POLIESPANSO CONSTRUCTION SYSTEM

TECHNICAL NOTEBOOK

WALL PLASTBAU® 3

INSTALLATION STEPS

Introduction - Description - Specification Item

- **STEP 1**
  Laying of Wall Plastbau® 3 elements
- **STEP 2**
  Laying of reinforcement steel bars and execution details
- **STEP 3**
  Formwork (ICF – Insulated Concrete Form)
- **STEP 4**
  Concrete casting
- **STEP 5**
  Installations and finishing

POLIESPANSO®

INTRODUCTION

This Technical Notebook contains information for the user as suggestions to facilitate the laying and design of the **Wall PLASTBAU® 3** solution. This document does not describe all laying methods, but only some of them, in that the "best" method in the construction site is subjective, and may be changed according to the physical characteristics and dimension of the elements and the safety rules to be complied with.

DESCRIPTION

Wall PLASTBAU® 3 is an Insulated Concrete Form (ICF) with a basic reinforcement steel core grid. This system of formwork for reinforced concrete is made with high density and rigid expanded polystyrene (EPS) panels that stay in place, after concrete casting as a permanent interior and exterior wall insulation system.

Each **Wall PLASTBAU® 3** element is 120cm wide and has variable heights between 40cm and 450cm; this thermo-insulated formwork system has a pre-mounted basic reinforcement steel core grid connecting and supporting 2 EPS panel; one panel is internal and has a variable thickness of 5; 7.5 or 10cm, the other is external and has a variable thickness of 5; 7.5; 10; 15,20 or 25cm. Upon request the external panel may be higher to obtain the insulating board of floor bond-beams.

Pre-mounted reinforcement steel core grid is made of 2 vertical bars - diameter 8 or 10mm of B450C steel, with improved adherence, every 20cm and related connections.

Vertical core grid bars can be supplemented by placing – where necessary – extra reinforcement steel bars, both vertical and horizontal, as per indications and supervision by the structural engineer for stronger wall and according proper calculation.

SPECIFICATIONS ITEM

Above ground ordinary reinforced concrete wall:

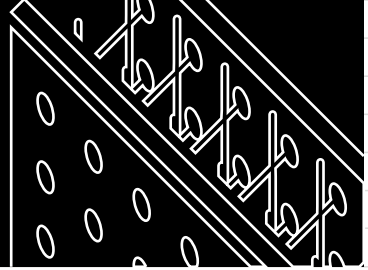
- Suggested cement concrete for XC1 / XC2 exposure class, with a maximum a/c of 0.6 and minimum resistance class C25 /30 (300Kg/cm^2) and S4 consistency class and a maximum diameter of aggregate of 15mm

- Pre-mounted reinforcement steel core grid steel type B450C

- Thermo-insulating boards have a U-value of at least U < 0,30 Wm^{2}K, internal/external insulation is guaranteed by EPS 150 Euroclass E, expanded polystyrene, with features compliant with the standard EN 13163 CE-marked

STEP 1

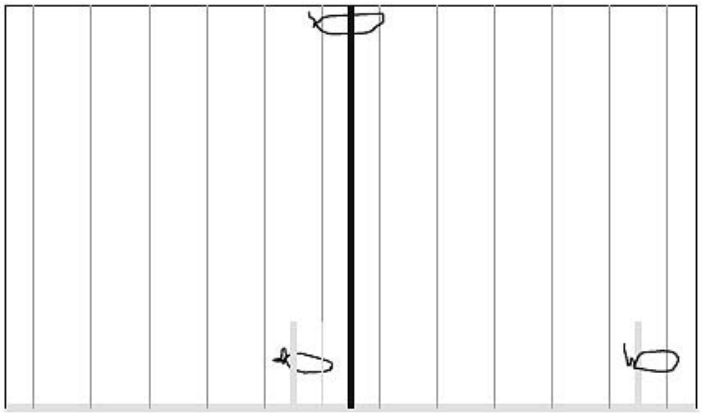
Laying of Wall Plastbau® 3 elements



Wall PLASTBAU® 3 elements are manufactured 120cm wide, with variable height according to the customer's needs, from 250cm to 450cm usually. Upon request the external panel may be higher to obtain the insulating board of floor bond-beams; thus obtaining a rib that prevents thermal bridges, at the same time containing the bond-beam cement.

The height of this rib shall be the same as thickness of the horizontal floor/slab to the unfinished building. In case of formworks destined to build internal walls or spine walls, this detail is not usually necessary.

Elements will be placed one close to the other, tying with a metal wire at the base of the most accessible trellis of the formwork to the jutting rod and tying – in the highest part - the closest trellises of the 2 elements to connect.



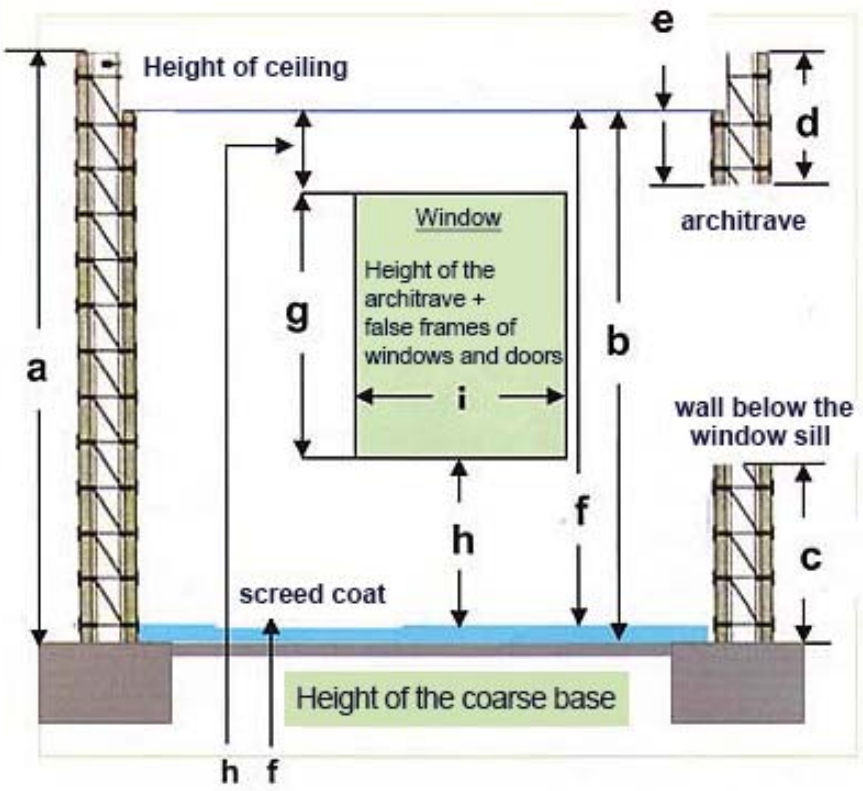
Detail of the rib for floor grid

Cutting of formwork element in-situ -
same cutting can be done manually by normal wood saw

To determine the amount and size of components needed for construction (thickness of cement and EPS slabs, net and gross heights of the rooms, the windows, etc... will be already established), the designer may use the scheme below.

The time needed to unload the panels from the truck (picture), the piling up of panels and their laying is extremely fast.

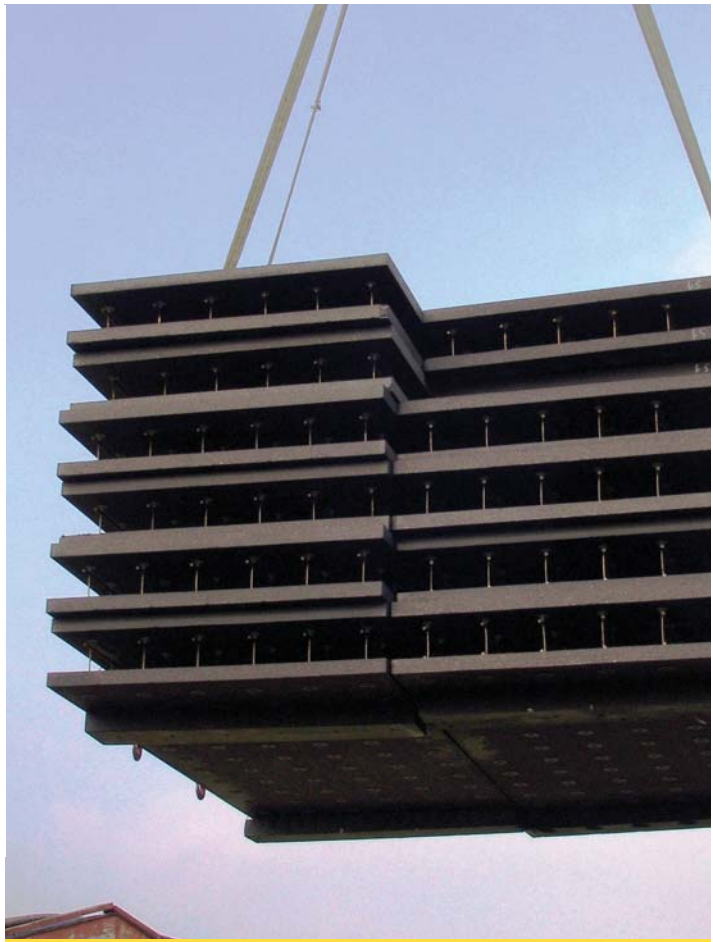
Indeed, the operational time needed to rationalize the construction site management is reduced to the bare minimum, thanks to our experience in many construction sites and in different working situations.



Measures to indicated for formwork orders

a. *Height of external slab*
b. *Height of the internal slab*
c. *Height below the window*
d. *External height of the architrave*
e. *Internal height of the architrave*
f. *Height from the screed coat*
g. *Height of window span*
h. *Height below the window from the screed coat*
i. *Window span*

The external slab of the formwork without rib shall be as high as the internal slab

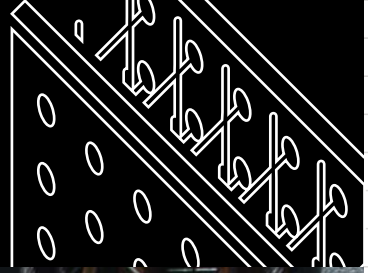


Unloading with crane

Laying the **Wall PLASTBAU® 3** Laying the Wall Plastbau® 3 (ICF) elements is a manual operation, and is facilitated by U-shaped hot-dip galvanized steel profiles, previously fixed to the base, at the internal slab level of the panel. The same steel profile, used on the upper edge of the slab, shall keep the panels perfectly aligned.

STEP 2

Laying of reinforcement steel bars and execution details

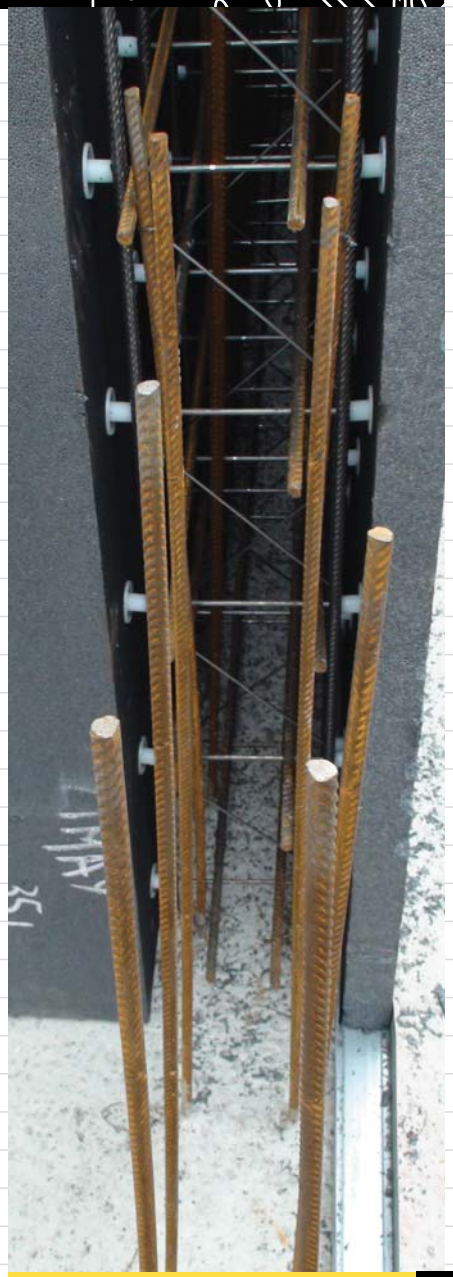


Laying of connecting rods – slab/wall

While creating the foundations of the basement and floors, namely from the laying surface of **Wall PLASTBAU® 3** elements, pairs of connecting rods will have to be placed at intervals and diameters decided upon by the designer (roughly every 20cm), immersed vertically in a suitable depth and protruding around 60 - 70cm along all perimeters and/or positions where the external, internal or spine **Wall PLASTBAU® 3** elements are to be laid.

These connecting steel rods, immersed in the vertical **Wall PLASTBAU® 3** elements, must be made of B450C steel.

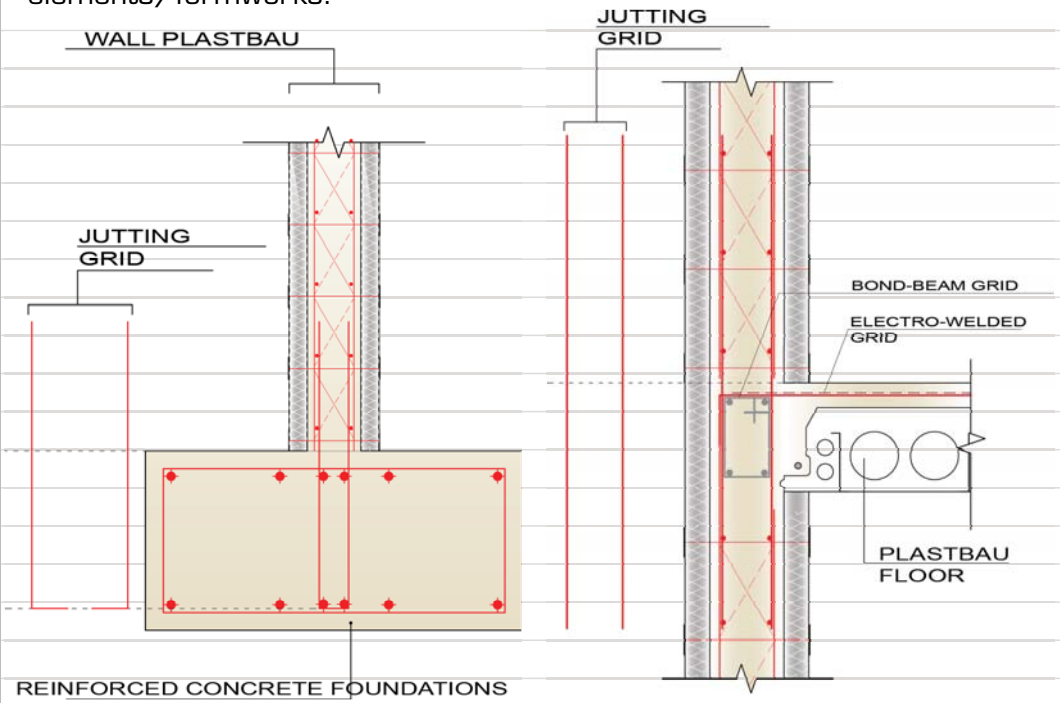
They ensure connecting and anchoring between the horizontal and vertical structures.



Indeed, once the horizontal slab is aged, vertical steel rods shall be firmly anchored and the **Wall PLASTBAU® 3** elements placed, by lowering them from the top. The rods will squeeze through the space between the two EPS formwork panels, and come up beside the vertical Ø 8mm or Ø 10mm of trellises making up the formwork grid.

A valid and strong connection will be put in place, once the concrete into vertical formworks will be aged.

Vertical connection rods, placed in pairs, shall be separated from another according to the width of the empty space between the two EPS slabs. At times, and according to the indications given by the designer, related to the static situation, instead of being placed in pairs the connecting rods may be placed in a single row, at the level of the formwork centerline. In any case it is necessary to predict the position according to the future laying of **Wall PLASTBAU® 3** elements/formworks.

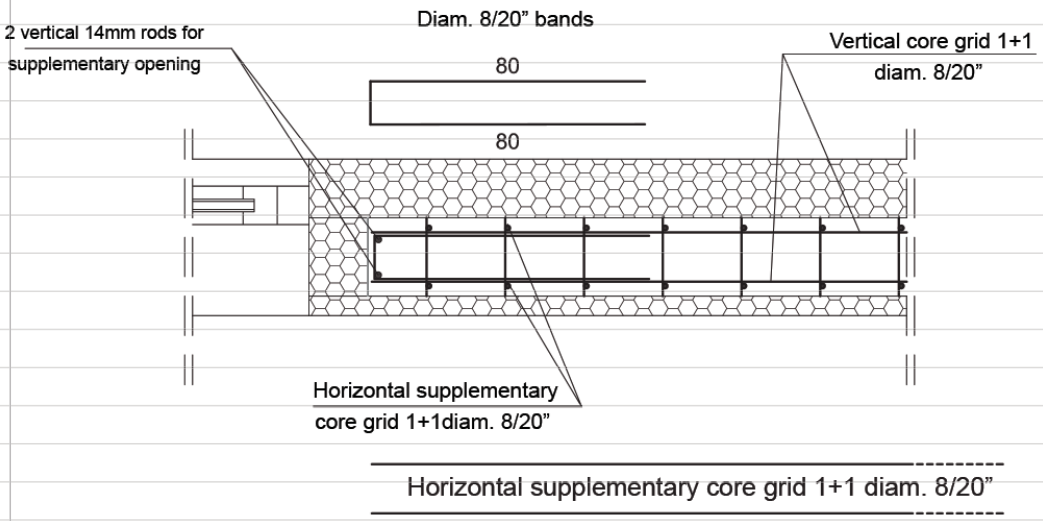


Laying of extra steel rods in addition to those contained in the Wall Plastbau® 3 elements

Upon receipt for cement, the Wall Plastbau® 3 form (ICF) shall be arranged by placing any extra horizontal rods and any extra vertical rods, following the indications of structure designers. Horizontal rods are to be placed just close to the vertical ones. The configuration of **Wall PLASTBAU® 3** basic steel core grid is such that the horizontal extra rods are automatically placed at the lower intersection of diagonal rods. .

The horizontal extra rods are inserted manually starting from corners, from door and window openings. It may be difficult to insert long steel rods, because they may get stuck.

DETAIL OF OPENINGS



Horizontal supplementary core grid 1+1 diam. 8/20"

Supplementary reinforcing rods for openings

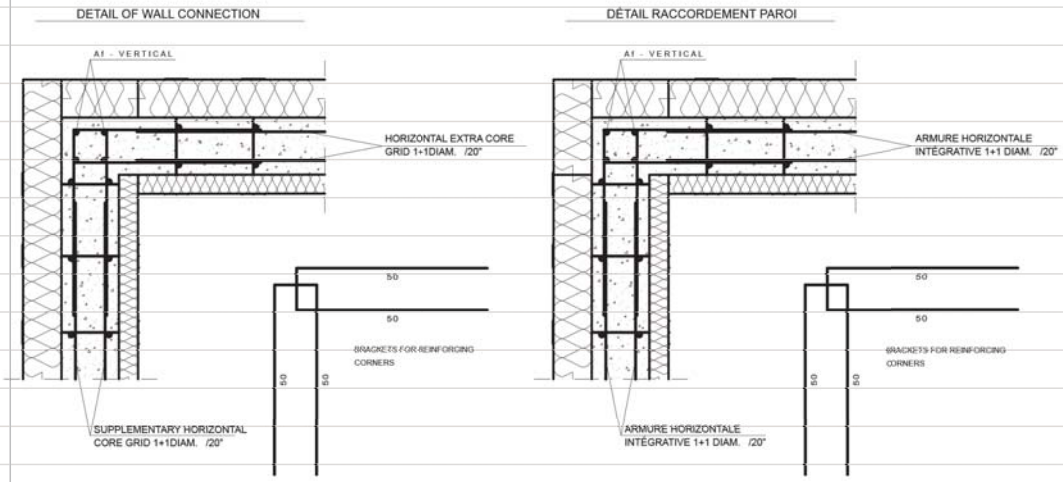
Insertion of horizontal extra rods

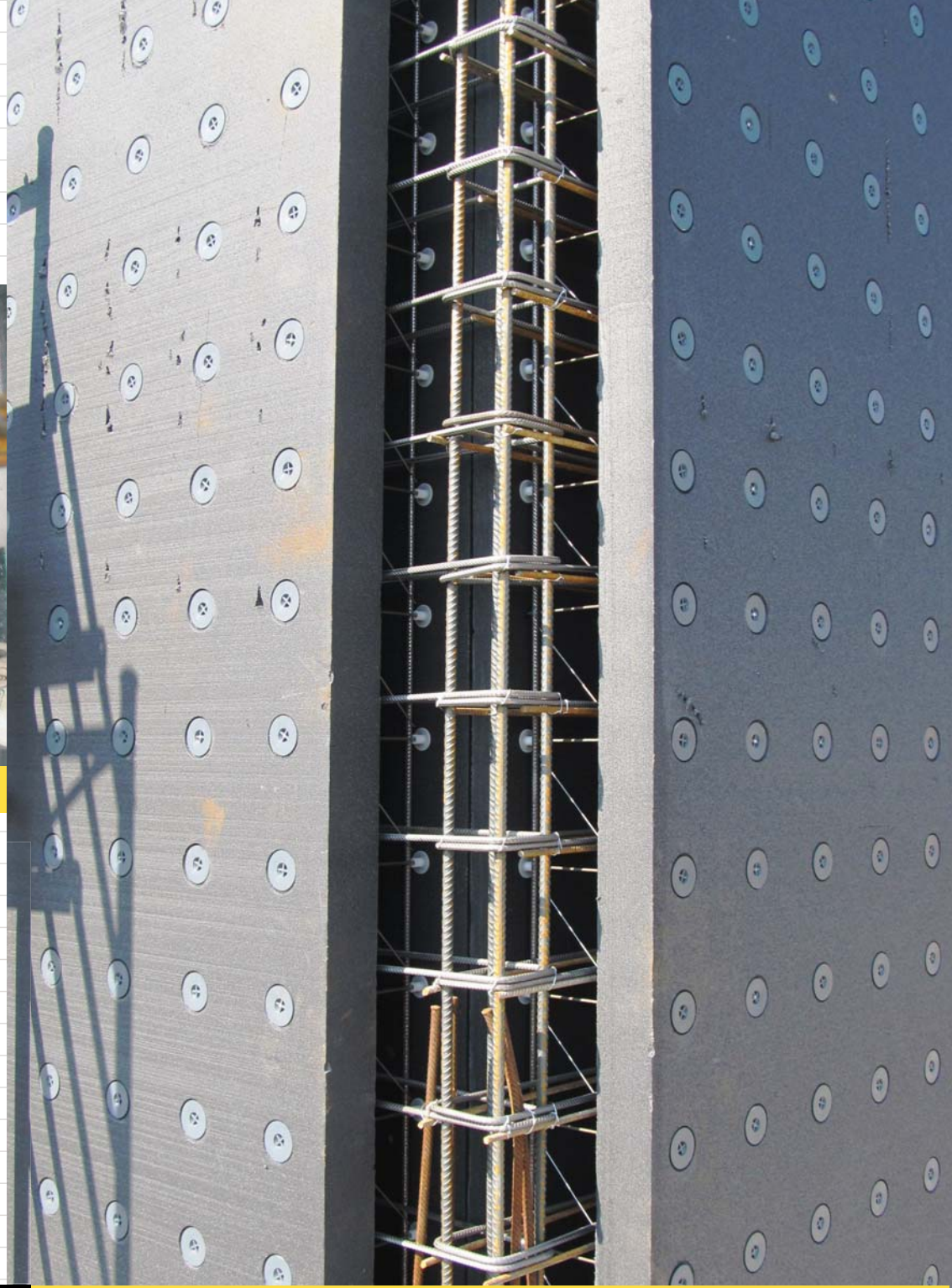
In this case we recommend inserting first a plastic tube (like those used for electrical installations) having a suitable section; the rod is then inserted in the tube and the tube is pulled out. Another acceptable method is placing only a part of formwork elements, inserting rods, adding other formwork elements and letting rods slide forwards. The Wall Plastbau® 3 elements are placed one close to the other, tying with a metal wire the base of the most accessible trellis of the Wall Plastbau® 3 elements to the jutting rod and tying – in the highest part - the closest trellises of the 2 elements.

Corner node / reinforcement

The corner reinforcement is built according to designer's indications (roughly with 4 Ø 14 mm vertical rods, with brackets, and tied every 20cm), inserting the U-shaped brackets of suitable width in the space prepared below the diagonal rods.

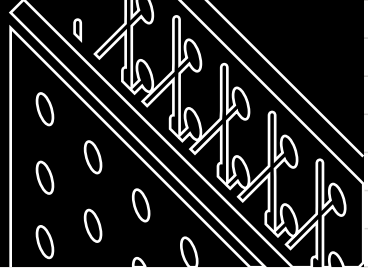
Semi-open corner node / reinforcement





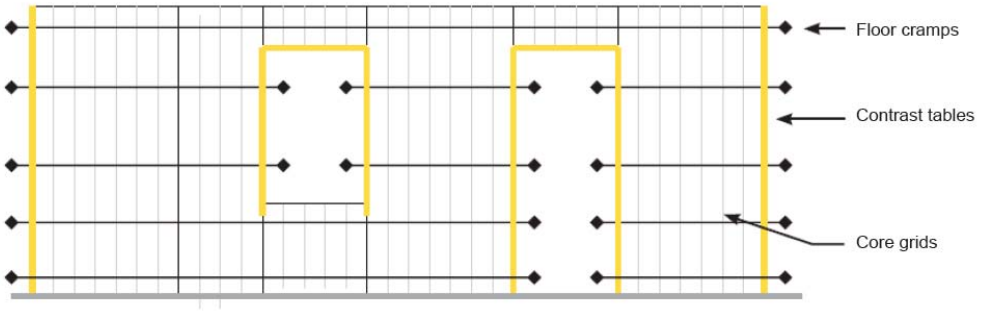
STEP 3

Formwork (ICF - Insulated Concrete Form)



Thanks to its stiffness and stability, the **Wall PLASTBAU® 3** element does not need heavy bracing. One strut each **Wall PLASTBAU® 3** element is generally sufficient, as plumb-line.

Together with **Wall Plastbau® 3** elements and U-shaped metal profiles, extra EPS panels will be supplied in order to close **Wall Plastbau® 3** element heads at the level of doors and windows; EPS panels are also supplied, to close the corners and thus eliminate thermal bridges.



Wall Plastbau® 3 elements put close to one another and plumb, by means of diagonal struts joined by a continuous band -nailed on panel PB3 Plugs

Hook-on rods

Laying of EPS head

Locking with clips - CLIP

After placing **Wall PLASTBAU® 3** elements and U-shaped metal profiles, connecting them with horizontal core grids, and placing the corners and shoulders, it is necessary to put them plumb before casting, acting according to the usual practice.

Wall PLASTBAU® 3 elements are kept plumb by push-pull struts, or any other equipment the builder considers suitable.

Corner formwork

Metal push-pull elements

Fixing the upper part of the strut to the wall is possible thanks to the polypropylene PB3 Plugs, which can be unscrewed allowing to block the strut head. Alternatively, it is possible to screw the strut fulcrum with self-tapping screws.

The lower end of the struts is usually fixed on the ground, with tables and nails inserted in the concrete slab.

- *Openings for doors and windows can be equipped with different methods according to the kind of door or window selected.*
- *Using made-to-measure EPS blocks it is possible to mount formworks on all types of windows and doors, even in case of vaults.*
- *It is possible to use prefab sub-frames to be mounted as formworks before casting.*

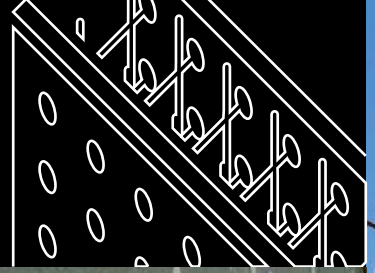
Prefab sub-frame to be mounted before casting

Wooden sub-frame

Mounting formworks to vaulted architraves

Mounting formwork with made-to-measure EPS blocks

STEP 4
Concrete casting



To make a perfect concrete casting, we recommend you check that:

1. *Wall Plastbau® 3 elements are all perfectly and closely linked to one another.*
2. *There are no damaged panels or weak points that could open during the casting operation.*
3. *Plumb and alignment of Wall Plastbau® 3 elements are perfect.*
4. *The corners, the heads and ny small portions of panels (soffits, architraves) are properly blocked.*
5. *Correct cement features: check slump, class and diameter of inserts before casting.*

Plumbing

Casting with bucket

Casting with pump

The concrete casting can be performed with bucket, with various types of pumps, or with conveyors. Casting range speed must not exceed 8 - 10m^3/h and the concrete casting itself must be oriented to the vertical center of each Wall Plastbau® 3 element.

Cement fluidity must correspond to slump S4, with a grading curve whose biggest aggregates do not exceed 15-18mm. Concrete casting should not be carried out at one time for the entire height of the formwork, but moving back and forth, placing in the formworks casting strips around 40 – 50 cm high, to reach a height – within the formwork – of 10 -15 cm from the upper edge of the internal side / EPS panel.

If the height of jet so requires, use extension tubes to reduce it

According to the operational habits, the casting may get flush with the internal slab. There will be enough room for the horizontal floor bond-beam, protected and insulated by the external EPS panel.

During the casting operation, cement can be compacted with submersible concrete vibrators. Take care not to touch core grids and not to cause formwork burst.

At the same time, it is better to use a rubber hammer to beat the formwork while casting going up in narrow especially, and in various points, placing a wooden table between the formwork and the hammer, to avoid damaging the formwork / insulation surface. A better distribution of hammering vibrations will be obtained.

In any case, we recommend a cement whose minimum resistance is C25/30 (Rck ≥ 300 Kg/cm^2). In any case, the designer will decide the class of conglomerate (28 days) according to the static use envisaged.

Tests carried out by the Portland Cement Association show that cement cured in a humid environment for all the time needed, as in case of Wall Plastbau® 3 formworks, reaches a compressive strength greater by over 50% than the one of cement in which the formwork is removed after 3 days.

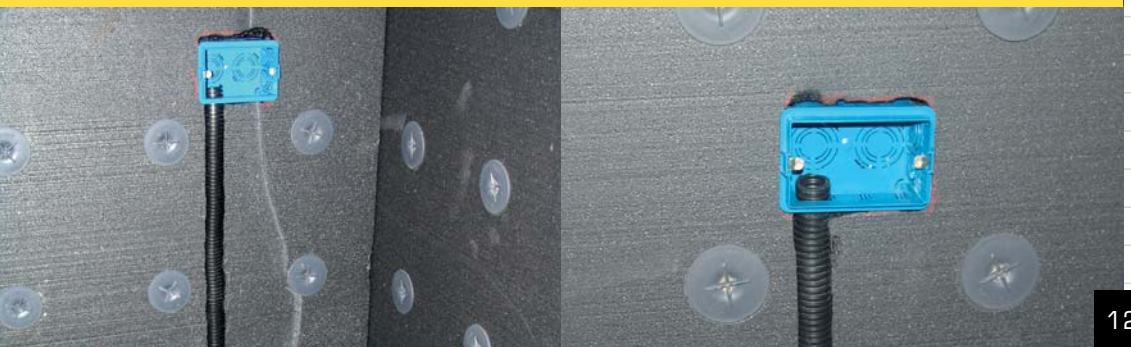
Beating on Wall Plastbau® 3 formworks by a wooden table and a rubber hammer while casting going up

STEP 5
Installations and finishing

INSTALLATIONS

The design of installations usually envisaged in a building is the same of that of buildings erected with traditional systems, in that most of cable transits are contained in a thickness of 5 - 7,5 - 10cm (available in the **Wall Plastbau® 3** versions/models), i.e. thickness of the EPS internal slab. Electrical cases or any other feature whose thickness exceeds that of the EPS internal slab, should be positioned, before casting, in the wall formwork.

Installations, ducts on the Wall Plastbau® 3 internal panel



Easy tracing for installations ducts

The preparation of "ducts" for installations on the walls is easier if you have surfaces on which you can write with a simple ruler, when needed.

Then, with a very simple hot-bladed tool or a cutter (controlled by a common drill-driver or electrical borer) it is possible to obtain rapidly and neatly – in the EPS slab thickness – the ducts needed to lay the electrical system, water and sanitary installations, and the related branching boxes.

The expensive wall cuttings for installations, which normally require time and personnel, are not necessary anymore and the construction site will be tidier and cleaner.

INTERNAL FINISHING

For internal finishing, 3 different types of finishing can be applied on the Wall Plastbau® 3 elements: plaster, skim plaster and dry.

It is possible to plaster and apply skim plaster by using proper products indicated in the protocols issued and drafted by main and leading manufacturers for the same Plastbau System and/or any ICF construction system.

Plaster finishing

Internally, the **Wall Plastbau® 3** can be plastered or skim plastered.

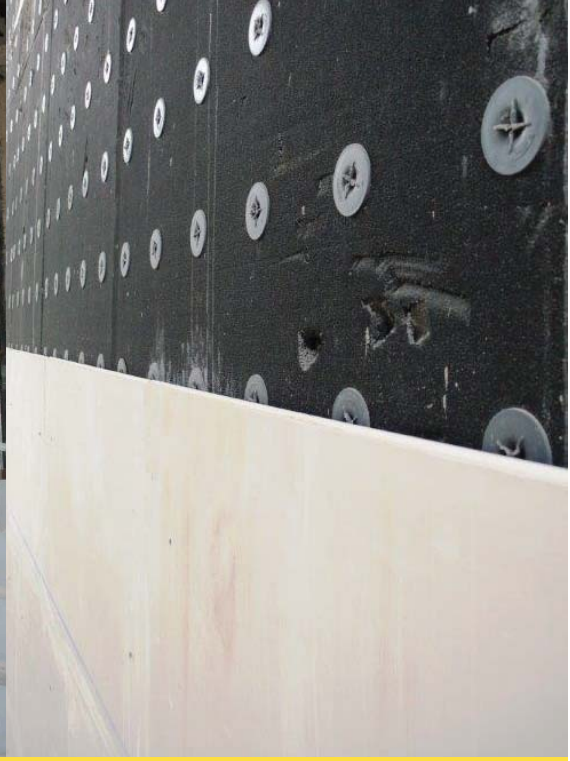
Both applications are recommended with protocols drafted by the manufacturers. For plasters, pre-mixed mortars are used, based on plaster and perlite.

Dry finishing

Dry finishing may take advantage of round PB3 Plugs on the **Wall Plastbau® 3** - once unscrewed, they may be used to correct possible misalignments or to ensure a small layer of still air between the EPS and the finishing.

Cladding is normally applied using metal profiles; some types may be glued and screwed directly to the wall.

Plasterboard mounted on a structure



Fibred plaster glued to the wall

Finishing with wood

EXTERNAL FINISHING

It is possible to finish the Wall Plastbau® 3 elements externally in many ways: EPS external wall insulation plastering, plaster, wall cladding with stones or bricks and dry wall cladding systems, mechanically screwed.

EPS external wall insulation plastering

If you chose the **Wall Plastbau® 3** version with a covered or recessed PB3 Plugs, and the surfaces of the EPS **Wall Plastbau® 3** boards appear sufficiently level and plumb, it is possible to apply a thin finishing using the techniques for EPS external wall insulation rendering and plastering. On average, skim plastering with fiberglass rendering mesh layers whose thickness does not exceed 10/12mm.

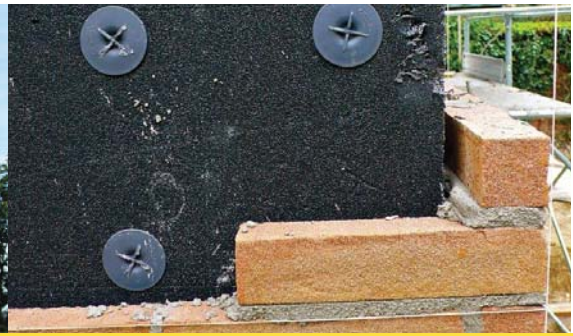
Plaster

Concrete plasters on EPS behave differently than on brickwork. The difference lies in the fact that EPS does not condition mortar – by absorbing water – during the plastering stage. Therefore, during the curing stage and when mixtures are not well balanced, shrinking-related cracking may occur. The thickness of such finishing may vary from 12 to 15mm, to offset any misalignment in the panels. Specific products exist consider the specific features of this application.

Stone façade solution, glued

Decorative and protective wall cladding with stone facade solutions can be glued on the **Wall Plastbau® 3** EPS external wall insulation by following the indications of protocols drafted by the various manufacturers. Roughly, these protocols have a mechanical strength up to 35 kg/m^2

Stone façade solution



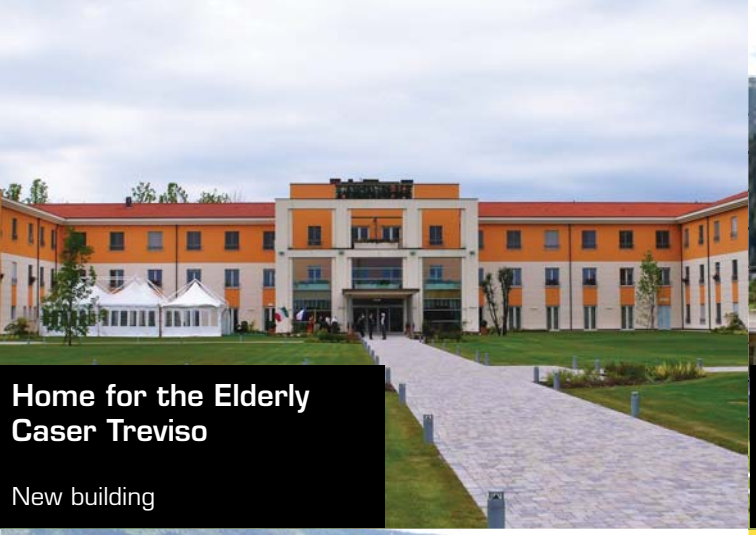
Brick cladding system

Dry wall cladding systems, mechanically screwed

Wall Plastbau® 3 can match with all types of wall dry cladding systems, mechanically screwed. Using proper dowels, it is possible to reach the cement layer below the insulation. If the loads and the height of buildings are suitable, it is possible to use the PB3 Plugs contained in each panel to screw the girders that support the cladding system for the building external finishing.

Plaster finishing

Dry wall system, mechanically screwed



Home for the Elderly Caser Treviso

New building

Hotel Talljorgele in Val Ridanna, Bolzano

Enlargement

4EQ residential building Via Marchi, Lodi

New building

Residential building in Trento

New building

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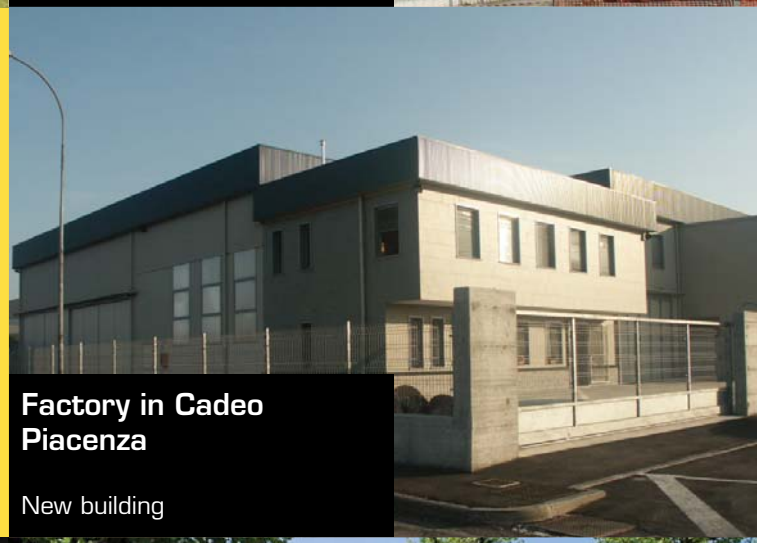
OUR REFERENCES

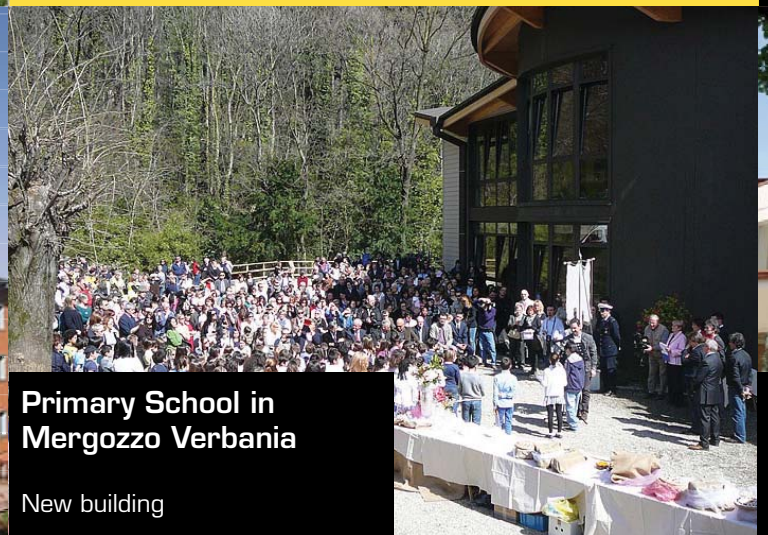


Factory in Cadeo Piacenza

New building

Hotel in Somma Lombardo Varese

New building



Primary School in Mergozzo Verbania

New building

Clinic in Mantua

New building

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