BMTPC
PACS
PERFORMANCE APPRAISAL CERTIFICATION

PIR DRY WALL PRE-FAB PANEL SYSTEM

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:
M/s Covestro (India) Pvt. Ltd.
Bayer House, Central Avenue
Hirandani Estate,
Thane (West), Maharashtra-- 400607
Tel: 022-25866177, 09975248821
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Performance Appraisal Certificate

PAC No.:1**039-S/ 2018**
Issue No. **01**
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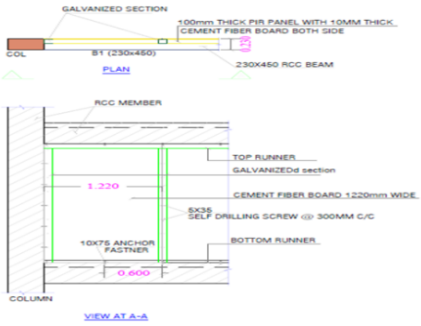

bmtpc

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PERFORMANCE APPRAISAL CERTIFICATE

FOR

PIR DRY WALL PRE-FAB PANEL SYSTEM

ISSUED TO

M/s COVESTRO (INDIA) PVT. LTD., THANE (MAH.)

STATUS OF PAC NO.: 1039-S/2018

S. No.	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remark	Signature of authorized signatory
				No.	Date			
1.	2.	3.	4.	5.	6.	7.	8.	9.
1	01	30-08-2018	30-08-2019	--	--	29-08-2019	--	

CONTENTS

PART 1 CERTIFICATION

1.1 Certificate Holder: M/s Covestro (India) Pvt. Ltd
Bayer House, Central Avenue
Hirandani Estate,
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Tel: 022-25866177, 09975248821
E-mail: mansab.momin@covestro.com

1.2 Description of System

1.2.1 *Name of the System* – PIR Dry Wall Pre-Fab Panel System

1.2.2 *Brief Description* – PIR Dry Wall Pre-Fab Panel is a system where two fibre cement boards (FCB) of 10 mm thickness are filled with insulation material namely Poly Isocyanurate (PIR) in-situ and erected to produce straight to finish walls. The system shall be integrated with conventional column and beam for pre-engineered buildings. Insulation core provides effective insulation and strong bonding for better structural stability to facilitate higher loading and wider spans. This system can incorporate all types of services viz. electrical, gas and plumbing etc.
For the above mentioned system, M/s Covestro provides raw materials for production of fibre cement board and PPGI sheets and technology support/assistance to its pre-fab panel manufacturer i.e. M/s Sintex Prefab and Infra Ltd., Ahmedabad. Sintex adopts technology from Covestro for the above mentioned system and manufactures PIR technology based dry wall pre-fab panel system. This is in alignment as per technical assistance and guidance support from Covestro.

A Co-operation Agreement for Construction of Sanitary facility, Aganwadi and related construction using PIR Panel across India has been executed between both the firms on 31st July, 2017.

1.2.3 *Size of Panels*

1.2.3.1 *Size:* Panels are normally produced in sizes and dimensions as given below:

Length: 2400/2700/3000mm or as per requirements.
Width: 1200 mm
Thickness: For external wall, thickness is 120mm having 10mm thick cement fiber board on both sides and inside filled with Poly Isocyanu

Rate (PIR) of 100mm thick. For internal wall, thickness is 100mm/60mm having 10mm/6mm thick cement fiber board on both sides and inside filled with PIR depending upon thickness of wall.

Details of the panel is shown in Fig. 1.

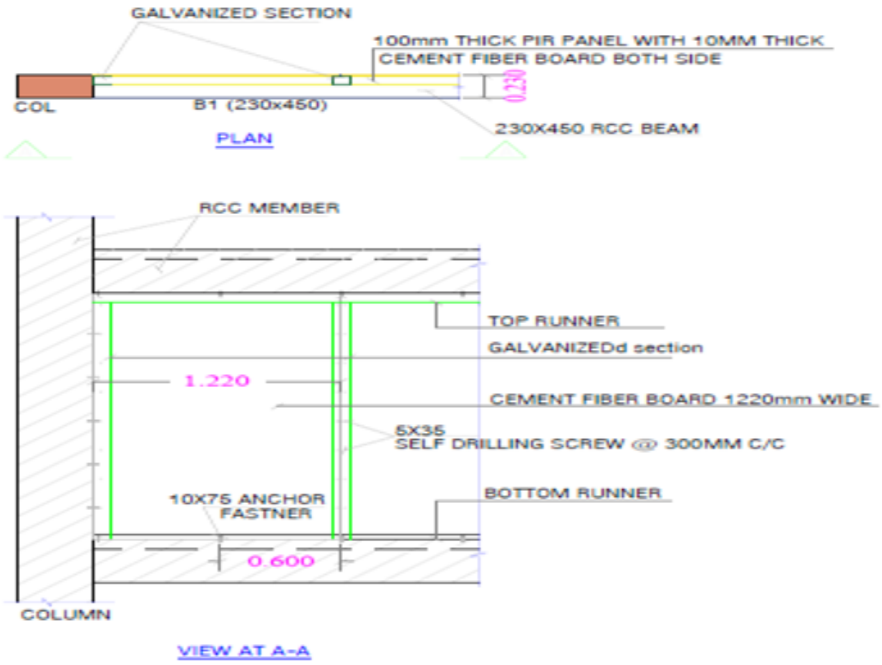


Fig. 1

1.3 Uses of Panels

1.3.1 *Uses*:

PIR Dry Wall Pre-Fab Panels shall be used as non-load bearing /filler walls for buildings including apartments, villas, low-rise buildings, commercial complexes, hotels, industrial buildings, etc.

1.4 Basis of Assessment

1.4.1 *Scope of Assessment*

1.4.1.1 Scope of assessment included conformance of non-load bearing walls for buildings including apartments, villas, commercial complexes, hotels, industrial buildings, etc.

1.4.2 *Basis of Assessment*

Assessment of the suitability of the PIR Dry Wall Pre-Fab Panels is based on:

i. Vetting of structural design and drawings of (G+3) LIG residential building at Jaipur for Rajasthan Housing Board by Malaviya National Institute of Technology, Jaipur in 2017.
ii. Summary Report of design of a structure using ETABS 2016, Integrated Building Design Software in 2018.
iii. Test Report for Fire Resistance by Sirim Qas International, Malaysia
iv. Assessment of quality assurance procedures implemented for Quality Assurance Scheme followed by the Certificate holder for process control as per Quality Assurance Plan is given in Annex I.

1.5 Design Parameters

1.5.1 The PIR panels are designed using ETABS 2016. The buildings constructed with PIR Panel modules shall be studied and if the structure is Ground or G+1 then dry wall vertical columns to support the RCC slab and if the structure is more than G+1 then it shall be designed as reinforced concrete structure since the parameters required for their design are the same as needed for traditional reinforced concrete. In the calculation model, the building shall be designed in accordance with IS 456:2000, as applicable.

1.5.2 The system is intended for use where Architectural drawings are available and satisfy the various requirements. The Architects and the 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.

1.5.3 The design engineer shall liaise with the engineer of the developer and provide the necessary loading information for the design of the foundation.

1.5.4 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):1987 and the data given by manufacturer for various panels. It shall also provide the required bearing resistance for earthquake and wind forces as per IS 1893 (Part 1):2016 and IS 875 (Part 3):2015 respectively, wherever applicable.

1.5.5 Foundation shall be specifically designed in accordance with provision given in IS 1904:1986. The design concept shall be same as that of the conventional building design. The safe bearing capacity and soil properties (soil investigation report)) shall be provided from the site after soil investigations. Foundation shall be designed based on the soil investigation report.

1.5.6 *Wind Loads*

Wind pressure and suction loads shall be calculated on the basis of IS 875 (Part-3):2015. Panels shall be designed for their capacity to withstand the local wind loads acting on them. The wind suction values shall be used to calculate the number of bolts for fixing the panels to the substructure.

1.5.7 *Substructures*

These supporting elements (purlins, sheeting rails, trimmers for windows, doors and industrial doors) transmit the loads from snow, ice, wind pressure and wind suction. They shall be designed to take into consideration the prevalent load conditions based on the relevant codes.

1.5.8 *Calculation of the number of fasteners*

Wind suction loads also determine the number of fasteners. The pull-out loads of the fasteners must be obtained from the manufacturer's technical approval certification. The partial safety factors specified in IS 800:2007 shall be applied.

1.5.9 *Factory-installed seals in panels*

Joint sealing tapes must be of the closed cell foam and be compressed to 60% of their initial thickness when assembling the panels on site. During the design process it must be ensured that wall and facade panels are sealed against outside air with joint sealing tape on the inside as well. Roof panels shall have a joint sealing tape, a sealing tape in the overlapping joint on the crown and an internal sealing tape in the seal. The internal joint tolerance in roof panels is ± 2 mm.

1.6 Conditions of Certifications

1.6.1 *Technical Conditions*

1. Raw materials and the finished wall panels shall conform to the requirements of the prescribed specifications.
2. M/s Sintex Prefab and Infra Ltd shall provide full details of manufacture and erection of the panels to the agency who may be engaged for production and construction.
3. The Certificate is being issued after visit to the site and satisfactory test results of the panels from Institute of Technology, Nirma University, Ahmedabad as per Indian conditions and Standards.

1.6.2 *Quality Assurance*

The Certificate Holder shall implement & maintain a quality assurance system in accordance with Quality Assurance Plan (QAP) given in Annex I attached with this Certificate.

1.6.3 Du*rability*

- PIR wall being non-loadbearing wall panels are to be supported with RCC/Steel Structural frame members.
- No plastering is required.
- Easy to paint on it as compared with convention system.
- PIR panels are thin and consumption of materials is less resulting into lighter structures and saving on building materials.
- PIR panels maintain its performance in the long term. Whilst a building remains fully insulated heating costs are kept under control, which also results in reduced CO_2 emissions.
- The durability of PIR insulation has a positive impact on the life cycle analysis (LCA) of a building project.

1.6.4 *Handling of User Complaints*

1.6.4.1 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.

1.6.4.2 The Certificate holder shall implement the procedure included in the Scheme of Quality Assurance (SQA). As part of PACS Certification, he/she shall maintain data on such complaints with a view to assess the complaint satisfaction and suitable preventive measures taken.

1.7 Certification

1.7.1 On the basis of assessment given in Part 3 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 Parts 1 & 2 of this Certificate, the panels covered by this Certificate are fit for use as set out in the Scope of Assessment.

PART 2 CERTIFICATE HOLDER'S TECHNICAL SPECIFICATIONS

2.1 General

2.1.1 The PAC holder shall manufacture the panels in accordance with

the requirements specified in the relevant Standards (See Part 5). In addition it shall follow the specific requirements of these sections for various materials used in the manufacturing of the panels.

2.2 Specifications

2.2.1 *Raw Materials*

(i) *Fibre Cement Board*: Shall be 100% asbestos free and of Type A, Category 3 min. as stipulated in IS 14862:2000.
(ii) *Poly Isocyanurate (PIR):* Shall be as per the specifications of the manufacturer
(iii) *PPGI sheet:* Shall be 0.5mm thick and as conform to IS 14246:2013
(iv) *Square Hollow Section (SHS)/ C Channel*: Shall be manufactured from pre-galvanized high tensile steel conforming to IS 277:2003.
(v) Fibre glass mesh: Shall be as per manufacturer specifications.
(vi) *Acrylic based glue*: Shall be as per manufacturer specifications.
(vii) *Galvanized MS screws:* Shall be as per manufacturer specifications.
(viii) *Anchor fasteners:* Shall be of 10mm to 12mm dia., 50mm to 75mm length and as per manufacturer specifications.
(ix) *Premix Putty*: Shall conform to IS 419:1967.

2.3 Production Machinery & Equipment

M/s Sintex Prefab and Infra Ltd. has various machines and equipment for manufacturing of the panels as per the Panel production line Flow Chart given in Annex II.

2.4 Manufacturing Process of PIR Panels

2.4.1 *Continuous and Discontinuous Panel Manufacturing Methods*

There are basically two panel manufacturing methods: continuous and discontinuous. In the continuous process, all the materials used are processed together and completely formed panel is cut to the desired length without stopping the line. In the discontinuous process, the materials are processed separately; this means the facings are formed and cut to the desired length and then assembled together in a press where the foam is injected.

2.4.2 *Continuous Process (For both Wall and Slab panels)*

A typical continuous line is made up of the following three sections:

- External layers processing section
- Insulating material processing section

• Panels handling section

2.4.2.1 In case of a sandwich panel with both exterior surfaces in cement fibre board for walls and sheet metal for roof and an insulating core in PIR foam, the first section starts with the sheet de-coilers and continues with all the equipment for forming the two sheets into the desired shape. The panel could be a panel for walls or for roofs. Sandwich panels with flexible layers are not roll formed. Both surfaces of the final panels are entirely flat. The surfaces are pre-heated to the temperature required by the process (usually between 60ºC 65º C) and then the insulating material is prepared.

2.4.2.2 In PIR panels, the foam is generated by starting from the required chemical components metered and mixed together in the foaming machine. The resulting liquid mixture is evenly distributed over the lower metal sheet. The metallic facings, foam and possible side strips or gaskets are pressed inside the double conveyor or continuous press. This machine has to maintain the metal sheets separated at the desired distance while the foam expands.

2.4.2.3 In this way, the panel will have the desired thickness and shape once the foam has expanded and fully cured. The most critical parameter to ensure a good result from the process is the temperature control of the chemical components, metal sheets and press area.

2.4.3 *Discontinuous Process (For Wall Panels only)*

Such panels either rigid or flexible, with flat or grooved profile can be produced using cement fibre board for walls and pre-painted metal sheet for roof slab.

Diverse technologies apply to the discontinuous production process, namely:

- Manual mode injection technology at closed mould;
- Automatic mode lance displacement at closed mould;
- Automatic mode injection technology at closed mould.

2.4.3.1 *Manual mode injection technology at closed mould*

A standard plant composition is based on a low pressure metering machine and a single or multi-daylight press depending on the production requirements of the end-user.

The production process includes the pre-assembly of the panel on the tray which will be then conveyed to the press for the foaming. Some wooden or metal side containments are placed all around the panel perimeter to contain the foam expansion.

Along the longitudinal side of the panel containment there will be holes (their number depends on the panel dimensions to be produced) suitable for the mixing head to be inserted during the foaming. The mixing head movement is through either a manual or power-driven carrier for entering the injection holes. All panels foaming phases within the press will be manually carried out by the operator.

2.4.3.2 *Automatic mode lance displacement at closed mould*

This is an alternative solution to the previous illustrated technology and it ensure an optimal distribution of the foam with a constant density.

A standard plant composition is based on a high pressure metering machine with relative mixing head which, through an automatic movement system, is introduced inside the panel cavity to the furthest extremity of the panel, previously preassembled and conveyed into the press. The foam distribution takes place during the mixing head retrieving phase/backward movement from the panel.

2.4.3.3 *Automatic mode injection technology at closed mould*

This technology is mainly used for the production of panels for walk-in cold rooms and refrigerated containers where high thickness and large width are needed to ensure a smooth and even distribution of the foam with a constant density.

Manufacturing Process Flow Chart is given in Annex III.

2.5 Installation and Joining of the Panels

2.5.1 Steps involved in installation of the PIR panels are as follows:

2.5.1.1 *RCC/Concrete Base*

- A concrete base shall be constructed as per the required design and drawings
- Surface over which square hollow section/C channel is to be fixed shall be cleaned

2.5.1.2 Square *Hollow Section (SHS)/C Channel*

- Square hollow section/C channel shall be placed over concrete surface.
- Top layer of square hollow section/C channel shall be drilled.
- Bottom layer of square hollow section that goes into concrete surface shall also be drilled.

- Fastener of 10mm to 12mm dia. and 50mm to 75mm length shall be inserted into the drilled hole @ 600mm c/c and fixed tightly.
- Above steps shall be repeated to fix entire square hollow section
- Panels shall be cleaned with all excess PIR foam/particles removed from cement board surface, panel edges and corners.

2.5.1.3 *Panel Installation over SHS/C Channel*

- Panel shall be identified with reference to respective points of installation as per the drawings.
- 15mm groove shall be made at panel edges, as required.

2.5.1.4 *Screwing Panels with SHS/C Channel*

- Screws shall be fixed on the points marked on the panels.
- Proper drilling procedure as specified by the manufacturer shall be followed to avoid cracks on panel surface.
- *SHS/C Channel* bottom runner G.I section shall be fixed at the RCC base with anchor fastener @ 600mm c/c on which the vertical G.I support will be screwed.
- Panel shall be supported on vertical support and bottom runner by screwing.

2.5.1.5 *Finishing of Panel Joints*

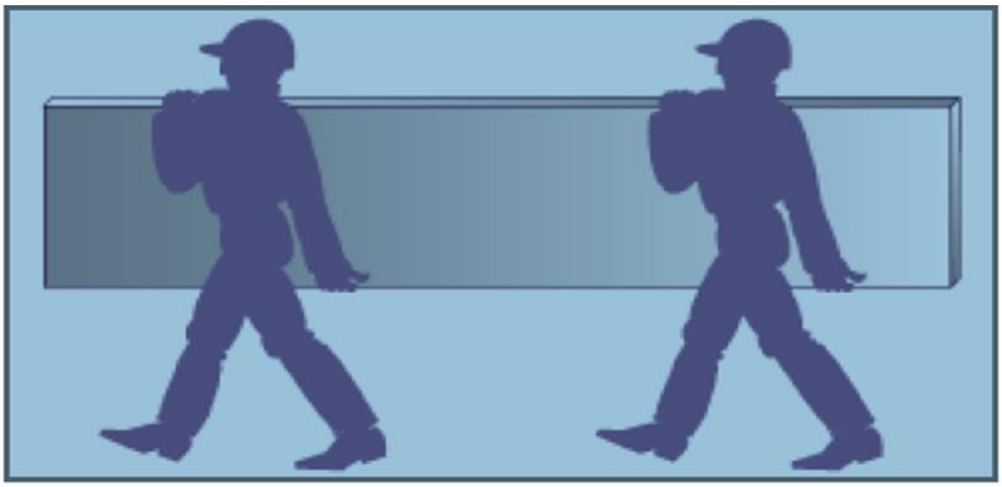
- MS flat rod shall be used to rub the joint edges so that edges become blunt and shall appear as V-shaped groove.
- Joints shall be cleaned to remove dust and other unwanted particles.
- V-Groove shall be provided at the joints to be filled with *elastomeric putty* and fiber mesh tape shall be pasted. (Figs.)
- *Pre-mix acrylic glue* shall be applied over joints, using a putty knife, and let it dry.
- Surface shall be smoothened with sand paper.
- After that glass fiber mesh shall be pasted over first coat of pre-mix glue.
- One more coat of pre-mix glue shall be applied properly over glass fiber mesh and let it dry for 5-6 hours.
- For final finish, surface shall be painted

Installation/ Instruction Manual is enclosed at Annex IV.

2.6 Storage and Handling and transportation

2.6.1 *Handling and transportation of Panels*

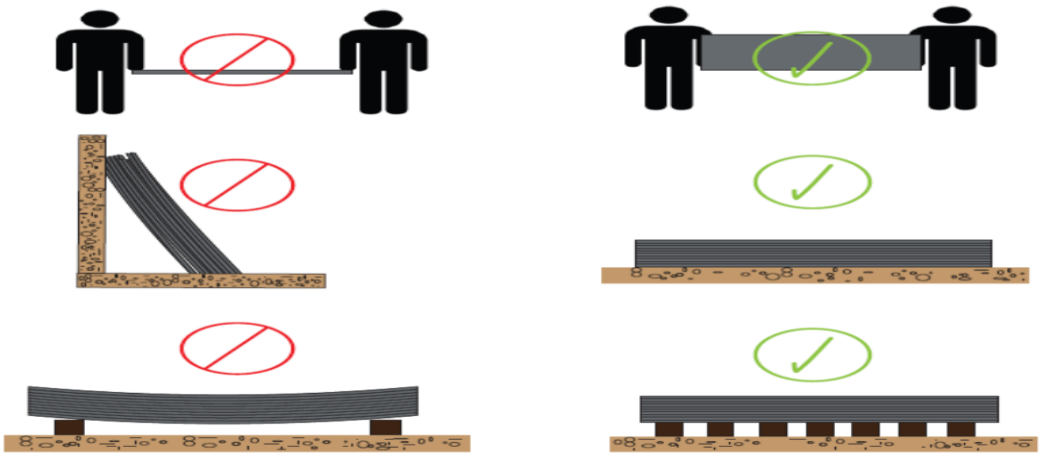
- Sheets shall be carried in vertical position as this will avoid bending and possible breakage.
- Single panels can be moved manually or using lifting tools. Do not lift the sandwich panel by holding it at the top facing. When lifting the panel manually, hold it at the bottom facing. Prevent sandwich panels from scratching and deformation.
- Use protective gloves and ensure that sandwich panels are not damaged. Draw particular attention to corners and edges. When moving the panel manually, hold it upright. Do not carry the panel flatly.



- When moving the panels with lifting devices, use appropriate lifting tools. Fasten the lifting tools according to instructions of tool manufacturer.
- When lifting the upper panel from the package take particular care to avoid any damage to the next panel beneath it.

2.6.2 *Storage of Panels*

Panels shouldn't be placed in such a way that it will get sag or bend. The image below shows the proper storage of panels.



2.7 Inspections & Testing

Inspections & testing shall be done at appropriate stages of manufacturing and installation process of all the elements. As part of quality assurance, regular in process inspections shall be carried out by the trained personnel of the PAC holder.

2.8 Manuals

PAC holder and the manufacturer shall provide Installation Manual, Quality Control Manual and a Manual for Health & Safety incorporating the PIR Dry-wall Pre-fab Panel System.

2.9 Skilled/Training Needed for Installation

The panels shall be installed under the direct supervision of trained personnel of the PAC holder and manufacturer or by manufacturer's authorized personnel only.

2.10 Guarantees/Warranties Provided by the PAC Holder

PAC holder and manufacturer shall furnish various performance warranties as required for project specifications.
The items covered by these warranties include weather tightness, corrosion and finish performance. Weather tightness warranties are subjected to the use of manufacturer's authorized contractors under its technical Engineer's supervision and periodic inspection.
The manufacturer shall ensure that all specifications and shop drawings are reviewed prior to warranty issuance.
In addition, warranties are limited to materials supplied by the manufacturer.

2.11 Responsibility

- Specific design using PIR Dry-wall Pre-fab Panel System is the responsibility of the designer with the instructions, supervision and guidance of the PAC holder and the manufacturer.
- 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.
- Providing necessary facilities and space for movement of cranes and vehicles is the responsibility of the building developer.

PART 3 BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Assessment

3.1.1 The technical assessment was done as per provisions of the Standards listed in Part 5 of this Certificate.

3.1.2 *Visit to Manufacturing Plant and Construction Site*

The manufacturing site of M/s Sintex Prefab and Infra Ltd., Kalol, Gujarat was inspected by Officers of the Council and members of TAC. The finished panels were found to be as per specifications. M/s Sintex Prefab and Infra Ltd. has got necessary manufacturing to produce the required components as per design and specifications. It operates a Quality Assurance system in the factory to ensure that the product conforms to the specified requirements. Persons involved in testing were found to be well conversant with testing procedures required for the quality control of the system.
Technical team also visited the G+3 flats of total area of approx. 800 sq. m. for Rajasthan Housing Board at Partap Nagar, Jaipur constructed by the PAC holder using the panels.

3.2 Tests Performed on Panels

3.2.1 Testing of samples of 100mm thick panels collected by the IO at Sintex Prefab and Infra Ltd., Kalol, Gujarat for carrying out the tests by Institute of Technology, Nirma University, Ahmedabad. The test results of the panels are given below:

S.No.	Test conducted	Test Method	Test Result
1.	Compressive strength	IS 11239 (Part 11):1985	137.37 kN/m^2
2.	Thermal conductivity	ASTM C 177	0.0395 W/m.K
3.	Dimensional stability	IS 11239 (Part 3):2009	Length:0.50% Width:0.81%
4.	Horizontal burning	IS 11239 (Part 12):1988	49.25mm
5.	Water vapour transmission	IS 11239 (Part 4):2014	5.7 ng/Pasm

3.3 Execution of Projects

The manufacturer, as reported, has executed the projects as per the details given below:

S. No.	Name & location of the Project	Quantity (sqm) approx.	Year of Completion
1.	Affordable L.I.G Housing project for Rajasthan Housing Board (G+3) at Jaipur	800 sq. m.	2016
2.	Private House (Ground) at Kanchipuram (TN)	35 sq m	2012
3.	Model House (Ground) at Sri Lanka	---	2017

Photographs of the completed projects are given in Annex V.

PART 4 STANDARD CONDITIONS

The certificate holder shall satisfy the following conditions:

4.1 The certificate holder shall continue to have the product reviewed by BMBA.

4.2 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.

4.3 The quality of the product shall be maintained by the certificate holder.

4.4 The product user should install, use and maintain the product in accordance with the provisions in this Certificate.

4.5 This certificate does not cover uses of the product outside the scope of this appraisal.

4.6 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.

4.7 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)

4.8 The certificate holder agrees to inform BMBA of their distributors / licensees whenever appointed by him and agrees to provide to BMBA a six monthly updated list thereof.

4.9 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.

4.10 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.

4.11 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.

4.12 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.

4.13 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.

4.14 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.

4.15 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

4.16 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.

4.17 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_____

For and on behalf of Chairman TAC & Member Secretary, BMBA

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

PART 5 LIST OF STANDARDS AND CODES USED IN ASSESSMENT

5.1 Standards - These Standards are referred for carrying out a particular test only and do not specify the requirement for the whole product as such.

5.1.1 IS 277:2018 – Specifications for galvanized steel sheets (Plain & corrugated)

5.1.2 IS 419:1967 (Reaffirmed 2009) – Specifications for putty

5.1.3 IS 456:2000 (Reaffirmed 2016) – Code of practice for reinforced cement concrete

5.1.4 IS 800:2007 (Reaffirmed 2013) -- Code of practice for general construction in steel

5.1.5 IS 801:1975 (Reaffirmed 2010) – Code of practice for use of cold formed light gauge steel structural members in general building construction

5.1.6 IS 875 (Parts1 to 3):1987/2015 – Code of Practice for design loads (other than earthquake) for buildings & structures

5.1.7 IS 1893 (Part 1):2016 – Criteria for earthquake resistant design of structures

5.1.8 IS 1904:1986 (Reaffirmed 2010) – Code of practice for design and construction of foundations in soils**:** general requirements.

5.1.9 IS 2062:2011 (Reaffirmed 2016) – Specifications for hot rolled medium & high tensile structural steel

5.1.10 IS 2380 (Part 5):1977 (Reaffirmed 2013) – Methods of test for wood particle board and other ligne cellulosic materials – tensile strength test.

5.1.11 IS 11239 (Part 1, 3, 4, 11 & 12):2009/1985/1988/2014 -- Method of tests for rigid cellular thermal insulations

5.1.12 IS 14246:2013 – Continuously pre-painted galvanized sheets & coils

5.1.13 IS 14862:2000 (Reaffirmed 2010) - Specifications for Fibre Cement Flat Sheets

5.1.14 IS 16700:2017 – Criteria for structural safety of tall concrete buildings

5.1.15 ASTM D 570-08 -- Standard test method for determination of Water

absorption

5.1.16 ASTM D 695-15 -- Standard test method for determination of Compressive strength

5.1.17 ASTM D 790-17-- Standard test method for determination of Flexural strength

5.1.18 BS 476 (Parts 5, 6, 7) -- Fire Tests on Building Materials & Structures – Method of test of Fire Ignitability, Fire Propagation & Surface spread of flame of materials/products

5.2 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.

5.3 References

5.3.1 Vetting of structural design and drawings of (G+3) LIG residential building at Jaipur for Rajasthan Housing Board by Malaviya National Institute of Technology, Jaipur in 2017.

5.3.2 Summary Report of design of a structure using ETABS 2016, Integrated Building Design Software in 2018.

5.3.3 Test Report for Fire Resistance by Sirim Qas International, Malaysia

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **PIR Dry Wall Pre-Fab Panel System** bearing the mark manufactured by M/s Covestro (India) Pvt. Ltd. is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No. 1039-S/2018** is awarded to **M/s Covestro (India) Pvt. Ltd., Thane (Maharashtra)**.

The period of validity of this Certificate is for a period of one year i.e. from 30.08.2018 to 29.08.2019 as shown on Page 1 of the PAC.

This Certificate consists of a cover page and pages 1 to 34.

Embossing Seal of BMBA

Dr. Shailesh Kr. Agarwal
Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing & Urban Poverty Alleviation, (Govt. of India)
New Delhi-110 003

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 Affairs, Government of India

Place: New Delhi, India

Date: 30.8.2018

PART 6 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.

ANNEX I

(Clause 1.4.2)

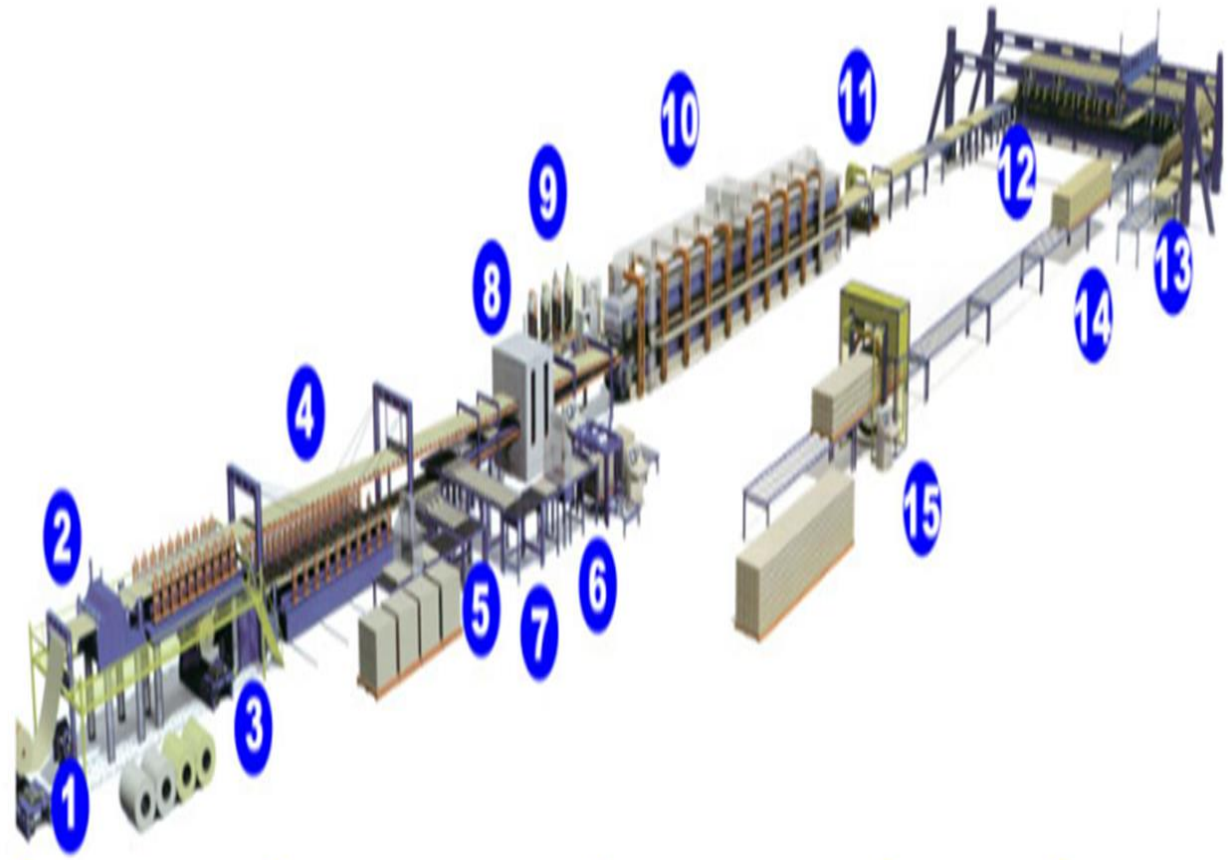
Quality Assurance Plan of PIR Dry Wall Pre-Fab Panel System

S. No.	Parameters to be inspected	Requirement Specified	Test Method	Frequency of Testing
	I. Raw Materials			
1.	Poly Isocyanurate (PIR)	As per manufacturer specifications	Manufacturer's test report	Every batch/lot
2.	Hollow Section/C Channel	As per IS 14246: 2013/S 277: 2018	Manufacturer's test report	Every batch/lot
3.	Fibre cement board	As per IS 14862:2000	Manufacturer's test report	Every batch/lot
4.	Pre-painted GI Sheet	As per IS 14246:2013	Manufacturer's test report	Every batch/lot
4.	Fibre glass mesh	Manufacturer's test report	Manufacturer's test report	Every batch/lot
5.	Acrylic based glue	Manufacturer's test report	Manufacturer's test report	Every batch/lot
6.	MS screws/fasteners	Manufacturer's test report	Manufacturer's test report	Every batch/lot
7.	Putty	As per IS 419:1967	Manufacturer's test report	Every batch/lot
	II. Finished Panels			
1.	Tensile strength	0.02 MPa max.	IS 2380 (Part 5):1977	Every six months
2.	Compressive Strength	2.1 MPa max.	ASTM D 695-15	Every six months
3.	Water Absorption	25% max.	ASTM D 570-08	Every six months
4.	Flexural strength	4.7 MPa max.	ASTM D 790-17	Every six months
4.	Thermal Conductivity	0.033 W/mK min.	ASTM C 518	Every six months
5.	Density Core	40 ±2 kg/m^3	Water dip method	Every six months
6.	Dimensional stability	± 2%	ASTM D 2126	Every six months
7.	Fire Resistance	Integrity 180 min. Failure occurred 158 min.	BS 476 (Part 22):1987	Every year

ANNEX II

(Clause 2.3)

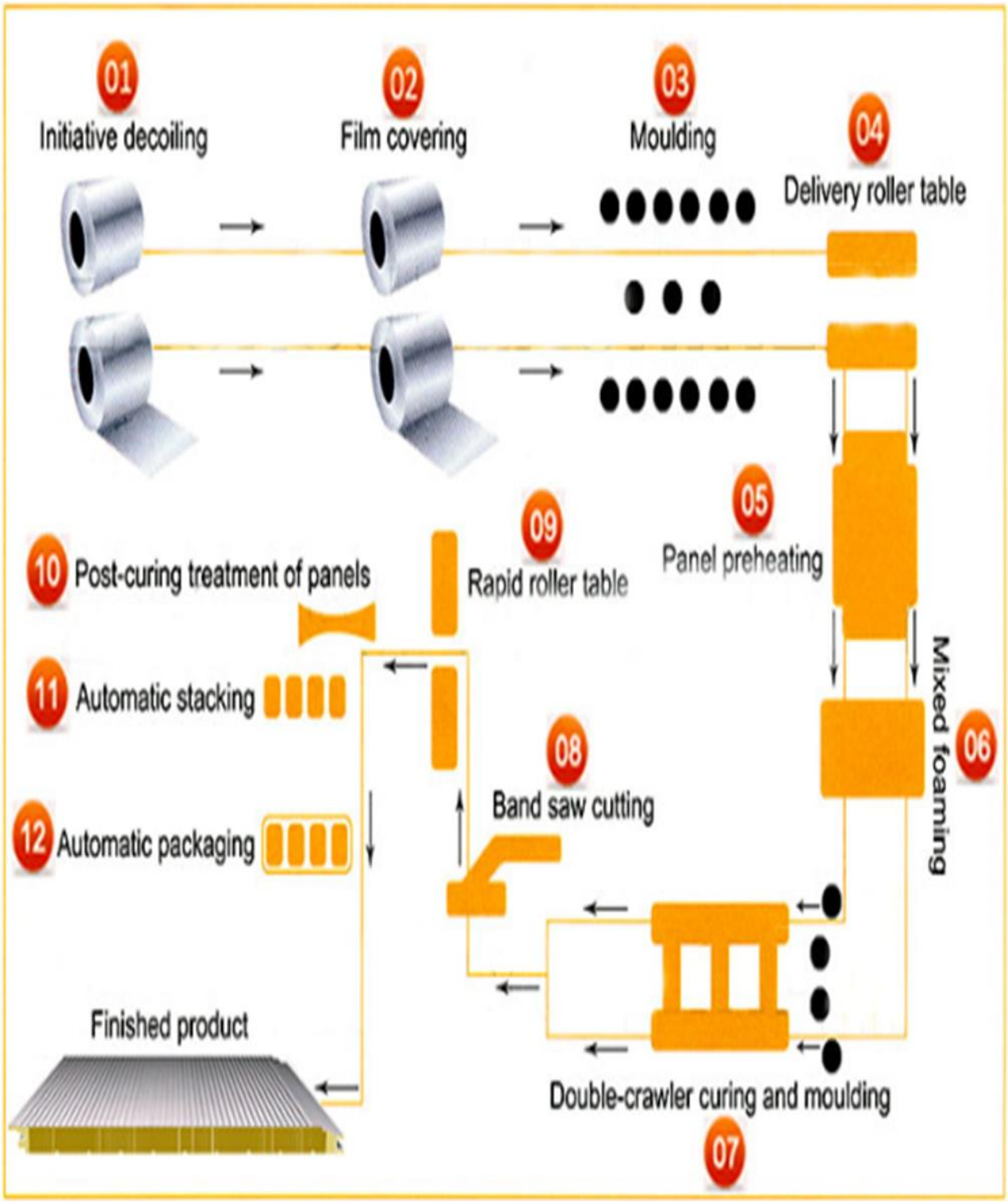
Panel Production Line Flow Chart



ANNEX III

(Clause 2.4.3.3)

Production Process Flow Chart



ANNEX IV

(Clause 2.5.1.5)

Installation/Instruction/ Construction Manual

The sequence of Installation of the panels as supplied by the manufacturer is as follows:

With Floor Slab

- After concreting is done and RCC slab /surface is ready for the installation of PIR wall, it must be ensured that the concrete surface is smooth and not rough so that there won't be any undulation in the panel surface.
- Center line for wall shall be marked and cross check it with the drawings and after that fix the bottom runner section at the base to RCC slab with the help of anchor fastener.
- After fixing the runner base, cross check the dimensions with drawing and ensure that all walls are as per drawing straight and perpendicular. After checking, insert the PIR panels in the runner base and fix the supporting pipes at the end of panel after inserting the panels and pipe, fix the pipe with runner base with screws and PIR panels with supporting pipes by screws.

- During installation the alignment of panel, verticality and perpendicularity shall be checked.

With Column

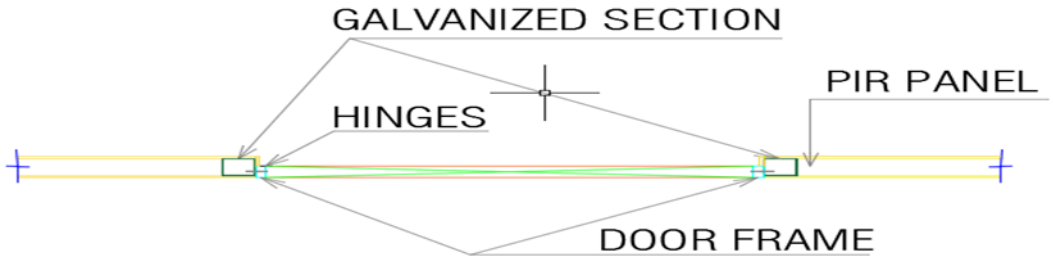
- After concreting is done and column surface is ready for the installation of PIR wall, it must be ensured that the concrete surface is smooth and not rough so that there won't be any undulation in the panel surface.
- Center line for column shall be marked and cross check it with the drawings and after that fix the runner section at the side of column or at the end of wall with the help of anchor fastener to be placed at 600mm c/c.

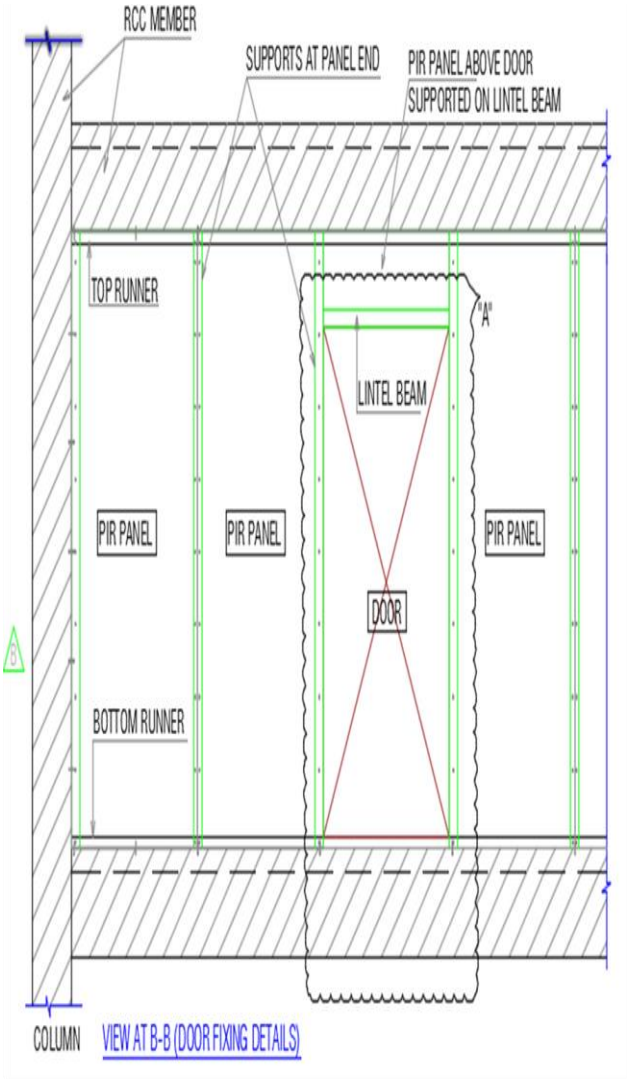
Fixing of door and window

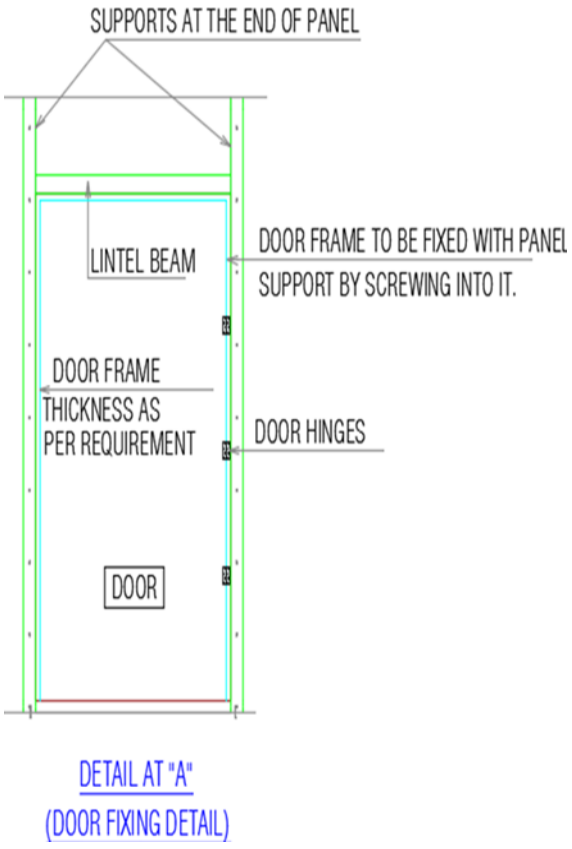
- Cut the panel with the help of jig saw cutter / panel cutting machine for fixing of door and windows as per location in the drawing.
- Fix the door panel with supporting pipes which are placed at

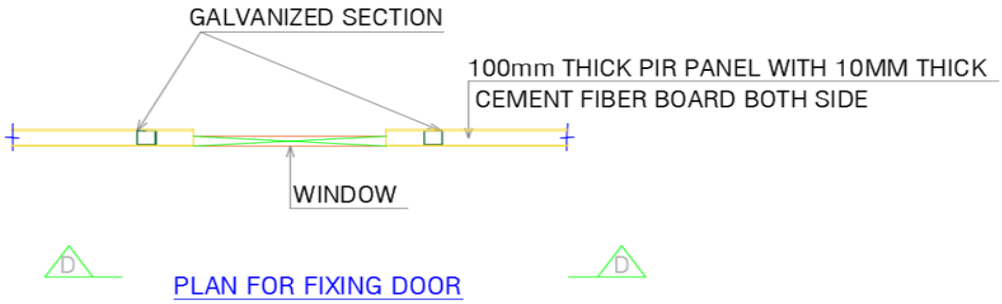
the end of each panel and fix the door panels and door.

- For the windows place the c-shape runner at all corner and fix the window frame on it as per the given images below.

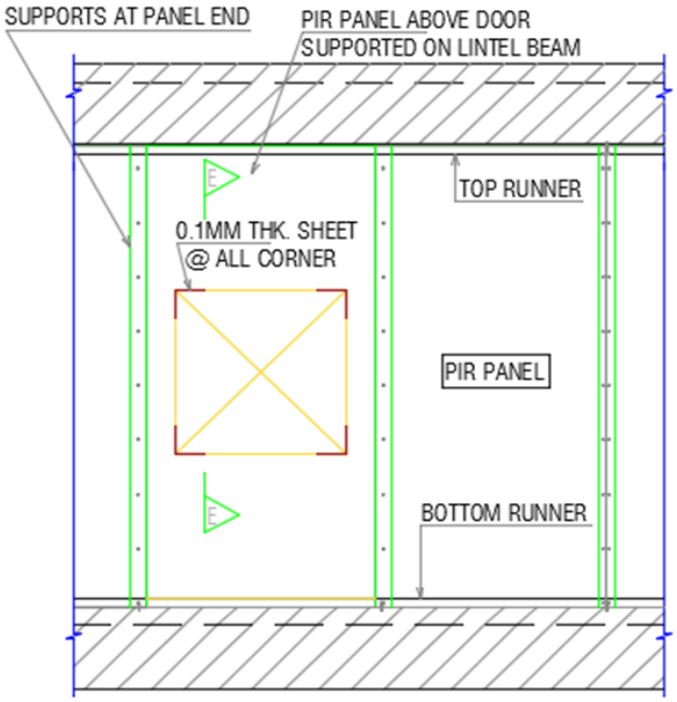




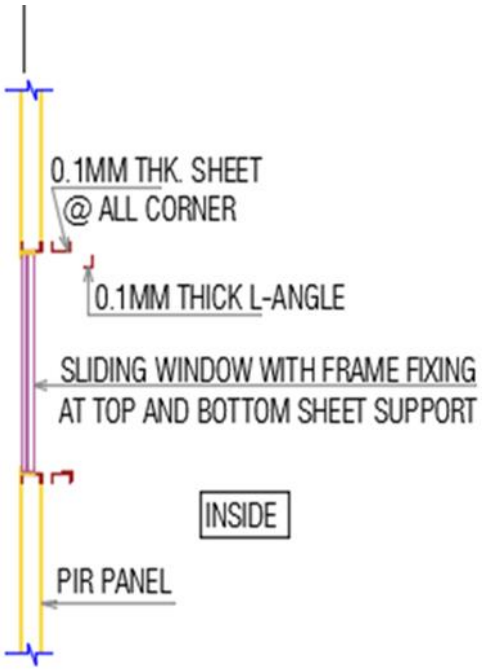




PLAN FOR FIXING DOOR



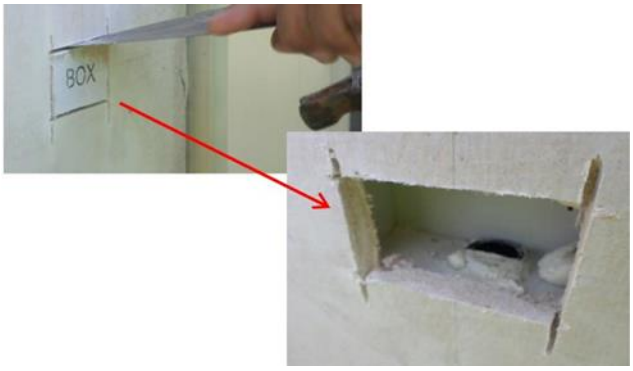
VIEW AT D-D (WINDOW FIXING DETAILS)



SECTION E-E

Electrical

- Route of all planned electrical wiring or conduits inside of panel that won't be visible from outside and location of boxes on surface of the walls shall be marked with marker.
- Electrical boxes with surface mounting side ears shall be installed similarly by removing a piece of foam next to a stud flange and using course threaded screws secured to the flange.

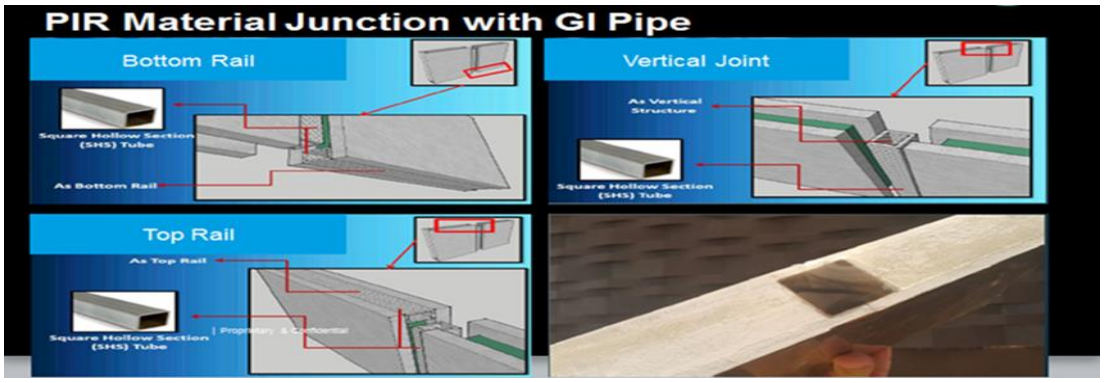


Plumbing

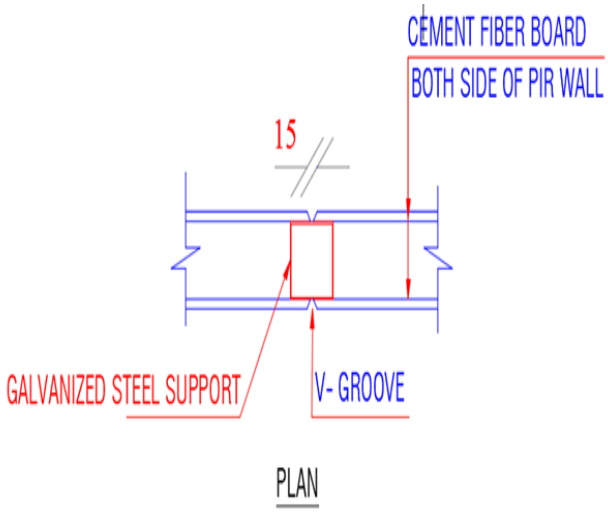
- Good practices of plumbing shall be followed. Plumbing pipes shall usually be not fixed on exterior walls, except kitchen sinks. A channel of required size shall be made for drain, vent and water supply pipes having 60mm foam on inside of the wall.

Joint Treatment

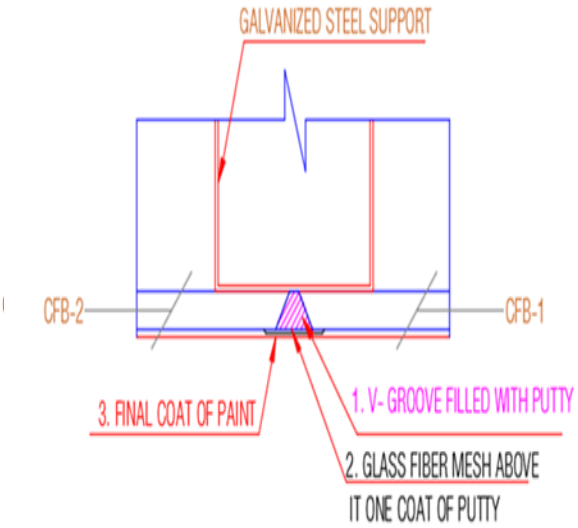
- Apply elastomeric putty at the joints between two panels and then allow it to dry. After that fix the glass fiber mesh on the joints, after fixing again apply putty on the net and then apply putty on all over cement fiber board and allow it to dry and apply final coat of paint on it.



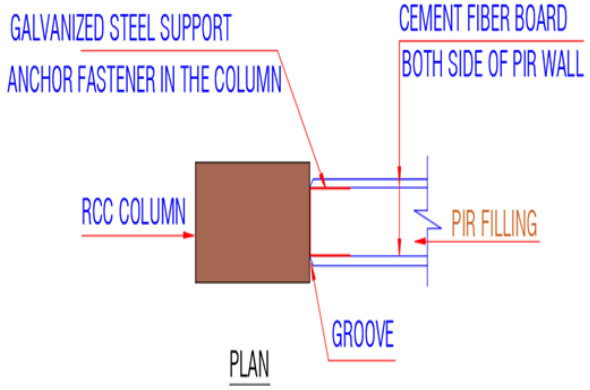
- Provide V-groove at 3 to 5mm gaps at every joint and then fill these gaps with elastomeric putty and allow it to dry. After that fix glass fiber mesh at joints and again apply putty and final coat of paint on it



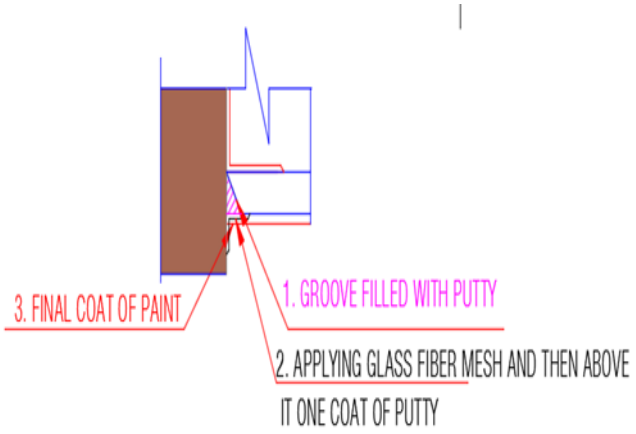
Panel to panel junction detail



Panel to panel joint treatment detail



Panel with RCC Column Junction



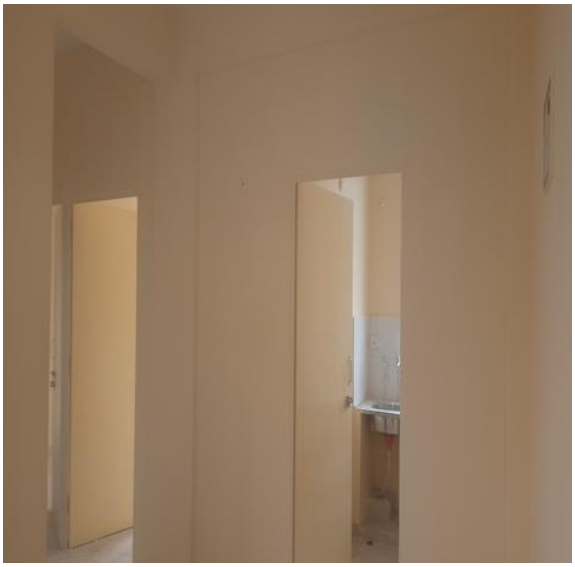
Panel to RCC Column joint treatment detail

ANNEX V

(Clause 3.3)

Photographs of the Completed Works

Affordable L.I.G Housing project for Rajasthan Housing Board (G+3) at Jaipur



Private House (Ground) at Kanchipuram (TN)

Model House (Ground) at Sri Lanka

Solar Panel