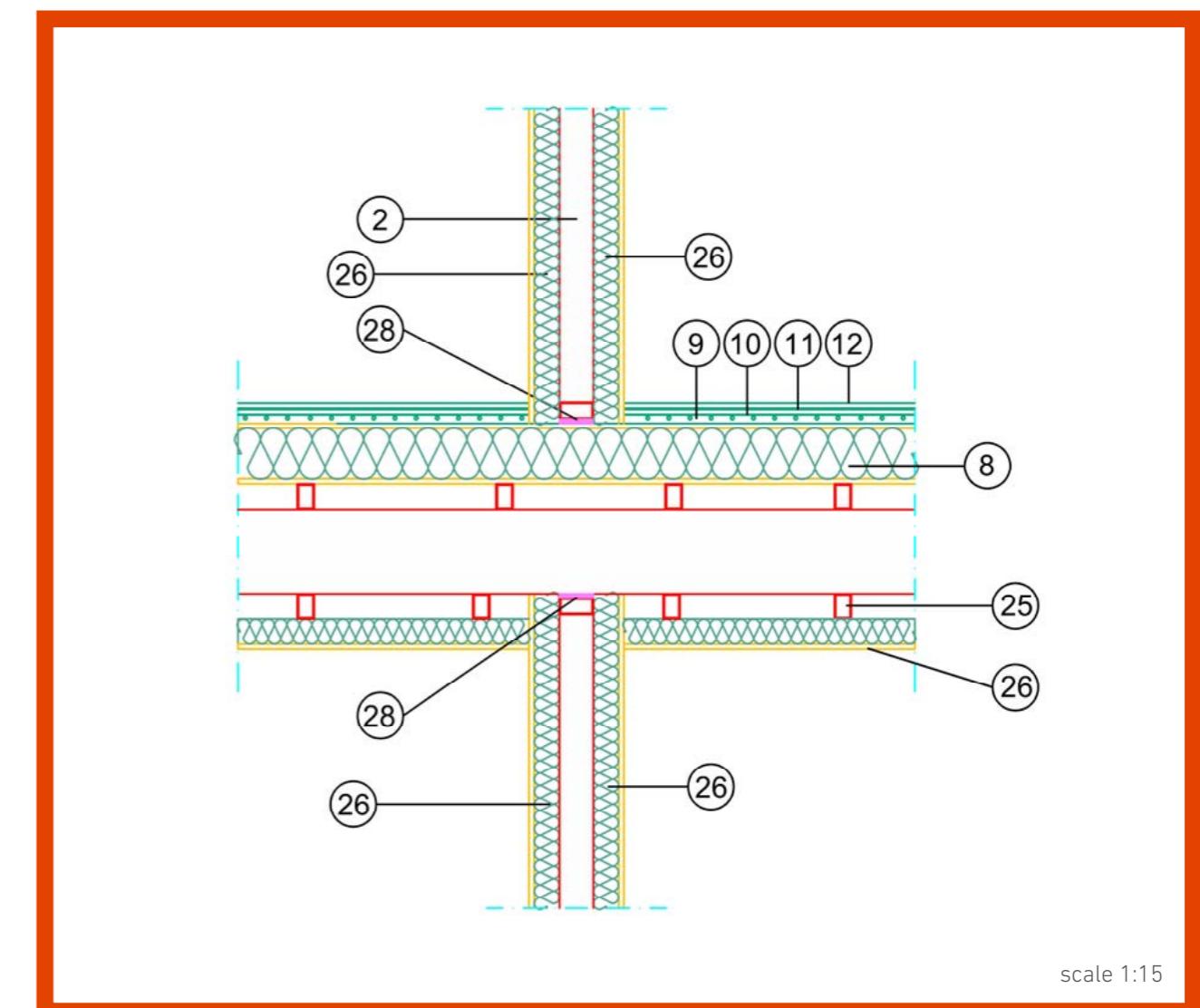
- 1. 12 mm fibrous plaster slab
- 2. CONTINUOUS MALE/FEMALE 4-SIDED INSULATION [XPS]
- 3. 12 mm fibrous plaster slab

TOP LAYER heating and floor tiling

- 9. Technical panel for underfloor heating (upper metal sheet)
- 10. Protective separation membrane
- 11. 20 mm fibrous plaster slab
- 12. Interior flooring

Detail 05.c

MEETING POINT BETWEEN INTERIOR PARTITION - INTERMEDIATE FORMWORK



D.05.c

02. Structure (additional inner insulation between the structure)

08. THERMOCHIP FLOOR (sealed joints)

09. Technical panel for underfloor heating (upper metal sheet)

10. Protective sheet metal separation membrane

11. Fibrous plaster slab for floor e: 12 mm

12. Interior flooring

25. Profiles to install dropped ceilings

26. THERMOCHIP DECO

28. Acoustic insulation tape (reduced aerial and structural noise transmission)

SUMMARY OF CONSIDERATIONS

As described in this document, the **THERMOCHIP HOUSING** system is comprised of different panels used for individual uses. All of them together in a single building provide unbeatable results as concerns all regulatory requirements, design requirements and usage needs.

Unbeatable **thermal insulation** with ranges below 0.10 kwm²/°K for certain and long-lasting building **energy efficiency** which eliminates thermal bridges and fosters heating and cooling savings.

Double-layer **continuous insulation** throughout the envelope, absolute **air and water tightness** and the highest **waterproofing** level for guaranteed considerable energy savings.

Without considering the final facade and interior panelling, the **THERMOCHIP HOUSING** system offers more than 532 dBA R(A) in **sound insulation**.

Reaction to **fire classification behaviour** of B-s1, d0 on both exterior sides as well as on interior sides in contact with the load bearing structure where there is a classification requirement of B-s3, d0, as per SI table 4.1.

The recommendations provided in this document must be adapted for the specific conditions of each project and approved by the Site Management. **THERMOCHIP** waives all liability deriving from the foregoing specifications.

As concerns the **fire resistance** of the **THERMOCHIP HOUSING** system for facades, it offers EI120 which not only meets the requirements for facades but also for dividing walls in residences and tertiary buildings.

The **THERMOCHIP HOUSING** system allows for the development and design of any type of architecture and design in buildings where it is used, offering **certainty in behaviour** and **adaptability** for each project.

Since it is more flexible and adaptable, **THERMOCHIP HOUSING** achieves significant **installation cost savings** because the manufacturing and installation system greatly reduces the time, labour and transport required in addition to improving completion reliability and the quantities needed for the project.

The **Industry 4.0** technology and concept come hand in hand with the **THERMOCHIP HOUSING** system with possibilities for project development through **BIM** models and a next-generation industrial manufacturing process.

ADVANTAGES OVER THE REGULATORY MINIMUM

APPLICATION	REGULATORY DEMANDS	THERMOCHIP HOUSING
HE - ENERGY SAVINGS		
THERMAL INSULATION (W/m ² K)		
Facade	0,55	0,285
Floor	0,35	0,299
Roof	0,35	0,290
AIR PERMEABILITY (m ³ /m ² /h)		
All	0,06	0,002
HR - NOISE PROTECTION (dBA)		
All	25 - 53	52,1
HS - HEALTH STANDARDS		
WATERPROOFING (CTE grades)		
All	1 - 5	5
CONDENSATION (MN·s/g)		
All	> 10	15
SI - FIRE SAFETY		
FIRE RESISTANT		
All	EI 30 - EI 120	EI 120
REACTION TO FIRE		
All	C-s2, d0 - B-s1, d0	B-s1, d0
CHAMBER FOR UTILITY SYSTEMS		
All	B-s3, d0	B-s1, d0

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