
EIPCO
ADVANCED BUILDING SYSTEM
Build Your Dreams

WALL WITH SINGLE EMMEDUE PANEL

PSM – PST – PSS1 - PSMHP | **CARD 1.0**

GENERALITIES

The EMMEDUE industrialised system can be used to realise constructions with supporting partitions in reinforced concrete. These have excellent isolation, resistance and cost performance.

The building system comprises of panels produced in the establishment and completed on laying by two external layers of structural plastering.

DESCRIPTION OF THE PANELS

The single EMMEDUE panels are made up of two electro-welded galvanised steel meshes positioned adjacent to the faces of a central block in wave-shape expanded polystyrene.

The automatic industrial production assures the constant quality of the product. The mesh is also realised automatically and continuously by machines. The parameters that influence welding are set in these machines.

The density of the panel polystyrene blocks is variable from 0.9 to 2.2 pound/ft^3 (15-35 kg/m^3) as is the thickness of the block, from 1.6 to 12.6 in. (40-320 mm).

The two meshes are connected by means of metal connectors positioned across the nodes.

The panels produced are characterised by a standard width of 3.7 ft. and a variable length depending on the engineering requirements.

The steel used for the meshes is drawn with hot galvanisation, whose average resistance to pull results higher than 87023 PSI (600 MPa).

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USES

The walls with EMMEDUE panels have great flexibility and have many uses (see the following page):

1) Vertical support structure: PSM Single Panel

Using the single Emmedue panel with two external layers of structural plaster on both sides, a supporting wall is obtained with excellent thermal acoustic, resistance and cost performance.

2) Infill or partition: PST Single Panel

The walls with single panels are optimal for use for partitioning walls, internal dividing walls and external infills, in houses or industrial and commercial buildings, even of great size.

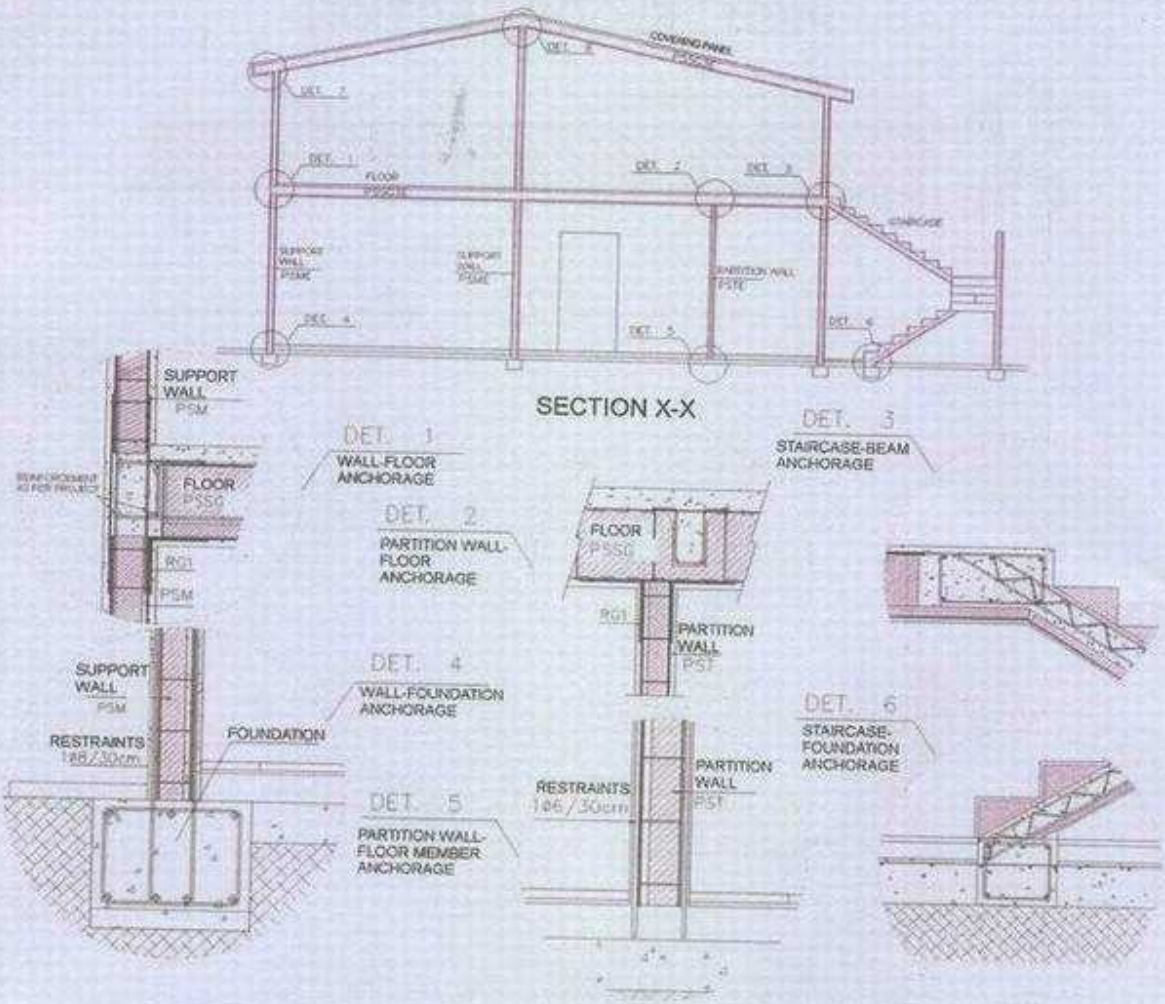
3) Isolating panel for external covering: Cladding Coat Panel PST-C

With the EMMEDUE cladding coat panel, it is easy to re-establish the correct heat isolation inside existing buildings, obtaining great benefits from the total elimination of heat channels and consequent energy and economic savings.

4) Horizontal structure with isolating functions and disposable insulating formwork: PSS1 Single Floor Panel

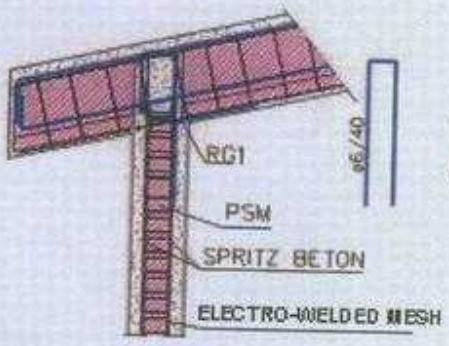
The single panel is used for covering or floors, combining isolating functions and disposable insulating formwork to support capacities.

APPLICATION OF THE EMMEDUE PANEL

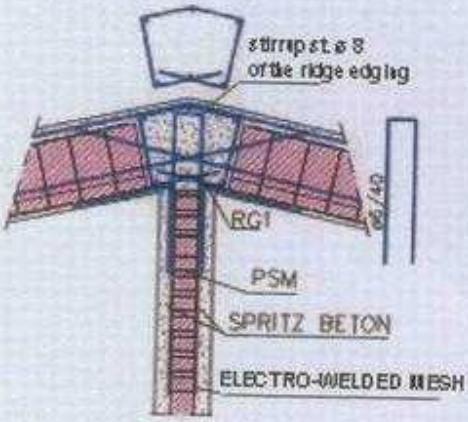


SINGLE WALL ANCHORAGE WITH COVERING PANELS

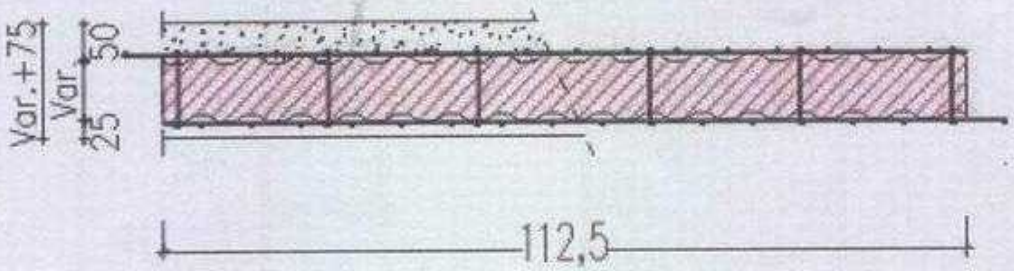
DET. 7
CONNECTION EDGING
FLOOR-PANEL-CORNICE



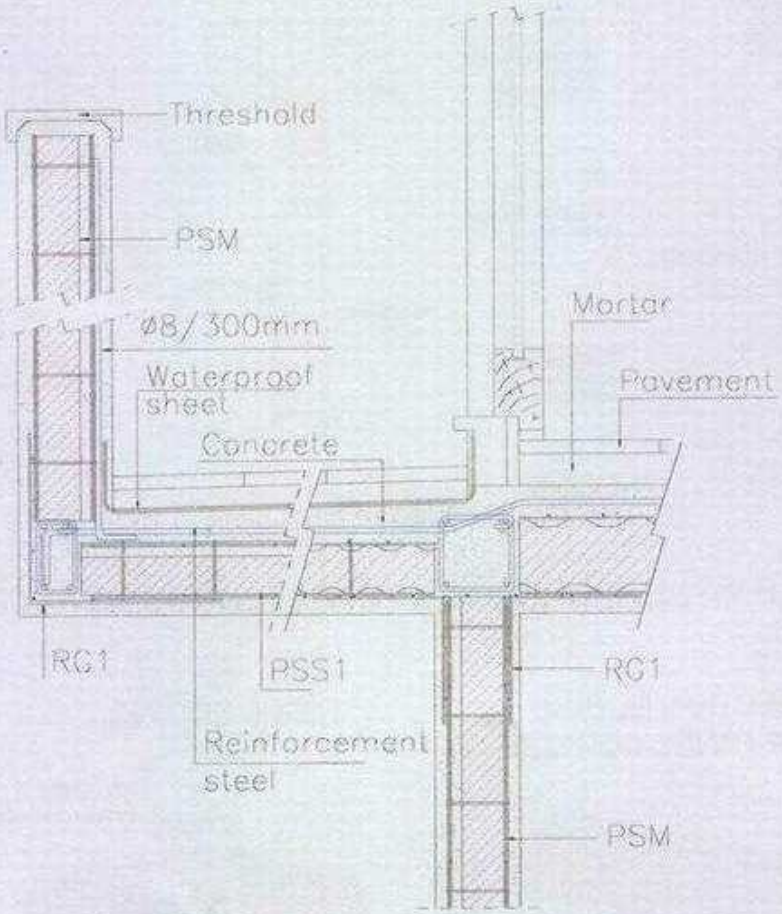
DET. 8
RIDGE EDGING



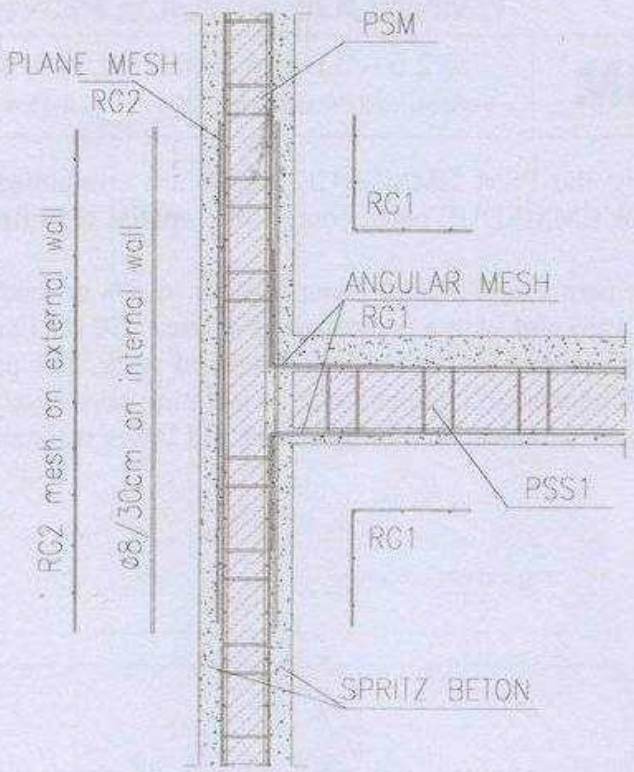
PSS1 FLOOR SECTION



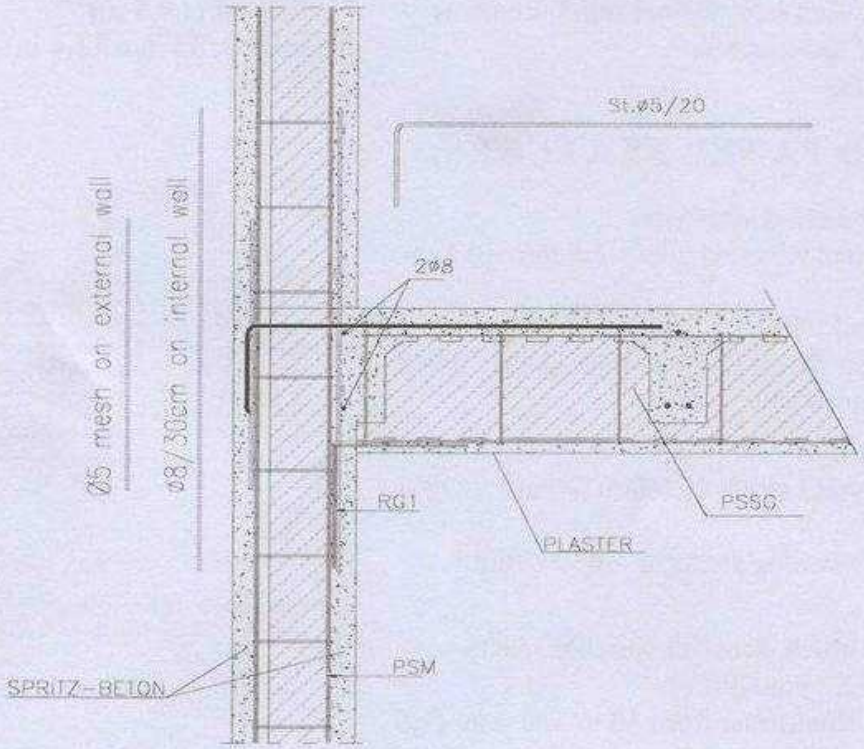
BALCONY SECTION WITH PSM



PSM WALL – PSS1 FLOOR ANCHORAGE



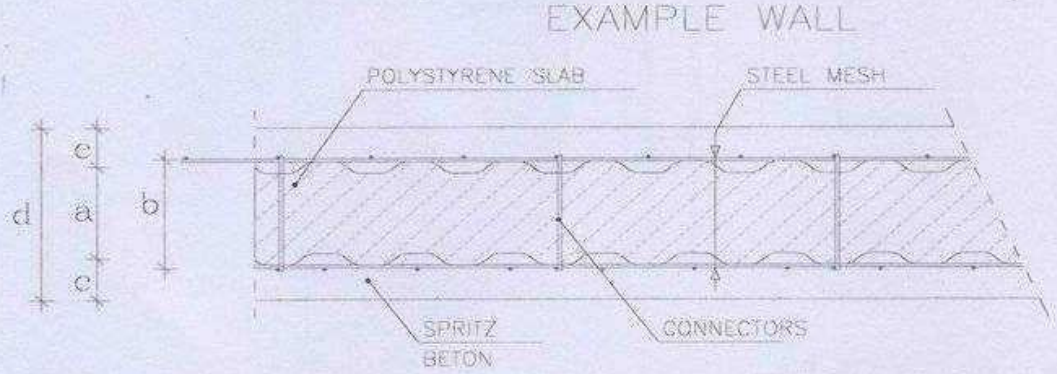
PSM WALL – PSSG FLOOR ANCHORAGE



LOAD BEARING WALL WITH EMMEDUE SINGLE PANEL

PSM	Ø 2.5 – 3.5 mm (Ø 0.1 - 0.14 in) Variable wall thickness 110-390 mm (4.3-15.4 in)	CARD 1.1

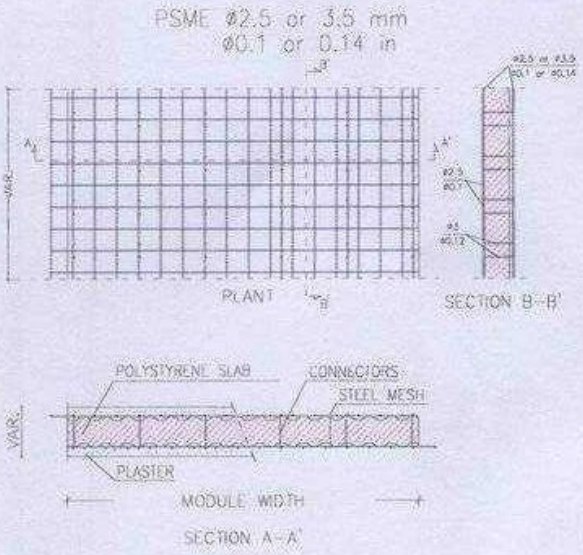
The structures performed using the PSM EMMEDUE panels are completed on laying by two external layers of plastering. The EMMEDUE panel comprises a spatial steel framework that covers the intermediate polystyrene.
A double layer of structural cement based plaster (lime inferior to 5% on cement weight), with a thickness of at least 35 mm (1.4 in) and with a resistance of at least 250 daN/cm^2 (3556 PSI), must be applied to both sides of the panel in order to use it in structural work. The panel obtained in this way will form a double block of reinforced concrete with an isolating core of expanded polystyrene. For non-structural use, the plaster can have smaller thickness and lower resistance, as long as it has a cement base.



a = EPS nominal thickness (variable according to the type of panel)
b = distance between longitudinal reinforcements (a + 20 mm / 0.8 in)
c = thickness of the concrete (average ≥ 35 mm / 1.4 in)
d = total thickness (c x 2 + a)

STANDARD PANEL FEATURES:

- **Mesh in galvanised steel wire**
  - Longitudinal steel wires: Ø 2.5 or 3.5 mm (0.1 or 0.14 in)
  - Transversal steel wires: Ø 2.5 mm (0.1 in)
  - Steel connection wires: Ø 3.0 mm (0.12 in) - about 68 per m² (about 6/ft²)
- **Steel features:**
  - Characteristic yield stress f_{yk} > 600 N/mm² (87023 PSI)
  - Characteristic breaking stress f_{tk} > 680 N/mm² (98626 PSI)
- **Polystyrene block density:** variable 15÷35 Kg/m³ (0.9÷2.2 pound/ft^3)
- **Polystyrene thickness:** from 40 to 320 mm (1.6 – 12.6 in)
- **Finished wall thickness:** variable from 110 to 390 mm (4.3 – 15.4 in)



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PSM WEIGHT AND THICKNESS

PSM Ø 2,5-3,5 Density 15 daN/m³	EPS thickness (mm)	Concrete thickness (mm)	Distance between the two meshes (mm)	TOTAL THICKNESS (mm)	Panel weight (Kg/m²)	Wall weight (panel+concrete.) (Kg/m²)
PSM 40	40	35	62.5	110	3.54	146.5
PSM 50	50	35	72.5	120	3.73	146.7
PSM 60	60	35	82.5	130	3.93	147.0
PSM 80	80	35	102.5	150	4.32	147.4
PSM 100	100	35	122.5	170	4.71	147.9
PSM 120	120	35	142.5	190	5.10	148.4
PSM 140	140	35	162.5	210	5.49	148.9
PSM 160	160	35	182.5	230	5.88	149.4
PSM 180	180	35	202.5	250	6.27	149.9
PSM 200	200	35	222.5	270	6.66	150.3

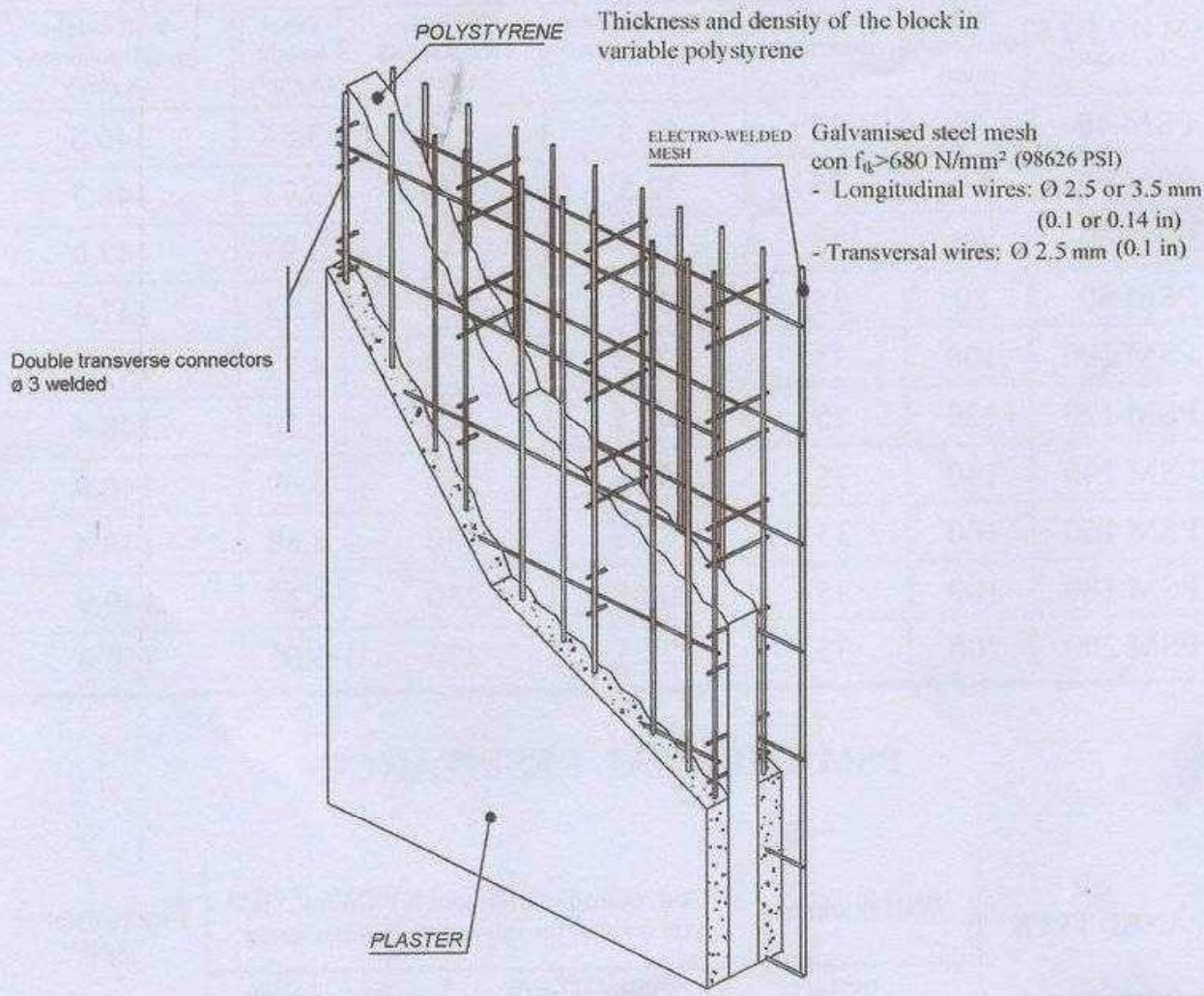
PSM THERMAL RESISTANCE

PANEL TYPE	Wall thickness	Convection coefficient Kt (W/m^2 °K)* (in brackets the values with stainless steel)		Fire resistance REI(+)
	mm	density 15Kg/m^3	density 20 Kg/m^3	
PSM50	120	0,810 (0.715)	0,780 (0.685)	
PSM60	130	0,713 (0.618)	0,687 (0.592)	
PSM80	150	0,584 (0.489)	0,564 (0.469)	120
PSM100	170	0,503 (0.408)	0,486 (0.391)	
PSM120	190	0,447 (0.352)	0,433 (0.338)	

* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

(+) Experimental test performed by Giordano Institute of Rimini and C.S.I. of Milán

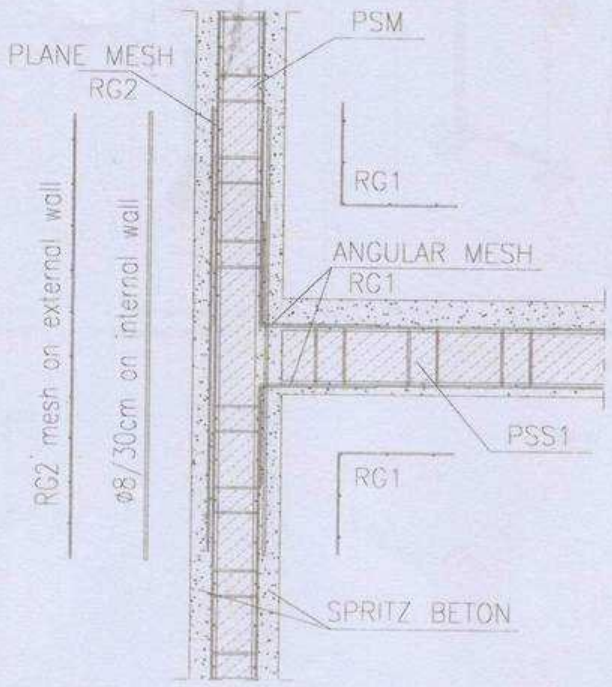
WALL WITH PSM PANELS



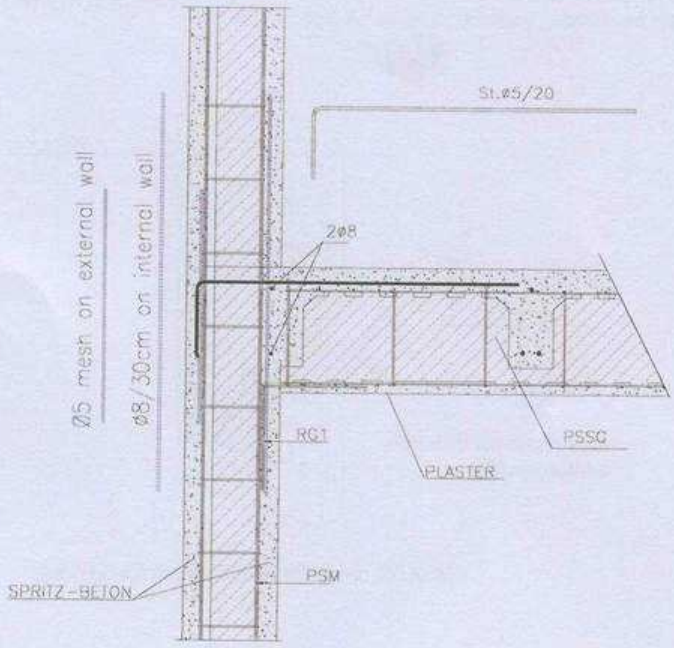
- The EMMEDUE panels have a standard module width of mm 1125
- The high quality of the EMMEDUE panel is assured by the automatic execution of the various processes that intervene in the production, which are in compliance with UNI-EN-ISO 9001:2000 Standards
- On request the panels can be realised with different features (thickness and density of the polystyrene can be varied or pitch and diameter of the wires)

- DRAWING DETAILS

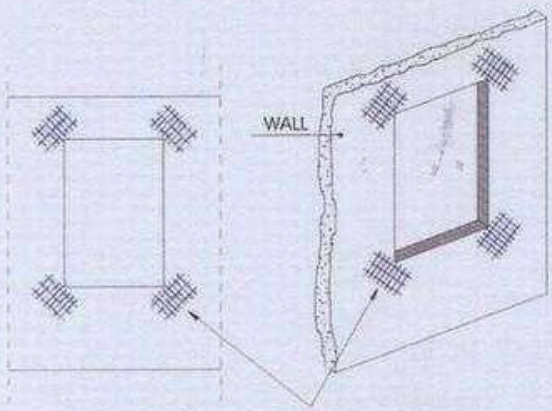
PSM WALL – PSS1 FLOOR ANCHORAGE



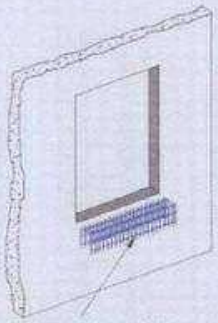
PSM WALL – PSSG FLOOR ANCHORAGE



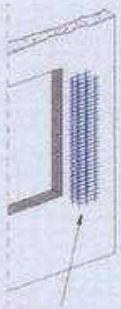
REINFORCEMENT MESHES



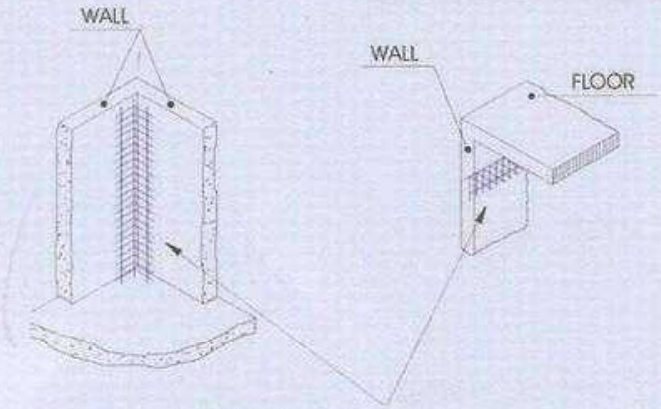
Flat mesh at 45 on door-window hole corners



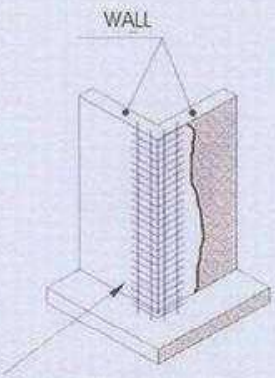
RGU mesh for reinforcement of horizontal edges (door/window)



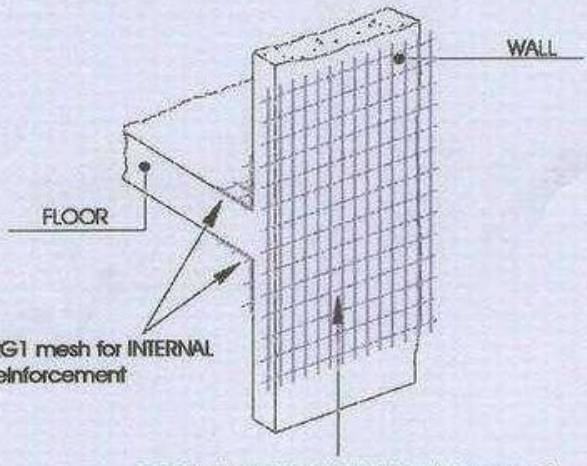
RGU mesh for reinforcement of hole mullions (door/window)



Bent/reinforced mesh INTERNAL:
horizontal angle (wall/floor) - vertical corner (wall/wall)



Bent mesh/EXTERNAL reinforcement -
Vertical corner (wall/wall)

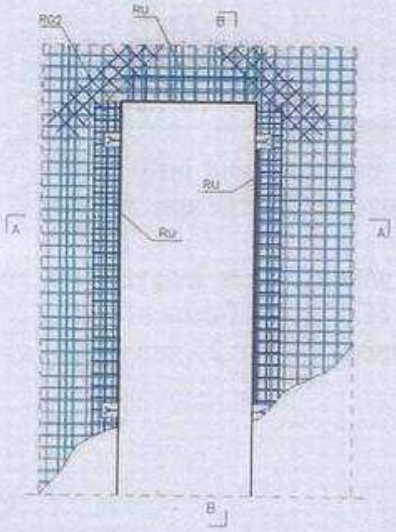


RG2 flat mesh for EXTERNAL reinforcement

PSM	Ø 2.5 –3,5 Wall thickness from 110 to 390 mm	FICHA 1.1.5

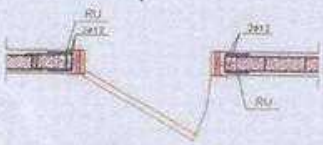
DOOR REINFORCEMENT DETAIL

FRONTAL VIEW



SECTION B-B

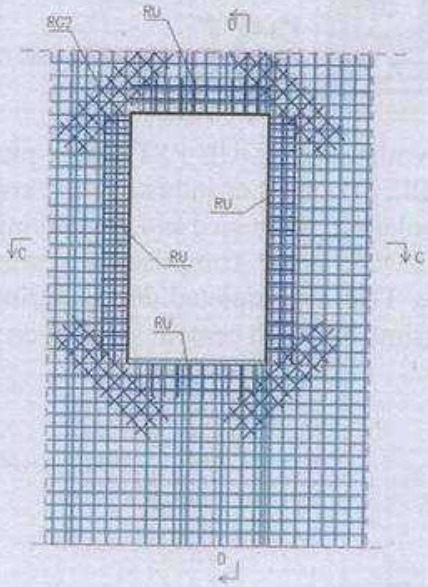
SECTION A-A



DETAIL 1

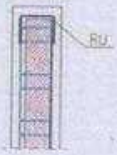
WINDOW REINFORCEMENT DETAIL

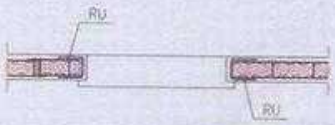
FRONT VIEW



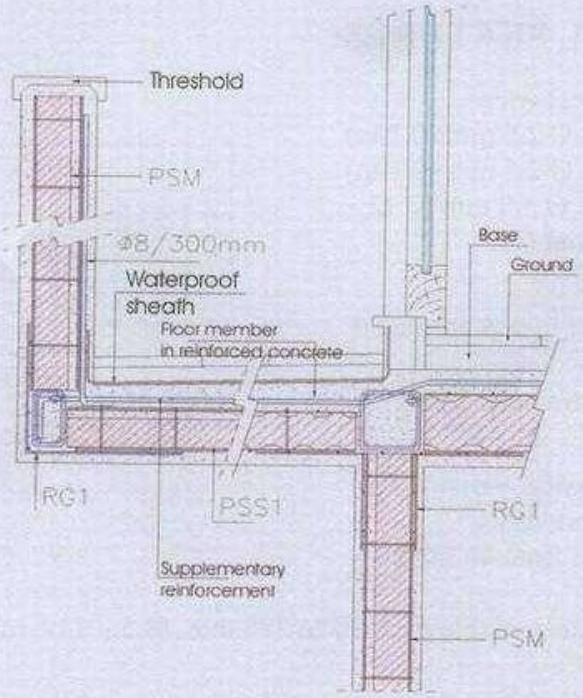
SECTION D-D

Detail 2





BALCONY SECTION WITH SINGLE PANEL

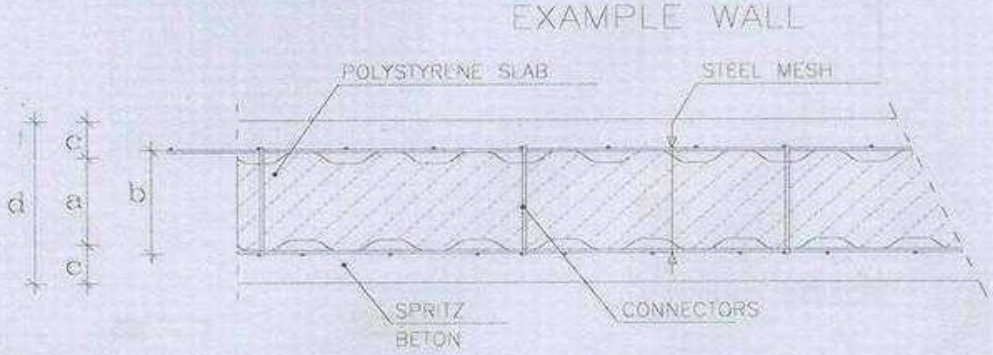


PSM	Ø 2,5 –3,5 Wall thickness from 110 to 390 mm	FICHA 1.1.6

WALL WITH EMMEDUE PANEL AS PARTITION

PST	Ø 2.5 mm (0.1 in) Variable wall thickness 90-370 mm (3.5-14.6 in)	CARD 1.2

The walls with EMMEDUE PST single panels are optimal for partitions and infill walls, external infill, in houses or industrial and commercial buildings, even of a large size and has excellent isolating, resistance and cost saving features.
The EMMEDUE panel comprises a spatial steel framework, which covers intermediate polystyrene. This is completed during laying by the application of a layer of cement based plastering (lime < 5% on cement weight) on each side for a thickness of about 25 mm (1 in).

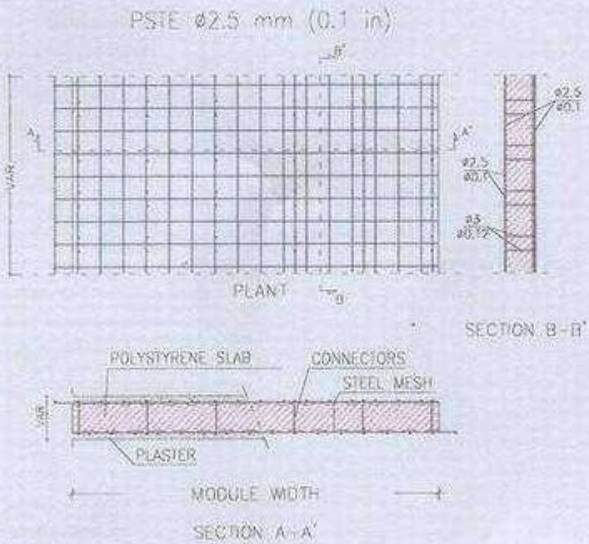


a	= EPS nominal thickness	(variable according to the type of panel)
b	= distance between longitudinal reinforcement	(a + 10 mm / 0.4 in)
c	= thickness of the concrete	(average ≥ 25 mm / 1 in)
d	= total thickness	(c x 2 + a)

STANDARD PANEL FEATURES:

- **Mesh in galvanised steel wire**
- Longitudinal steel wires: Ø 2.5 mm (0.1 in)
- Transversal steel wires: Ø 2.5 mm (0.1 in)
- Steel connection wires: Ø 3.0 mm (0.12 in) - about 68 per m² (about 6/ft²)

- **Steel features:**
- Characteristic yield stress f_{yk} > 600 N/mm² (87023 PSI)
- Characteristic breaking stress f_{tk} > 680 N/mm² (98626 PSI)



- **Polystyrene block density:** variable 15 ÷ 35 Kg/m³ (0.9 ÷ 2.2 pound/ft³)
- **Polystyrene thickness:** from 40 to 320 mm (1.6 – 12.6 in)
- **Finished wall thickness:** variable from 90 to 370 mm (3.5 – 14.6 in)

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PANEL WEIGHT AND THICKNESS

TYPE PST Ø2.5	EPS THICKNESS (mm)	CONCRETE THICKNESS (mm)	DISTANCE BETWEEN MESHES (mm)	TOTAL THICKNESS (mm)	PANEL WEIGHT (Kg/m²)	WALL WEIGHT (panel+concrete) (Kg/m²)
PST 40	40	25	52.5	90	3.49	106.4
PST 50	50	25	62.5	100	3.69	106.6
PST 60	60	25	72.5	110	3.88	106.9
PST 80	80	25	92.5	130	4.27	107.4
PST 100	100	25	112.5	150	4.66	107.8
PST 120	120	25	132.5	170	5.06	108.3
PST 140	140	25	152.5	190	5.45	108.8
PST 160	160	25	172.5	210	5.84	109.3
PST 180	180	25	192.5	230	6.23	109.8
PST 200	200	25	212.5	250	6.62	110.2

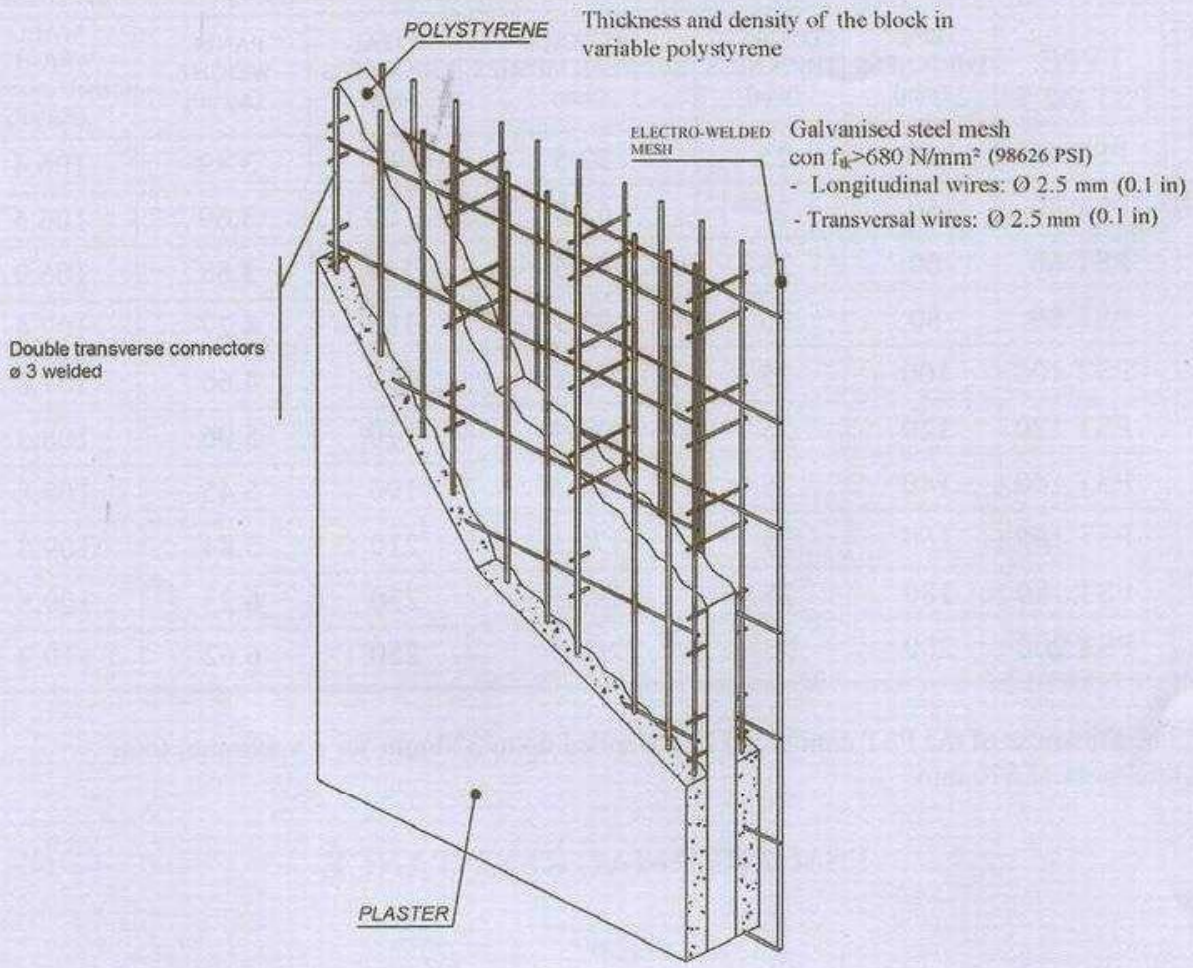
The thickness of the PST panels can be extended up to 320 mm for a maximum total thickness of 370 mm.

PSM THERMAL RESISTANCE

PANEL TYPE	Wall thickness	Convection coefficient Kt (W/m^2 °K)* (in brackets the values with stainless steel)	
	mm	density 15Kg/m^3	density 20 Kg/m^3
PST50	100	0,956 (0.861)	0,921 (0.826)
PST60	110	0,717 (0.622)	0,691 (0.596)
PST80	130	0,587 (0.492)	0,566 (0.471)
PST100	150	0,505 (0.410)	0,488 (0.393)
PST120	170	0,444 (0.349)	0,434 (0.339)

* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

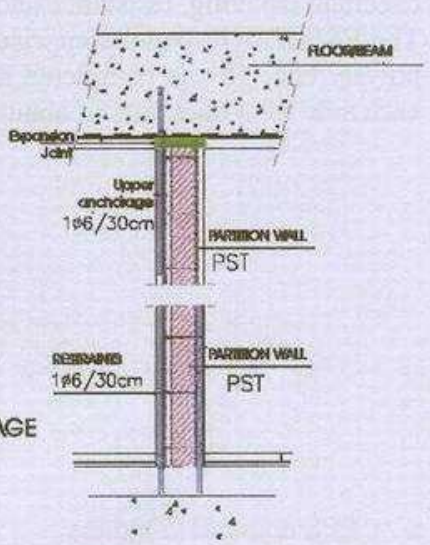
WALL WITH THE PST PANEL



- The EMMEDUE panels have a standard module width of mm 1125
- The high quality of the EMMEDUE panel is assured by the automatic execution of the various processes that intervene in the production, which are in compliance with UNI-EN-ISO 9001:2000 Standards
- On request the panels can be realised with different features (thickness and density of the polystyrene can be varied or pitch and diameter of the wires)

- LAYING THE INFILL OR PARTITIONING WITH THE PST EMMEDUE SINGLE PANEL

PARTITION WALL ANCHORAGE WITH FLOOR/BEAM



PARTITION WALL - FOUNDATION ANCHORAGE

The execution of walls using the EMMEDUE building system is easy and quick: firstly the tracing operation must be carried out along the sides, paying particular attention to planarity and verticality.

The panel can be fixed using C-shaped metal sections, with width equal to the thickness of the panel and fixed to the support using pressure nails, or by means of anchoring rebar. In the last case, the anchoring rebars must firstly be fixed tot he support wall to a depth of about 6 cm using an epoxy resin sealer and positioned with an interaxis of about 30 cm.

Successively the rebars are fastened to the perimeter of the panel, on both of its sides. The anchorage bars can have a diameter of 6-8 mm and must have a length measuring about 50 cm. These indications must be verified for particular types of partition wall or loads applied to it that standards.

If there are joints along the sides of the panel that must remain disconnected, before mounting the panels, an elastic membrane of a strip of polystyrene that is larger than the thickness of the finished panel must be fixed to it so that the plaster does not come into contact with the element from which the disconnection must be realised.

In this case the restraints must also be left free inside the holes.

The expansion joints are normally opportune walls longer than 6 metres and for heights exceeding those of the between floors.

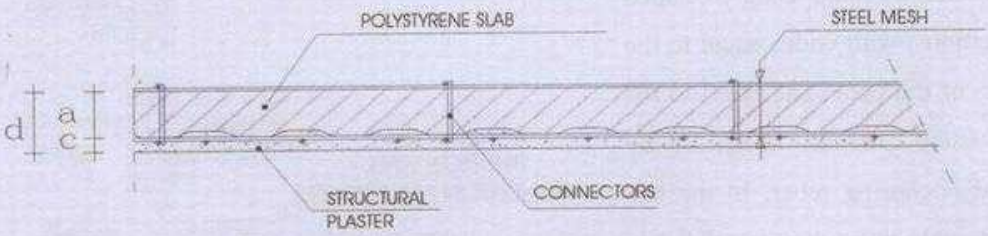
The panels should be preferably mounted before the foundation is carried out and, if anchoring rebars are used, after having positioned them.

EMMEDUE SINGLE PANEL CLADDING COAT

PST-C	Ø 2.5 mm. (0.1 in.) Var. wall thickness 60-80 mm.	CARD 1.3

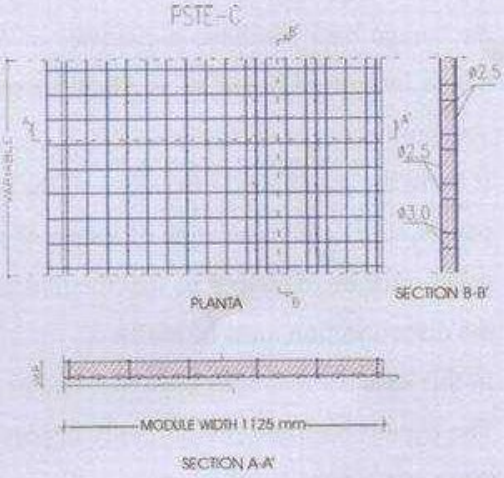
The EMMEDUE PST-C single panel is optimal for use as an isolating cladding coat for any walls in houses or industrial and commercial buildings, even of a large size and has excellent isolating, resistance and cost saving features.
The EMMEDUE panel comprises a spatial steel framework, which covers the intermediate polystyrene. This is completed during laying by the application of a layer of plastering on each side for a thickness of about 0.8 in. (2 cm.)

EXEMPLE OF WALL



a = EPS nominal thickness (variable according to the type of panel)
c = thickness of the plastering (average 20 mm / 0.8 in.)
d = total thickness (c + a)

STANDARD PANEL FEATURES:



- **Mesh in galvanised steel wire**
- External mesh: n°20 wires ø 2.5 (0.1 in.)
- Internal mesh: n°6 wires ø 2.5 (0.1 in.)
- Steel connection wires: Ø 3.0 mm (0.12 in.) - about 68 per m² (about 6/ft²)
- **Steel features:**
- Characteristic yield stress f_{yk} > 600 N/mm²
- Characteristic breaking stress f_{tk} > 680 N/mm²
- **Polystyrene block density**: variable 15÷35 Kg/m³
- **Polystyrene block thickness:** from 40 to 60 mm
- **Finished wall thickness:** variable from 60 to 80 mm

Panels can be realised with features that differ from standard panels
(thickness and density of the polystyrene can vary or the pitch and diameter of the wires)

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PANEL TYPE PSTE-C	SEP THICKNESS (mm)	PLASTER THICKNESS (mm)	TOTAL THICKNESS (mm)
PSTE-C 40	40	20	60
PSTE-C 50	50	20	70
PSTE-C 60	60	20	80

- The EMMEDUE panels have a standard module width of mm 1125
- The high quality of the EMMEDUE panel is assured by the automatic execution of the various processes that intervene in the production, which are in compliance with UNI-EN-ISO 9001:2000 Standards
- On request the panels can be realised with different features (thickness and density of the polystyrene can be varied or pitch and diameter of the wires)

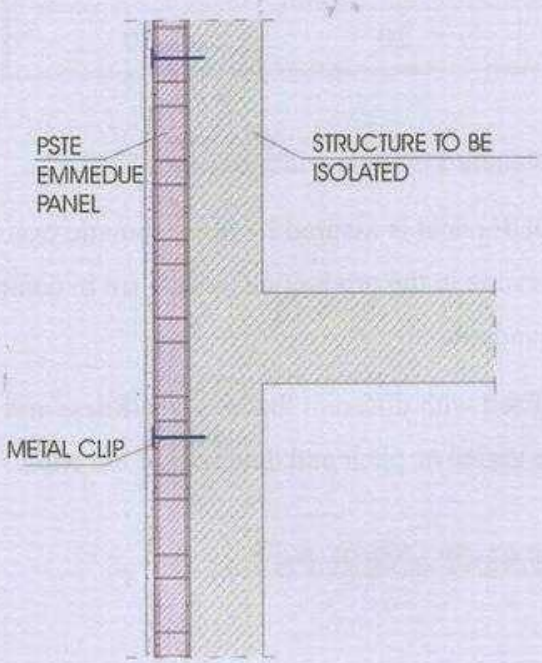
THERMAL RESISTANCE PST-C

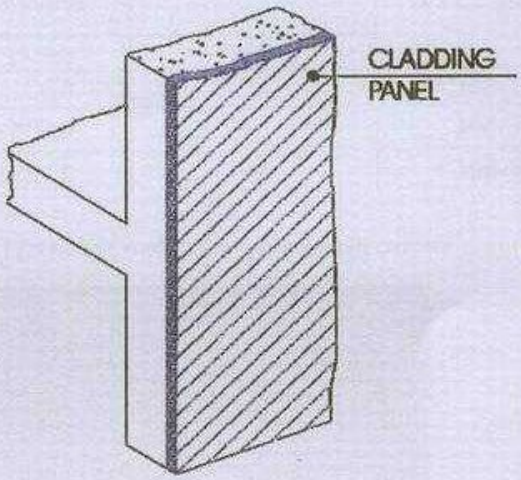
PANEL TYPE	Wall thickness	Convection coefficient Kt (W/m^2 °K)* (in brackets the values with stainless steel)	
	mm	density 15Kg/m^3	density 20 Kg/m^3
PST-40C	60	0,971 (0.876)	0,934 (0.839)
PST-50C	70	0,826 (0.731)	0,795 (0.700)
PST-60C	80	0,725 (0.630)	0,698 (0.603)

* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

DRAWING DETAILS

PANEL-WALL ANCHORAGE



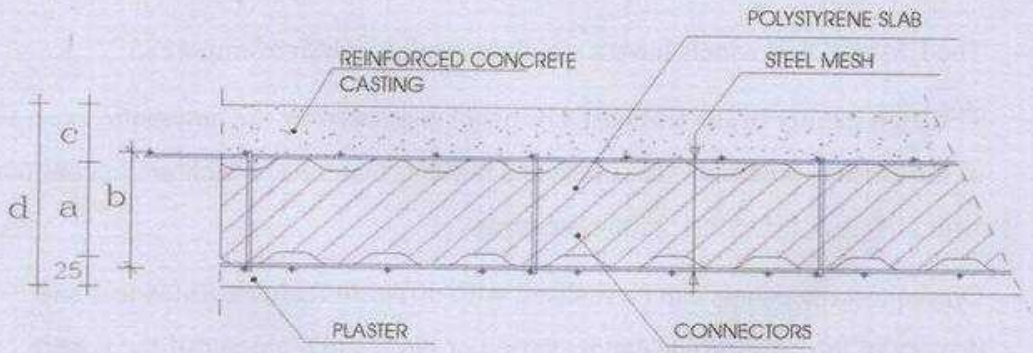


SINGLE EMMEDUE PANELS AS HORIZONTAL STRUCTURE

PSS1	Var. floor thickness 125-275 mm.	**CARD 1.4**

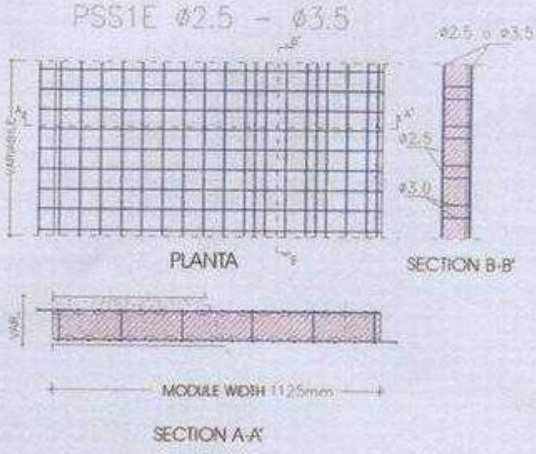
The single EMMEDUE PSS1 panel is used for coverings or floors, combining bearing capacity, isolating functions and disposable insulating formwork in a unique element.
The EMMEDUE panel is made up of spatial steel framework, which covers the intermediate polystyrene. The floor is completed on laying with casting of concrete at the extrados and cement based spritz-beton (lime < 5% on cement weight) at the intrados.
The panel obtained in this way will form a double block of reinforced concrete with an isolating core placed in the expanded polystyrene.

EXEMPLE OF WALL



a = EPS nominal thickness (variable according to the type of panel)
b = distance between reinforcements (at + 20 mm / 0.8 in.)
c = thickness of the concrete (average ≥ 50 mm / 2 in.)
d = total thickness (c + a + 25 mm / 1 in.)

STANDARD PANEL FEATURES:



- **Mesh in galvanised steel wire**
- Longitudinal steel wires: Ø 2.5-3.5 mm (0.1 or 0.14 in)
- Transverse steel wires: Ø 2.5 mm (0.1 in)
- Steel connection wires: Ø 3.0 mm (0.12 in.) - about 68 per m² (about 6/ft²)
- **Steel features:**
- Characteristic yield stress f_{yk} > 600 N/mm² (87023 PSI)
- Characteristic breaking stress f_{tk} > 680 N/mm² (98626 PSI)

- **Polystyrene block density:** variable 15÷35 Kg/cm³ (0.9÷2.2 pound/ft³)
- **Polystyrene block thickness:** from 50 to 200 mm (2 – 7.9 in.)
- **Finished floor thickness:** variable from 125 to 275 mm (4.9 – 10.8 in.)

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PANEL WEIGHT AND THICKNESS

PANEL TYPE	EPS THICKNESS (mm)	THICKNESS OF EXTRADOS CONCRETE (mm)	DISTANCE BETWEEN THE REINFORCEMENTS (mm)	TOTAL THICKNESS (mm)	PANEL WEIGHT (Kg/m²)	FLOOR WEIGHT (panel+concrete) (Kg/m²)
PSS1 80	80	50	102.5	155	4.32	157.4
PSS1 100	100	50	122.5	175	4.71	157.9
PSS1 120	120	50	142.5	195	5.10	158.4
PSS1 140	140	50	162.5	215	5.49	158.9
PSS1 160	160	50	182.5	235	5.88	159.4

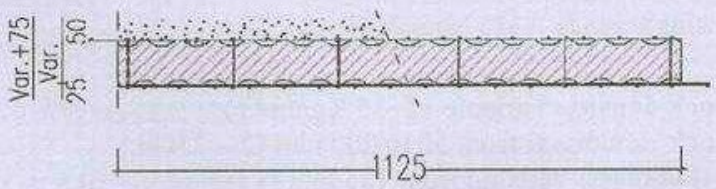
- The EMMEDUE panels have a standard module width of mm 1125
- The high quality of the EMMEDUE panel is assured by the automatic execution of the various processes that intervene in the production, which are in compliance with UNI-EN-ISO 9001:2000 Standards
- On request the panels can be realised with different features (thickness and density of the polystyrene can be varied or pitch and diameter of the wires)

PSM THERMAL RESISTANCE

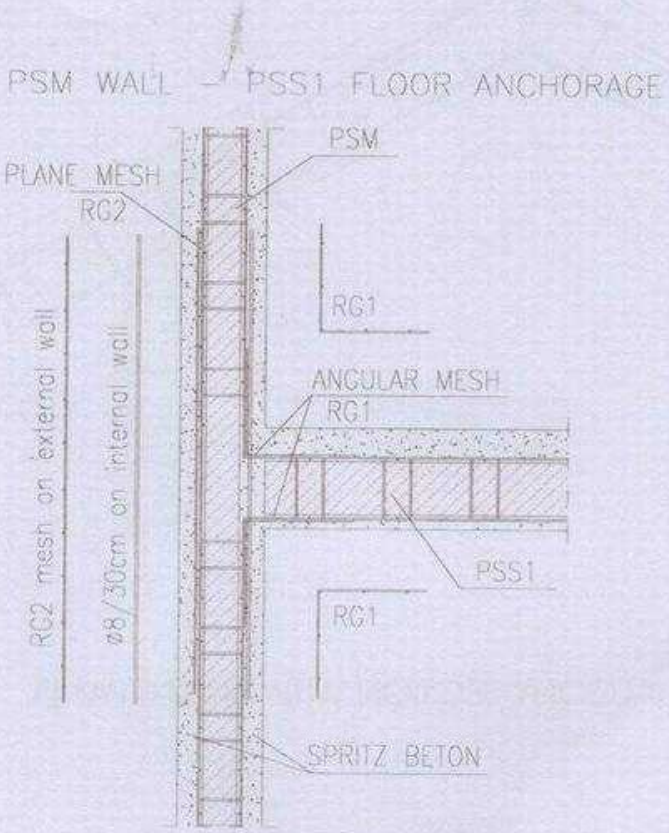
PANEL TYPE	Wall thickness	Convection coefficient Kt (W/m² °K)* (in brackets the values with stainless steel)	
	mm	density 15Kg/m³	density 20 Kg/m³
PSS1 80	155	0,578 (0.483)	0,560 (0.465)
PSS1 100	175	0,502 (0.407)	0,485 (0.390)
PSS1 120	195	0,447 (0.352)	0,432 (0.337)
PSS1 140	215	0,406 (0.311)	0,393 (0.298)

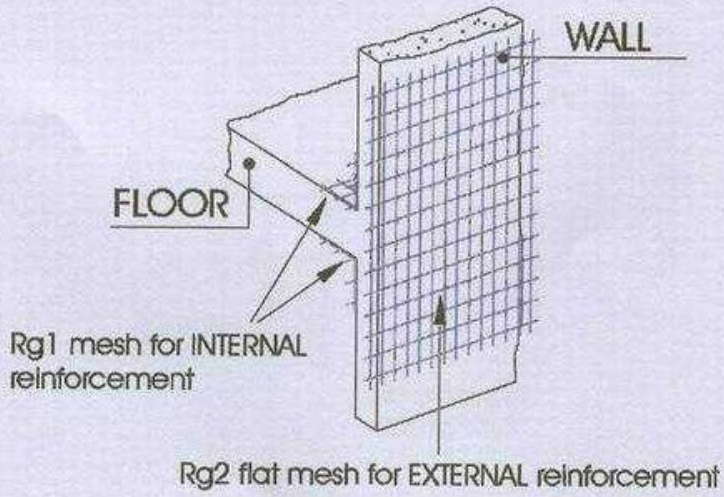
* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

PSS1 FLOOR SECTION

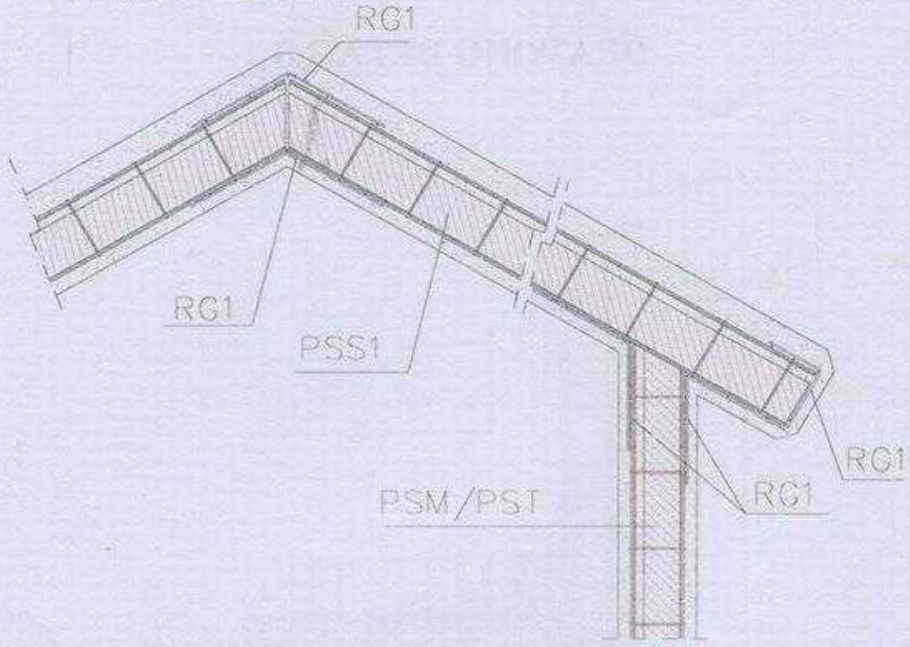


DRAWING DETAILS



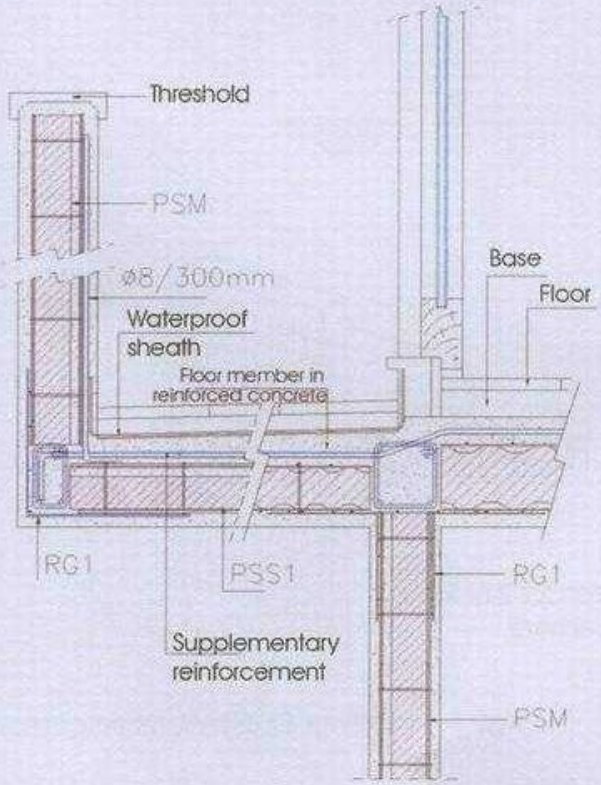


ROOF DETAIL



WALL AND ROOF ANCHORAGE WITH PSM

BALCONY SECTION WITH SINGLE PANEL



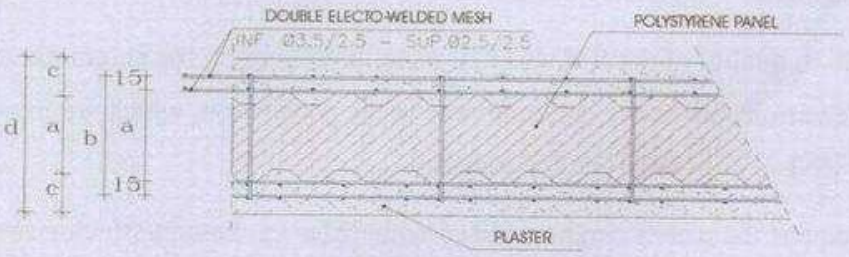
PSS1	Ø 2.5 – 3.5 Var. floor thickness 125-275 mm.	CARD 1.4.4

WALL WITH SPECIAL EMMEDUE PANEL WITH DOUBLE MESH

PSMHP	Ø 2.5 - 3.5 (0.1 - 0.14 in.) Var. wall thickness 150-300 mm (5.9-11.8 in.)	CARD 1.5

EMMEDUE PSMHP panels are realised by the coupling of two electro-welded meshes, which are joined with passing connectors, also electro-welded. They confine a variable-thickness polystyrene core.
This special panel has been designed for the specific building in which high resistance to orthogonal stress on the surface of the block are required.
In fact, the extreme variability of the components of the EMMEDUE panels allow to carry out a true and proper "project" of the element depending on specific requirements.
The panel is completed during laying by the application of a layer of cement based spritz beton (lime <5% on cement weight) on both sides for a thickness of at least 2 in. In this way a double layer of reinforced concrete is formed with an isolating expanded polystyrene.

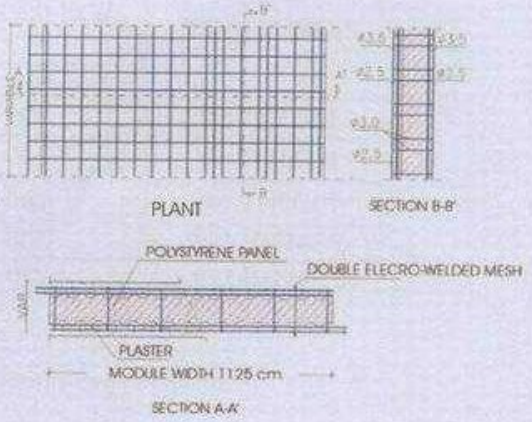
EXEMPLE OF WALL



a = EPS nominal thickness (variable according to the type of panel)
b = distance between longitudinal reinforcements (at + 30 mm / 1.18 in.)
c = thickness of the concrete (average ≥ 2 in.)
d = total thickness (c x 2 + a)

STANDARD PANEL FEATURES:

- **Mesh in galvanised steel wire**
  - Longitudinal steel wires: Ø 2.5 or 3.5 mm (0.1 or 0.14 in)
  - Transversal steel wires: Ø 2.5 mm (0.1 in)
  - Steel connection wires: Ø 3.0 mm (0.12 in) -about 68 per m² (about 6/ft²)
- **Steel features:**
  - Characteristic yield stress f_{yk} > 600 N/mm² (87023 PSI)
  - Characteristic breaking stress f_{tk} > 680 N/mm² (98626 PSI)



- **Polystyrene block density:** variable 15÷35 Kg/m³ (0.9÷2.2 pound/ft³)
- **Polystyrene thickness:** from 50 a 200 mm (2 – 7.9 in)
- **Finished wall thickness:** variable from 150 to 300 mm (5.9 – 11.8 in)

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PANEL THICKNESS

PANEL TYPE PSMHP	EPS THICKNESS (mm)	CONCRETE THICKNESS PER SIDE (mm)	DISTANCE BETWEEN REINFORCEMENTS (mm)	THICKNESS FINISHED WALL (mm)
PSMHP 50	50	50	80	150
PSMHP 60	60	50	90	160
PSMHP 80	80	50	110	180
PSMHP 100	100	50	130	200
PSMHP 120	120	50	150	220
PSMHP 140	140	50	170	240
PSMHP 160	160	50	190	260
PSMHP 180	180	50	210	280
PSMHP 200	200	50	230	300

- The EMMEDUE panels have a standard module width of mm 1125
- The high quality of the EMMEDUE panel is assured by the automatic execution of the various processes that intervene in the production, which are in compliance with UNI-EN-ISO 9001:2000 Standards
- On request the panels can be realised with different features (thickness and density of the polystyrene can be varied or pitch and diameter of the wires)

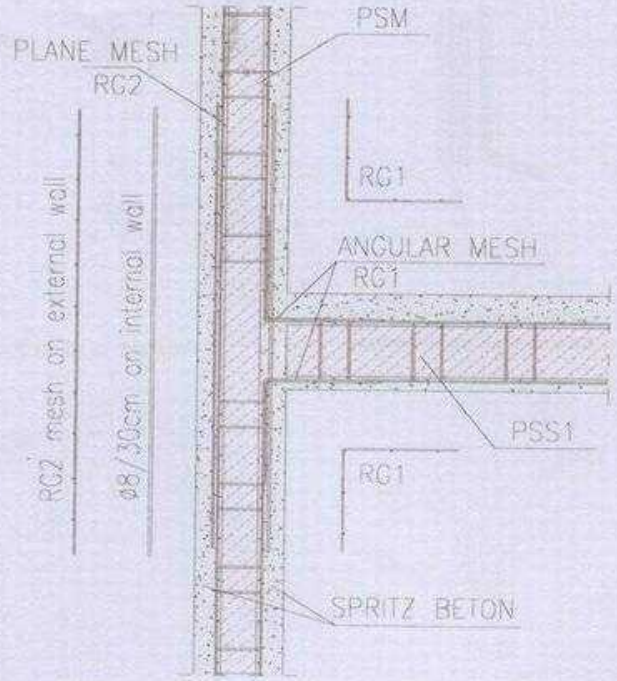
PSM THERMAL RESISTANCE

PANEL TYPE	Wall thickness	Convection coefficient Kt (W/m^2 °K)* (in brackets the values with stainless steel)	
	mm	density 15Kg/m^3	density 20 Kg/m^3
PSMHP 50	150	0,800 (0.705)	0,772 (0.677)
PSMHP 60	160	0,706 (0.611)	0,681 (0.586)
PSMHP 80	180	0,580 (0.485)	0,560 (0.465)
PSMHP 100	200	0,501 (0.406)	0,484 (0.389)
PSMHP 120	220	0,445 (0.350)	0,431 (0.336)

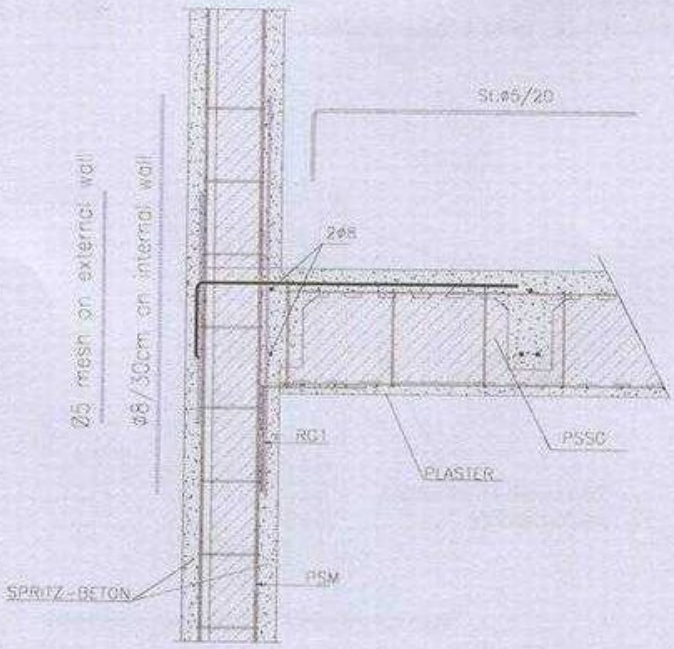
* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

- DRAWING DETAILS

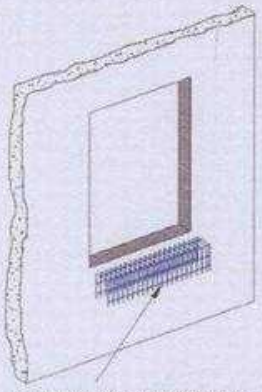
PSM WALL - PSS1 FLOOR ANCHORAGE



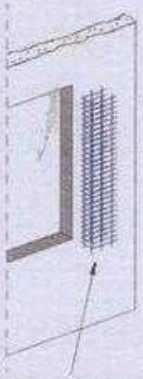
PSM WALL - PSSC FLOOR ANCHORAGE



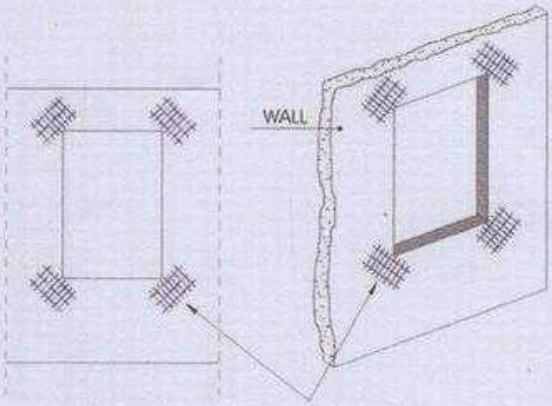
REINFORCEMENT MESHES



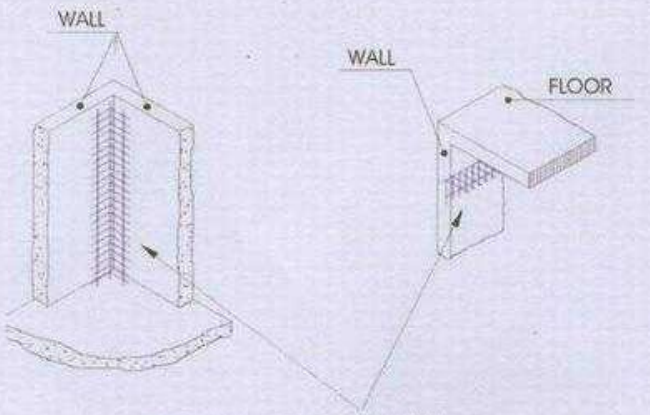
RGU mesh for reinforcement of horizontal edges (door/window)



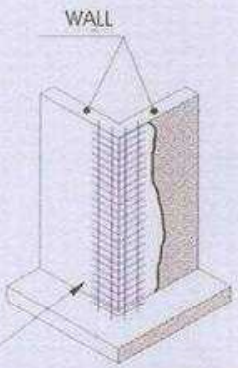
RGU mesh for reinforcement of hole mullions (door/window)



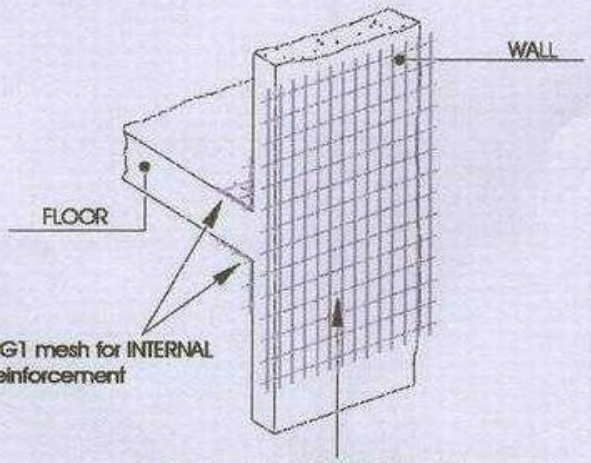
Flat mesh at 45 on door-window hole corners



Bent/reinforced mesh INTERNAL:
horizontal angle (wall/floor) - vertical corner (wall/wall)



Bent mesh/EXTERNAL reinforcement -
Vertical corner (wall/wall)

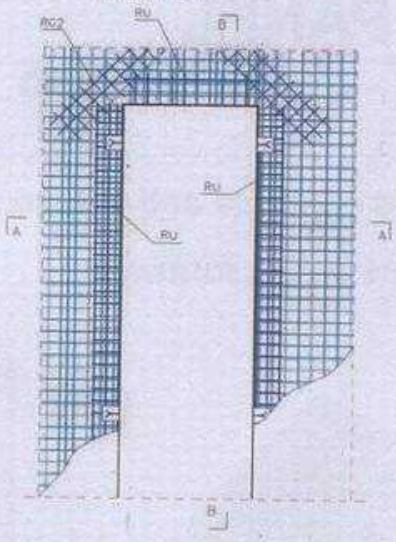


RG2 flat mesh for EXTERNAL reinforcement

PSMHP	Ø 2.5 Var. wall thickness 150 - 300 mm (5.9 – 11.8 in.)	CARD 1.5.4

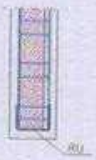
DOOR REINFORCEMENT DETAIL

FRONTAL VIEW



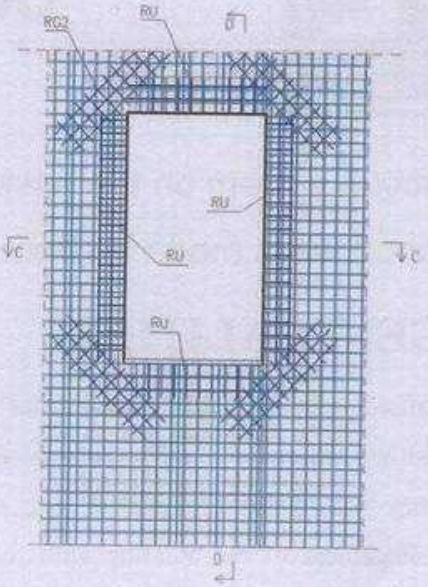
SECTION B-B

DETAIL 1



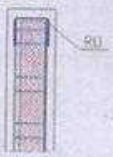
SECTION A-A

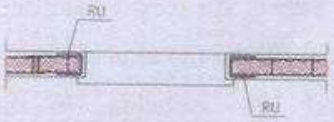
WINDOW REINFORCEMENT DETAIL
FRONT VIEW



SECTION D-D

Detail 2





WALL WITH EMMEDUE DOUBLE PANEL

PDM | **CARD 2.0**

Construction system on the basis of reinforced concrete anti-seismic support walls made up from disposable insulating formwork

GENERALITIES

Buildings realised with Emmedue panels offer high resistance and are optimal for use in seismic areas. Moreover, they are perfectly isolated and allow economic management of the building with respect for the environment.

Emmedue double panels are used to realise support structures that also fulfil the function of formwork for casting, infill and heat isolation. In this way construction costs are greatly reduced thanks to the speed of execution.

DESCRIPTION OF THE PANELS

The wall realised with Emmedue double panels is made up of two polystyrene blocks reinforced with electro-welded meshes that are connected to each other by a central partition of concrete, casted on laying. The walls are completed externally using traditional plaster.

The Emmedue construction system is flexible and easy to work:

- it can be adapted to many architectonic requirements
- any flat or curved shape can be made
- any size of holes can be made for windows, doors etc.
- the tracks can be easily made on the polystyrene surface.

Isolation is extremely effective thanks to a continuous layer of polystyrene that allows elimination of heat channels and favours the consequent noteworthy energy saving.

The panel also functions as a disposable insulating formwork, optimising realisation times and costs.

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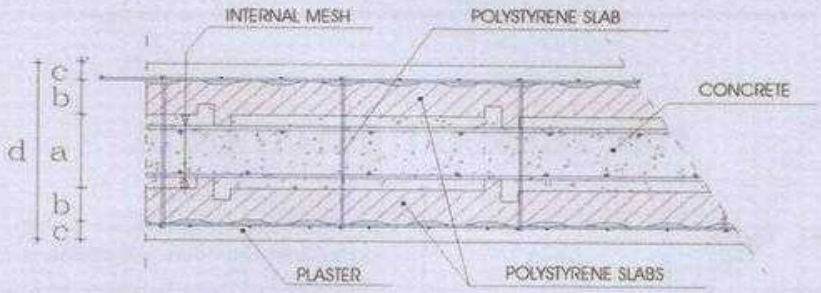
WALL WITH EMMEDUE DOUBLE PANEL AS SUPPORT WALLS

PDM	Var. internal reinforced concrete thickness 80-200 mm (3.1-7.9 in.) var. finished wall thickness 230-350 mm (9-13.8 in.)	CARD 2.1

The EMMEDUE PDM double panel comprises two blocks of polystyrene with interconnected electro-welded annexed steel meshes, which create an internal space into which concrete with relative features and resistance is cast during laying. It is successively completed with external plastering, realising constructions with supporting partitions, whose concrete thickness is established depending on the structural requirements to be satisfied.
A wall is created which, as well as having excellent thermo-acoustic isolation, resistance and cost performance, also acts as a disposable insulating formwork.

EXEMPLE OF WALL

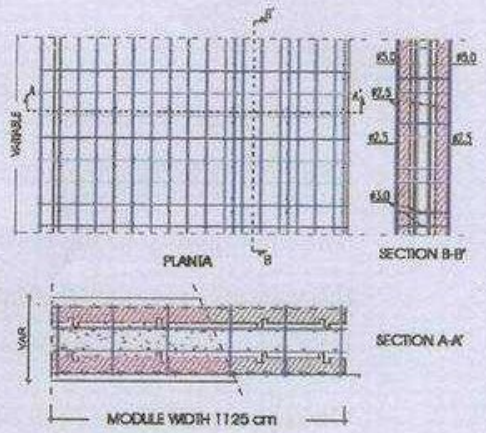


a = thickness of reinforced concrete partition (depending on structural requirements)
b = EPS nominal thickness (about 50 mm / 2 in. per side)
c = thickness of the plastering (about 25 mm / 1 in. per side)
d = total thickness [a+(2xb)+(2xc)]

STANDARD PANEL FEATURES:

- **External mesh in galvanised steel wire:**

- Longitudinal steel wires: Ø 2.5 mm (0.1 in.) every 65 mm (2.6 in.)
- Transverse steel wires: Ø 2.5 mm (0.1 in.) every 65 mm (2.6 in.)
- Steel connection wires: Ø 3.0 mm (0.12 in.) about 68 per m² (6/ft²)



- **Steel features:**

- Characteristic yield stress f_{yk} >600 N/mm² (87023 PSI)
- Characteristic breaking stress f_{tk} >680 N/mm² (98626 PSI)

- **Internal mesh:**

- Longitudinal steel wires: Ø 5 mm (0.2 in.) every 100 mm (3.94 in.)

Transverse steel wires: Ø 5 mm (0.2 in.) every 260 mm (10.2 in.)
(the pitch halves to about 130 mm / 5.1 in. with the addition of connection clamps)

- **Steel features** FeB44K

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- **Polystyrene block density:** 25 Kg/m^3 (1.56 pound/ft^3)
- **Polystyrene block thickness:** about 50 mm. (2 in.)
- **Internal space thickness:** variable from 80 to 200 mm. (3.1-7.9 in.)

PANEL WEIGHT AND THICKNESS

PANEL TYPE PDM	EPS THICKNESS PER SIDE(mm)	REINFORCED CONCRETE THICKNESS (mm)	PLASTER THICKNESS (mm)	TOTAL THICKNESS (mm)	PANEL WEIGHT (Kg/m²)	WALL WEIGHT (panel+concrete) (Kg/m²)
PDM 80	50	80	25	230	12.47	310.45
PDM 100	50	100	25	250	12.50	357.50
PDM 120	50	120	25	270	12.53	404.55
PDM 150	50	150	25	300	12.56	475.13

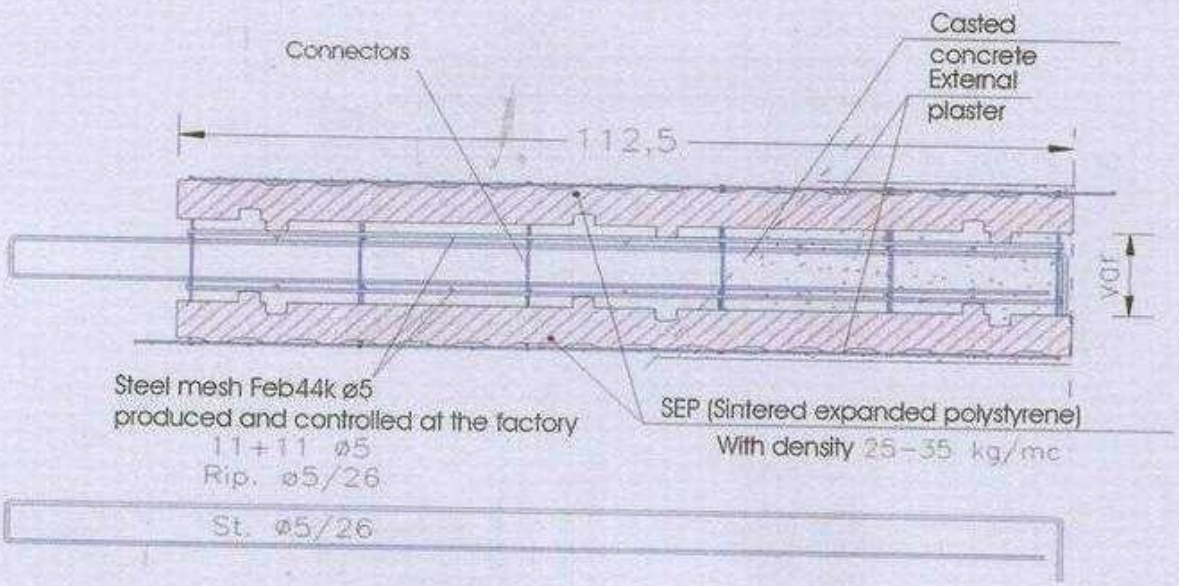
PDM THERMAL RESISTANCE

PANEL TYPE	Wall thickness (mm.)	Convection coefficient Kt (W/m^2 °K)* (in brackets the values with stainless steel)
PDM 80	230	0.474 (0.379)
PDM 100	250	0.473 (0.378)
PDM 120	270	0.471 (0.376)
PDM 150	300	0.469 (0.374)

* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

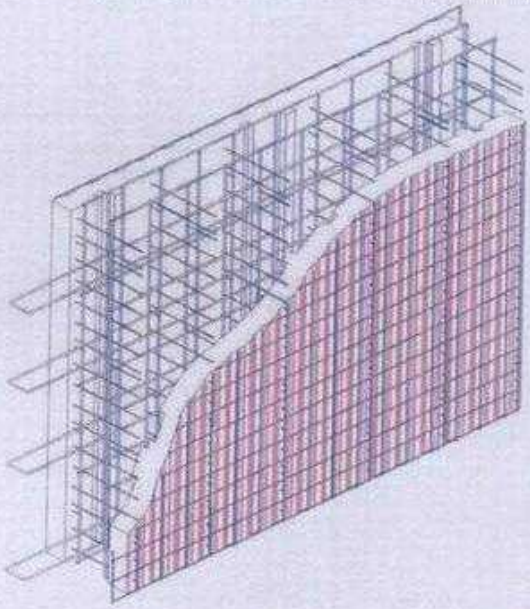
PDM MODULE

- The EMMEDUE panels have a standard module width of mm 1125 (3.7 ft.)
- The high quality of the EMMEDUE panel is assured by the automatic execution of the various processes that intervene in the production, which are in compliance with UNI-EN-ISO 9001:2000 Standards
- On request the panels can be realised with different features (thickness and density of the polystyrene can be varied or pitch and diameter of the wires)

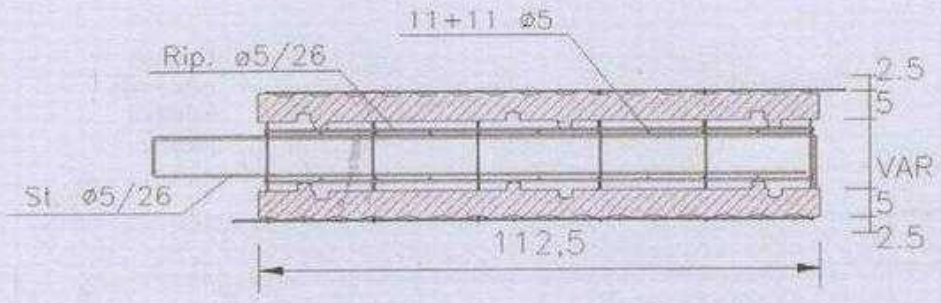


The behaviour of the wall normally leads back to that of a reinforced concrete partition.
Therefore reference can be made to a reinforced concrete partition structure, to which normal project and verification criteria can be applied.

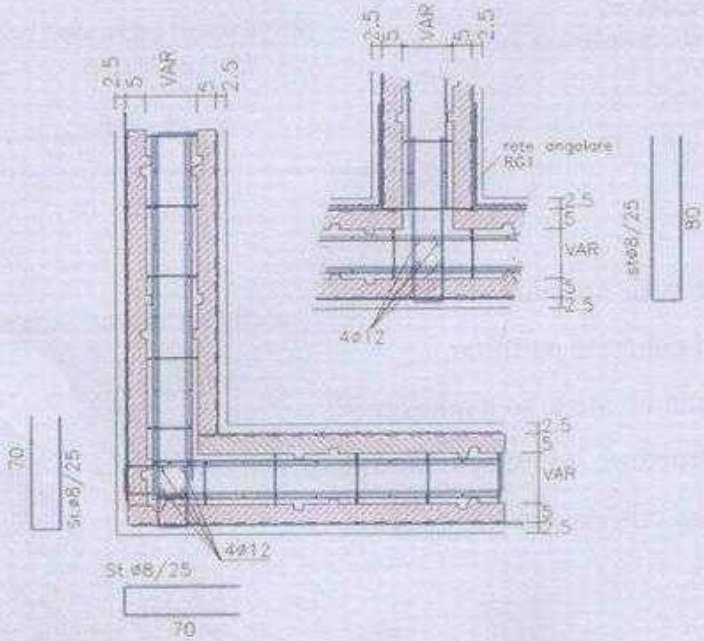
AXONOMETRIC PROJECTION OF THE VERTICAL PANELS



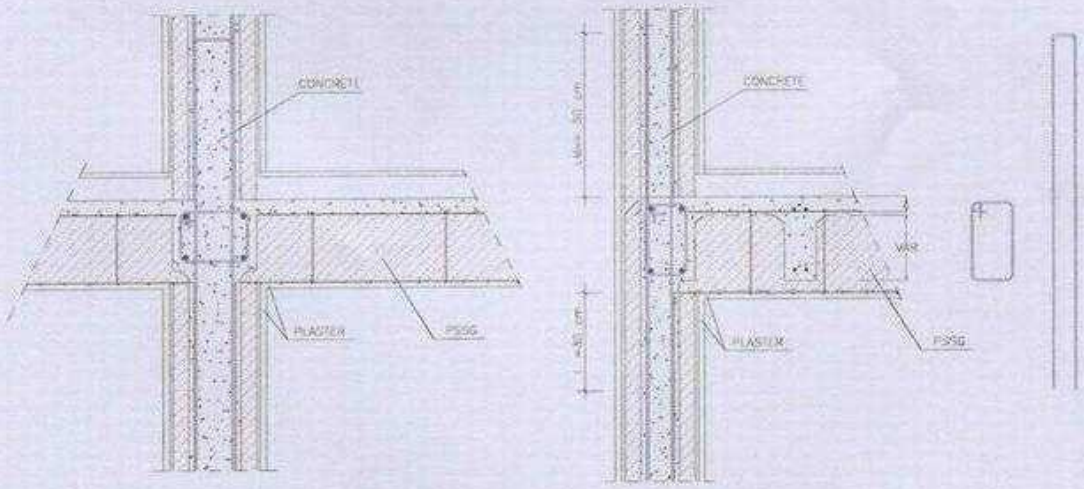
CONSTRUCTION DETAILS



DETAIL OF TYPE OF ANCHORAGE

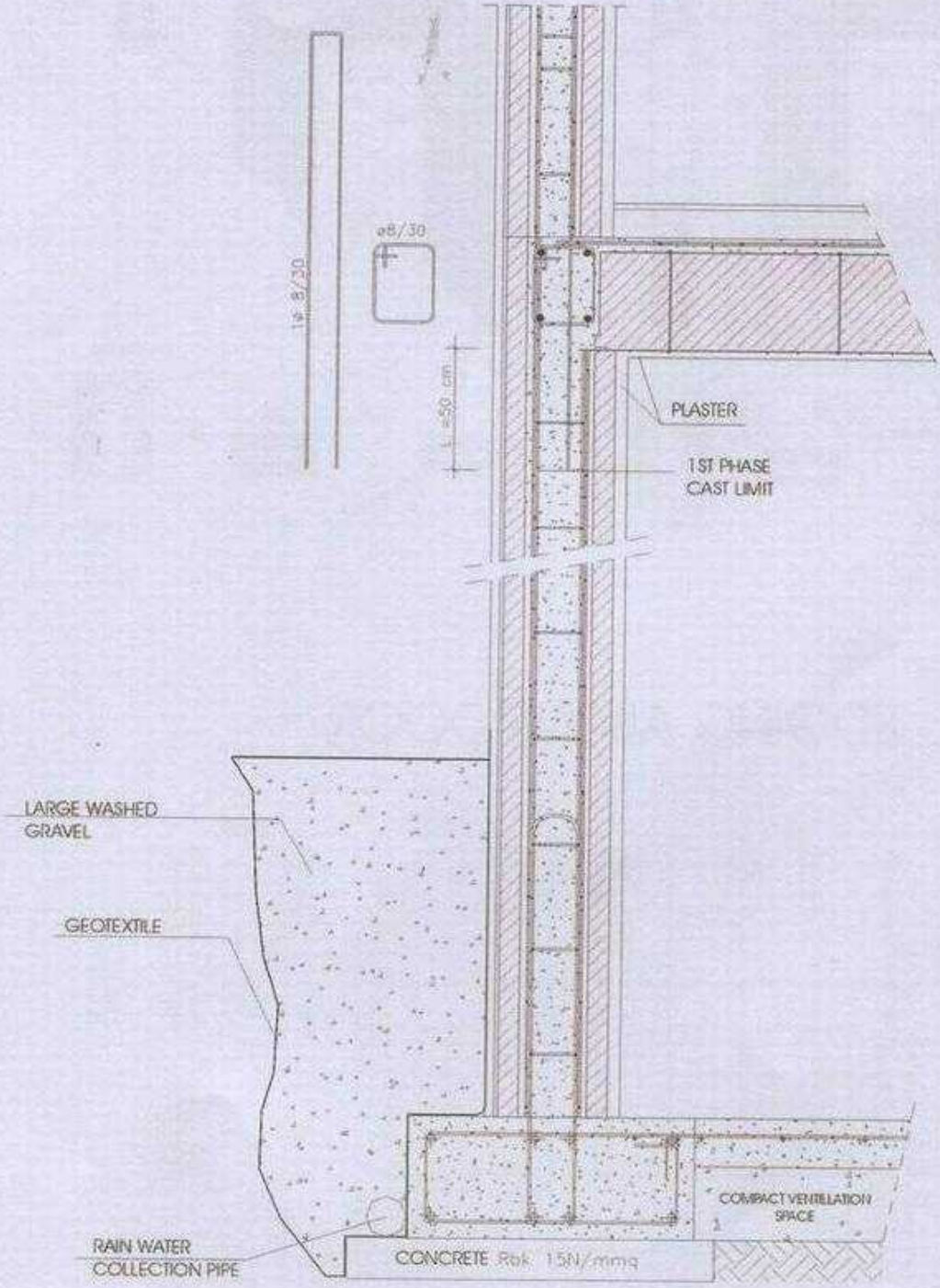


FLOOR PSSG ANCHORING



PDM	Var. internal reinforced concrete thickness.80-200 mm (3.1-7.9 in.) var. finished wall thickness 230-350 mm (9-13.8 in.)	CARD 2.1.4

Wall section and perimeter foundation beam

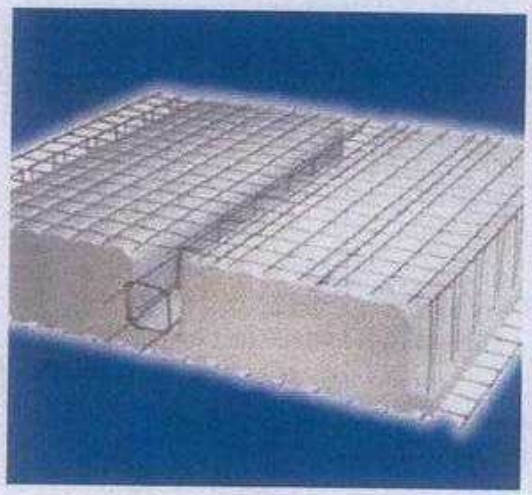


PDM	Var. internal reinforced concrete thickness 80-200 mm (3.1-7.9 in.) var. finished wall thickness 230-350 mm (9-13.8 in.)	CARD 2.1.5

FLOOR USING EMMEDUE FLOOR PANELS

PSSG2 - PSSG3 | **CARD 3.0**

GENERALITIES



EMMEDUE floor panels are used to realise light-weight floors with reinforced concrete support elements. These have noteworthy advantages in terms of lightness, heat isolation and assembly speed.

The panel produced by EMMEDUE is made up of a shaped expanded polystyrene block between two interconnected electro-welded wire meshes.

The panel is used to realise blocks and building coverings with the addition of integrative steel inside the relevant beams and successive casting of concrete on laying.

This panel is a great solution for floors with span up to 8.50 m. (27.9 ft.)

For coverings it is possible to reach a span of 10.20 m (33.5 ft.)

In order to optimise assembly, it is possible to insert C-shaped sheet steel inside the polystyrene which allow the self-support of the floor in the casting phase up to a length of 1.20 m. / 3.9 ft. (2.50 m. / 8.2 ft. for hollow section of steel).

The EMMEDUE floor panels are very useful in seismic areas. In fact, by using light floors, with parity of resistance, there is a reduction of stress transmitted from the horizontal elements to the vertical structures. If, for example, a traditional cement floor is compared with a PSSG2 floor, the latter weighs 33% less.

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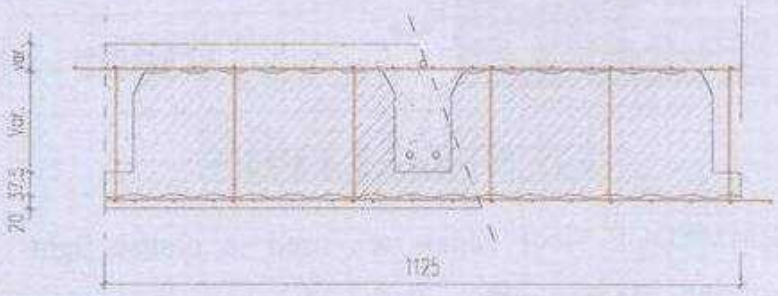
DESCRIPTION OF THE PANELS

Beam interaxis i=560 or 375 mm (1.84 ft. or 1.23 ft.)

Beam width l=100 mm (3.9 in.); these can be modified at the designer's discretion.



Floor height from 120 to 340 mm (4.7 – 13.4 in.)

Maximum span 8.50 m (27.9 ft.)

Thermal transmission co-efficient:

$Kt < 0.366\ W/m^2\ °K$ (min.)

Acoustic insulation index:

$R'_w = 47$ dB value measured in on laying as an experiment

Thermal-acoustic isolation can be easily enlarged with the increase of the thickness or density of the polystyrene

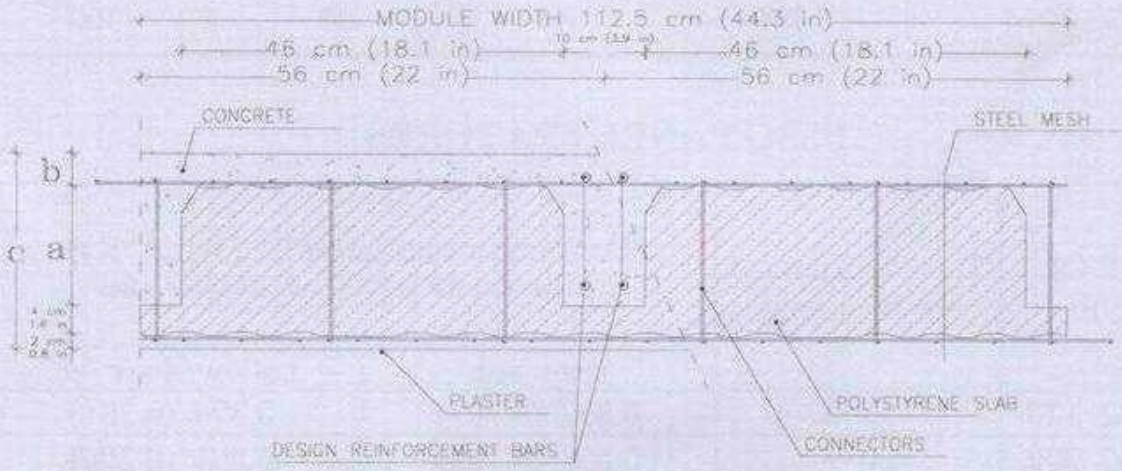
THE EMMEDUE FLOOR PANEL IS FLEXIBLE AND EASY TO WORK WITH:

- It can be adapted to many architectonic requirements
- The tracks can be easily made on the polystyrene surface or, alternatively, the cavities inside the sections can be used.
- Isolation is extremely effective thanks to a continuous layer of polystyrene that allows elimination of heat channels and favours the consequent noteworthy energy saving.
- The panel also functions as a disposable insulating formwork, optimising realisation times and costs.

FLOOR WITH EMMEDUE FLOOR PANELS

PSSG2	Beam width = 100 mm (4 in.) Beam interaxis= 560 mm (22 in.) Var. thickness 120-320 mm (4.7-12.6 in.)	CARD 3.1

The ceilings made with the EMMEDUE PSSG2 floor panels, realise floors and coverings with excellent isolation, resistance and cost performance.
The panel produced by EMMEDUE is made up of shaped expanded polystyrene confined by two inter-connected electro-welded steel meshes. This is completed during laying with the addition of supplementary steel in the relevant beams and successive casting of the concrete.
The job is completed at the intrados with traditional or pre mixed cement based plaster (lime <5% on cement weight).
The floor obtained in this way will form a reinforced concrete ribbed plate with an isolating core of expanded polystyrene.



a = beam height
b = thickness of upper floor member
c = total thickness (a+b+6 cm. / 2.4 in.))

STANDARD PANEL FEATURES:

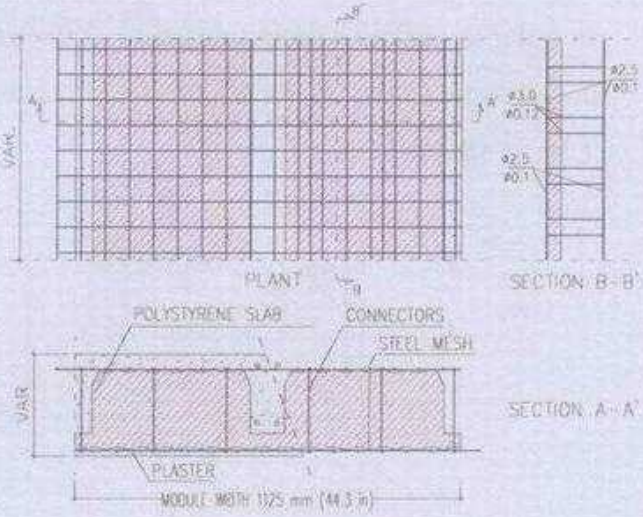
- **Meshes in galvanised steel wires**

- Longitudinal steel wires: Ø 2.5 mm (0.1 in)
- Transversal steel wires: Ø 2.5 mm (0.1 in)
- Steel connection wires: Ø 3.0 mm (0.12 in) - about 68 per m² (about 6/ft²)

- **Steel features:**

- Characteristic yield stress f_{yk} > 600 N/mm² (87023 PSI)
- Characteristic breaking stress f_{tk} > 680 N/mm² (98626 PSI)

- **Polystyrene block density:** 15 Kg/m³ (0.9 pound/ft³)



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PANEL THICKNESS

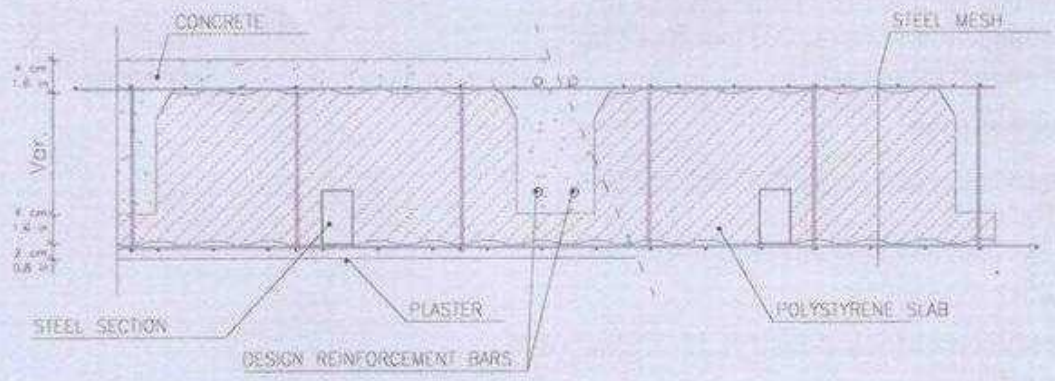
TYPE OF PANEL PSSG2	FLOOR HEIGHT		THICKNESS FROM THE LOWER + PLASTER (mm)	TOTAL THICKNESS (mm)
	hollow blocks	Compression cape		
	h (mm)	s (mm)		
PSSG2 8+4	80	40	60	180
PSSG2 10+4	100	40	60	200
PSSG2 12+4	120	40	60	220
PSSG2 14+4	140	40	60	240
PSSG2 16+4	160	40	60	260
PSSG2 18+4	180	40	60	280
PSSG2 20+4	200	40	60	300

PSSG PANEL FEATURES

TYPE OF PANEL	Total thickness of the floor (cm)	Convection coefficient Kt (W/m^2 °K)* (in brackets the values with stainless steel)	
		beam sec.	hollow block sec.
PSSG2 120	12+4	0.892 (0.797)	0,376 (0.281)
PSSG2 200	20+4	0.858 (0.763)	0,301 (0.206)

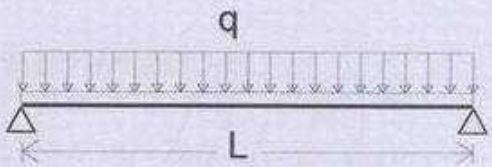
* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

In order to optimise mounting times, it is possible to insert sheet steel sections inside the polystyrene shape. These allow the floor panel to be underpinned with an interaxis of about 2.50 m (8.2 ft.)



CALCULATIONS AND CHECKS OF THE FLOOR PANEL

A series of diagrams and tables useful for designing the floor are shown below.



The calculations and checks have been carried out using the limit state method and the allowable stress method.

Remember when dimensioning the floor that the minimum thickness must be greater than 1/25 of the calculation span and depending on loads, in a way to have deformations compatible with the working conditions of the floor.

MOMENT AND RESISTANT CUT OF A PSSG2

CHECKS AT THE LIMIT STATES

Beam interaxis i =56 cm (22 in.)
Beam width l =10 cm (3.9 in.)
Supposed reinforcement 2+2 Ø12/ beam

TYPE OF FLOOR PANEL	HEIGHT OF FLOOR		*Own weight*	*Ultimate moment of the ind. beam*		*Cut limit of the ind. beam*	
	hollow block h (cm)	floor member s (cm)	(kN/m^2)	MRd+ (kNm)	MRd- (kNm)	VRd1 (kN)	VRd2 (kN)
PSSG2 8+4	8	4	1.70	7.99	-7.01	9.00	43.10
PSSG2 10+4	10	4	1.80	9.59	-8.70	10.40	51.70
PSSG2 12+4	12	4	1.90	11.23	-10.38	11.30	60.40
PSSG2 14+4	14	4	2.00	12.89	-12.05	12.20	69.00
PSSG2 16+4	16	4	2.05	14.51	-13.73	13.00	77.60
PSSG2 18+4	18	4	2.15	16.14	-15.41	13.80	86.30
PSSG2 20+4	20	4	2.25	17.78	-17.09	14.60	94.90

GRAPHICS FOR THE MAXIMUM PRE-DIMENSIONING OF AN EMMEDUE PSSG2E FLOOR PANEL

FLOOR PANEL PSSG2 with reinforcement bars 2+2ø12/joist

These graphics represent a means of carrying out an immediate maximum pre-dimensioning of Emmedue floor panels.

The dimensioning of the floor panel is estimated depending on the calculation span and loads.

The different curves represent the different PSSG2 panel sections. The first number identifies the height of the hollow block in EPS and the second the thickness of the concrete compression cape, considering an additional reinforcement of 2+2 ϕ 12/ beam.

The load refers to a 1m strip of floor and includes its own weight.

The graphics are obtained by referring to a moment in a span of $M = \frac{ql^2}{8}$.

For configurations different to those proposed, the designer must verify the additional reinforcements necessary.

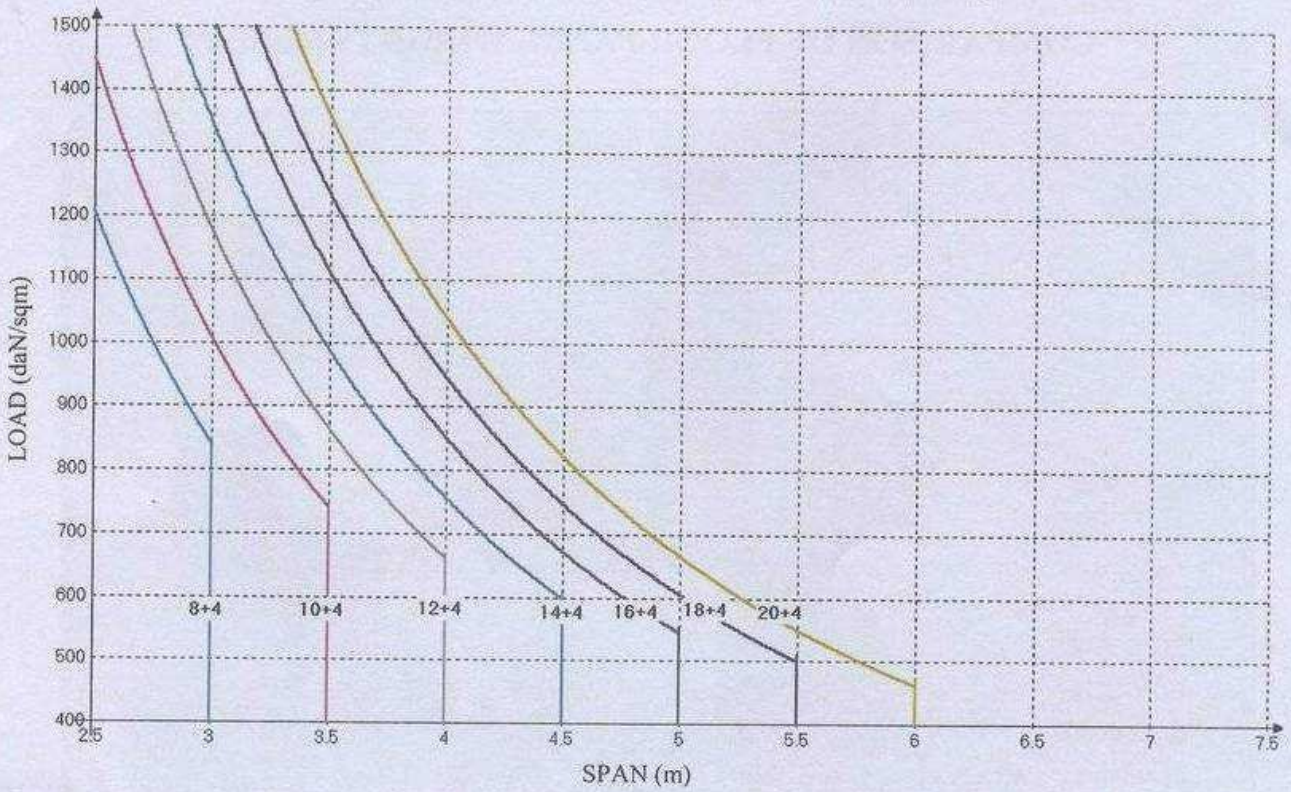
MAXIMUM MOMENT AND CUT OF A PSSG2

CHECKS TO THE ALLOWABLE STRESS

Beam interaxis — i (cm) = 56 (22 in.)
Beam width — l (cm) = 10 (3.9 in.)
Check carried out with reinforcement — 2+2Ø12
Values for a strip of flooring of 1 m

TYPE OF FLOOR PANEL	HEIGHT OF FLOOR		Own Weight	M_{max}	T_{max}
	hollow block	floor member			
	h (cm)	s (cm)	(daN/m^2)	(daNm)	(daN)
PSSG2 8+4	8	4	173	944	964
PSSG2 10+4	10	4	183	1133	1157
PSSG2 12+4	12	4	193	1322	1350
PSSG2 14+4	14	4	203	1511	1543
PSSG2 16+4	16	4	213	1700	1736
PSSG2 18+4	18	4	223	1889	1929
PSSG2 20+4	20	4	233	2078	2121

FLOOR PANEL PSSG2 with reinforcement bars 2+2ø12/joist



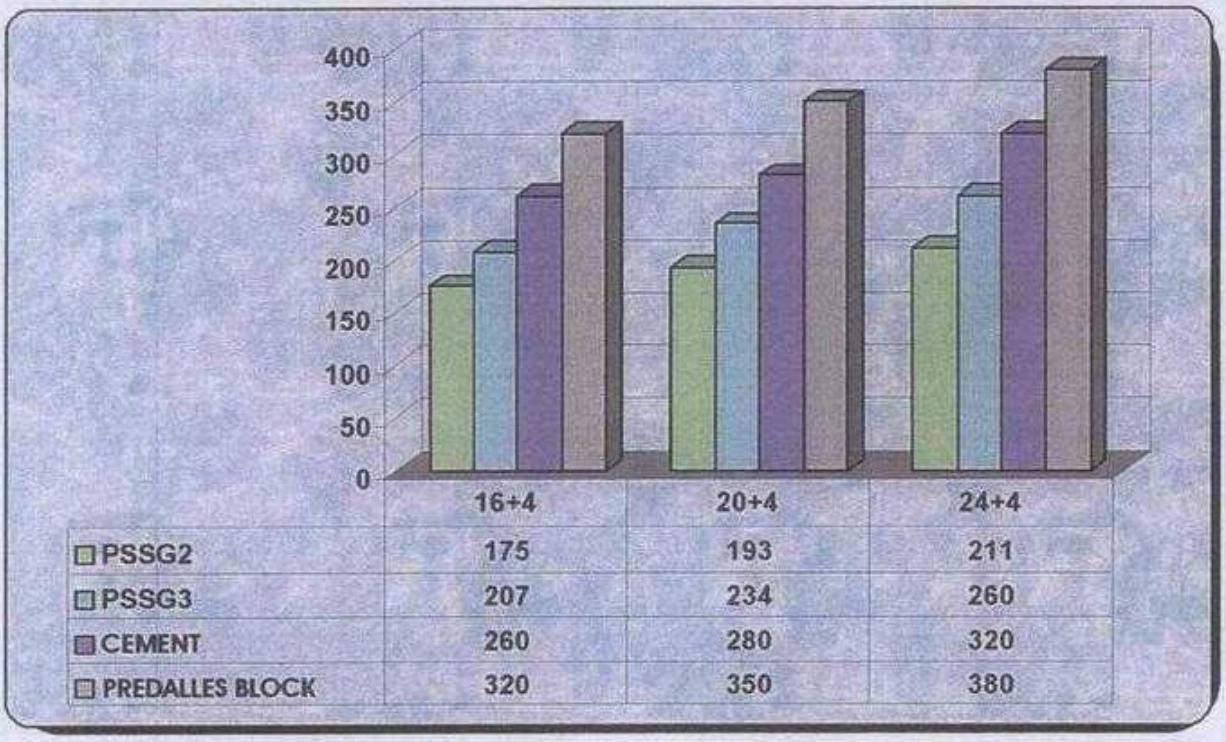
CALCULATION OF THE MAXIMUM LOADS AT THE ALLOWABLE STRESSES

PSSG2 floors	Mmax in daNm	load Q (daN/m²)	SPAN L (m) 2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00
PSSG2 20+4	2078		2660	1847	1357	1039	821	665	550	462
PSSG2 18+4	1889		2418	1679	1234	945	746	604	500	420
PSSG2 16+4	1700		2176	1511	1110	850	672	544	450	378
PSSG2 14+4	1511		1934	1343	987	756	597	484	400	336
PSSG2 12+4	1322		1692	1175	863	661	522	423	350	294
PSSG2 10+4	1133		1450	1007	740	567	448	363	300	252
PSSG2 8+4	944		1208	839	616	472	373	302	250	210

LIGHTER FLOORS

The EMMEDUE floor panel is a very good solution in seismic areas thanks to its much lower weight with respect to traditional floor panels. In fact, the seismic intensity is proportional to the weight of the construction: by using lightweight panels, with equal resistance, there is a reduction of stress transmitted by the ceilings to the vertical structures. If, for example, a traditional cement floor is compared with a PSSG2 floor, the latter weighs 33% less (see relative graphics).

COMPARISON OF FLOOR PANEL WEIGHTS (daN/m²)



	16+4	20+4	24+4
PSSG2	175	193	211
PSSG3	207	234	260
CEMENT	260	280	320
PREDALLES BLOCK	320	350	380

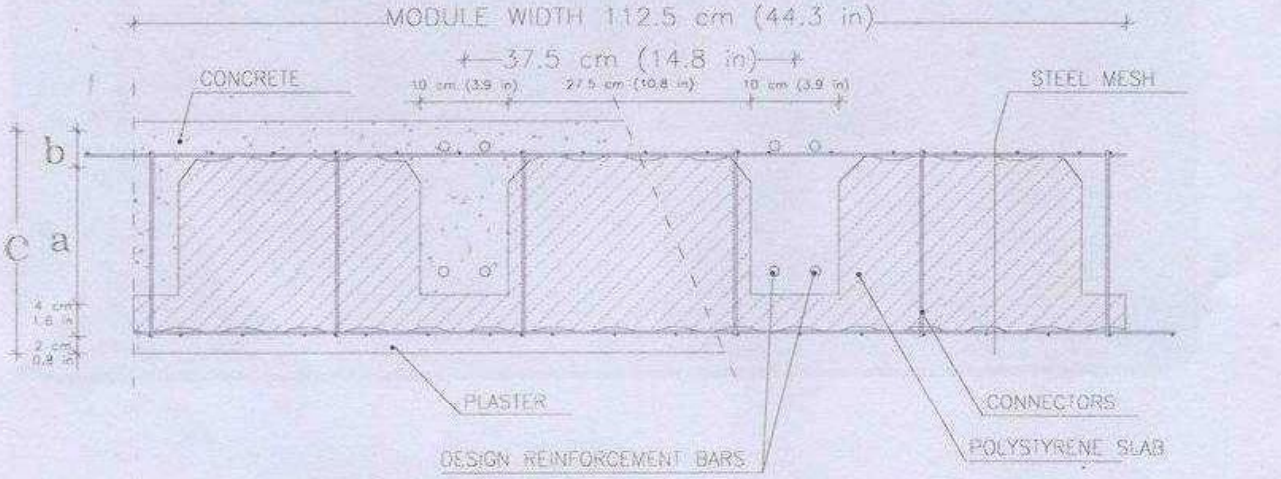
COMPARISON OF FLOOR PANEL WEIGHTS ON SITE (daN/m^2)

	16+4	20+4	24+4
PSSG2	14	15	16
PSSG3	14	15	16
CEMENT	150	190	210
PREDALLES BLOCK	110	110	110

FLOOR WITH EMMEDUE FLOOR PANELS

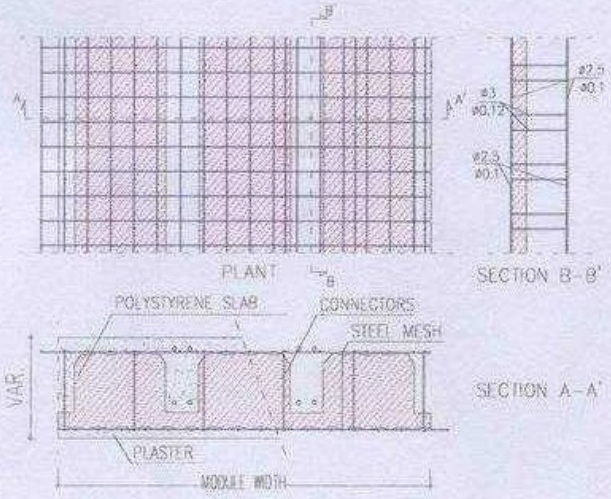
PSSG3	Beam width= 100 mm (4 in.) Beam interaxis= 375 mm (14.8 in.) Var. thickness 120-340 mm (4.7-13.4 in.)	**CARD 3.2**

The ceilings made with the EMMEDUE PSSG3, floor panels, realise floors and coverings with excellent isolation, resistance and cost performance.
The panel produced by EMMEDUE is made up of shaped expanded polystyrene confined by two inter-connected electro-welded steel meshes. This is completed during laying with the addition of supplementary steel in the relevant beams and successive casting of concrete.
The job is completed at the intrados with classical plastering or plasterboard finishing.
The floor obtained in this way will form a reinforced concrete ribbed plate with an isolating core of expanded polystyrene.



a = beam height
b = thickness of upper floor member
c = total thickness (a+b+6 cm. / 2.4 in.)

STANDARD PANEL FEATURES:



- **Meshes in galvanised steel wires**

- Longitudinal steel wires: Ø 2.5 mm (0.1 in)
- Transversal steel wires: Ø 2.5 mm (0.1 in)
- Steel connection wires: Ø 3.0 mm (0.12 in) - about 68 per m² (about 6/ft²)

- **Steel features:**

- Characteristic yield stress $f_{yk} > 600$ N/mm² (87023 PSI)
- Characteristic breaking stress $f_{tk} > 680$ N/mm² (98626 PSI)

- **Polystyrene block density:** 15 Kg/m³ (0.9 pound/ft³)

Panels can be realised with features that differ from standard panels
(thickness and density of the polystyrene can vary or the pitch and diameter of the wires)

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PANEL THICKNESS

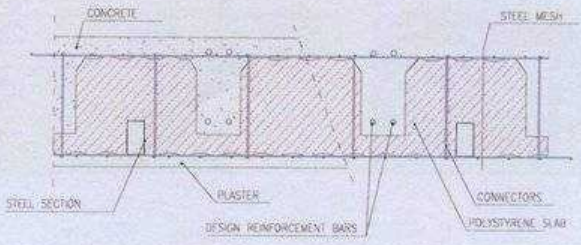
TYPE OF PANEL PSSG3	FLOOR HEIGHT		THICKNESS OF THE LOWER + PLASTER (mm)	TOTAL THICKNESS (mm)
	hollow block	compr. cape		
	h (mm)	s (mm)		
PSSG3 12+4	120	40	60	220
PSSG3 14+4	140	40	60	240
PSSG3 16+4	160	40	60	260
PSSG3 18+4	180	40	60	280
PSSG3 20+4	200	40	60	300
PSSG3 22+4	220	40	60	320
PSSG3 24+4	240	40	60	340
PSSG3 26+4	260	40	60	360

PSSG3 PANEL FEATURES

TYPE OF PANEL	Total thickness of the floor (cm)	Convection coefficient Kt (W/m^2 °K)* (in brackets the values with stainless steel)	
		beam sec.	hollow block sec.
PSSG3 120	12+4	0.892 (0.797)	0,376 (0.281)
PSSG3 200	20+4	0.858 (0.763)	0,301 (0.206)

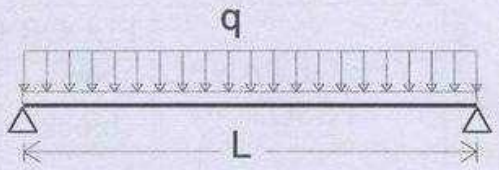
* Thermo-hygrometric verifications, following UNI EN ISO 6946 de 1999

In order to optimise mounting times, it is possible to insert sheet steel sections inside the polystyrene shape. These allow the floor panel to be underpinned with an interaxis of about 2.50 m (8.2 ft.)



CALCULATIONS AND CHECKS OF THE FLOOR PANEL

A series of diagrams and tables useful for designing the floor are shown below.



The calculations and checks have been carried out using the limit state method and the allowable stress method.

Remember when dimensioning the floor that the minimum thickness must be greater than 1/25 of the calculation span and depending on loads, in a way to have deformations compatible with the working conditions of the floor.

MOMENT AND RESISTANT CUT OF A PSSG3E

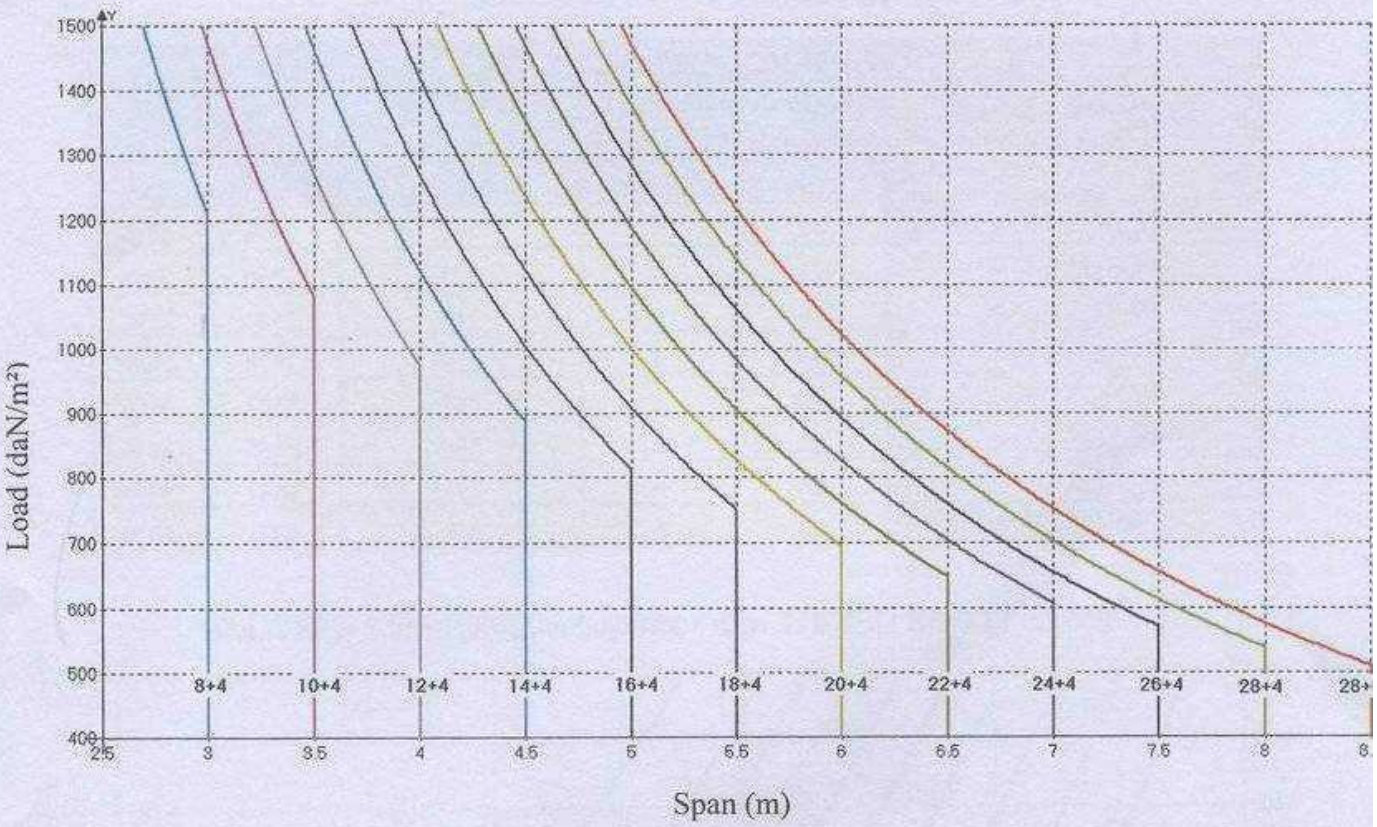
CHECKS AT THE LIMIT STATES

Beam interaxis i = 37.5 cm (14.8 in.)
Beam width l = 10 cm (4 in.)
Supposed reinforcement 2+2 Ø12/ joist

TYPE OF FLOOR PANEL	HEIGHT OF FLOOR		Own weight	Ultimate moment of the ind. beam		Cut limit of the ind. beam	
	hollow block	floor member		MRd+	MRd-	VRd1	VRd2
	h (cm)	s (cm)	(daN/m²)	(daNm)	(daNm)	(daN)	(daN)
PSSG3 12+4	12	4.00	215	1097	-1038	1130	6040
PSSG3 14+4	14	4.00	225	1262	-1205	1220	6900
PSSG3 16+4	16	4.00	240	1429	-1373	1300	7760
PSSG3 18+4	18	4.00	255	1597	-1541	1380	8630
PSSG3 20+4	20	4.00	265	1762	-1709	1460	9490
PSSG3 22+4	22	4.00	280	1926	-1875	1540	10350
PSSG3 24+4	24	4.00	290	2091	-2042	1610	11210
PSSG3 26+4	26	4.00	300	2257	-2209	1680	12080

GRAPHICS FOR THE MAXIMUM PRE-DIMENSIONING OF AN EMMEDUE PSSG3 FLOOR PANEL

PSSG3 FLOOR HEIGHT with additional reinforcement 2Ø12/ joist



These graphics represent a means of carrying out an immediate maximum pre-dimensioning of Emmedue floor panels.

The dimensioning of the floor panel is estimated depending on the calculation span and loads.

The different curves represent the different PSSG3 panel sections. The first number identifies the height of the hollow block in EPS and the second the thickness of the concrete floor member, considering an additional reinforcement of 2+2Ø12/ joist.

The load refers to a 1 m (3.3 ft.) strip of floor and includes its own weight.

The graphics are obtained by referring to a moment in a span of $M = \frac{ql^2}{8}$.

For configurations different to those proposed, the designer must verify the additional reinforcements necessary.

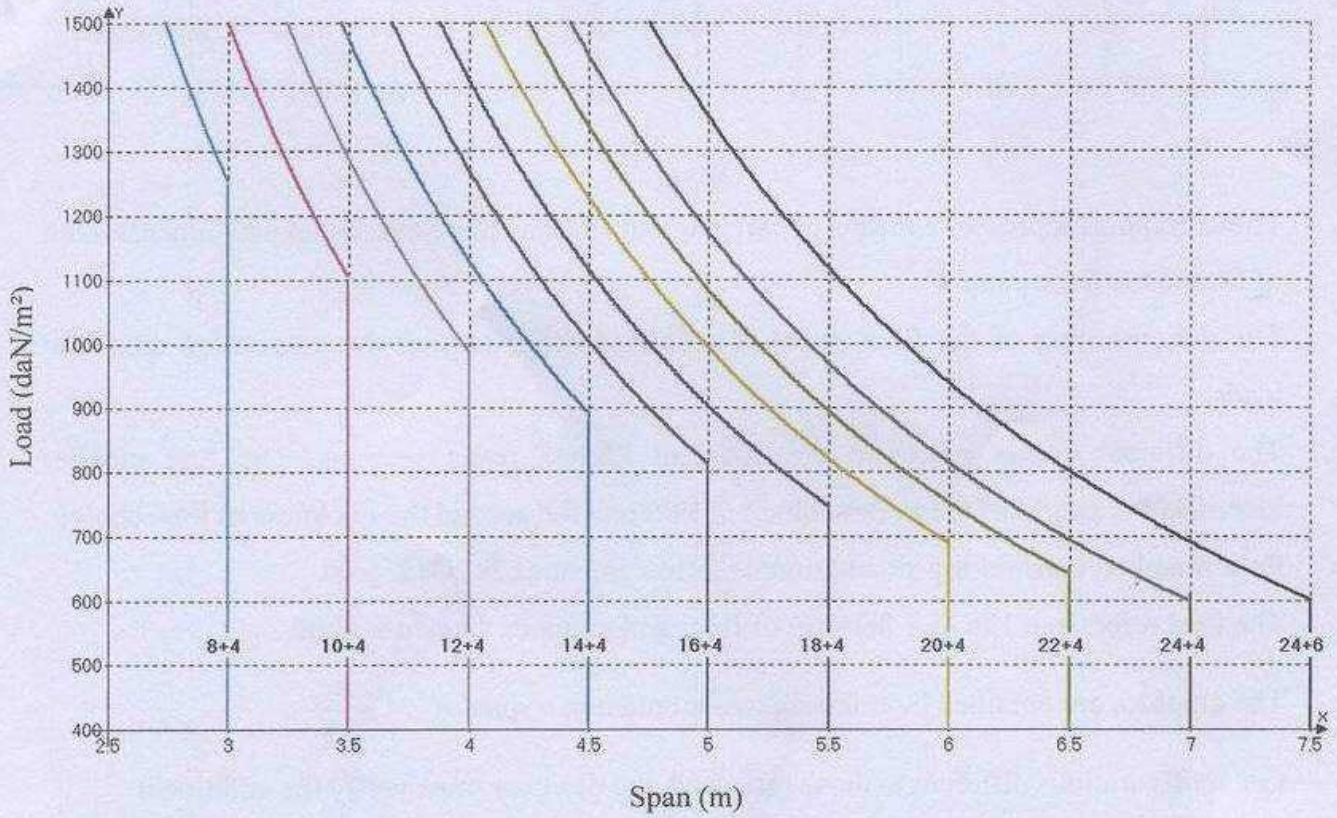
MAXIMUM MOMENT AND CUT OF A PSSG3

CHECKS TO THE ALLOWABLE STRESS

Beam interaxis	i = 37.5 cm. (14.8 in.)
Beam width	l = 10 cm. (4 in.)
Reinforcement	2+2Ø12
Values for a strip of flooring of 1 m	

TYPE OF FLOOR PANEL	HEIGHT OF FLOOR		Own Weight	M_{max}	T_{max}
	hollow block	compr. cape			
	h (cm)	s (cm)	(daN/m^2)	(daNm)	(daN)
PSSG3 12+4	12	4	215	1974	2016
PSSG3 14+4	14	4	225	2256	2304
PSSG3 16+4	16	4	240	2538	2592
PSSG3 18+4	18	4	255	2820	2880
PSSG3 20+4	20	4	265	3103	3168
PSSG3 22+4	22	4	280	3385	3456
PSSG3 24+4	24	4	290	3667	3744
PSSG3 24+6	26	6	340	4231	4320

PSSG3 FLOOR HEIGHT with additional reinforcement 2+2Ø12/ joist



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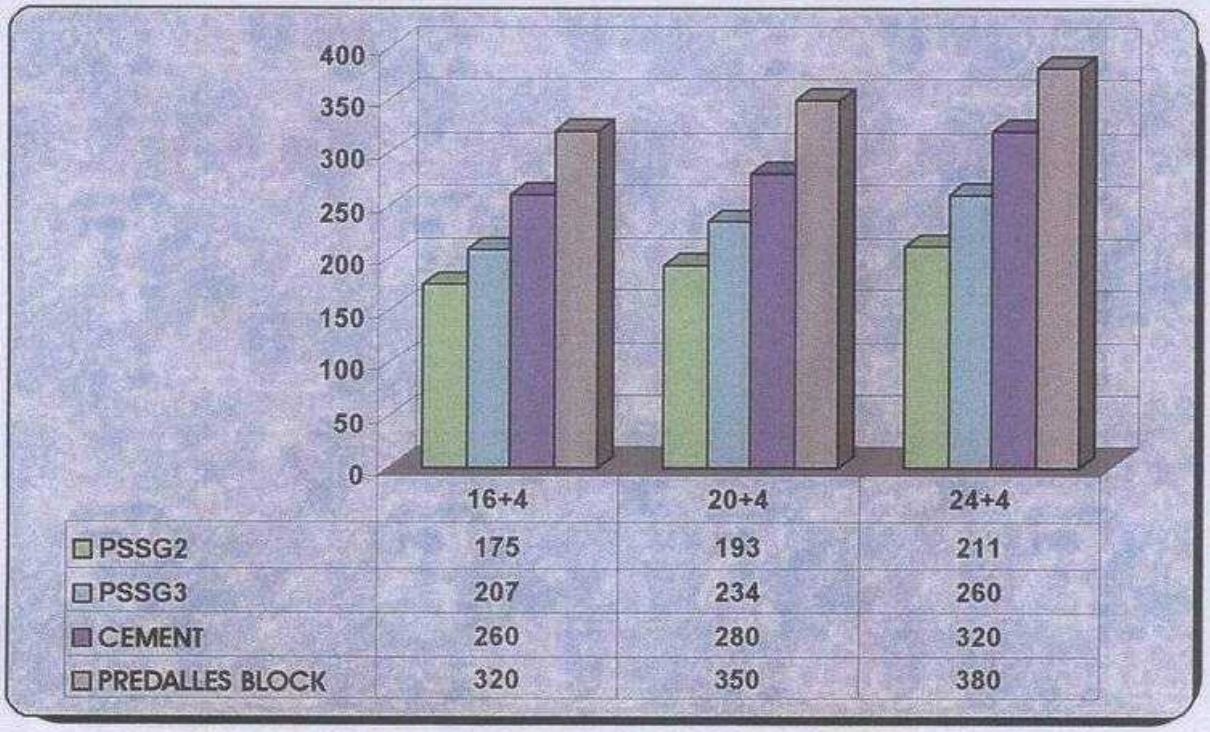
floor panels PSSG3	Mmax in daNm	load Q (daN/m²) Q=M*8/L²	SPAN L (m) 2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
PSSG3 24+6	4231		5415	3760	2763	2115	1671	1353	1118	940	801	690	601
PSSG3 24+4	3667		4694	3260	2395	1834	1449	1173	970	815	694	599	522
PSSG3 22+4	3385		4333	3009	2211	1693	1337	1083	895	752	641	553	481
PSSG3 20+4	3103		3972	2758	2026	1552	1226	993	821	690	588	507	441
PSSG3 18+4	2820		3610	2507	1842	1410	1114	902	746	627	534	460	401
PSSG3 16+4	2538		3249	2256	1657	1269	1003	812	671	564	481	414	361
PSSG3 14+4	2256		2888	2005	1473	1128	891	722	597	501	427	368	321
PSSG3 12+4	1974		2527	1755	1289	987	780	632	522	439	374	322	281

LIGHTER FLOORS

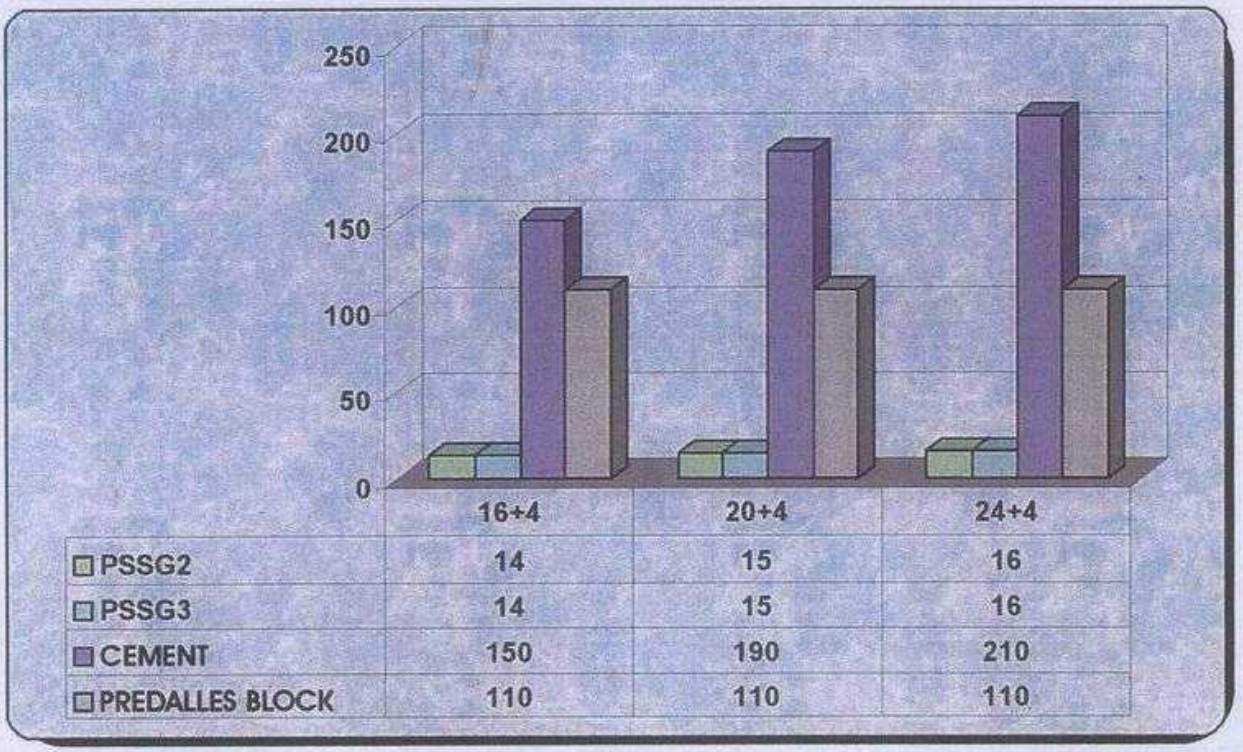
The EMMEDUE floor panel is a very good solution in seismic areas thanks to its much lower weight with respect to traditional floor panels. In fact, the seismic intensity is proportional to the weight of the construction: by using lightweight panels, with equal resistance, there is a reduction of stress transmitted by the ceilings to the vertical structures. If, for example, a traditional cement floor is compared with a PSSG3 floor, the latter weighs 33% less (see relative graphics).

COMPARISON OF FLOOR PANEL WEIGHTS (daN/m²)



	16+4	20+4	24+4
PSSG2	175	193	211
PSSG3	207	234	260
CEMENT	260	280	320
PREDALLES BLOCK	320	350	380

COMPARISON OF FLOOR PANEL WEIGHTS ON SITE (daN/m^2)



	16+4	20+4	24+4
PSSG2	14	15	16
PSSG3	14	15	16
CEMENT	150	190	210
PREDALLES BLOCK	110	110	110

STAIRCASE WITH EMMEDUE STAIRCASE PANEL

	PSSC	CARD 4.0

GENERALITIES

The staircase realised with EMMEDUE panels consists in a block of expanded polystyrene, relevantly shaped according to design requirements and reinforced with a double steel mesh, which is joined to the polystyrene by many electro-fusion welded steel wire sewing.
In the laying phase the EMMEDUE staircase panel is relatively reinforced by the introduction of ribbed bar framework into the appropriate spaces, which will then be successively filled with concrete.

The staircase panel has a standard maximum width of 1200 mm (3.9 ft.), but larger staircases can be realised by assembling several modules.
The staircases realised using EMMEDUE panels have high resistance and are optimal for restructuring and generally in all situations in which the weight factor is determinant.
Thanks to the EMMEDUE staircase panel the support structure and the shape of all steps can be realised quickly in a unique phase. Therefore, construction costs are greatly contained thanks to speed of execution.

DESCRIPTION OF THE PANELS

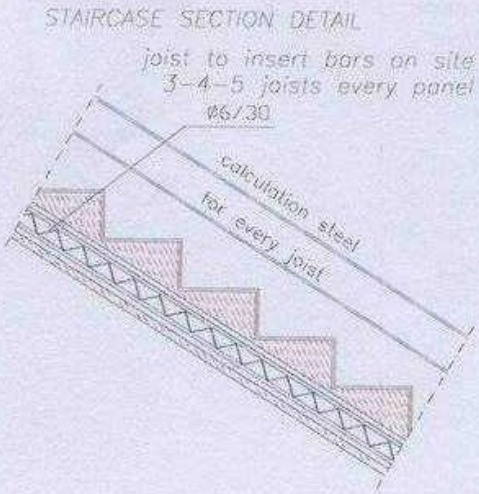
- **Mesh in galvanised steel wire**

- Longitudinal steel wires: Ø 2.5 mm (0.1 in)
- Transversal steel wires: Ø 2.5 mm (0.1 in)
- Steel connection wires: Ø 3.0 mm (0.12 in)

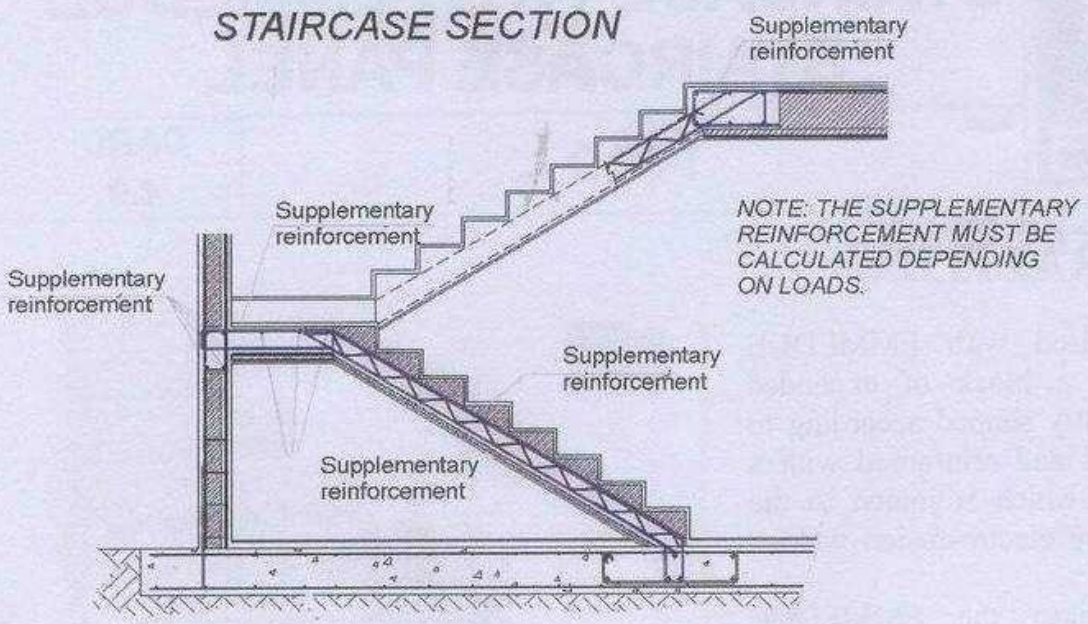
- **Steel features:**

- Characteristic yield stress $f_{yk} > 600$ N/mm² (87023 PSI)
- Characteristic breaking stress $f_{tk} > 680$ N/mm² (98626 PSI)

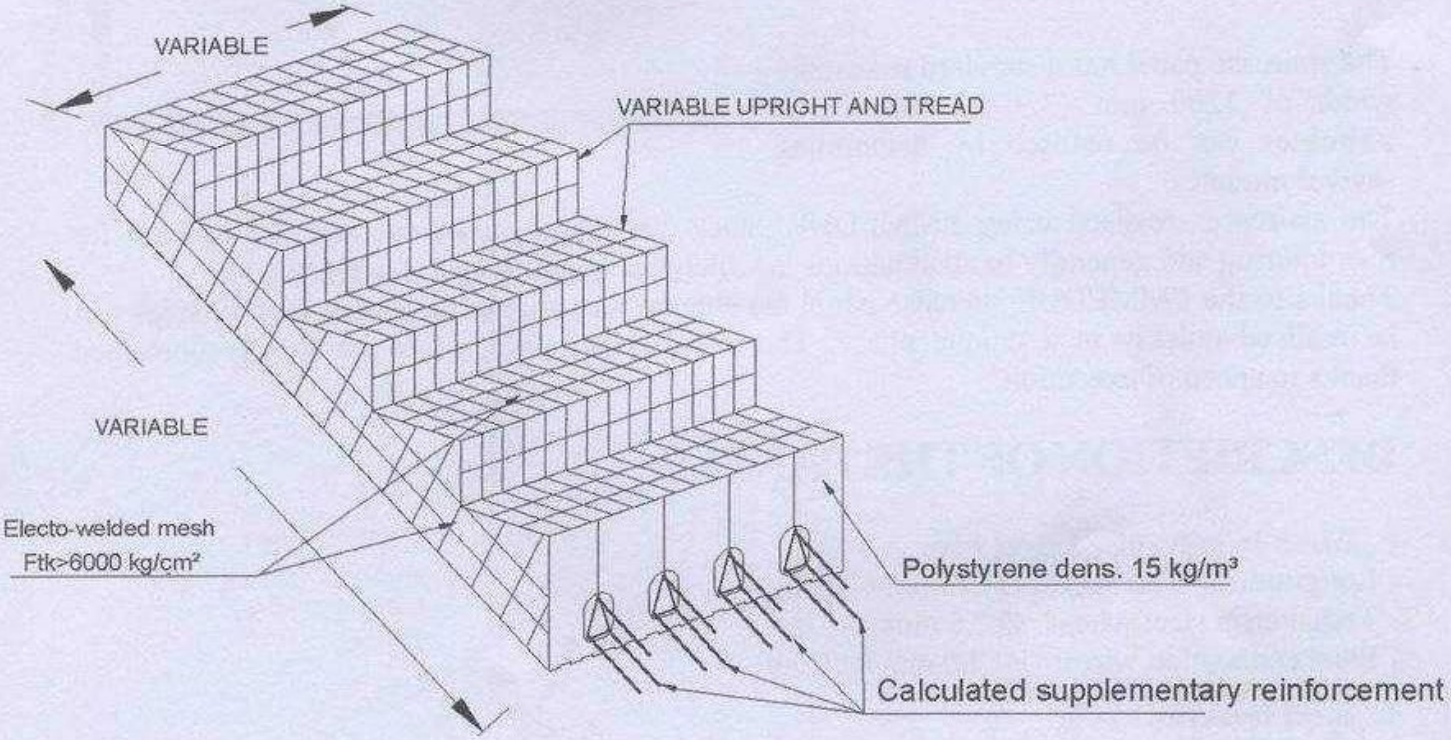
- **Polystyrene block density:** 15 Kg/m³ (0.9 pound/ft^3)

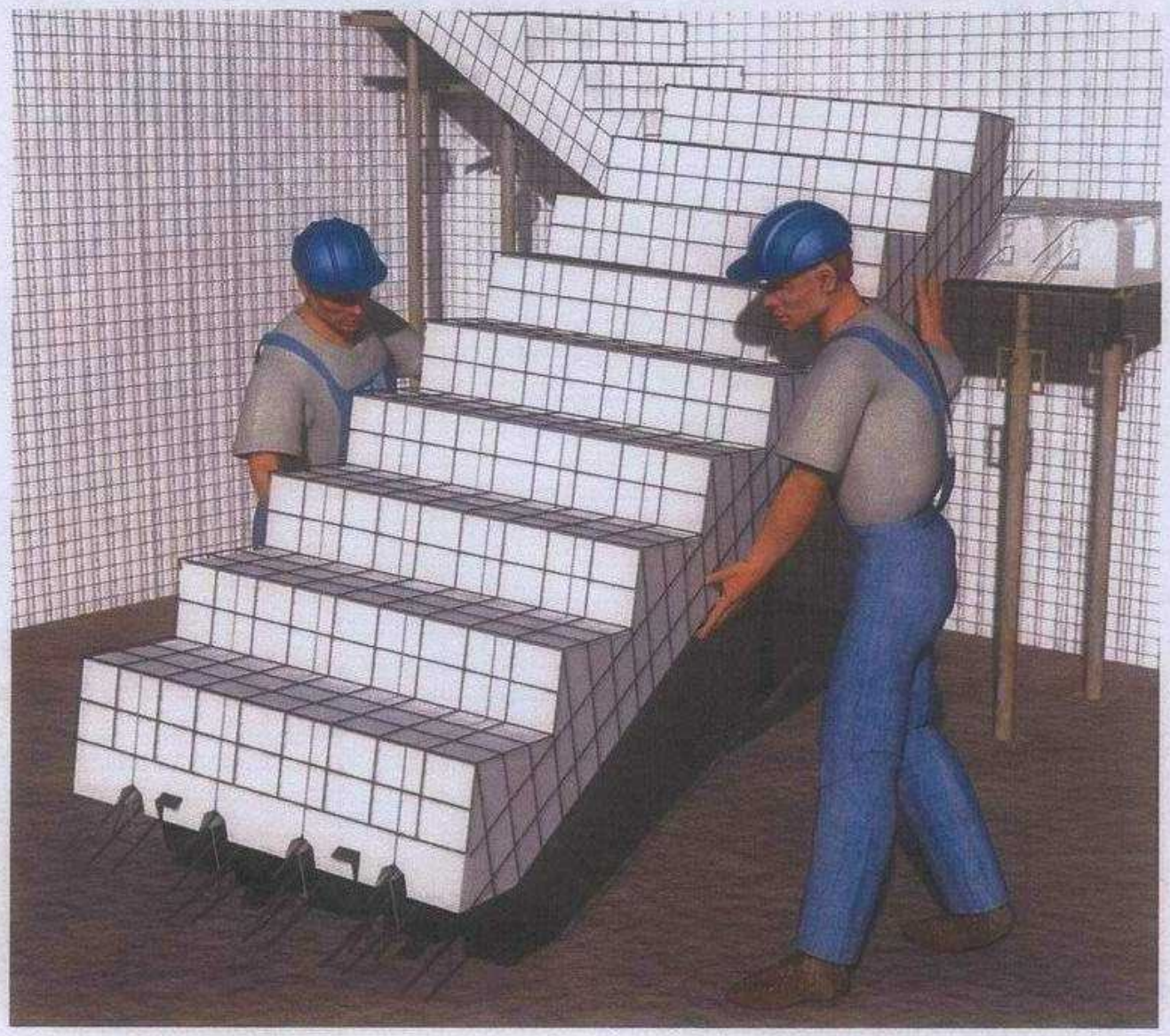


STAIRCASE SECTION



STAIRCASE PANEL DETAIL





- The high quality of the EMMEDUE panel is assured by the automatic execution of the various processes that intervene in the production, which are in compliance with UNI-EN-ISO 9001:2000 Standards
- On request the panels can be realised with different features (thickness and density of the polystyrene can be varied or pitch and diameter of the wires)

ADVANTAGES OF THE PANELS

CARD 5.0

w w w . m d u e . i t - i n f o @ m d u e . i t
EMMEDUE S.p.A. Via Toniolo 39 B – Z.I. Bellocchi – 61032 FANO (PU) ITALY – Tel. ++39 0721 855650/1 – Fax ++39 0721 854030

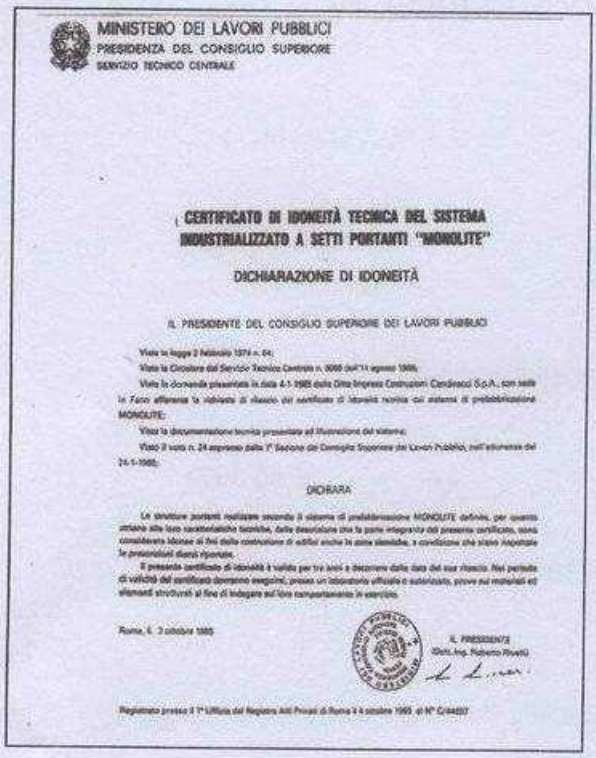
⇒ HIGH RESISTANCE

The support features of EMMEDUE panels have been determined by experiments and through tests run generally up to breakage, in a way to identify the "last" resistances of the structure.
On the basis of data obtained in this way, and by adopting precautionary values of the safety co-efficient on breakage, experimental values of the maximum working resistances have been obtained. These are used to base the static design of the structure realised using the panels.

CERTIFICATIONS

The first *Certificate of Technical Suitability* was issued in Italy in 1985 by the Department of the Environment, with a favourable opinion issued by I Section of the Governing Council of Public Works. In this seat, the support structures of our building system have been considered suitable for building in seismic areas.
The results of the tests are summarised successively in reference to the different types of stress.

The prescribed and necessary tests for attainment of the various certificates of suitability obtained by EMMEDUE technology were carried out in laboratories and prestigious institutes such as the University of Melbourne and Deakin (Australia), the University of Padoa, the University of Perugia and the Istituto Giordano (Italy), The Instituto Messicano del Concreto y del Cemento (Mexico), the Instituto de investigaciones y Ensayos de Materiales (Chile), the Instituto del Cemento Pórtland argentino (Argentina) and the Instituto de Pesquisas Tecnológicas – São Paulo (Brazil).



MINISTERO DEI LAVORI PUBBLICI
PRESIDENZA DEL CONSIGLIO SUPERIORE
SERVIZIO TECNICO CENTRALE

CERTIFICATO DI IDONEITÀ TECNICA DEL SISTEMA INDUSTRIALIZZATO A SETTI PORTANTI "MONOLITE"

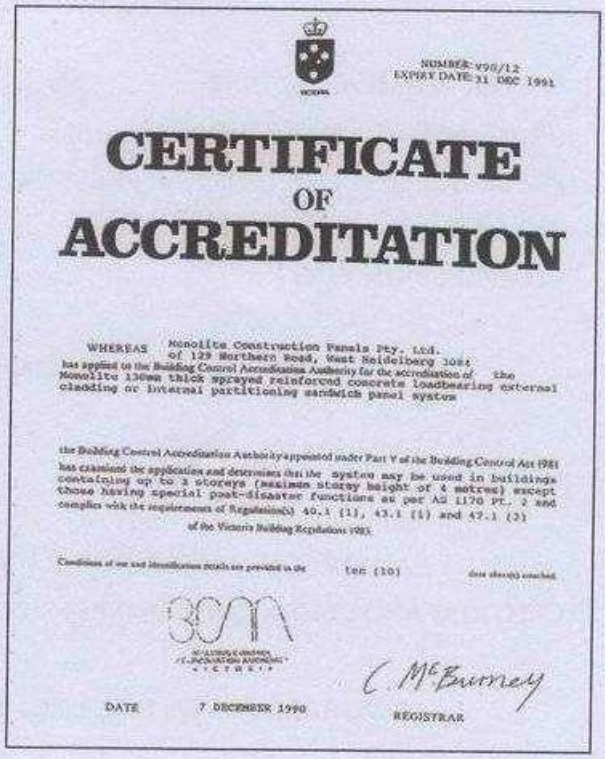
DICHIARAZIONE DI IDONEITÀ

IL PRESIDENTE DEL CONSIGLIO SUPERIORE DEI LAVORI PUBBLICI

DICHIARA

Roma, 6 ottobre 1985

IL PRESIDENTE
(Dott. Ing. Roberto Rivetti)



NUMBER: V90/12
EXPIRY DATE: 31 DEC 1991

CERTIFICATE OF ACCREDITATION

WHEREAS Monolite Construction Panels Pty. Ltd. of 129 Northern Road, West Heidelberg 3081 has applied to the Building Control Accreditation Authority for the accreditation of the Monolite 130mm thick sprayed reinforced concrete loadbearing external cladding or internal partitioning sandwich panel system

the Building Control Accreditation Authority appointed under Part V of the Building Control Act 1981 has examined the application and determines that the system may be used in buildings containing up to 2 storeys (maximum storey height of 4 metres) except those having special post-disaster functions as per AS 1170 Pt. 2 and complies with the requirements of Regulation(s) 40.1 (1), 43.1 (1) and 47.1 (2) of the Victoria Building Regulations 1983.

Conditions of use and identification details are provided in the ten (10) days sheets attached.

DATE 7 DECEMBER 1990

REGISTRAR

LIST OF TESTS AND RELATIVE STANDARDS

MEXICO- MEXICAN INSTITUTE OF CEMENT AND CONCRETE

COMPRESSION TEST	ASTM E72-80
SHEAR TEST	ASTM E519-81
STATIC LOAD FOR RESISTANCE TO CUTTING THE WALL SURFACE (RACKING SHEAR) FOR BUILDINGS	ASTM E564-86
INFLAMMABILITY FEATURES OF CONSTRUCTION MATERIALS	ASTM E84-87

CHILE – INSTITUTE OF RESEARCH AND MATERIAL TESTS

SOFT BODY IMPACT	NCH 804 EOF 71
ECCENTRIC COMPRESSION	NCH 801 EOF 71
HORIZONTAL LOAD (MONOTONIC) RISING AND CYCLIC	NCH 802 EOF 71
FLOOR SUPPORTED ON THE FOUR EDGES FIRE RESISTANCE OF THE WALL	NCH 935/1
FIRE RESISTANCE OF THE FLOOR	NCH 935/1

AUSTRALIA – DEAKIN UNIVERSITY

WATER PERMEANCE TEST (Permeability of water on exposure to storms)	ASTM E514-74
PRESSURE TEST FOR LATERAL PRESSURES AIR BAG	s/ AS 3600
COMPRESSION TEST	ASTM E72-80

AUSTRALIA – CONNEL WAGNER INSTITUTE

BEND TEST	s/ AS 3600

AUSTRALIA – MELBOURNE UNIVERSITY – Civil Engineering Dept.

CENTRED AND ECCENTRIC COMPRESSION

AUSTRALIA – Csiro División Of Building Construction and Engineering

FIRE RESISTANCE	AS 1530

PHILLIPINES - UNIVERSITY OF THE PHILLIPINES – Building Research Service

COMPRESSION TEST	ASTM E72-80
SHEAR TEST	ASTM E519-81

ITALY– UNIVERSITY OF PERUGIA – FACOLTY OF ENGINEERING

COMPRESSION TEST
BEND TEST
SHEAR TEST
SEISMIC TEST

ITALY – UNIVERSITY OF PADOA – FACULTY OF ENGINEERING

COMPRESSION TEST	
BEND TEST	
SHEAR TEST	
TENSILE TEST OF ELECTRO-WELDED MESHES	
DETACHMENT TEST OF THE WELDED MESH NODE	UNI ISO 10-287

ITALY – ISTITUTO GIORDANO

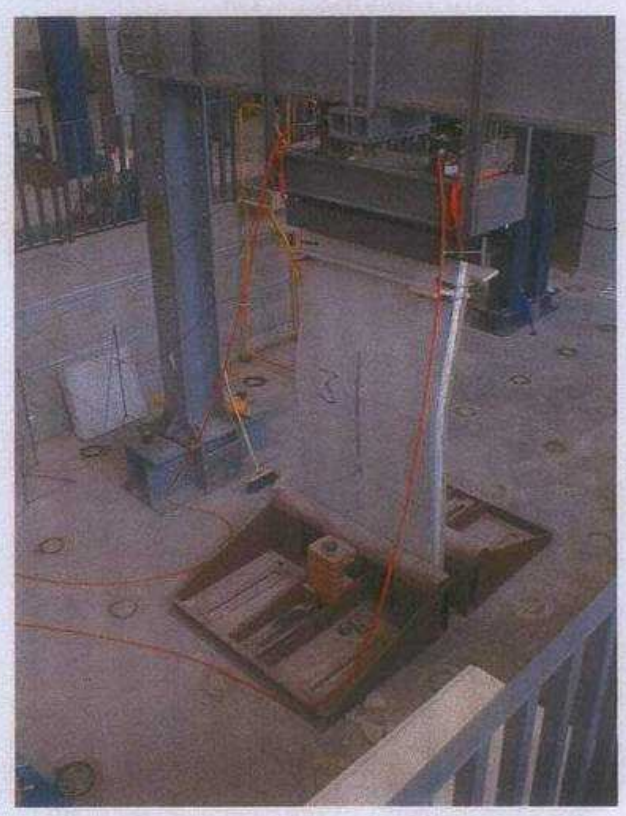
PROVA DI TRASMITTENZA TÉCNICA UNITARIA	ASTM C 236
SOUND INSULATION TEST	
FIRE RESISTANCE TEST	CIRC. 91
SOFT BODY IMPACT TEST	ICITE 3.1.2.1.
VERTICAL ECCENTRIC LOAD	ICITE 3.1.3.

BRASIL – INSTITUTO DE PESQUISAS TECNOLÓGICAS

RESISTANCE TO HORIZONTAL LOADS	ME 45/81
SOFT BODY IMPACT TEST	ME 43/81
FIRE RESISTANCE	
THERMAL STRESS	
ACOUSTIC INSULATION	
RESISTANCE TO THE DEVELOPMENT OF FUNGI	

SUMMARY OF THE MOST SIGNIFICANT RESULTS

1. CENTRED AND ECCENTRIC COMPRESSION



A large number of tests have been carried out on panels with different thicknesses and heights, the results are shown below:

Centred compression

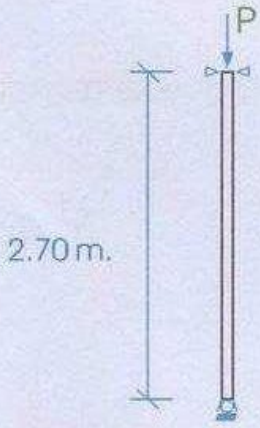
4 cm panel – Height 200 cm – Maximum linear load = 760 kN/m
6 cm panel – Height 400 cm – Maximum linear load = 590 kN/m
6 cm panel – Height 300 cm – Maximum linear load = 1130 kN/m
8 cm panel – Height 270 cm – Maximum linear load = 1340 kN/m

Eccentric compression
(with eccentricity equal to 1/3 total thickness)

4 cm panel – Height 240 cm - Maximum linear load = 566 kN/m
6 cm panel – Height 300 cm - Maximum linear load = 707 kN/m
6 cm panel – Height 400 cm - Maximum linear load = 360 kN/m
8 cm panel – Height 270 cm - Maximum linear load = 680 kN/m

Thanks to further tests on the vertical bearing capacity of the walls with EMMEDUE single panel, the following data was detected:

the test was carried out with PSM80 panels with a polystyrene mass equal to 20 kg/m^3 (1.25 pound/ft^3) and with structural plaster with the thickness of 3.5 cm (1.4 in.) per side.



External layers of structural plaster with R_{ck} = 30 MPa (on cube) and surface control.
Limit value of the axial load P_{lim} = 700 kN/m

The maximum acceptable load during working depends on the value assigned to the safety co-efficient ***r*** with respect to the limit situation.

Regarding the safety co-efficient value to be assumed in the passage between the latest resistance values to those acceptable in exercise, reference can be made to that envisioned by regulations for reinforced concrete structures in the experimental establishment field of these resistances.
In the specific case of the simple panels examined here it must be deduced that, in the light of that detected up to now, it is a good idea to assume a prudential value of the breakage safety co-efficient equal to F_S =3.

With these considerations, the following acceptable working values for stress of normal strain can be assumed on the basis of the design and the static verification of the walls realised with Single EMMEDUE panels:

Walls with interlayer height up to about 300 cm:
σ_{adm} = (70000/(100x7))/3= 33 daN/cm²; 3.3 MPa.

The values stated above must be intended as compatible with structural plaster for realisation of external layers with a characteristic resistance: Rck ≥ 25 MPa.

N.B.: For wall heights greater than 2.70 m. and up to 3.30 m. a corrective factor ***k*** is applied to the load P_{max}, therefore reducing the acceptable load to the P_{max}/k value:
- ***k*** linearly variable from 1.00 to 1.24 for wall heights from 2.70 to 3.50 m.

OBSERVATIONS:

If a multi-floor building, which is used for housing or offices is taken into consideration, a central support wall between two floor panels with m. 4.50 span, will transmit a load to the foot of the wall. This value is about 30÷40 kN for each floor.
It is therefore concluded that, in this situation, 4 floors can be envisioned (4-floor building).

2. SIMPLE BENDING

The bend tests have been generally carried out with different configurations. Below the most significant breaking moments during panel tests are illustrated.

4 cm panel: 3 cm compression hood – last M = 8.1 kNm/m
7 cm panel: 3 cm compression hood – last M = 12.2 kNm/m
Last strain of recorded cut = 13.6 kN/m
8 cm panel: 3 cm compression hood – last M = 12 kNm/m
Arrow on breakage = L/100 (*)

(*) It must be considered that the static layout of the tests is just to support of the ends, therefore vertical movement of the edges is not prevented and the inflection is not really the plate resting on the four edges, forced into deflection, as really happens.

3. SHEAR TEST (SHEARING FORCE)

The cutting tension highlighted by the tests refer to the total thickness of the panel.
4 cm panel (10 cm total) = 1.5 MPa
8 cm panel (15 cm total) = 1.3 MPa

4. HORIZONTAL LOAD TEST CONTAINED IN THE LAYER

The capacity of the panels, in relation to this stress is such that the tests have always ended due to the collapse of the connections between the element and the anchorage base. In each case these values
are sufficiently high to connote a more satisfying behaviour (50/100 kN at 2.40 m in height –4 cm panel). In the alternate cyclic horizontal load tests values of 350 kN were reached (4 cm panel).

5. SOFT BODY IMPACT TEST

The 4 cm thick panels received 540 Joule impacts (height of the fall = 1.80 m) widely recovering the instantaneous arrows in compliance with regulation requirements.

6. HARD BODY IMPACT TESTS

A 2 m fall of a steel ball weighing 3.5 kg. leaves an imperceptible indentation in the surface if the concrete.

7. FATIGUE TEST

Panels with 4 cm polystyrene thickness have sustained, in compliance with regulations, moments of 300 Nm during a period of 24 hours, without any consequences .

8. SEISMIC TESTS

A prototype of a house built entirely with single panels with a polystyrene thickness of 80 mm (walls, frame, staircases, roof) underwent a cyclic dynamic load with various frequencies (including that of the structure itself), caused by a Vibrodine applied to various points on the model. This caused horizontal accelerations equal to 10 m/s^2; and no damage or cracking was recorded.
Normally an earthquake in a high risk area induces horizontal accelerations in the order of 3.5 m/s2.

9. DETACHMENT TEST OF THE WELDED NODE

The resistance of the welding points of the electro-welded mesh has been verified as requested by UNI ISO 10287 Standards and by Ministerial Decree 9/01/96. In all cases it is noted that this resistance exceeds 2.26 times the reference force given by the Standard.
Minimum detachment load for this series of tests = 1.66 kN
Reference load = 0.74 kN

10. BALLISTIC IMPACTS

In no case have bullets coming from small firearms passed through the blocks of any thickness, also considering calibres such as .357 Magnum or .45 Auto. The same occurred using Brenneke calibre 12 bullets (arm: Franchi SPAS); Firing distance: 5.50 m.

⇒ HEAT AND ACOUSTIC INSULATION

HEAT INSULATION

EMMEDUE panels are made up of expanded polystyrene, which has a high isolating property due to the special characteristics of its cellular structure. The low heat conductivity that characterises the EPS, is because of the particular conformation of the material. It is in fact made up of 98% air, enclosed in cells with conformation and dimensions such as to prevent convective movements.

A series of tests have been carried out for the establishment of the total hat transmission of the dividing walls. The following table summarises the values that the total heat transmission co-efficient K reaches, for the different walls built using EMMEDUE.

TOTAL HEAT TRANSMISSION K ($W/m^2 °K$)

	DENSITY (kg/m^3)	
TYPE OF PANEL	15	20
PSM 50	0,810	0,780
PSM 60	0,713	0,687
PSM 80	0,584	0,564
PSM 100	0,503	0,486

As you may note, the level of heat insulation enormously exceeds the values of the dividing walls or infill obtained with traditional systems.

It is said that two partition walls are thermically equivalent when they have the same heat transmission value. As an illustrative example we have indicated heat transmission values K, expressed in $W/m^2 °K$, for different classes of traditional building partition walls, and their relationship with that of a EMMEDUE wall with total thickness of 10 cm / 4 in. (EPS thickness 4 cm. / 1.6 in. and plaster 3 cm. / 1.2 in. every layer), stated above.

COMPARISON BETWEEN DIFFERENT TRANSMISSION LEVELS

Type of partition	**Thickness**	**K ($W/m^2 °K$)**	**Ratio**
Wall with single EMMEDUE panel	10 cm	0.95	
Reinforced concrete wall	27.5 cm	2.51	2.64
Brick wall	15.0 cm	2.91	3.06
Double full brick wall with 3 cm air chamber	30.5 cm	1.47	1.55
Full bricks with two heads brick wall	25.0 cm	1.86	1.96
Hollow brick wall with 3 cm air chamber and plastered brick wall	30.0 cm	1.90	2.00
Hollow concrete blocks	19.0 cm	2.70	2.84

ACOUSTIC INSULATION

The acoustic insulation of the EMMEDUE panels is one of the advantages that the system has in order to reach an excellent level of lifestyle comfort in compliance with the most demanding conditions.

The results of the acoustic insulation tests realised on panels with the following features are illustrated below:

1) Simple panel with 4 cm thickness, expanded polystyrene with density of 12 kg/m³, plastered with concrete on both sides for a final thickness of 9.5 cm.

2) Simple panel with 8 cm thickness, expanded polystyrene with density of 12 kg/m³, plastered with concrete on both sides for a final thickness of 14 cm.

The test results have been evaluated according to methods established in DIN 4109, ISO 717 and IRAM 4043. The tests were carried out in the Instituto de Pesquisas Tecnológicas – São Paulo –Brazil, and without particular types of plaster e.g. sound/proofing.

The application of the method indicated in the mentioned standard give the following values for the curves obtained in the tests:

4 cm EMMEDUE panel	38dB
8 cm EMMEDUE panel	45dB

For example: the IRAM 4044 Standard recommends the following insulation values for aeroplane noise in typical cases:

Partition walls inside an environment	37dB
Between environments of the same office	44dB

The following table specifies the values, measured in the laboratory, for the typical materials used for the construction of walls and partition walls.

Experimental tests carried out on the panels supplied the following results:

4 cm EMMEDUE panel	38dB
8 cm EMMEDUE panel	45dB

Comparison with traditional materials supplied the following results:

Hollow bricks 12/20/40 without plaster	36dB
Hollow bricks 11/17/31 plaster on two sides (15 cm)	38dB

Hollow bricks 18/19/40 without plaster	42dB
Hollow bricks 18/19/40 plaster on one side (20 cm)	43dB
Hollow bricks 12 without plaster	40dB

These values demonstrate the suitability of the panels even in the strictest conditions, in compliance with technical regulations in force.

If we compare the data stated above, we arrive at the conclusion that, from an acoustic point of view, 4 cm polystyrene EMMEDUE panel completed on laying, gives the same insulation as a hollow brick wall measuring 15 cm and exceeds the requirements suggested by the IRAM Standard regarding internal partition walls. Using an 8 cm polystyrene panel, the acoustic insulation of a 20 cm hollow brick plastered is exceeded along with the requirements for dividing walls.

If higher acoustic insulation values are required, they can be obtained by the use of special panels that have a layer of mineral wool placed in the polystyrene. The wool has variable thickness and density according to necessity.

ELIMINATION OF HEAT CHANNELS

Thanks to the layer of continuous polystyrene on every surface making up the construction, insulation is extremely effective and offers elimination of heat channels and a consequent noteworthy energy saving.

In fact, thanks to the polystyrene, the walls realised with EMMEDUE panels act as uniform cladding, permeable to steam, which do not absorb water and supply indisputable advantages also in the maintenance phase.

⇒ LIGHT AND QUICK TO INSTALL

LIGHT

Thanks to their container weight, EMMEDUE panels are manageable, easily transported and simple to mount, allowing use in any condition.
The lightness of the panels is however combined to good stiffness, due to the electro-welded meshes, which guarantee their integrity and correspondence to the use to which the elements are destined.
The weight per m² of the panels, before application of the structural plaster, is shown in the table below.
The very modest weight allows an individual operator to easily move several m² of panel, without any problems.

SINGLE PANELS

Panel type	SPRITZ BETON THICKNESS (cm)	PANEL WEIGHT (Kg/m²)	FINISHED PANEL WEIGHT (Kg/m²)
PSM40	3+3	3.5	126
PSM60	3+3	3.9	127
PSM80	3+3	4.3	127
PSM100	3+3	4.7	128
PSM120	3+3	5.1	128

DOUBLE PANELS

Panel type	CONCRETE THICKNESS (cm)	PANEL WEIGHT (Kg/m²)	FINISHED PANEL WEIGHT (Kg/m²)
PDM100	10	11.7	321
PDM120	12	11.8	369
PDM150	15	11.9	441

FLOOR PANELS

Panel type	CONCRETE COMPRESSION CAPE THICKNESS (cm)	PANEL WEIGHT (Kg/m²)	FINISHED WALL WEIGHT (Kg/m²)
PSSG2/140	4	5.8	203
PSSG2/160	4	6.2	213
PSSG2/200	4	6.8	233
PSSG3/140	4	5.6	236
PSSG3/160	4	5.9	251
PSSG3/200	4	6.5	280

QUICK TO INSTALL

The EMMEDUE system allows high time and cost savings.
In fact, many experiences carried out in the most disparate conditions in different parts of the world and with the most varied workers have allowed the acquisition of important information regarding the possibility to lay EMMEDUE panels also in relation to the type of constructions to which they are destined.

code	description	Mounting hours/m²	Plastering hours/m²
PDM	double panel	0.55	0.60
PSM	single panel	0.35	0.70
PSS1	single floor panel	0.70	0.40
PSSG2	floor panel	0.80	0.40
PST	single partition panel	0.35	0.60
PSSC	staircase panel	0.80	0.60

Times indicated for plastering (two coats) refer to traditional products applied using EMMEDUE plastering machines. The yield is greatly improved if continuous plasters and pre-mixed products are used.

SPECIALISED LABOUR IS NOT REQUIRED

The EMMEDUE panels offer the great advantage of laying without specialised labour.
In fact, the great manageability of the panels and the ease of transport, allow even inexpert operators to acquire the capacity to install the walls without fatigue.

⇒ ECONOMICAL

SAVINGS IN THE CONSTRUCTION PHASE

EMMEDUE panel represent a true economical advantage both for final users and businesses that use them as they allow to reach the better performance than traditional products and a much lower cost.

In fact, the possibility of having a unique element that performs as infill, heat and acoustic insulation all at the same time and that is completed on site with structural plaster, realising a wall with very high resistance features, allows a sure saving of time and costs.

Regarding this, economical comparison between realisations using EMMEDUE and other systems with equal performance have shown a saving of about 20% in the double panel and 40% for single panels. The greater economy does not consider the time saved as a consequence of the use of an industrial product that optimises the mounting sequence and limits staff intervention on site to a minimum.

ENERGY SAVING IN THE HOME

The total heat transfer Kt value of a wall made up of a panel formed by a block of polystyrene measuring 4 cm (density 15 kg/m^3) and two plastered faces with a thickness of 3 cm, and total thickness of 10 cm, is equal to K = 0.95 W /m^2 °K

If the wall is realised with an 8 cm panel of expanded polystyrene (density 15 kg/m3) the value calculated for heat transmission K is equal to 0.60 W /m^2 °K.
Such a level of heat insulation enormously exceeds the values of dividing walls or infills obtained with traditional systems. As a comparison, the table below states the heat transmission values of walls realised using traditional solutions.

Type of wall	**Thickness**	**Kt**
Reinforced concrete wall	27.5 cm	2.51
Brick wall	15.0 cm	2.91
Double full brick wall with 3 cm air chamber	30.5 cm	1.47
Full bricks with two heads	25.0 cm	1.86
Hollow brick with 3 cm air chamber and full brick plastered wall	30.0 cm	1.90
Hollow concrete blocks	19.0 cm	2.70

⇒ INSTALLATION OF THE PLANTS

The type of EMMEDUE panels allows easy and quick mounting of electrical sanitary plants etc. the tracks for the plants can be easily and quickly made on the polystyrene surface using a jet of hot air.

Thanks to the flexibility and optimal workability of EMMEDUE panels it is possible to make adaptations for the architectonic requirements of the project. This means that on laying, even before the application of concrete, the spaces necessary for connections "in tracks", for domestic water and electric plants and holes of any shape for doors windows etc can be easily made.

The laying of flexible pipes and accessories for the electric plant and for rigid pipes used in the domestic water and heating plants, is carried out after complete mounting of the panels and before completion with concrete structural plaster.
In order to pass the pipes underneath the mesh, a track must be made in the polystyrene block using a hot hair dryer or another heat source.
The flexible pipes pass easily under the mesh. For the rigid pipes, it may be necessary to cut the mesh. This must be successively restores by the overlapping and fixing of a further RG2 reinforcement mesh in the interested zone.

Note: Copper pipes can be isolated from the steel mesh using a felt, PVC or similar covering.

⇒ FIRE RESISTANCE

The resistance, verified in tests realised in different laboratories, satisfies the requisites requested by the most demanding regulations.
For example a finished wall with thickness measuring 10 cm , obtained starting from a wall realised with a panel with expanded polystyrene measuring 4 cm, has a direct resistance of 110 minutes (Istituto di Ricerca e di Prove dei Materiali, Chile).
Expanded polystyrene is not a very inflammable material and requires a great quantity of air as a combustion agent (about 150 times its own volume) for the fire to destroy it completely. Therefore, as it is confined and protected by two layers of concrete, it cannot burn. Also, the quality of expanded polystyrene used by EMMEDUE is type F, self-extinguishing according to DIN 4102 Standards. The material does not have the tendency for combustion.

Even when undergoing a state of stress, the EMMEDUE walls have optimal structural resistance to fire.
Recent laboratory tests have shown that a PSME80 wall, with finished thickness of cm 15, has fire resistance, representative of the **simple PSM panel**:

REI > 150

The tests highlighted, for a wall in EMMEDUE panels, with core in concrete with a thickness of 15 cm, undergoing the maximum sustainable working load (900 kN/m), that the resistance of the **PDM double panel**:

R > 180 min.

The component most present among the burnt gases, relevant from a toxicological point of view is, as for wood, carbon monoxide, even if in very limited quantities. According to DIN 53436 Standards, the emission of carbon monoxide during combustion of the different materials is the following:

- Wood wool: 69,000 ppm at 600 °C
- Wood: 15,000 ppm at 600 °C
- Cork: 29,000 ppm at 600 °C
- Type F expanded polystyrene: 1,000 ppm at 600 °C

As it can be noted in the table above, the exhalation of carbon monoxide is between 15 and 69 lower with respect to that of wood and its derivatives as construction materials.

⇒ BIO/COMPATABLE

EMMEDUE panels are similar to building that ever increasingly aims at Bio-compatibility and sustainability. In fact, EMMEDUE constructions satisfy housing needs however containing energy requirements for energy saving and to limit pollution.

HEAT INSULATION OF BUILDINGD FOR THE REDUCTION OF ATMOSPHERIC POLLUTION

EMMEDUE constructions are excellently heat isolated, therefore less fuel is consumed for internal heating.

This means the production of less CO_2 and less environmental pollution.

ENERGY SAVING IN THE HOME

The stratigraphy of the walls, which alternates layers of polystyrene and concrete, allows to obtain a continuous isolating surface that guarantees optimal insulation without heat channels.

The total heat transmission value Kt of a wall made up of a panel formed by a 4 cm block of polystyrene (density 15 kg/m^3) and two plastered faces measuring 3 cm in thickness, for a total thickness of 10 cm, is equal t K = 0.95 W /m^2 °K.

If the wall is realised with a panel with 8 cm expanded polystyrene block (density 15 kg/m3) the calculated heat transmission value Kt is equal to 0.60 W /m^2 °K.

For walls realised with double panels and partition of 12 cm of intermediate reinforced concrete a transmission value equal to 0.50 W /m^2 °K is obtained.

Such a level of heat insulation enormously exceeds the values of structures obtained with traditional systems.

DIRECTIVES FOR THE CONTAINMENT OF THE ENERGY REQUIREMENTS

Energy saving in the building sector is becoming compulsory. In fact, in Italy the draft of the regulations is ready that introduces new design and construction methods in order to contain energy requirements of the building, on implementation of CE 2002/91 Directives.

Once it has entered in force, the decree will be applied to all new buildings, but also re-structuring.

Moreover, on activation of the European Directive, the energy certification of buildings should also be actuated.

At the moment only Bolzano ha san instrument that adopts this provision in full, with CasaClima certification.

In order for the building companies in this Municipality to obtain the habitability certification for new buildings, they must respect class C conditions. These envision a thermal index lower than 70kWh per m², while buildings within class A have the right to 10% discount on urbanisation fees (as well as other benefits envisioned by the Provincial and Municipal regulations).

CASACLIMA EXAMPLE

The CasaClima certificate informs the consumer, by means of a simplified presentation, regarding the energy requirements of a house. The sense of the CasaClima certificate is, among other things, that of making it easier for the user to decide whether to purchase or rent a home by means of transparency of energy costs.

As an example, a typical house has been analysed in order to detect the thermal indexes, according to the standards established by the Casaclima Certificate.

The calculations are carried out by supposing a construction realised with the EMMEDUE construction system.

Without envisioning forced ventilation plants, the house has a thermal index below 50kWh per m² and is within CasaClima class B.

If it is then verified that by installing a mechanical ventilation plant the house would be within CasaClima class A with a thermal index lower than 30kWh per m².

By comparing the values obtained from the house built with the EMMEDUE type system with the traditionally insulated house, a saving of the yearly heating requirement of 35% can be noted.

POLYSTYRENE AND BIO-BUILDING

For further information refer to "polystyrene and the environmental impact" and "Respect the environment – EPS and Bio-building" and. BE.MA - AIPE books

PHYSICAL-CHEMICAL STABILITY OF POLYSTYRENE

Polystyrene and concrete are both very chemically stable materials, a virtue that our technology has inherited by logical consequence, in so much as the result of the combination of the two materials. Also the absence of empty spaces and biodegradable materials inside the walls and floors of our system prevent the development of colonies of insects of any type.

The superior water repellent isolating capacity is verified thanks to the low absorption capacity of the component materials: that of concrete, achieved thanks to the dosing and compacting of the layers, which is obtained during its pneumatic projection. That of the polystyrene, depending on the hermetically closed cell structure, which in the total immersion test for 28 days showed water absorption of only 2% in weight.

BIOLOGICAL BEHAVIOUR

The polystyrene blocks do not supply nutrition for any living beings, including microrganisms, they do not decay or rot.

Polystyrene is not a hazard for the environment or water storage. It is not a health hazard in building insulation (it has been used in building for more than 70 years) and the health laws allow expanded polystyrene, as an isolating product, to come into contact with food products. It is not a surprise then that it has been used for packaging for more than 30 years.

EPS AND BENEFITS FOR THE ENVIRONMENT

- SAFETY

EPS is not toxic and totally inert. It does not contain CFC's (chlorofluorcarbons) or HCFC's and they are not used during production. It does not contain any nutritional elements and therefore does not allow the nesting of microrganisms.

- RECYCLABLE

The EPS can be recycled in many ways: inside new products, burned to recover energy, or re-used for second purposes.

- HEALTH

The EPS is not a health hazard for anyone using it or installers.

- POLLUTION

The use of 10 Kg of EPS for heat insulation of a building allows to save 4000 litres of diesel in 50 years for heating.

- The life of EPS

The use of EPS contributes in a positive way to the living environment. The energy used to produce expanded polystyrene is minimal if compared with that saved during the lifespan of a correctly isolated building. The EPS is universally recognised as a material that is not a hazard for whoever uses it or for installers. It does not create allergies and is not toxic.

Steam and humidity do not lead to permanent damage of the material.

The mechanical and heat features are supplied for the entire lifespan of the building where it is installed. The EPS is also realised in the self-extinguishing form. The fumes and gases emitted during exposure to the flame are less noxious than those emitted from analogue materials such as wood or cork.

⇒ VERSATILITY

MADE-TO-MEASURE PANELS WITH VARIABLE LENGTHS AND THICKNESSES.

The type of products to which EMMEDUE panels can be destined are varied and original. The panels can be used as vertical support elements, dividing elements, covering walls, and infill. In all of these cases it is possible to easily obtain particular shapes and bends by cutting the elements on site. The heat and acoustic insulation, fire resistance, manageability and easy to mount features, make it suitable for several uses.

CHOICE OF FINISHINGS

The EMMEDUE walls can be completed, at a finishing level, in any. It is possible to apply a thick covering directly onto the rough plaster or alternatively traditional paintwork onto smoothed plaster. Coverings with brick battens or with walls or plasterboard are all possible. No possibility is excluded.

⇒ DURABILITY

PRESERVATION THROUGH TIME

The component materials (steel and polystyrene) are chemically inert materials and resistant to the normal chemical-physical conditions of the environment and are stable. They are also confined and protected by a double block of structural plaster that prevents direct contact with any aggressive chemical agents both internally and externally.

IMPERMEABILITY TEST IN STORMS

The panels have been classified as class E (the best) after having being exposed to 140 mm/h rain with wind at 106 km/h for 24 hours +dry+72 hours.

PANEL COMPONENTS

CARD 6.0

The basic element of the system is the undulated expanded polystyrene panel, completed on both sides by galvanised steel meshes that are joined by about 68 electro-welded connectors per square metre of surface (6 connectors / ft^2).

THE MESHES

The meshes are made in high-tensile steel, with yield stress higher than 600 Mpa (87023 PSI) and are formed by bars with diameter varying from 2.5 to 5 mm. (0.1-0.2 in.).


CERTIFICATO

Nr. 50 100 2912 - Rev. 03

Si attesta che / This is to certify that

IL SISTEMA QUALITÀ DI
THE QUALITY SYSTEM OF

EMMEDUE S.p.A.

SEDE PRINCIPALE / VIA TONIOLO 39/B Z. I. BELLOCCHI I-61032 FANO (PU)

SEDE SECONDARIA: VIA CONSELVANA 163/A I-35020 MASERA' DI PADOVA (PD)

È CONFORME AI REQUISITI DELLA NORMA
HAS BEEN FOUND TO COMPLY WITH THE REQUIREMENTS OF

UNI EN ISO 9001:2000

Questo certificato è valido per il seguente campo di applicazione
This certificate is valid for the following product or service range

Progettazione, fabbricazione e posa in opera di pannelli per sistema costruttivo Emmedue; produzione di reti elettrosaldate; progettazione, fabbricazione ed assistenza post vendita di impianti per la produzione di pannelli e reti elettrosaldate
(IAF 17, 12, 28b)

Design, manufacture and installation of panels for Emmedue Building System; manufacture and electrowelded wire meshes; design, manufacture and after-sale service pf plants for the production of panels and electrowelded meshes (IAF 17, 12, 28b)

Data di emissione / Issue date
2007-10-01

Per l'Organismo di Certificazione
For the Certification Body
TÜV Italia S.r.l.

SINCERT

Rinnovo del certificato emesso per la prima volta in data 2003-06-12

ZERTIFIKAT ◆ CERTIFICATE ◆ CERTIFICADO ◆ CERTIFICAT

Panels can be supplied with wires of different diameters and geometrical features.

The meshes project by 50 mm (2 in.) from each side, in a way that their mutual overlapping assures the continuity of the reinforcements, without the need for additional connection elements. The continuous connection is obtained at the cross-over of the elements with the angular meshes, supplied for this scope.

It is important to underline that all processes that intervene in the manufacture of the elements that make up the EMMEDUE system continually undergo controls envisioned by ISO Standards.

It is for this reason that on 1/10/07 the UNI-EN-ISO 9001:2000 certificate issued by the TÜV Certification Body was renewed for the following aims:

Design, manufacture and laying of panels for the Emmedue Building System; production of electro-welded meshes; design, manufacture and after-sales assistance for plants producing panels and electro-welded meshes.

All industrial plants worldwide use exactly the same type of machines and technology for the production of panels as those used by Bellocchi di Fano (PU), which has obtained Quality Certification.

THE POLYSTYRENE (EPS)

The thickness of the polystyrene core can vary depending on the necessity of the architectonic design. The minimum density normally used is 15 kg/m³ (0.9 pound/ft³).

POLYSTYRENE is a hard thermoplastic resin, transparent, similar to glass, which is obtained by polymerisation of STYRENE (styrene is a colourless inflammable liquid).
Polymerisation is a process in which small molecules (monomers) join together giving place to the formation of high molecular weight composites. In synthesis, polystyrene is a composite of carbon and hydrogen molecules which with the addition of additives becomes self-extinguishing or can improve burning behaviour.

The EPS (Sintered Expanded Polystyrene) generally has a volumetric mass between 10 and 40 kg/mc and is comprised of 98% air and 2% of pure hydrocarbon structural material.

PHYSICAL FEATURES OF POLYSTYRENE

Products with EPS have no odour and do not irritate the skin.
As well as having good heat conductivity, polystyrene has the following features:

- Isotropicity.
- Preservation of heat isolation with the passing of time
- Resistance to temperature variation.
- Low absorption of water due to immersion.
- No water absorption due to capillarity.
- Putrification
- Dimensional stability.
- Is not toxic.
- Reflects heat.
- Easily worked
- Can be re-cycled
- Easily transported

BURNING BEHAVIOUR OF POLYSTYRENE

The EPS, which is made up of carbon and hydrogen, is a combustible material. It starts its decomposition at about 230-260°C, with the emission of inflammable fumes, but only ignites at 450-500°C. The successive propagation takes place successively in normal EPS, if there is a sufficient contribution of oxygen, while in improved burning behaviour EPS (EPS/RF), obtained with relative additives, propagation ceases on running short of the cause of ignition.

For risk evaluation of use relative to burning behaviour of the EPS, the following must be kept in mind:

- The EPS requires a certain amount of energy for ignition; a spark or a cigarette is not sufficient.

- The contribution of EPS in terms of the energy balance of a fire is modest in relation to its low volumetric mass: 1dm cube of 15 Kg/mc EPS has a heating power of 590 j against the 9,200 j of the same amount of fir wood.

- The EPS is generally protected by other materials and does not have the immediate availability of the air necessary for its combustion (about 130 times its volume).

- Combustion can develop as toxic gases, essentially carbon monoxide, not differently from wooden materials present in buildings or furniture but in a reduced proportion.

- Combustion with EPS does not produce dioxins which therefore are not found in the fumes produced during a fire

OTHER ASPECTS OF POLYSTYRENE (EPS)

- ENVIRONMENTAL SAFETY

The EPS has no nutritional value able to sustain the growth of fungi, bacteria or other micro organisms; therefore it does not rot or become mouldy. The EPS does not provide nutriment for any living organism (it is widely used for food containers). The EPS is also non-toxic, inert and does not contain chlorofluorocarbons (CFC's) or hydro-chlorofluorocarbons (HCFC's). Due to its chemical and biological stability the EPS is not a hazard for environmental hygiene and for water storage. The EPS used for isolating, is not a health hazard as it does not release toxic gases. Handling of the mechanical workings is absolutely harmless and in particular there is no ranger from inhaling particles or allergic reactions. The discharged EPS packaging does not pollute the ground or the atmosphere.

- RESISTANCE TO STEAM

The EPS is permeable to steam, therefore it is breathable, but it is impermeable to water. The permeability to steam means that mould does not form inside buildings and environments isolated using EPS. Important data is that regarding the resistance tot he diffusion of steam expressed as a ratio μ (dimensionless) between the thickness of air that offers the same resistance to the passage of steam and the thickness of the material in question. For EPS the value of μ is between limits that increase with the volume mass, as shown in the table below, regarding UNI 7819.

EPS RESISTANCE TO STEAM DIFFUSION

Volume mass (kg/m^3)	μ minimum	μ maximum
15	20	40
20	30	50
25	40	70
30	50	100
35	60	120

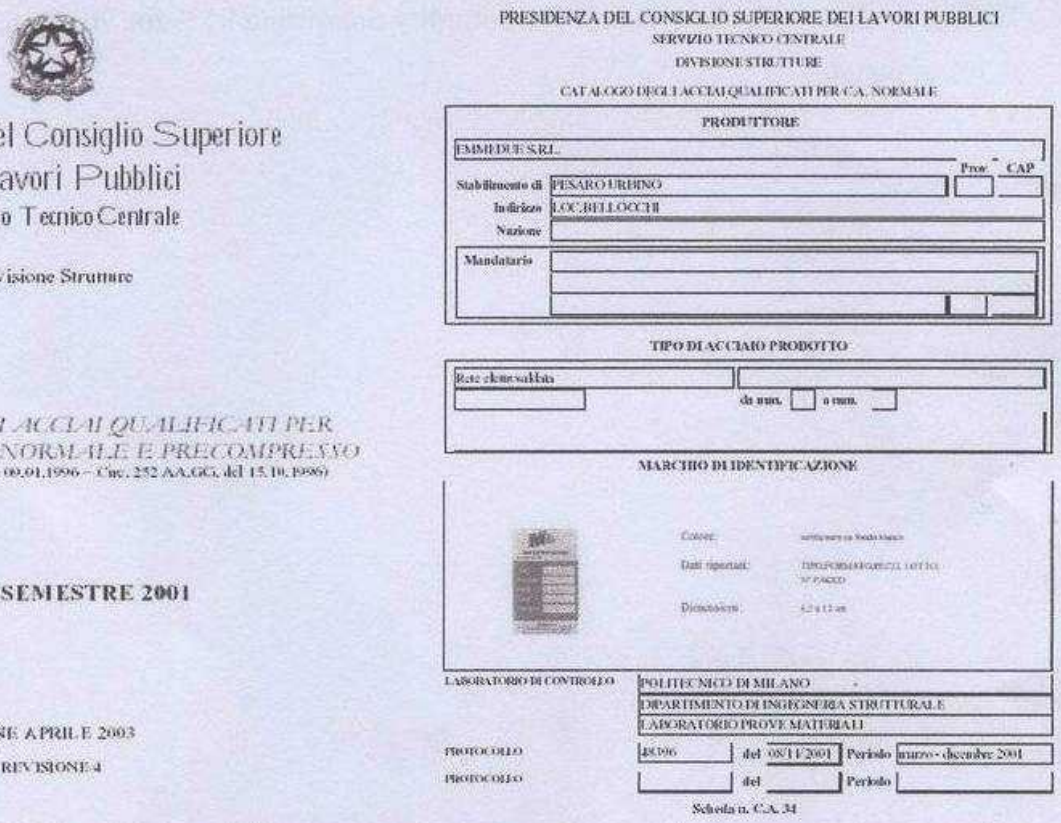
- THE BEHAVIOUR OF POLYSTYRENE REGARDING WATER

The behaviour of EPS regarding water is EXCELLENT. Water does not melt EPS and does not pass the walls of closed cells. Absorption due to immersion is a situation that is difficult to verify in EMMEDUE panels. It amounts to a maximum of 5% in volume for EPS with density of 15 and 3% for EPS with density of 30. The results of absorption due to capillarity (practically nil) and most of all absorption of moist air are more interesting. A 20 EPS in contact with air with relative humidity measuring 95% for 90 days, shows absorption of 0.7% in weight.

THE MESHES

EMMEDUE is a qualified producer of FeB44K electro-welded meshes for reinforced concrete with diameters from 5 to12 mm, with which any mesh type and geometry can be realised.

The Company owns a laboratory for the execution of tests on the meshes (with pull of the welded wire and detachment of the node) and monthly it undergoes the quality control visit by technicians of the Politecnico di Milano (Milan Polytechnic) for the issue of certificates.



Presidenza del Consiglio Superiore
dei Lavori Pubblici
Servizio Tecnico Centrale

Divisione Strutture

CATALOGO DEGLI ACCIAI QUALIFICATI PER CEMENTO ARMATO NORMALE E PRECOMPRESSO
(Legge 5.11.1971 n. 1086 - D.M. 09.01.1996 - Circ. 252 AA.GG. del 15.10.1996)

I° E II° SEMESTRE 2001

EDIZIONE APRILE 2003

REVISIONE 4

PRESIDENZA DEL CONSIGLIO SUPERIORE DEI LAVORI PUBBLICI
SERVIZIO TECNICO CENTRALE
DIVISIONE STRUTTURE
CATALOGO DEGLI ACCIAI QUALIFICATI PER C.A. NORMALE

PRODUTTORE
EMMEDUE S.R.L.
Stabilimento di: PESARO URBINO — Prov. — CAP
Indirizzo: LOC.BELLOCCHI
Nazione:
Mandatario:

TIPO DI ACCIAIO PRODOTTO
Rete elettrosaldata
da mm. — a mm.

MARCHIO DI IDENTIFICAZIONE
Colore:
Dati riportati:
Dimensioni:

LABORATORIO DI CONTROLLO: POLITECNICO DI MILANO
DIPARTIMENTO DI INGEGNERIA STRUTTURALE
LABORATORIO PROVE MATERIALI

PROTOCOLLO 48/96 del 08/11/2001 Periodo marzo - dicembre 2001
PROTOCOLLO del Periodo

Scheda n. C.A. 34

The types of steel that can be used for structural purposes are only those produced and/or worked by qualified subjects.

In the site of the Ministry for Public Infrastructure it is possible to consult the list of qualified manufacturers of steel and electro-welded meshes.

THE GALVANISED MESHES

All external meshes are realised starting from cold drawn wires and galvanised by hot immersion. Drawing improves the mechanical features of the steel in a significant manner (yield stress, breaking stress); the low carbon content guarantees the weldability and ductility; the galvanisation confers greater durability regarding oxidisation processes.