



Advanced Building System EMMEDUE

User should check the validity of the Certificate by contacting Member Secretary, BMBA at BMTPC or the Holder of this Certificate.

Name and Address of Certificate Holder:

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Via Toniolo, 39/b Z. I.
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Italy

Performance Appraisal Certificate No.

PAC No **1010-S/2014**
 Issue No. **01**
 Date of Issue: **08.1.2014**

Building technique
 6. Three panels installation

LOAD BEARING SINGLE PANEL
 EPS (Expanded Polystyrene Sintered)
 Variable thickness (40-300 mm)
 Variable density (15-30 kg/mc)
 Polystyrene plate
 Double Mesh of galvanized steel
 Shotcrete



Building Materials & Technology Promotion Council
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PERFORMANCE APPRAISAL CERTIFICATE


FOR

ADVANCED BUILDING SYSTEM – EMMEDUE

ISSUED TO

M/s EMMEDUE S.P.A, Italy

STATUS OF PAC 1010-S/2014

S. No	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remarks	Signature of authorized signatory
				No.	Date			
1.	2.	3.	4.	5.	6.	7.	8.	9.
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PART – I CERTIFICATION

I – 1 CERTIFICATE HOLDER: EMMEDUE S.P.A,
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I – 2 DESCRIPTION OF SYSTEM

I – 2.1 Name of the System– Advanced Building System--EMMEDUE

I – 2.2 Brand Name – EMMEDUE

I – 2.3 Brief Description – The EMMEDUE Advanced Building System consists of panels of expanded polystyrene (EPS) insulation and steel reinforcement which are site applied with concrete. The system is suitable for the walls and floors of housing and commercial buildings. The *EMMEDUE* panel comprises of a layer of mesh on either side of EPS core welded together by steel orthogonal (trusses) which penetrates through EPS core. The panels are joined together in a desired configuration on site and sprayed on both sides with shotcrete to form a sandwich type construction. The exterior of the panels may be finished with weather proof coating such as plaster while interior surfaces (walls) and ceilings can either be plastered or lined with conventional lining material.

I – 2.4 Types of EMMEDUE Panels

1. *Single Bearing Panel: PSM* panels are manufactured in types of PSM 60 to 140 in thicknesses varying from 130 mm to 210 mm.
2. *Single Partition or boundary Panel: PST* panels are manufactured in types of PST 40 to 200 in thicknesses varying from 90 mm to 250 mm.
3. *Single Panel for horizontal structure PSS1* are manufactured in types of PSS1 80 to 160 in thickness varying from 155 mm to 235 mm.
4. *Floor Panels with two humps PSSG 2 and Floor Panels with three humps PSSG 3* are manufactured in types of PSSG 100 to 240.
5. *Double Panel PDM: panels* are manufactured in types of PDM 120 to 180.
6. *Staircase Panel PSSC*

I – 3 ASSESSMENT

I – 3.1 Scope of Assessment

I – 3.1.1 Scope of assessment included suitability of manufactured panel to the specified requirements for use in building construction as:

- i) Load bearing wall panel
- ii) Non-load bearing wall panel
- iii) Shear Wall
- iv) Floor/ roof slab

The structural and water tightness design for each specific structure is the responsibility of the building designer.

I – 3.2 Basis of Assessment

The system is assessed for use with framed door and window joinery installed with vertical jambs. Assessment of the suitability of panels manufactured as load bearing wall, shear wall, floor/ roof slab etc. is based on

- i) Performance tests conducted on single storey housing unit using panels brought from Italy. The tests included load test, rain simulation test, rebound hammer, nailing test, acoustic comfort test, thermal comfort test, ponding test on roof slab and fire resistance test.
- ii) Tests on construction materials including individual roof panel, tensile test of galvanized wire, expanded polystyrene and cement mortar vis-à-vis requirements contained in the specifications;
- iii) Technical Manual of EMMEDUE Advanced Building System
- iv) Technical report on experimental Evaluation of Building System by the Laboratory of Earthquake-Resistant Structures, University of Peru;
- v) Analysis and validation of the static and seismic behavior of EMMEDUE buildings by ENEA, Italian Agency for New Technologies, Energy and the Environment and
- vi) Quality Assurance Scheme followed by the Certificate holder for process control.

I – 4 USE OF THE EMMEDUE PANELS

I – 4.1 The panel may be used generally in the following ways:

- 1) As load bearing walling in buildings
- 2) As high capacity vertical and shear load bearing structural walling in multi-storey construction.
- 3) Non Load bearing wall panels
- 4) As partition infill wall in multi-storey framed building:
- 5) As floor/ roof slabs
- 6) As cladding for industrial building
- 7) As staircase panel

I – 4.2 Special Aspects of use:

- 1) The building to be constructed using *EMMEDUE* panel shall be manufactured in accordance with the specifications prescribed in Technical Manual of EMMEDUE Advanced Building System and designed by competent structural Engineers.
- 2) Plumbing and Electrical services shall be governed by the provisions and details given by the manufacturer.
- 3) EMMEDUE Advanced Building System should be constructed only with technical support or supervision by qualified engineers and

- builders, based on structural designs complying with prevailing standards and specifications; this is applicable even for low-rise and affordable mass housing to provide safety of structures.
- 4) It is strongly recommended that structural engineers and building designers associated with EMMEDUE panel construction should be thoroughly familiar with the various structural aspects. It is also recommended that architects and construction Engineers who undertake EMMEDUE building design and construction gain familiarity with the properties of material, characteristics of EMMEDUE panels and its application and construction system.

I – 5 CONDITIONS OF CERTIFICATION

I – 5.1 Technical Conditions

1. The production capability and quality of the panels' vis-à-vis requirements specified and competence of the technical persons for design and proper erection of the panels at site shall need verification for each plant/ establishment engaged in the production and execution of the system.
2. The Certificate holder shall inform BMTPC as and when any plant is set up in India. EMMEDUE S.P.A. shall provide full details of design, manufacture and erection of the panels to the agency who may be engaged for production and construction.
3. EMMEDUE S.P.A. shall also provide necessary training to the technical persons of the agency engaged for production, design and construction.
4. The Certificate holder shall provide a detailed Quality Assurance System for production and execution of the system in the field.
5. EMMEDUE shall submit evidence of performance of the G+3 or higher structure against earthquake forces as per IS 1893 (Part 1):2002 before undertaking project using load bearing wall panels for structures more than G+3 storey.
6. The Certificate will be reviewed after one year when more information and experience is available in India.

I – 5.2 Handling of User Complaints

- I – 5.2.1** The Certificate holder shall provide quick redressal to consumer/user complaints proved reasonable & genuine and within the conditions of warranty provided by it to customer/purchaser.

I – 6 CERTIFICATION

- I – 6.1** On the basis of assessment given in Part III of this Certificate & subject to the conditions of certification, use & limitations set out in this Certificate and if selected, installed & maintained as set out in Part I & II of this Certificate, the panels covered by this Certificate are fit for use set out in the Scope of Assessment.

PART – II CERTIFICATE HOLDER'S TECHNICAL SPECIFICATIONS

II – 1 GENERAL

II – 1.1 The PAC holder shall manufacture the panels in accordance with the requirements specified in the Panel Specifications of EMMEDUE Advanced Building System.

II – 2 SPECIFICATIONS FOR THE SYSTEM & DESIGN INFORMATION

II –2.1 TECHNICAL SPECIFICATIONS

The EMMEDUE Advanced Building System consists of panels manufactured to form a three dimensional truss type welded space frame integrated with a fire retarded EPS (expanded polystyrene) core. The panels are placed in position and layers of concrete of appropriate grade not less than M25 and of appropriate thickness not less than 35 mm are applied on both sides.

Panels are butt-jointed with extra layers of welded wire fabric spliced over the joints, around openings and at internal and external corners. Reinforced ties and bars are used at building element junctions to add strength to joints.

II –2.1.1 Raw Materials

1. Zinc Coated Cold Drawn Steel Wire – Shall be of 2.5/3.0 mm dia and zinc coating galvanizing shall be of $60 \text{ gm/m}^2 \pm 5 \text{ gm/m}^2$

1.1 Mechanical characteristics

Yield stress	: > 600 N/mm ²
Breaking load	: > 680 N/mm ²
Elongation	: > 8%

1.2 Chemical characteristics -- Weldability

% C	: < 0.24
% P	: < 0.055
% S	: < 0.055
% Ceq	: < 0.52

2. Expanded Sintered Polystyrene – Self-extinguishing type EPS 80 in accordance to UNI EN 13163:2013 (IS 4671: 1984) having density not less than 15 kg/m^3

II – 2.1.2 EMMEDUE PANELS

1. Single Panel PSM

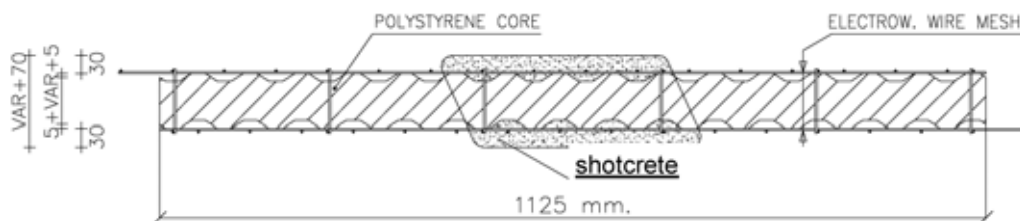


Fig. 1

Galvanized steel wire mesh:

Longitudinal wires: \varnothing 2.5 mm or \varnothing 3.5 mm every 65 mm
 Transversal wires: \varnothing 2.5 mm every 65 mm
 Cross steel wire: \varnothing 3 mm (approx. 68 per m^2)
 Steel wire yield stress: $> 600 \text{ N/mm}^2$
 Steel wire fracture stress: $> 680 \text{ N/mm}^2$

Polystyrene slab density: $> 15 \text{ kg/m}^3$
Polystyrene slab thickness: 60 mm
Finished wall thickness: 130 mm min

For the structural use of these panels, the polystyrene core shall be at least 60 mm thick and an average quantity of traditional or pre-mixed cement based plaster should be sprayed on each side of minimum 35 mm thick of M25 grade or above as required from environmental exposure conditions.

Thermal transmittance shall vary with thickness.

Recommended Thermal resistance and Panel weight & thickness are given in Appendix I.

2. Single Panel PST

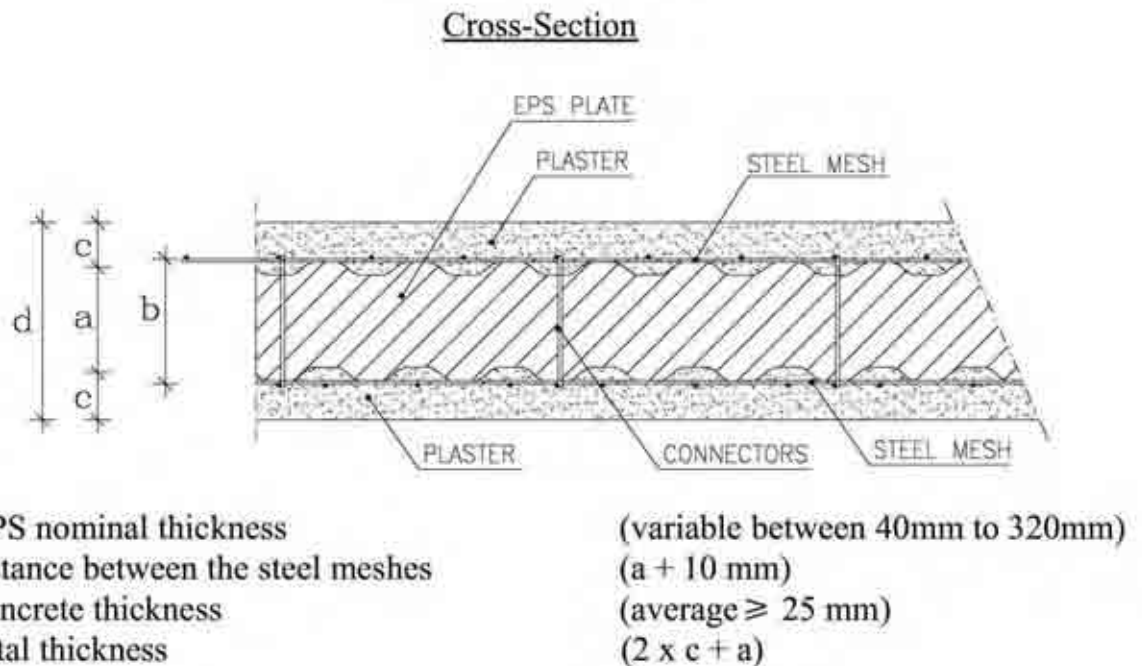


Fig. 2

Galvanized steel wire mesh:

Longitudinal wires: 2.5 mm dia. every 70 mm
 Transversal wires: 2.5 mm dia. every 70 mm
 Cross steel wire: 3.0 mm dia. (approx. 68 per m^2)

Polystyrene slab density: $> 15 \text{ kg/m}^3$
 Polystyrene slab thickness: 40 mm to 320mm
 Finished masonry thickness: 90 mm to 370 mm

This panel may be used as internal partitions, external curtain walls and insulating walls etc.
 It is similar to the PSM panel except for its polystyrene core outline that is thinner and requires less plaster for its finishing.
 Thermal transmittance shall vary with thickness.
 Recommended Thermal resistance and Panel weight & thickness are given in Appendix II.

3. Single Panel PSS1 for horizontal structures

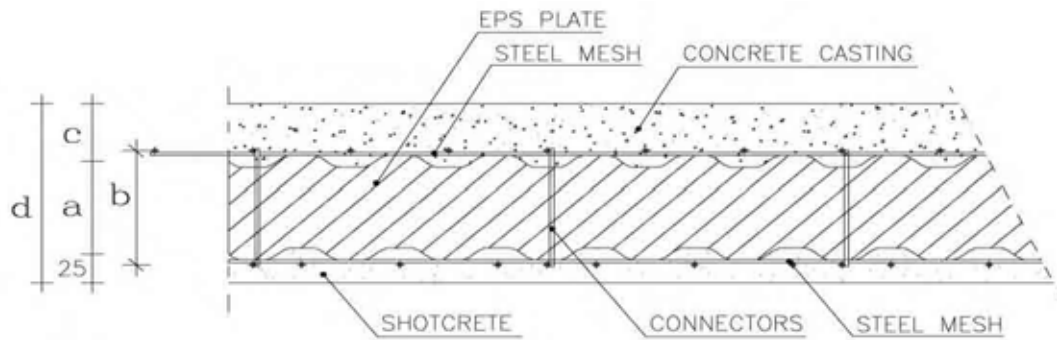


Fig. 3

Galvanized steel wire mesh:

Longitudinal wires: 2.5 mm – 3.5 mm dia. every 65
 Transversal wires: 2.5 mm dia. every 65 mm
 Cross steel wire: 3.0 mm dia. (approx. 68 per m²)

Polystyrene slab density: 15 – 25 kg/m³
 Polystyrene plate thickness: 80 mm to 160mm
 Finished element thickness: 155 mm to 235 mm

This panel is used for floors and roofs, including in a single element, bearing capacity, thermal insulation and disposal insulating formwork. The panel is completed at job site with concrete on the upper side and structural plaster sprayed on the lower side.

These panels are generally used for buildings of not more than 4 storey for floor slabs and covering slabs with max span of 4m. However, in such cases the panels are required to be further reinforced with additional meshwork and greater amount of concrete layer on the upper side up to 40 mm to 60 mm in keeping with the calculations made.

Recommended Thermal resistance and Panel weight & thickness are given in Appendix III.

4. Staircase Panel PSSC

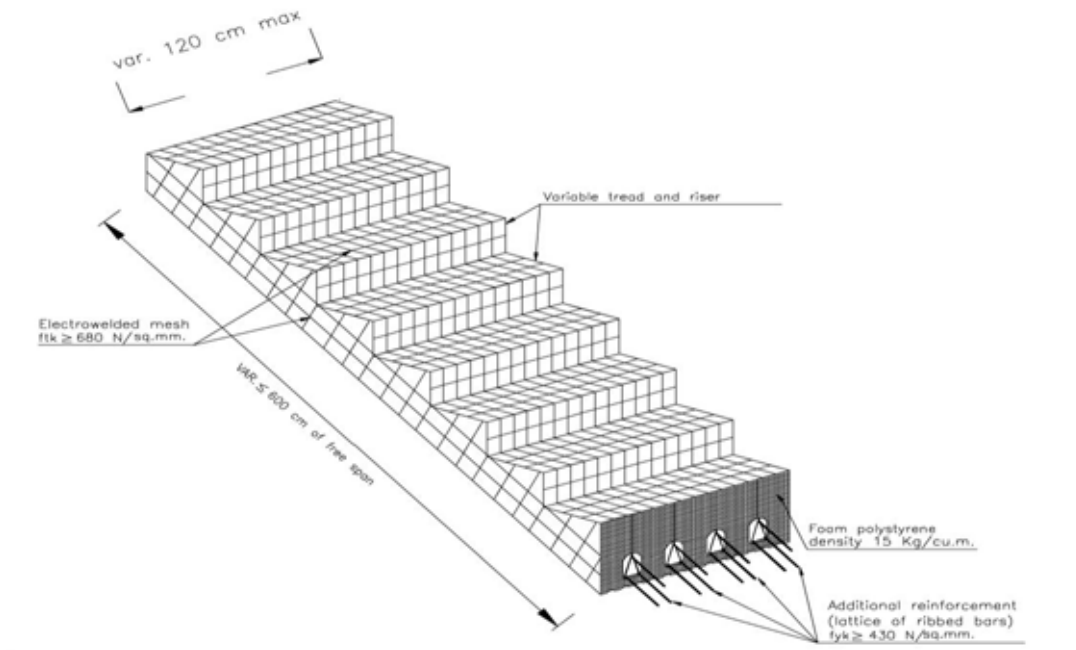


Fig. 4

Galvanized steel wire mesh:
Longitudinal wires: 2.5 mm dia.
Transversal wires: 2.5 mm dia.

Galvanized steel wire mesh:
Longitudinal wires: 2.5 mm dia
Transversal wires: 2.5 mm dia
Cross steel wire: 3.0 mm dia
Polystyrene slab density: > 15 kg/m³

This panel consists of expanded polystyrene block shaped according to designing requirements and reinforced by a steel mesh. The block is joined by steel wire connectors welded in electro-fusion across the polystyrene core.

These are used for the construction of flight of stairs up to a max span <6m having a live load of 4kN/m².

The reinforcement steel bars have to be placed inside the holes before concrete casting.

5. Floor Panels PSSG2 and PSSG

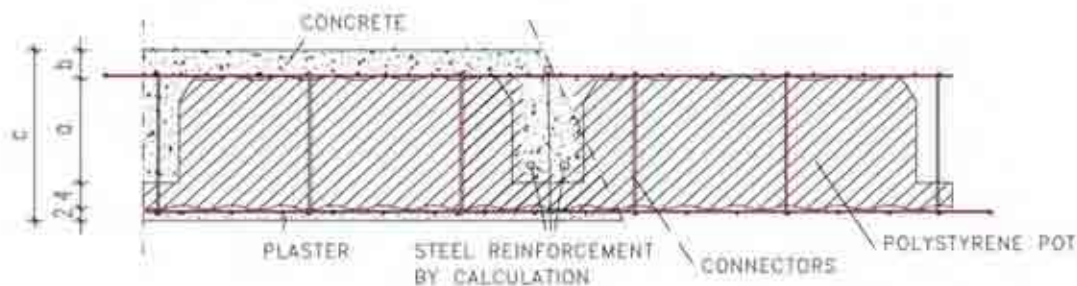


Fig. 5

Galvanized steel wire mesh

Longitudinal wires: 2.5 mm dia. every 70 mm
 Transversal wires: 2.5 mm dia. every 70 mm
 Cross steel wire: 3.0 mm dia. (approx. 68 per m²)

Polystyrene slab density: > 15 kg/m³

This panel is used for the floor and the roof system and it is reinforced in the joists with concrete casting on the site.

The reinforcement of the panel is integrated during the panel assembly by additional reinforcing bars inside the joists as per the design.

These are suitable for slabs having spans up to 8 m and with live loads up to 4 kN/m²;

Recommended Thermal resistance is given in Appendix IV.

6. Double Panel PDM

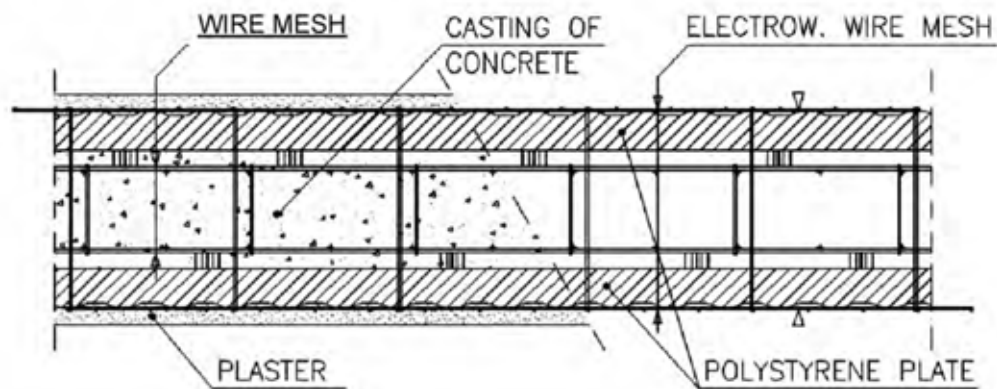


Fig. 6

Galvanized steel wire external mesh:

Longitudinal wires: 2.5 mm dia. every 65 mm
 Transversal wires: 2.5 mm dia. every 65 mm
 Cross steel wire: 3.0 mm dia. (approx. 68 per m²)

Galvanized steel wire internal mesh:

Longitudinal wires: 5 mm dia. every 100 mm
 Transversal wires: 5 mm dia. every 260 mm

Polystyrene component density: 25 kg/m³

Polystyrene component thickness: 50 mm to 80mm

Finished inter-plate thickness: 120 mm to 200 mm

The double panels consist of two panels facing each other and joined by connectors at a distance established for the structural requirements.

The space between the panels is filled with concrete as this gives the unit suitable strength (the panel functions as insulating elements as well as a form work).

Externally the panels are sprayed with traditional or pre-mixed cement based plaster.

Recommended Thermal resistance is given in Appendix V.

II – 2.2 DESIGN INFORMATION

II – 2.2.1 General

The *EMMEDUE* Advanced Building System may be designed using the appropriate design software. The system may be used as an alternate solution to a building designed using conventional brickwork masonry wall and RCC roofing.

The system is intended for use where Architectural drawings are available and satisfy the various requirements. The Architect and Engineer designer team of the concerned developer (client) is responsible for the drawings and overall building design to comply with the various regulatory requirements applicable to the area.

Structural design for any project shall be done by the structural engineer trained by EMMEDUE. The EMMEDUE engineer shall also liaise with the engineer for the developer and provide the necessary loading information for the design of the foundation.

The system shall be designed to provide the required performance against the loads to be taken into account in accordance with IS 875 (Parts 1-5):1987 and the data given by the EMMEDUE for various panels. It shall also provide the required bearing resistance for earthquake and wind forces as per IS 875 (Part 3):1987 and IS 1893 (Part 1):2002, wherever applicable. The details of design shall be made available by EMMEDUE on demand for vetting, if required.

Foundation shall be specifically designed in accordance with provision given in IS 1904:1986. Both single and double panels should have starter bars from either foundation or ground floor slab. All foundations should be designed by experienced engineer with appropriate reference.

In addition, any other requirement regarding safety against earthquake need to be ensured by the designer as per prevailing codal requirements.

II – 2.2.2 Structure

The *EMMEDUE* Advanced Building System panel receives its outer plane strength and rigidity by truss action where the shotcrete layers are the chord members. The design of *EMMEDUE* Advanced Building System shall follow the requirement of relevant Indian Standards wherever applicable. Design guidelines and requirements set out in the Technical literature provided by EMMEDUE shall be followed.

II—2.2.3 Wind Uplift

The design of roof to wall connections shall be to a specific design to ensure that the roof structure is properly restrained against uplift.

II – 2.2.4 In-fill Wall

When used as in-fill wall in framed RCC structure, the structure shall be designed in accordance with IS 456:2000. The fixing of the panels shall be done in accordance with the details provided by EMMEDUE. (See Figs.10 to 12)

II – 2.2.5 Water Tightness

Externally the walls shall be protected by an approved render applied to 35 mm sprayed 25 MPa concrete. DPC/radar barrier shall be installed at ground level to prevent rising damp. DPC shall also be used around window sills and a sealant shall be applied around window or door

frames.

II – 2.2.6 Durability

IS 456:2000 specifies exposure conditions, concrete strength and cover requirements. As EMMEDUE Advanced Building System may be used in different parts of the country, different situations may arise. Exterior coating may be applied to provide additional protection to the reinforcement against corrosion in aggressive environment.

II – 2.3 Manufacturing process

These panels are generally used for buildings of not more than 4 storey for floor slabs and covering slabs with max span of 4m. However, in such cases the panels are required to be further reinforced with additional meshwork and greater amount of concrete layer on the upper side up to 40 mm to 60 mm in keeping with the calculations made. Panels shall be machine manufactured using specified quality of raw materials to get the desired configuration and following proper Quality Assurance System.

II – 2.4 Inspections & Testing

Inspections & testing shall be done at appropriate stages of manufacturing process. The inspected panels shall be stored & packed to ensure that no damage occurs during transportation. As part of quality assurance, regular in-process inspections shall be carried out by the trained personnel of the PAC holder.

II – 2.5 Handling , Storage and Identifying the Components

The panels should be stored on a clean, flat hard surface area on the site. The panels should not be laid down directly on the ground to prevent them from getting dirty, which could lead to problems of plaster adhesion. Preferably, panels should be stored on timber battens approx. 2m apart. The panels should not be exposed to sunlight for not more than 1 month either in storage or during construction in order to prevent changing the polystyrene appearance. The panels should be bound carefully to make sure these are not accidentally blown by the wind.

Long term storage of the panels shall be done in a covered, protected, dry environment so that corrosion of the reinforcement does not occur and the panels do not get damaged.

Panels shall be stored and transported to site in a manner that prevents damage, buckling or sprawling of the polystyrene or bending of the mesh reinforcement. Operatives should place the panels in position and tie them down to starter bars of adjoining panels and slabs in the manner described in the Operational Manual.

Panels should be properly braced to provide rigid temporary support to the walls during erection and concrete spraying and placing of concrete in slabs. Propping of walls and slabs should be in accordance with EMMEDUE Operational Manual.

The panels shall be delivered to the site with an identification issued by the manufacturer that reports the element height.

The panel layout shall provide instructions for laying the components correctly.

II – 3 SELECTION & INSTALLATION

The EMMEDUE Advanced Building System shall be completed by trade persons with an understanding of EMMEDUE concrete system, in accordance with the technical literature and the PAC.

II – 3.1 General

Wall panels shall be erected vertically and in-plumb, starting at corners and working along. Connections between the panels and the foundation of floors must be made by means of structural bars that have been cast or set into the foundation or floor and wired to the welded fabric. Panels must be plumbed and temporarily supported as erection takes place. Final adjustments of supports for correct alignment may be carried out when all the panels are erected.

Panels may be cut to shape and size or openings formed in them by cutting with power saw or using bolt cutters on the welded wire fabric and a sharp blade, hand saw or hot wire on the EPS.

All the joints shall be connected by means of a bracing mesh to create a continuous reinforcing mesh over the wall. Bracing mesh work shall also be fitted at internal and external corners. Bracing mesh may not be required around openings at doors and windows reveals unless required by specific structural engineering design. (See Figs. 9 & 13)

All the building internal and external corners, either vertical or horizontal, are reinforced with angular meshes (RG1), which are attached to the structural mesh of the panels. (See Fig. 13)

The openings are braced using flat mesh (RG2) at 45° above and below corners of the opening. The door and window lintels according to their length and the window sills whose span is longer than 1.2m can be integrated with additional reinforcements on both sides. To avoid cold bridging at door and window openings, a thermal break is provided between the internal and external concrete. (See Fig. 13)

The upper wall panels, if applicable, must be installed as for the ground floor wall panels. Any built-in hold down or fixing devices required shall be attached in the correct position before concreting commences.

When the vertical panels are assembled on site, the verticality of the walls shall be checked and the bracing meshes positioned on all the corners. The horizontal bracing meshes are then put to connect the floor/roof to the vertical panel. The bracing U mesh (RU) shall be fixed on the entire perimeter of the floor/roof, at level of the intrados. (See Fig. 13)

After checking of bracing meshes, the floor/roof panels are positioned on them. The reinforcement of the panel is integrated during the panel assembly by additional reinforcing bars – following the design inside the joists. The arrangement is for floor slab having span up to 8.50 m and with live loads up to 4kN/m². For large spans, steel stiffening ribs in the pods of the panel may be used. These shall be verified by the design engineer. Doors and windows shall be fixed in the panels as per the guidelines issued by the manufacturer. (For details of the joints, bracings and application of the panels, see Figs. 7 to 9).

II – 3.2 Staircase

The staircase shall be designed. Once the stair panel is assembled and the reinforcement lattices are placed inside the panel internal channel, the latter are completed with gravel concrete (size <12mm). The concrete

may be cast in the panel ribs simultaneously with casting of the upper floor. Subsequently, 25 MPa sprayed concrete (50 mm thick) is applied both on the lower face and on the upper side of the flight while on its upper side, the flooring (marble, ceramic tiles etc.) may be directly laid on an adhesive layer. This panel enables the execution of stair of conventional dimensions only.

II – 3.3

Services

The laying of pipes for plumbing, electrical installation, heating services etc. takes place after the panels have been erected and before spraying of concrete takes place.

Services may be concealed within the panels by installing them behind the welded wire fabric. The chases in the polystyrene are carried out by a hot-air gun or similar tools. If insufficient space exists between the welded-wire fabric and polystyrene, the polystyrene may be cut away sufficiently to form the chase for the services. The area surrounding the cut should be restored by the addition of extra mesh connected to the meshwork of the panel. Copper pipes, if used, should be insulated from the meshwork with felt PVC or similar protection. No props greater than 50 mm dia. should be insulated in the polystyrene. Service pipes or ducts 100 mm in diameter or more should be placed outside the structure or in ducts within the building. The location of services should be as per the service drawing for the structure. Any alteration or change should be addressed to EMMEDUE and noted in the service drawings.

PVC sheet and electric cables shall not come in contact with EPS and shall, therefore be contained within a conduit or be laid without conduits away from EPS. Where services penetrate the external panels, the penetration shall be made watertight on the outside. Clearances for service movement shall be made in accordance with the service element providers' specifications.

II – 3.4

Concrete Installations

All concreting work shall be done in accordance with IS 456:2000 with regard to workmanship and materials.

Concrete is sprayed on the walls and ceiling using shotcrete pumps and is pumped in place for floor topping slabs. Upper level floor toppings slabs are usually placed before internal walls and ceilings to upper levels and allowed to cure to give a platform for spraying the interior. For shotcreting, guidance may be taken from IS 9012:1978. Some supports under slabs may be removed after 3 days but critical supports such as those at mid-span shall be left in place until the slab is fully cured. The structural engineering design shall provide the appropriate details for supports and sequence and timing of removal.

Concrete shall be of correct strength and mix design as required by the structural engineering design. Generally, concrete shall be applied in two layers. The first layer shall be applied to a thickness to cover the welded-wire fabric and the second layer to give the final required thickness. The first layer shall usually be left to cure for a few days to provide initial load transfer to the panels. Any supports or stiffeners that have been attached to the panels shall be removed before the second layer is sprayed and the gaps left by the supports are in-filled with sprayed concrete.

The first layer of concrete shall be left rough so as to give adequate key to second layer. Correct concrete thickness shall be measured as work proceeds. Screed points of concrete shall be used as gauges to give correct thickness and lines. Hand trowel finishing of the second layer shall be required to give the appropriate finish and surface tolerances. The ability to provide concrete finishes to the tolerances required by the designer is dependent on the skill and workmanship of the concrete finishes.

Curing of concrete shall be carried out as set out in IS 456:2000; and required a minimum of 7 days for external concrete and 3 days for internal concrete. The concrete may be kept damp by applying water to the surfaces. This may also be carried out by means of fine spray hose or wet screens placed over the surface.

II – 3.5 Precautions

- Do not overload partition walls on one side only. Instead, spray the concrete on both sides alternatively.
- If the panel is cut during erection and its meshwork has no wire-crossing points, panels should be joined with flat meshwork (min. width 225 mm)

II – 3.6 Finishing

After joinery installation has been completed using the details set out in the Technical literature, the interior and exterior finishes may be applied to the concrete surfaces. Interior surfaces (walls and ceiling) may be finished with a thin coat interior plaster applied in accordance with the Technical literature. Alternatively, any other suitable lining system may be applied.

II – 3.7 Health and Safety

The EMMEDUE Advanced Building System Technical literature shall be consulted for guidance for health and safety requirements such as personal protective clothing, protective glasses etc.

II –3.8 Choosing size and thickness

Appropriate size and thickness of the panels shall be chosen to suit the structural, fire, acoustic and thermal requirements of the structure.

II – 3.9 Fixing object to walls

Light weight object: 2.5 mm screws, pins or similar devices may be used.

Heavy object (shelves, water tanks etc.): Plastic pins with 45 mm screws or similar devices are recommended.

Very heavy object: During erection, metal pins may be inserted in plaster pallets. Alternatively, threaded pins fastened with epoxy resin may be used.

II – 4 MAINTENANCE REQUIREMENTS

A proper maintenance guide shall be given by the PAC holder to the client. When building is to be repainted with fresh coat of paint after scraping existing paint, check for joint sealant, pipe joint, sun shade etc. and carry out required maintenance and apply primer before paint is applied.

- II – 5 SKILLED /TRAINING NEEDED FOR INSTALLATION**
Workers shall be trained/ oriented on handling of panel and its erection, support system, clamping system, infilling of reinforcement and concrete etc. with all required safety measures taken including heavy hats, protective shoes etc. PAC holder shall arrange training of workers, as required in this regard.
- II--6 GUARANTEES/WARRANTIES PROVIDED BY THE PAC HOLDER**
PAC holder shall provide necessary guarantees/ warranties. A brochure giving relevant details and warrantee detail shall be made available to the client.
- II – 7 SERVICES PROVIDED BY THE PAC HOLDER TO THE CUSTOMER**
In-house testing of panels at regular intervals as per the Quality Control Assurance requirement shall be ensured by PAC Holder.
- II – 8 MANUALS**
A site Erection Manual and a Manual for Health & Safety shall be provided for each project incorporating the EMMEDUE Advanced Building System.
- II – 9 RESPONSIBILITY**
- Specific design using *EMMEDUE* Advanced Building System is the responsibility of the designer with the instructions, supervision and guidance of EMMEDUE S.P.A.
 - Quality of installation of the system on site is the responsibility of the trade persons engaged by the agency
 - Quality of maintenance of the building is the responsibility of the building owner.

Part--III BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

III – 1 ASSESSMENT

III – 1.1 The assessment has been done as per provisions of the standards listed in Part V of this Certificate.

III-1.2 The assessment of the system is based on the panels manufactured, used, installed and maintained as per statement given in the PAC. At present the panels are not manufactured in India. However, assessment of the suitability of panels manufactured as load bearing wall, shear wall, floor/ roof slab etc. is based on

- i) Performance tests conducted on single storey housing unit using panels brought from Italy. The tests included load test, rain simulation test, rebound hammer, nailing test, acoustic comfort test, thermal comfort test, ponding test on roof slab and fire resistance test.
- ii) Tests on construction materials including individual roof panel, tensile test of galvanized wire, expanded polystyrene and cement mortar vis-à-vis requirements contained in the specifications;
- iii) Technical Manual of EMMEDUE Advanced Building System

- iv) Technical Report on Experimental Evaluation of Building System M2 by the Laboratory of Earthquake-Resistant Structures, University of Peru;
- v) Analysis and validation of the static and seismic behavior of EMMEDUE buildings by ENEA, Italian Agency for New Technologies, Energy and the Environment and
- vi) Quality Assurance Scheme followed by the Certificate holder for process control

III – 2 **LABORATORY TESTS PERFORMED FOR ASSESSMENT**

III – 2.1 **Testing of samples by Foreign Laboratory/ Institute**

III – 2.1.1 **By Lapi Laboratory, Italy**

The following tests were carried out on three different samples of Polystyrene 15 – EPS 80 of density 15 kg/m³ and of thickness 40mm, 50mm and 300mm:

(i) Thermal performance of building materials and products – Determination of long term water absorption by immersion as per test method given in Standard EN 12087:2008

Parameters relating to level of water absorption for partial immersion and total immersion on four batches for long period were observed which were found to be satisfactory according to Standard UNI EN 13163:2003.

(ii) Ignitability of building products subjected to direct impingement of flame as per test method given in Standard EN ISO 11925-2:2002

Parameters relating to ignition, tip of the flame spread and filter paper ignition were observed which were found to be satisfactory according to Standard UNI EN 13238.

(iii) Fire classification of construction products and building elements using data from reaction to fire tests as per test method given in Standard EN ISO 11925-2:2002

Parameters relating to filter paper ignition by surface flame impingement and edge flame impingement for 15 & 30 seconds were observed which were found to comply with the requirement that the product in connection with its behavior to fire is classified as **E** according to Standard EN 13501-1:2009.

(iv) Thermal insulating properties for building applications – Determination of compression behavior as per test method given in Standard EN 826:1998

Parameter relating to level 10% deformation stress was observed which was found to be satisfactory according to Standard UNI EN 13163:2003.

(v) Thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance as per test method given in Standard UNI EN 12667:2002

Parameters relating to average thickness, thermal conductivity, thermal resistance and density were observed which were found to comply according to Standard UNI EN 13172.

III – 2.1.2 By Department of Engineering, University of Peru

As per the Technical Report on ‘Experimental Evaluation of Building System ‘M2’’ of Department of Engineering, University of Peru, following tests has been conducted:

(i) Vertical load test on the module:

It has been concluded that the real ceilings of the M2 system would pass the vertical test.

(ii) Seismic test on the module:

It has been concluded that since the module remained quite stable, it passed the seismic test.

(iii) Bending test on the slab panels:

The sequence of failure was experimentally proved.

(iv) Eccentric compression test on walls

(v) Shearing test on walls

(vi) Transversal seismic test on partition walls:

It has been concluded that since the partition wall when faced with a “catastrophic” earthquake, supported a load of 140% higher than the standard load, the partition wall of the M2 system can be used without problems.

(vii) Testing the components of M2 system

Compression tests on (a) cubic mortar samples – individual panels & module and on (b) standard concrete samples – foundation & upper layers of the slabs have been carried out.

III – 2.2 By Indian laboratory – Civil-Aid Technoclinic Pvt. Ltd. Bangalore - - NABL Accredited as per ISO 17025

III – 2.2.1 Tests conducted on construction materials and panels

1. Tensile test on weld mesh sample:

Tensile test was carried out on weld mesh sample used for making sandwich panels as per IS 1608:2005. The results indicate that the tensile strength falls in the range of 750 N/mm² to 850 N/mm² which is within the permissible limits.

2. Test on Expanded Polystyrene (EPS):

The compressive strength test was carried out on the extracted sample. The results indicate that the compressive strength was found to be 0.253 N/mm² which is within the permissible limits. The density also meets the minimum requirement as specified.

3. Load test on individual roof panel:

Load test was conducted as per IS 456:2000 and IS 875(Part 1):1987. The load of 250 kg/m² was imposed on the roof slab by ponding water uniformly over the entire area. The maximum deflection was observed to be 1.61mm at the end of 24 hours of loading. The deflection recovery was observed to be 95% on removal of test load within 24 hours of unloading which is within the permissible limits.

4. Tests conducted on core samples collected from floor slab and roof slab:

Tests were carried out on the extracted samples of *EMMEDUE* panel as per IS 456:2000 and IS 516:2008 for assessment of the compressive strength and its recovery. The results indicate that the compressive strength of the core samples fall in the range of 18N/mm² to 21 N/mm² and 12 N/mm² to 15 N/mm² for floor slab and roof slab respectively which are within the permissible limits.

III – 2.2.2 Performance tests conducted on a model house constructed using *EMMEDUE* system at Hesarghatta, Bangalore

III – 2.2.2.1 Main features of model house

i) Sub structure

The foundation consisted of PCC and SS masonry up to plinth level over which M 20 reinforced concrete laid.

ii) Super structure

The super structure has been made up of sandwich panel comprising of EPS and welded galvanized wire mesh on both faces of the Expanded Polystyrene board. These are interconnected with steel studs of the same material at regular intervals. These panels are then connected in line with dowel bars at predetermined locations as per the plan. The outer and inner faces of the panel are provided with premixed cement mortar. The top and bottom surfaces of the roof panels are provided with concrete and mortar on the ceiling. The roof panels are then erected on these walls with additional mesh and tied thereafter.

III – 2.2.2.2 Performance Tests

1. Load test on roof slab:

Load test was conducted as per IS 456:2000 and IS 875(Part 1):1987. The load of 250 kg/m² was imposed on the roof slab by ponding water uniformly over the entire area. The maximum deflection was observed to be 0.8mm at the end of 24 hours of loading. The deflection recovery was observed to be 100% on removal of test load within 24 hours of unloading which is within the permissible limits.

2. Ponding test on roof slab:

Test was carried out by ponding water to a height of 250mm directly on the roof slab for a period of 24 hours by constructing masonry bund all around. No dripping or leakage of water through slab during 24 hours of ponding was observed except for minor damp patches on the ceiling at few places.

3. Rain simulation test on wall surface:

Rain simulation test was carried out by jetting on the external surface of the wall continuously. The inner face of the wall was observed to be free from which was found to be within the permissible limits dampness or sweating during 10 hours of jetting at regular intervals of 30 minutes.

4. Nailing test on wall surface:

Nailing test was carried out, at random, as per the standard practice. Out of 20 nails of varying diameter and lengths, 8-10 nails penetrated up to their half-lengths and rest of the nails could not be penetrated as they buckled in the beginning.

5. Rebound hammer test on panel:

This test was carried out on walls and roof panel at random. The quality of the mortar was observed to be good.

6. Door shutter tests:

Tests namely dimensional measurement, edge loading, slamming, misuse and shock resistance were carried out as per IS 2202(Part-1):1999 and IS 4020:1998 to check the performance of the door shutter fixed in the model house. The results indicate that the door shutter provided for the housing unit performed satisfactorily under all the tests.

7. Acoustic Thermal test:

Sound intensity was measured outside and inside the unit to know the difference in sound levels using sound level meter. The results showed reduction of sound level by 35dB indicating a good acoustic comfort.

8. Thermal comfort test:

The reduction in outside and inside temperature was recorded up to 5.8°C indicating a good thermal comfort.

9. Fire resistance test:

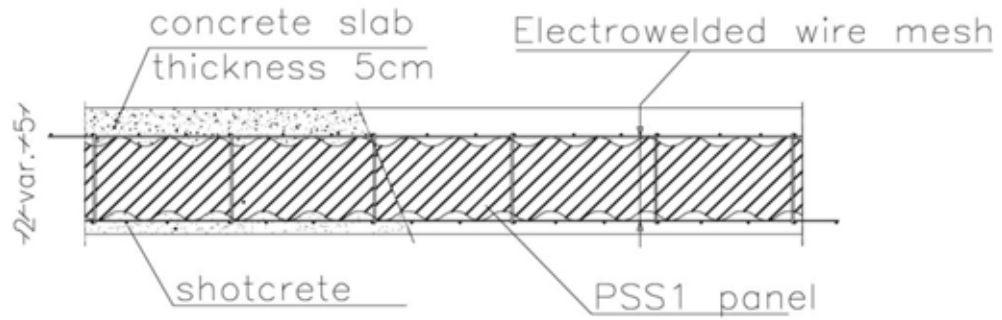
Test was carried out by igniting fire inside the building. During the fire (temp. raised up to 163°C). No distress/distortion of panels was observed in any part of the unit except breaking of a window glazing.

III -3

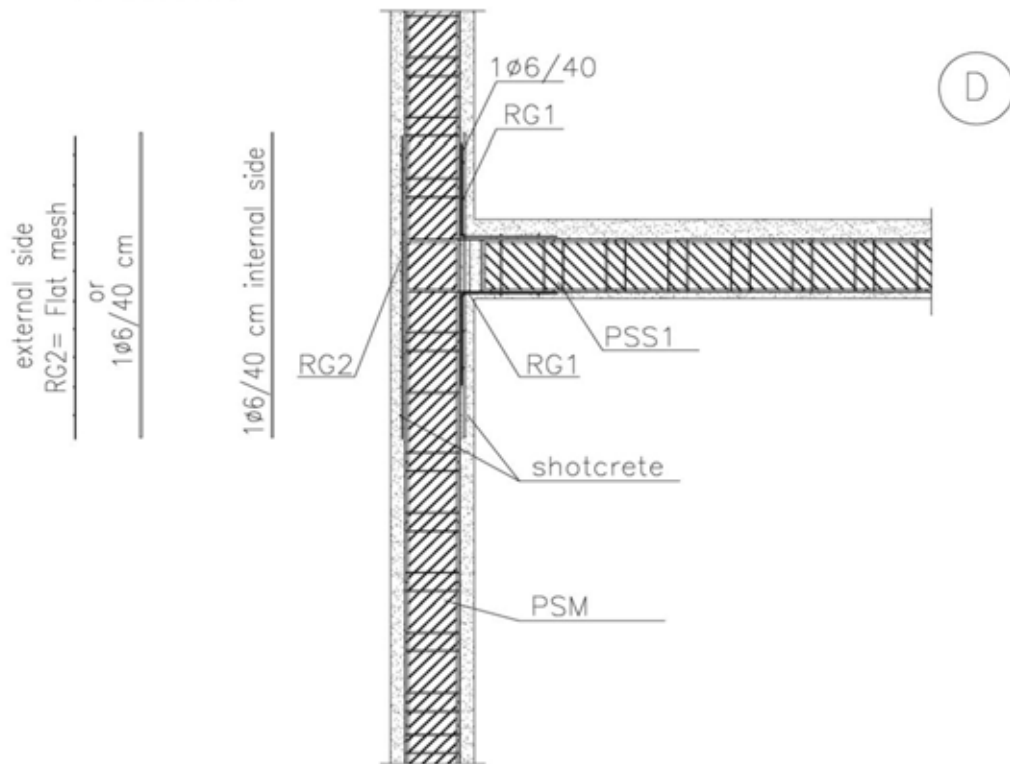
USAGE OF THE SYSTEM

The manufacturer has constructed a model single storey housing unit in Bangalore using panels brought from Italy. However, EMMEDUE has constructed various residential s& commercial buildings, offices, hospitals & hotels etc. from 1998 to date in many countries namely Italy, Spain, Argentina, Venezuela, Mexico, Indonesia and Angola etc.

Floor panel PSS1



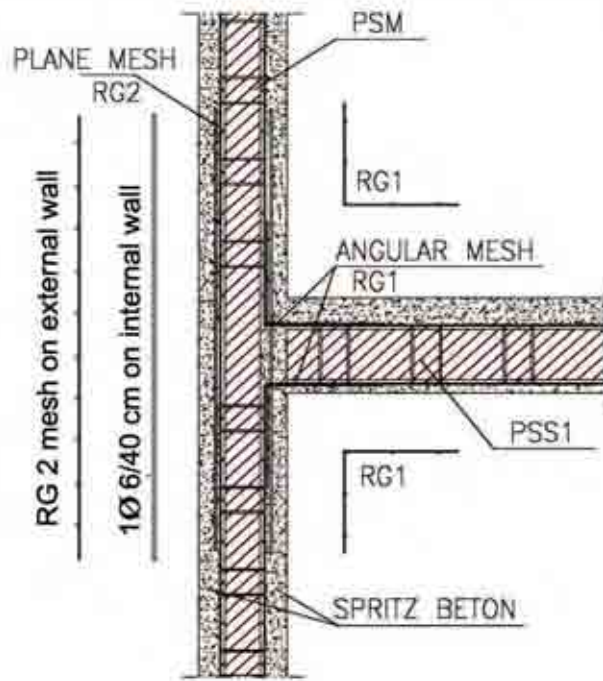
Panel joints (vertical section) SECTION



NB. ABOVE-MENTIONED DIAMETERS AND PITCHES OF REINFORCEMENTS SHOULD BE CALCULATED ACCORDING TO THEIR LOAD-BEARING. WHAT SHOWN IS ONLY USED AS AN EXAMPLE.

Fig. 7

PSM WALL – PSS1 FLOOR ANCHORAGE



PSM WALL – PSSG FLOOR ANCHORAGE

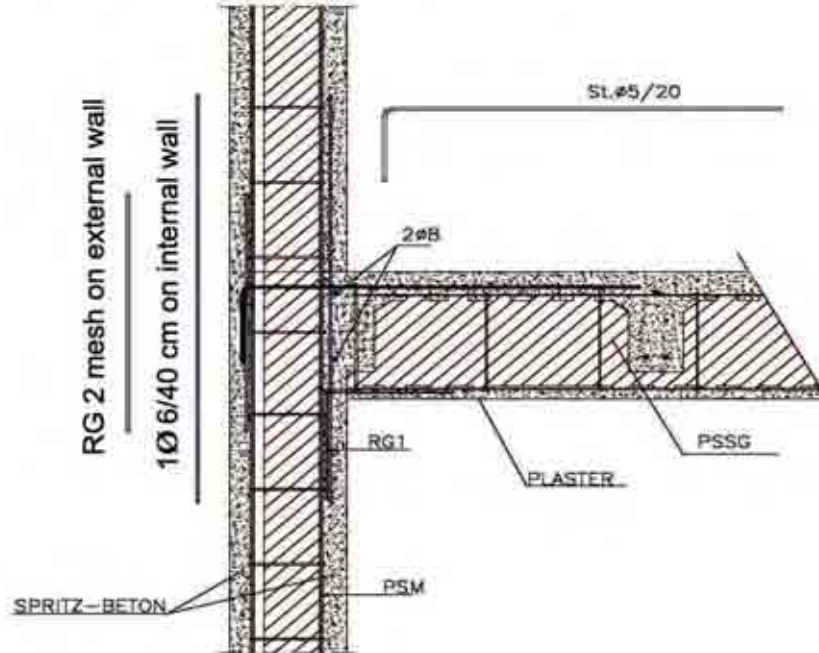
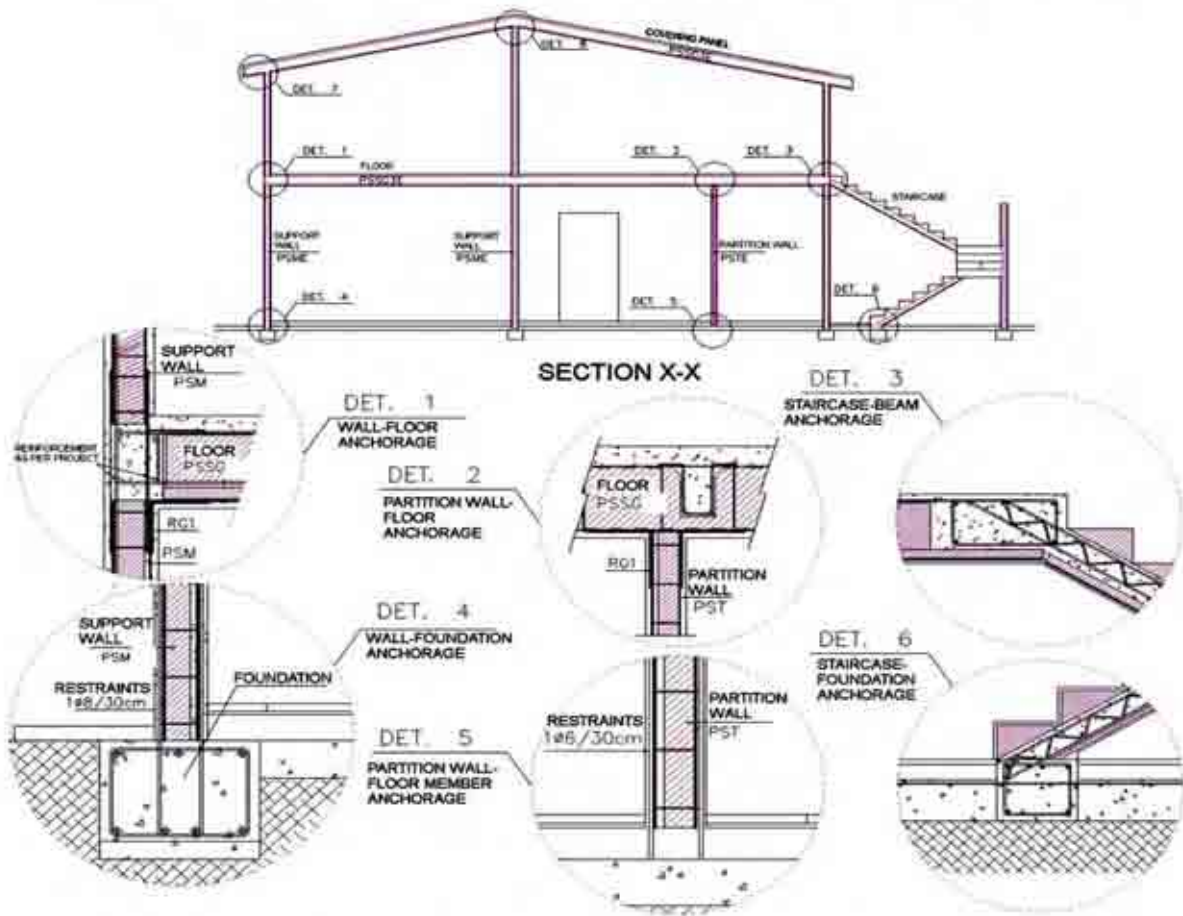


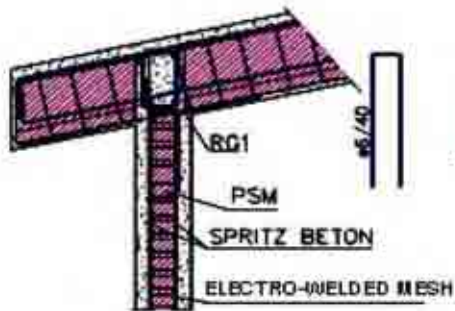
Fig.8

APPLICATION OF THE EMMEDUE PANEL



SINGLE WALL ANCHORAGE WITH COVERING PANELS

DET. 7
CONNECTION EDGING
FLOOR-PANEL-CORNICE



DET. 8
RIDGE EDGING

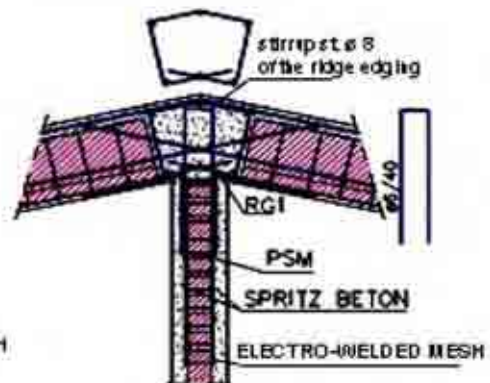


Fig.9

INFILL - TYPE 1: PANEL INSIDE THE STRUCTURE

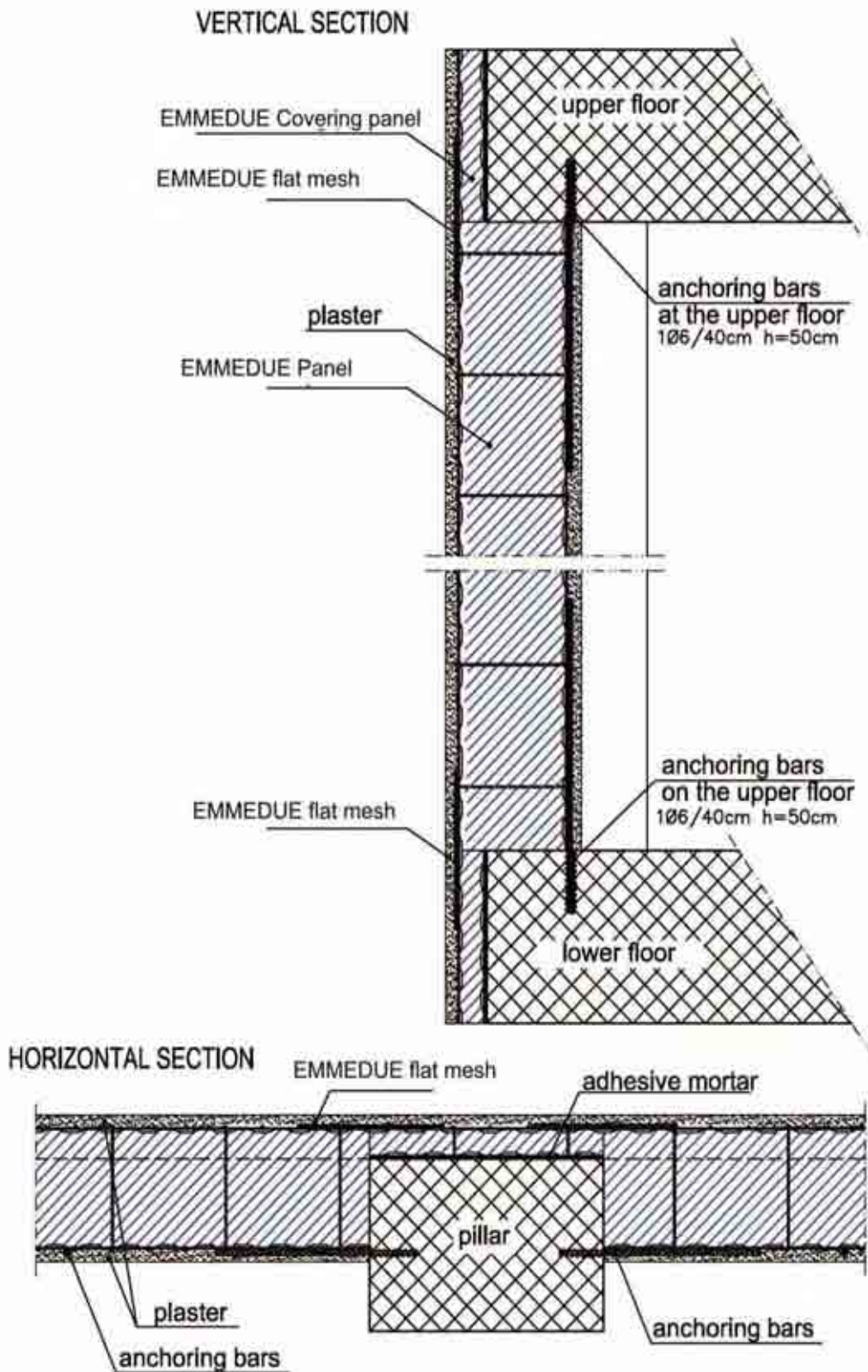


Fig. 10

INFILL - TYPE 2: CONTINUOUS PANEL EXTERNAL

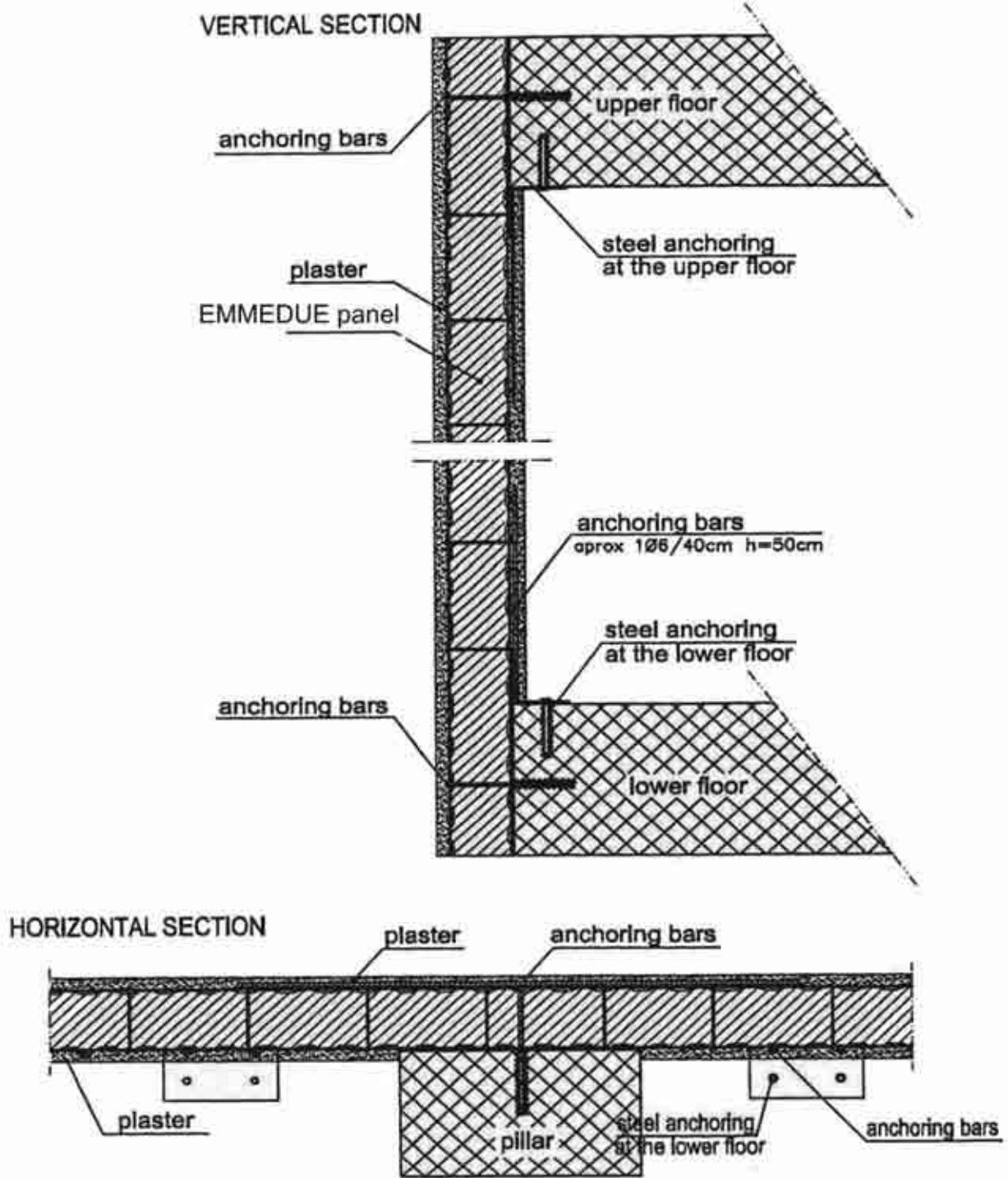
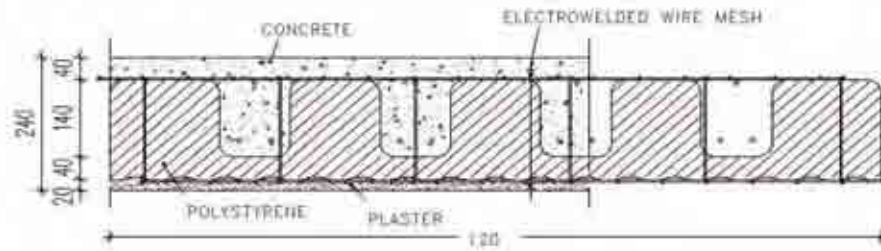


Fig.11

LANDING PANEL TYPICAL SECTION



REINFORCEMENT MESHES

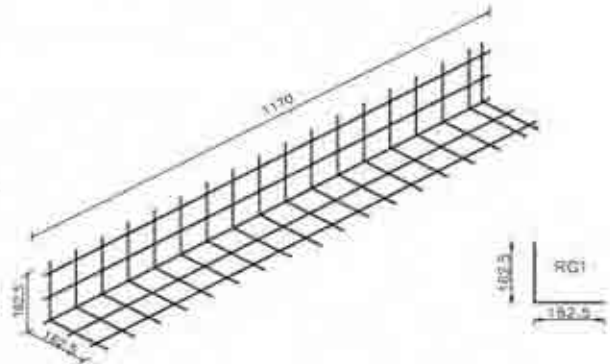
Made with galvanized steel wire (Ø gauge 12 (2.5 mm.))

The meshes are used to reinforce all the openings and corner-joints between panels so to obtain a monolithic behaviour of the structure.

rev. 04 of 02/12

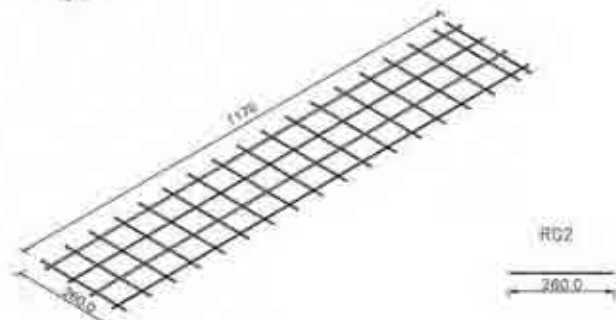
ANGULAR MESH RG1

- used on every wall intersection
- used on every wall and ceiling intersection



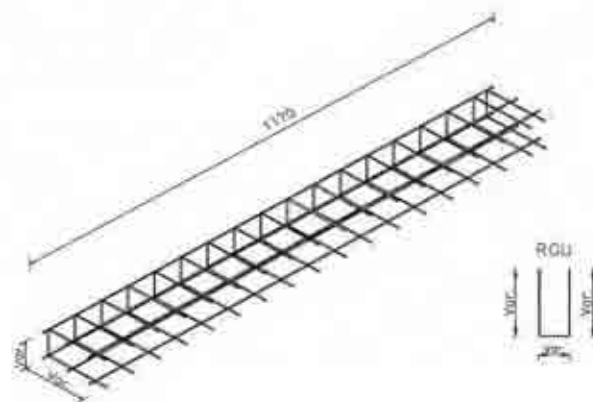
FLAT MESH RG2:

- used on every opening corner
- used on every discontinuity of the mesh.



"U" SHAPED MESH RU:

- used around any opening
- used to complete the top side of wall panels such as parapet and garden walls.



Panel specifications

Fig.12

DOOR & WINDOW REINFORCEMENT DETAILS

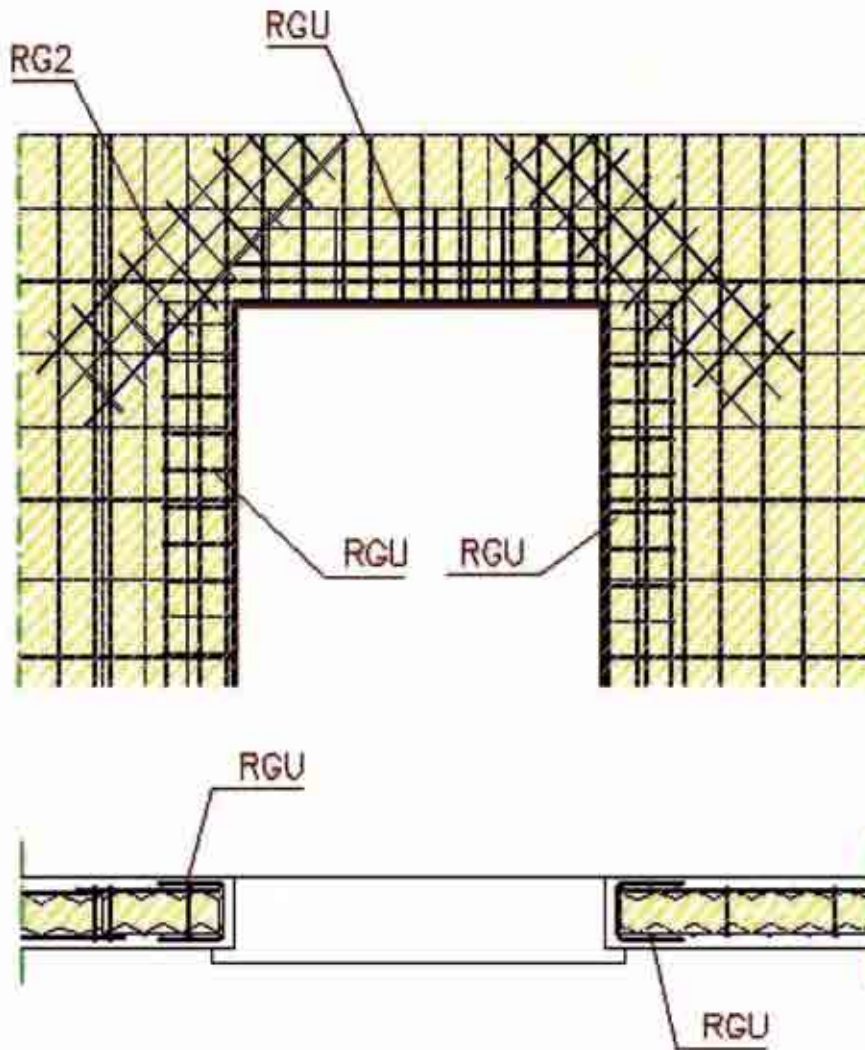


Fig-13

PART-IV STANDARD CONDITIONS

This certificate holder shall satisfy the following conditions:

- IV-1** The certificate holder shall continue to have the product reviewed by BMBA.
- IV-2** The product shall be continued to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this certificate. The Scheme of Quality Assurance separately approved shall be followed.
- IV-3** The quality of the product shall be maintained by the certificate holder. Complete testing facilities shall be installed for in-process control.
- IV-4** The product user should install, use and maintain the product in accordance with the provisions in this Certificate.
- IV-5** This certificate does not cover uses of the product outside the scope of this appraisal.
- IV-6** The product is appraised against performance provisions contained in the standards listed in Part-V. Provisions of any subsequent revisions or provisions introduced after the date of the certificate do not apply.
- IV-7** Where reference is made in this Certificate to any Act of Parliament of India, Rules and Regulations made there under, statutes, specifications, codes of practice, standards etc. of the Bureau of Indian Standards or any other national standards body and the International Organization for Standardization (ISO), manufacturer's company standards, instruction/manual etc., it shall be construed as reference to such publications in the form in which they were in force on the date of grant of this Certificate (and indicated in Part V to this Certificate)
- IV-8** The certificate holder agrees to inform BMBA of their clients with details of construction on six monthly basis.
- IV-9** The certificate holder agrees to provide to BMBA feedback on the complaints received, the redressal provided, and the time taken to provide redressal on complaint to complaint basis as soon as redressal is provided. BMBA agrees to provide the certificate holder the user feedback received by it, if any.
- IV-10** If at any time during the validity period, PACH is unable to fulfill the conditions in his PAC, he should on his own initiative suspend using the PAC and notify Chairman, TAC the date from which he has suspended its use, the reason for suspension and the period by which he will be able to resume. He shall not resume without the prior permission of BMBA. He shall also inform, simultaneously, his agents, licensees, distributors, institutional, government, public sector buyers, other buyers and all those whom he has informed about his holding the PAC. He shall also inform all those who buy his product(s) during the period of suspension. He shall provide to BMBA at the earliest the list of who have been so informed by him.

IV-11 In granting this Certificate, BMBA takes no position as to:

- (a) The presence or absence of patent or similar rights relating to the product;
- (b) The legal right of the Certificate holder to market, install or maintain the product;
- (c) The nature of individual installations of the product, including methods of workmanship.

IV-12 BMTPC and the Board of Agreement of BMTPC (BMBA) take no position relating to the holder of the Performance Appraisal Certificate (PACH) and the users of the Performance Appraisal Certificate (PAC) respecting the patent rights / copy rights asserted relating to the product / system / design / method of installation etc. covered by this PAC. Considerations relating to patent / copy rights are beyond the scope of the Performance Appraisal Certification Scheme (PACS) under which this PAC has been issued. PACH and users of this PAC are expressly advised that determination of the Claim / validity of any such patent rights / copy rights and the risk of infringement of such rights are entirely the responsibility of PACH on the one hand and that of the users on the other.

IV-13 It should be noted that any recommendations relating to the safe use of the product which are contained or referred to in this Certificate are the minimum standards required to be met with when the product is installed, used and maintained. They do not purport in any way to restate or cover all the requirements of related Acts such as the Factory Act, or of any other statutory or Common Law duties of care, or of any duty of care which exist at the date of this Certificate or in the future, nor is conformity with the provisions of this Certificate to be taken as satisfying the requirements of related Acts.

IV-14 In granting this Certificate, BMTPC and BMBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the use of this product.

IV-15 The certificate holder indemnifies BMBA, its officers and officials involved in this assessment against any consequences of actions taken in good faith including contents of this certificate. The responsibility fully rests with the certificate holder and user of the product.

IV-16 The responsibility for conformity to conditions specified in this PAC lies with the manufacturer who is granted this PAC. The Board (BMBA) will only consider requests for modification or withdrawal of the PAC.

IV-17 The PAC holder shall not use this certificate for legal defense in cases against him or for legal claims he may make from others.

Place: New Delhi

Date of issue: 8.1.14



Chairman TAC & _____ for and on behalf of

Member Secretary, BMBA

Dr. Shallesh Kr. Agarwal
Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
Core 5A, 1st Floor, India Habitat Centre, Lodi Road,
New Delhi-110 003

PART – V LIST OF STANDARDS & CODES USED IN ASSESSMENT

Part - V.1 Standards - These Standards are referred for carrying out particular tests only and do not specify the requirement for the whole product as such.

- Part –V.1.1 IS 456:2000 --** Code of practice for plain and reinforced concrete
Part –V.1.2 IS 516:1959 -- Method of tests for strength of concrete
Part –V.1.3 IS 875:1987 -- Code of practice for design loads for buildings and structures
Part –V.1.4 IS 1608:2005 -- Mechanical testing of metals-tensile testing
Part –V.1.5 IS 4020: (Part1-16):1998 -- Door shutters - method of tests
Part –V.1.6 IS 4671:1984 – Specifications for expanded polystyrene for thermal insulation purposes
Part –V.1.7 IS 8811:1998 -- Method for emission spectrometric analysis of plain carbon steel
Part –V.1.8 IS 13311 (Part II):1992 -- Non-destructive testing of concrete -rebound hammer
Part –V.1.9 IS 14856:2000 -- Glass fiber reinforced plastic panel type door shutter

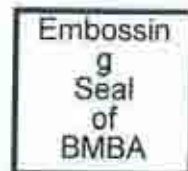
Part – V.2 Company Standards of the PAC holder – The branded design & specifications of the raw materials and finished product are as submitted by the manufacturer. The PAC holder has to make available the company standards to the consumers according to which testing have been done.

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Advanced Building System EMMEDUE** bearing the mark manufactured by M/s EMMEDUE S.P.A. is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No.1010-S/2014** is awarded to M/s **EMMEDUE S.P.A., Italy.**

The period of validity of this Certificate is as shown on Page 1 of this PAC. This Certificate consists of pages 1 to 38.

Udit Agrawal



On behalf of BMTPC Board of Agreement Chairman, Technical Assessment Committee (TAC) of BMBA & Member Secretary, BMTPC Board of Agreement (BMBA) Under Ministry of Housing and Urban Poverty Alleviation, Government of India

Place: New Delhi, India

Date: *8th January 2014*

PART -- VI ABBREVIATIONS

Abbreviations

BMBA	Board of Agreement of BMTPC
BMTPC	Building Materials and Technology Promotion Council
CPWD	Central Public Works Department
ED	Executive Director of BMTPC
IO	Inspecting Officer
MS	Member Secretary of BBA
PAC	Performance Appraisal Certificate
PACH	PAC Holder
PACS	Performance Appraisal Certification Scheme
SQA	Scheme of Quality Assurance
TAC	Technical Assessment Committee (of BMBA)

Performance Appraisal Certification Scheme - A Brief

Building Materials & Technology Promotion Council (BMTPC) was set up by the Government of India as a body under the Ministry of Housing & Urban Poverty Alleviation to serve as an apex body to provide inter-disciplinary platform to promote development and use of innovative building materials and technologies laying special emphasis on sustainable growth, environmental friendliness and protection, use of industrial, agricultural, mining and mineral wastes, cost saving, energy saving etc. without diminishing needs of safety, durability and comfort to the occupants of buildings using newly developed materials and technologies.

During the years government, public and private sector organizations independently or under the aegis of BMTPC have developed several new materials and technologies. With liberalization of the economy several such materials and technologies are being imported.

However, benefits of such developments have not been realized in full measure as understandably the ultimate users are reluctant to put them to full use for want of information and data to enable them to make informed choice.

In order to help the user in this regard and derive the envisaged social and economic benefits the Ministry of Housing & Urban Poverty Alleviation has instituted a scheme called Performance Appraisal Certification Scheme (PACS) under which a Performance Appraisal Certificate (PAC) is issued covering new materials and technologies. PAC provides after due investigation, tests and assessments, amongst other things information to the user to make informed choice.

To make the PACS transparent and authentic it is administered through a Technical Assessment Committee (TAC) and the BMTPC Board of Agreement (BMBA) in which scientific, technological, academic, professional organizations and industry interests are represented.

The Government of India has vested the authority for the operation of the Scheme with BMTPC through Gazette Notification No. 1-16011/5/99 H-II in the Gazette of India No. 49 dated 4th December, 1999.

Builders and construction agencies in the Government, public and private sectors can help serve the economic, development and environmental causes for which the people and Government stand committed by giving preference to materials and technologies which have earned Performance Appraisal Certificates.

Further information on PACS can be obtained from the website: www.bmtpc.org

Single Panel PSM

Recommended Thermal Transmittance

S.No.	Kind of Panel	Thickness of finished panel (mm)	Thermal transmittance U (W/m ² K)	
			density 15 kg/m ³	density 25 kg/m ³
1.	PSM 60	130	0.570	0.520
2.	PSM 80	150	0.440	0.400
3.	PSM 100	170	0.360	0.330
4.	PSM 120	190	0.300	0.270
5.	PSM 140	210	0.260	0.240

Sound Proofing Index:

41 dB

Single Panel PST

Recommended Thermal Transmittance

S.No.	Kind of panel	Thickness of finished panel (mm)	Thermal transmittance U (W/m ² K)	
			density 15 kg/m ³	density 25 kg/m ³
1.	PST 40	90	0.814	0.743
2.	PST 50	100	0.674	0.613
3.	PST 60	110	0.574	0.522
4.	PST 80	130	0.444	0.402
5.	PST 100	150	0.361	0.327
6.	PST 120	170	0.305	0.347
7.	PST 140	190	0.264	0.275
8.	PST 160	210	0.232	0.209
9.	PST 180	230	0.208	0.187
10.	PST 200	250	0.188	0.169

Sound Proofing Index: 41 dB

Panel Weight and Thickness

Panel type	EPS thickness mm	Plaster thickness mm	Distance between meshes mm	Total thickness mm	Panel weight kg/m ³	Wall weight (Panel+ plaster) Kg/m ³
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

Single Panel PSS1

Recommended Thermal Transmittance

S.No.	Kind of Panel	Thickness of finished panel (mm)	Thermal transmittance U (W/m ² K)	
			Density 15 kg/m ³	Density 25 kg/m ³
1.	PSSI 80	155	0.446	0.393
2.	PSSI 100	175	0.363	0.319
3.	PSSI 120	195	0.306	0.269
4.	PSSI 140	215	0.265	0.232
5.	PSSI 160	235	0.233	0.204

Sound Proofing Index:

41 dB

Panel Weight and Thickness

Panel type	EPS thickness mm	Concrete thickness mm	Distance between meshes mm	Total thickness mm	Panel weight kg/m ³	Wall weight (Panel+ plaster) Kg/m ³
PSSI 80	80	50	102.5	155	4.32	207
PSSI 100	100	50	122.5	175	4.71	207
PSSI 120	120	50	142.5	195	5.10	208
PSSI 140	140	50	162.5	215	5.49	209
PSSI 160	160	50	182.5	235	5.88	209

Floor Panel PSSG

Recommended Thermal Transmittance

Panel type	Plaster Thickness = 20mm Polystyrene slab = 40mm Concrete slab = 40mm Pot height mm (max.300 mm)	Thermal transmittance U (W/m ² K)
PSSG 100	90	0.301
PSSG 120	100	0.267
PSSG 140	110	0.240
PSSG 160	130	0.218
PSSG 180	150	0.199
PSSG 200	170	0.184
PSSG 220	190	0.170
PSSG 240	210	0.159

Recommended Weight

TYPE OF FLOOR PANEL	HEIGHT OF FLOOR		<i>Own Weight (including plaster)</i>
	hollow block	floor member	
	h (cm)	s (cm)	(daN/m ²)
PSSG2 10+4	10	4	190
PSSG2 12+4	12	4	199
PSSG2 14+4	14	4	208
PSSG2 16+4	16	4	217
PSSG2 18+4	18	4	226
PSSG2 20+4	20	4	235
PSSG2 22+4	22	4	245
PSSG2 24+4	24	4	254

Double Panel PDM

Recommended Thermal Transmittance

Panel type	EPS thickness	Core mm	Finished wall thickness mm	Thermal transmittance U (W/m ² K)
PDM 120	50+50		27	0.317
	70+70		31	0.232
	80+80		33	0.205
PDM 150	50+50		30	0.315
	70+70		34	0.231
	80+80		36	0.204
PDM 180	50+50		33	0.313
	70+70		37	0.230
	80+80		39	0.204

Fire resistance: REI 150
 Sound Proofing Index 40 dB

Recommended Wall Thickness & Weight

PANEL TYPE	EPS Core thickness(mm.)	Finished wall thickness (mm.)	Wall weight (panel + concrete + plaster) (daN/mq)
PDM 120	50+50	270	348,7
	70+70	310	349,9
	80+80	330	350,5
PDM 150	50+50	300	420,9
	70+70	340	422,1
	80+80	360	422,7
PDM 180	50+50	330	493,1
	70+70	370	494,1
	80+80	390	494,8