

BMTPC or the Holder of

this Certificate.



pulbc

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PERFORMANCE APPRAISAL CERTIFICATE

FOR

CONTINUOUS SANDWICH (PUF) PANELS WITH STEEL STRUCTURE

ISSUED TO

M/s JINDAL MECTEC PVT. LTD., GURGAON

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PART 1 CERTIFICATION

1.1	Certificate Holder:	M/s Jindal Mectec Pvt. Ltd.
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		Narsingpur, Gurgaon 122001
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1.2 Description Of System

- **1.2.1** Name of the System -- Continuous Sandwich (PUF) Panels with Steel Structure
- **1.2.2** Brief Description

Continuous sandwich panels are single piece, prefabricated, modular, factory made units which consist of an insulating layer of rigid polyurethane foam between two layers of metal sheets. The panels comprise of PUF bonded between two sheets of Pre-coated GI sheets of 0.5 mm thick to produce straight-to-finish panels. Insulation core provides effective insulation and strong bonding for better structural stability to facilitate higher loading and wider spans. These panels are available for both wall and roof.

The system can incorporate all types of architectural features like coving, boxes, cantilevers, projections, infill walls, mezzanine floors etc. This system can also incorporate all types of services viz. electrical, gas and plumbing etc. The design and engineering of the structures is executed by following the norms & guidelines stipulated in relevant Indian Standards.

Typical Isometric views of both roof and wall panels are shown in Figs. 1 & 2 respectively.



Fig. 1 Roof Panel



Fig. 2 Wall Panel

1.3 Size and profiles of PUF Panel

1.3.1 Size of panels

Panels are available in thickness from 25mm to 150mm, width 1000mm and length as per requirement of the customer.

1.3.2 *Profiles of the Panels*

1.3.2.1 Coldwell Wall panels

Coldwell wall panels are tongue-n-groove joinery for air-tight, effective panel to panel interlocking which provides an effective seal. Two types of panels - single groove and double groove systems are manufactured. While single groove panels are suitable for general purpose and application in buildings and shelters; double groove panels are suitable for cold room and cold chamber applications. Double groove ensures precise interlocking, dimensional accuracy and also eliminates the risk of air gaps and thermal bridging. Coldwell panels are in higher thicknesses are self-supporting free standing upto 6 metres. All joints are covered with flashings.

Profiles of these panels are given below: Inner & Outer skin: 3 types of rib configuration – Micro-rib, Wave and Mini box.

Facing Options: Pre-painted galvanized steel/aluminium, stainless steel and craft paper and perforated metal sheet for inner skin.

Surface finish: Mettalic, solid colours, Polyvinylidene fluoride (PVDF) & super polyster coatings.

Coldwell-1

These panels are available in thickness of 30, 40, 50, 60, 80 & 100mm. Detail of this panel is shown in Fig. 3.

Coldwell -2

These panels are available in thickness of 80, 100, 120 & 150mm. Detail of this panel is shown in Fig. 4.



1.3.2.2 Strupan Roof panel

Strupan is a structural roof panel with a trapezoidal profile on the top surface and a ribbed liner tray on the underside and a sandwiched insulation cover.

Profile of this panel is given below:

Inner skin: Ribbed liner, aluminium foil/craft paper

Outer skin: 35x250mm trapezoidal profile with 2 secondary ribs and anti-capillary flute.

This panel is available in thickness of 30, 40, 50, 60, 80 & 100mm.

Surface finish: Metallic, solid colours, Polyvinylidene fluoride (PVDF) & super polyster coatings. Detail of this panel is shown in Fig. 5.



1.3.2.3 Isoclad

Isoclad panels act as partition walls as well as façade cladding with permanent finishing and can be integrated well with structural glazing, curtain walls, windows and other type of fenestrations and openings.

Profile of this panel is given below:

Skins: 3 types of rib configuration – Micro-rib, Wave and Mini box This panel is available in thickness of 40, 50, 60 & 80mm.

Facing options: Pre-painted galvanized steel/aluminium

Surface finish: Metallic, solid colours, Polyvinylidene fluoride (PVDF) & super polyster coatings. Detail of this panel is shown in Fig. 6.



Fig. 6

1.4 Applications and Precautions to be taken

1.4.1 These panels are used as non-load bearing panels for residential and commercial buildings, school & training centers, steel

structures, modular & monolithic cabinets, management blocks & site offices, guard room/ porta cabins, etc.

1.4.2 *Precautions to be taken while lifting panels:*

- To prevent panels from damage while lifting, carefully pick up bundles one at a time.
- The recommended crane lifting method is to use nylon straps positioned at a minimum of two points along the length of the bundle.
- Suitable wood spreaders should be used located at the top and bottom of the bundles at the strap position to protect the edges of the upper and lower panels.
- Extreme care should be taken to avoid bumping and snatching of the bundles when lifting.
- When handling panels and / or panel bundles, ropes, steel cables or chains must not be used.
- Individual panels should never be moved in a flat position as excessive flexing may result. Excessive flexing may result in permanently distorts the facings and may lead to thermal blistering. When moving a panel, it must be turned on its edge first, then supported at each end with appropriate no of man power required for safe handling.
- Always lift the panel from underneath, never lift a panel from the top sheet only as it may result in joint damage and possible delamination.
- While removing individual panel from bundle, never drag a panel from a bundle or across other surfaces. It will scratch and damage the panel coating / finish. Always lift panels when removing from bundle.

1.5 Basis of Assessment

- **1.5.1** *Scope of Assessment*
- **1.5.1.1** Suitability of Continuous Sandwich (PUF) Panels to the specified requirements for use as non-load bearing panels for residential and commercial buildings, school & training centers, steel structures, school & training centers, steel structures etc.
- **1.5.2** Assessment
- **1.5.2.1** Assessment of the suitability of the Continuous Sandwich (PUF) Panels is based on:

- (i) Typical Erection Method Statement (Manual) giving details of Work execution process, unloading, storage etc. of panels and Safety measures to be taken.
- (ii) Review of structural design and drawings of a Lecture hall for BMSIGL at Bihar considering wind load, seismic load etc. complete duly vetted by NIT Kurukshetra, Haryana
- (iii) Review of structural design and drawings of one BHK Prefab Unit Project at Joshimath, Uttarakhand considering wind load, seismic load etc. complete duly vetted by NIT Kurukshetra (Haryana)
- (iv) Test Report of various tests carried out on 80mm thick PUF panel as per IS 12436:1988 by Bharat Test House, Delhi in 2011, 2012 & 2015.
- Brief Evaluation Report of Ignitability Evaluation carried out on 50mm thick PUF panel as per BS 476-Part 5 by CBRI, Roorkee in 2011.
- Brief Evaluation Report of Fire Propagation of carried out on 50mm thick PUF panel as per BS 476-Part 6 by CBRI, Roorkee in 2011.
- (vii) Brief Evaluation Report of Surface Spread of Flame carried out on 50mm thick PUF panel as per BS 476-Part 7 by CBRI, Roorkee in 2011.
- (viii) Falling Hammer Impact Test carried out on 25mm thick PUF panel as per IS 2380(Part 10):1977 by CBRI, Roorkee in 2011.
- (ix) Density of PUF as per IS 7888:1976 by Shriram Institute for Industrial Research, Delhi in 2011
- (x) Test Report of various tests carried out on 50mm thick PUF panel as per IS 11239 (Part 1):1985 and IS 101 (Part3/Sec2): 1989 by Aglow Quality Control Lab, Kolkata, NABL in 2017.
- (xi) Test Results of the samples carried out on 40mm thick PUF panel as per IS 12436:1988 and IS 11239 (Part 12):1985 by PEC University of Technology, Chandigarh in 2017.
- (xii) Assessment of quality assurance procedures implemented for Quality Assurance Scheme followed by the Certificate holder for process control as per Quality Assurance Plan attached at Annex A.

1.6 Design Consideration

1.6.1 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/ owner (client) is responsible for the drawings and overall building design to comply with the various regulatory requirements applicable to the area.

- **1.6.2** The building to be constructed using Continuous Sandwich (PUF) Panels shall be designed by competent structural engineer in accordance with the specifications following relevant codal requirements, manufactured as per the details worked out in design and constructed by trained persons only with technical support or supervision by qualified engineers and builders, based on structural designs and seismic evaluation & wind forces as per the details given in the Construction Manual and this PAC.
- **1.6.3** The structural engineers and building designers associated with such type of construction should be thoroughly familiar with the various structural aspects. It is also recommended that Architects and Construction Engineers who undertake such building design and construction gain familiarity with the properties and materials, characteristics of Continuous Sandwich (PUF) Panels and its applications.
- **1.6.4** The design engineer shall liase with the engineer of the developer for design of the foundation.
- **1.6.5** The design assumptions, detailed calculations, references to necessary and detailed design drawings shall be made available on demand, if required. The structural design calculations should clearly demonstrate structural integrity and stability including connection details.
- **1.6.6** Foundation shall be specifically designed in accordance with provisions given in IS 1904:1986. All foundations should be designed by structural engineer with appropriate reference.
- **1.6.7** In addition, any other requirement regarding safety against earthquake need to be ensured by the designer as per prevailing codal requirements.

1.7 Conditions of Certification

- **1.7.1** *Technical Conditions* -- Raw materials and the finished panels shall conform to the requirements of the prescribed specifications.
- **1.7.2** Erection Manual

Typical Erection Method Statement (Manual) giving details of Work execution process, unloading, storage etc. of panels and Safety measures to be taken need to be supplied by the manufacturer to the Client.

1.7.2 *Quality Assurance*

The Certificate Holder shall implement & maintain a quality assurance system in accordance with Scheme of Quality Assurance (SQA) given in Annex A attached with this Certificate.

1.7.3 Durability

Sandwich panels are typically single piece, prefabricated, modular, factory made units which consist of an insulating layer of rigid polyurethane foam between two layers of metals sheets. It provides effective insulation & long lasting strong bonding of insulation core which gives added structure stability to facilitate higher loading & wider span length.

- **1.7.4** *Handling of User Complaints*
- **1.7.4.1** 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
- **1.7.4.2** The Certificate holder shall implement the procedure included in the 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.

1.8 Certification

1.8.1 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 Part 1 & 2 of this Certificate, the sections covered by this Certificate are fit for use as set out in the Scope of Assessment.

PART 2 CERTIFICATE HOLDER'S TECHNICAL SPECIFICATION

2.1 General

2.1.1 The PAC holder shall manufacture these panels in accordance with the requirements specified in the relevant Standards (See Part 5). In addition it shall follow the Company standards specifying requirements of these sections for various materials used in the manufacturing of the panels.

2.2 Specifications for the System

2.2.1 Specification

The manufacturer shall only use the raw materials supplied with the relevant documents as laid down in the prescribed Quality Assurance Plan. The raw materials shall be subject to agreed controls and tests by the manufacturer before acceptance.

2.2.2 *Technical Specifications*

2.2.2.1 *Raw materials*

1. *Polyurethane Foam (PUF):* It is thermosetting material when exposed to fire, does not drip or melt; forms a strong carbonaceous char that protects the core and prevent spread of flame. It shall be Chlorofluorocarbon (CFC) free and self-extinguishing and shall conform to IS 12436: 1988.

2. *GI Pre-painted sheet (PPGI):* The pre-coated sheet shall have min. yield strength of 240 MPa conforming to IS 14246:2013 and shall have zinc coating of min. 120 gm/m² as per IS 277:2018. The sheet shall have 5-7 micron epoxy primer on both sides and polyester top coat of 15-18 micron. The sheet shall also have plastic protective guard film of min. 25 micron to avoid scratches during transportation.

3. U Channel: Made of PPGI sheet conforming to IS 14246:2013
and shall have zinc coating of min. 120 gm/m² as per IS 277:2018.
4. PU Chemical: Shall be as per the manufacturer's specifications

5. *Polyol Glue*: Shall be as per the manufacturer's specifications

2.3 Inspections & Testing

Inspections & testing shall be done at appropriate stages 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.

2.4 Manufacturing Machinery & Equipment

As per the details supplied, the manufacturer has various machines and equipment of required capacities and specifications for manufacturing, testing and installation of the panels. Details of the machines are available with the manufacturer.

2.5 Manufacturing Process

- Raw-material & Pre-Coated sheets (PPGI) shall be procured from the market and then loaded pre-coated sheet profiled and rolled as per the drawing of manufacturing process.
- Pre-coated GI coated sheets shall be loaded as coil in lower & upper section of the machine, for profiled and rolled as per the relevant drawing.
- Polyol/isocynate shall be sprayed in between pre-coated sheets. After passing double belt conveyor, the raw material for the required thickness shall pass as per the specification of the client and cooling conveyor cools the panel.
- The panel shall be cut as per the required size with cutting machine and end surface shall be cleaned.
- Inspection & testing shall be done at each stage of manufacturing process.
- After inspection of the material by the inspection team that the product is upto the mark as per the required specification of the client, the panels pass automatically towards wrapping & packing.
- After finished product is ready, the panels shall be dispatched to the client.

Process Flow Chart is given in Annex B.

2.6 Installation Procedure

Panels with damaged side joints, surface dents or scratches shall be set aside. Excess foam (if any) shall be removed from panel joints to allow proper panel engagement.

The first panel shall be installed plumb/level. A spirit level or transit shall be used on each panel. Adjoining panels shall be installed with overlapping rib/inserting tongue-in to the groove toward the last erected panel. Structural members shall be drilled, if required and fasteners installed at lapped rib. A chalk line shall be used to mark the girt location and maintain a straight line of screws, thus avoiding miss-drilling and possible leakage. The preferred procedure is to complete all wall sheeting before starting the roof sheeting.

2.6.1 Roof Panel

2.6.1.1 *Fastener installation*

It must be ensured that the fasteners are installed at locations indicated on the building drawings. It is easy to misjudge the location of the structural member, resulting in a fastener off the structural member or below the sealant at the end lap. The fastener shall be driven in until it is tight and the washer is firmly seated. A slight extrusion of neoprene around the washer is a good visual tightness check.

2.6.1.2 Orientation of panels before lifting

For maximum weather-tightness, start laying panels from the end of the building that will be in the lee of the worst-anticipated or prevailing weather. It is much easier and safer to turn panels on the ground than up on the roof. Before lifting panels on to the roof, it must be checked that this is the correct way up and the overlapping side is towards the edge of the roof from which side installation will start. Bundle of panels shall be placed over or near firm supports, not at mid span of roof members.

2.6.1.3 *Roof paneling sequence*

It is advised that both sides of the ridge of a building be sheeted simultaneously. When lifting panels onto the roof frame for laying and fastening, care should be taken to make sure all panels are the correct way up with the overlapping side towards the edge of the roof from which installation will commence.

2.6.1.4 *Installation of the first roof panel*

The roof panel shall be set in place over the inside closure ensuring the major ribs of the panel rest properly with the inside closure. The panel edge shall be aligned with the edge of the end wall roof line. With the panel properly placed, the line of panel shall be adjusted for squareness.

A nylon line projected from the eave strut by a certain distance shall be used to give correct distance and line. A chalk line shall be used to mark the location and maintain straight line of screws, thus avoiding miss-drilling and possible leakage. The panel shall be secured to the structure with appropriate fasteners. The fasteners will be installed after the overlapping is installed.

2.6.1.5 *Sealing the side laps*

The side lap sealant shall be applied to the weather side edge of the lower major. The sealant should only be applied to clean, dry surfaces. Press firmly along the length of the sealant to insure proper adhesion. The adjoining panel shall be installed positioning the overlapping rib with care. Required size pilot holes for the lap fasteners shall be drilled at the centre of the clearance holes in the overlapping panel. The lap shall be stitched with the self-fastening fasteners supplied with the screw line. Sealant shall not be placed inside of the screw line. (Fig. 7)



Fig. 7 Roof Panel -- Side Lap Detail Fig. 8 Roof Panel - End Cap Detail

2.6.1.6 *Installation of remaining roof panels*

With the first panel run installed & secured and side lap sealant applied, the second panel run may be started. The eave shall be prepared with an inside closure and sealant. The panel shall be positioned so that the overlapping ribs will rest properly. Proper overhang and panel coverage shall be checked. The major ribs of the two panels shall be stitched together and panels attached to the purlins.

2.6.1.7 Sealing the end laps

At the panel end laps, sealant shall be placed across the full panel below the fastener line. The panel end laps shall have a minimum overlap located over a purlin as per respective erection drawings. The fasteners shall be located on the centre of the flange of purlins. (Figs. 9 & 10)





Fig. 9 End Over Lap Detail



- 2.6.2 Wall Panel
- **2.6.2.1** Fastener installation

It must be ensured that the fasteners are installed at locations indicated on the building drawings. It is easy to misjudge the location of the structural member, resulting in a fastener off the structural member or below the sealant at the end lap. The fastener shall be driven in until it is tight and the washer is firmly seated. A slight extrusion of neoprene around the washer is a good visual tightness check. The fasteners shall be installed by drilling holes on the ridge and not on the valley as shown in Fig. 5.

2.6.2.2 Checking flatness and overhang

Before starting work it must be ensured that:

- > the supports for cladding are truly in the same plane
- the overhangs of panels from the top and bottom supports shall not exceed the limit, whilst also overhanging at least 50 mm into gutters. Necessary adjustments shall be made before laying panels, because it will be difficult or impossible to rectify later.

2.6.2.3 Positioning first panel

First panel shall be positioned before fixing to ensure that it is correctly located in relation to other parts of the building. It must be checked that the panel:

- aligns with the end-wall (or its barge or fascia), the type of flashing or capping treatment to be used; and
- aligns correctly at its ends in relation to the gutter and ridge (or parapet or transverse wall). (Figs. 11 to 14)



Fig. 11Wall Panel Profile (Micro Rib) Fig. 12 Panel for Wall cladding



Figs. 13 & 14 Wall Panel Fixing Details





2.6.2.4 *Positioning other panels*

After fixing the first panel in position, other panels shall be aligned using:

- the long edge of the previous pane;
- a measurement from the end of the panel to the fascia or purlin at the gutter. Gutter-end of all panels shall be kept in a straight line.
- each panel shall be fixed completely before laying the next; or
- the panel shall be fixed tightly to ensure it can't move, all panels shall be laid completely and then all the intermediate fasteners shall be placed later. (Figs. 15 & 16)
- 2.6.2.5 Checking alignment

It must be checked that each panel is parallel with the adjacent panel and gap is within the allowed limit. (Fig. 17)



Fig. 17 Outer/Inner Corner Flashing Fixing Details at Partition Walls

2.6.2.6 Wall panel fixing with floor

Wall panel of 80 mm for outer wall shall be fixed with U-channel of size 40x82x40x1.2mm on floor. U-channel shall be fixed with M6x65mm dash fastener at 300mm c/c spacing. (Fig. 18)

2.6.2.7 Wall panel fixing with slab

Wall panel of 80 mm for outer wall shall be fixed with self-drilling screw of 12-14x120x4.8mm at 300mm c/c spacing using L-Angle of 50x50x2mm above slab. (Fig. 18)

2.6.2.8 Wall partition panel fixing with slab top & bottom

Wall partition panel of 80 mm shall be fixed over RCC slab by PVC gitti screw of 35mm and pop rivet at 200mm c/c spacing using L-Angle of 50x50x1.2mm on both side of panel above slab. (Fig. 18)

2.6.2.9 Vertical corner closer

Vertical corner shall be closed using pop rivet at 300mm c/c spacing by using L-Angle of 50x50x0.5mm. (Fig. 18)



Fig. 18 Fixing Details of wall with floor, slab & partition

2.6.3 Ceiling Panel

2.6.3.1 Fastener installation

It must be ensured that the fasteners are installed at locations indicated on the building drawings. It is easy to misjudge the location of the structural member, resulting in a fastener off the structural member or below the sealant at the end lap. The fastener shall be driven in until it is tight and the washer is firmly seated. A slight extrusion of neoprene around the washer is a good visual tightness check.

2.6.3.2 Orientation of panels before lifting

For maximum weather-tightness, start laying panels from the end of the building that will be in the lee of the worst-anticipated or prevailing weather. It is much easier and safer to turn panels on the ground than up on the roof. Before lifting panels on to the roof, it must be checked that this is the correct way up and the overlapping side is towards the edge of the roof from which side installation will start. Bundle of panels shall be placed over or near firm supports, not at mid span of roof members.

2.6.3.3 Fixing of Aluminium 'T'

Aluminium 'T' shall be marked on the structural members and holes shall be drilled in the structural members. Sag rod connector shall be assembled on ground for longer drop length. After that Aluminium 'T' shall be assembled on ground with all accessories and erected one by one at specified locations.

The level and alignment of 'T' line shall be checked before fixing the panels. Bottom level of the 'T' shall be adjusted for roof ceiling by adjusting nut. Coupling plates shall be erected to connect adjacent 'T' members. Same procedure shall be repeated in case of multiple lines. (Fig. 19)



Fig. 19 Wall panel fixing with beam

2.6.3.4 *Ceiling panel installation*

Ceiling panel must be sheeted on both sides of the 'T' simultaneously. Proper coverage shall be checked frequently during progress. When lifting panels for laying and fastening, it must be ensured that all the panels are in the correct way up. For panel installation steps given below shall be followed:

- > Layout on the floor shall be marked as per the drawings.
- > U Track/ base angle shall be installed in water level.
- Step cutting at wall panels shall be made to make provision for ceiling panel resting.
- > Then wall panels shall be installed starting from one end wall and one side wall.

- Plumb and alignment of each panel shall be checked for starting the ceiling panels.
- > Inner and outer flashings shall then be installed to give temporary hold at wall panels.
- Partition/other side wall panel shall also be installed with inner and outer flashings.
- Ceiling panels shall then be lifted to the location after chcking the orientation as per the drawings before lifting.
- Strip flashing shall be installed on top of the ceiling panel after checking the alignment.

The chamber shall then be completed by following the above steps. Silicon sealant shall be filled at inner and outer face of all the panels. All flashings and accessories shall be installed as shown in the drawings. After that chemical filling shall be done as per the specifications. (Fig. 20)





2.6.3.5 Sealing the side laps

Apply the side lap sealant to the weather side edge of the lower major. The sealant should only be applied to clean, dry surfaces. Press firmly along the length of the sealant to insure proper adhesion. Install the adjoining panel positioning the overlapping rib with care. Drill, at the centre of the clearance holes in the overlapping panel, required size pilot holes for the lap fasteners. Stitch the lap with the self-fastening fasteners supplied with the screw line. Sealant shall not be placed inside of the screw line.





Fig. 24 Base Angle Fixing Details

More fixing details are given in Annex C.

For more details of the handling, Storage and Installation of the panels, reference be made to the Installation Manual of the manufacturer.

2.7 Skilled /Training Needed for Installation

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

2.8 Guarantees/Warranties Provided by the PAC Holder

PAC holder 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.

2.9 Services Provided by the PAC Holder to the Customer

The PAC holder shall take full care of after sales services such as leakages, repairing etc.

2.10 Manuals

Installation Manual, Quality Control Manual and a Manual for Health & Safety shall be provided for each project incorporating the Continuous Sandwich (PUF) Panels.

2.11 Responsibility

- Specific design using Continuous Sandwich (PUF) Panels is the responsibility of the designer with the instructions, supervision and guidance of the PAC holder.
- 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.

3.2 Visit to Manufacturing Plant and Construction Site

The manufacturing site at Nalagarh, Baddi (HP) was inspected by the Officers of the Council and member of TAC. The raw materials and finished products were found to be as per specifications. The firm has got necessary manufacturing and test facilities 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 warehouse of Hero Motorcorp of 10 meter height having area of 10,000 sqm constructed by the manufacturer using the panels at Neemrana (Rajasthan) in April, 2018.

3.3 Tests Done for Assessment

- **3.3.1** (i) Report of various tests carried out on 80mm thick PUF panel as per IS 12436:1988 by Bharat Test House, Delhi in 2011, 2012 & 2015.
 - Brief Evaluation Report of Ignitability Evaluation carried out on 50mm thick PUF panel as per BS 476-Part 5 by CBRI, Roorkee in 2011.
 - Brief Evaluation Report of Fire Propagation of carried out on 50mm thick PUF panel as per BS 476-Part 6 by CBRI, Roorkee in 2011.
 - (iv) Brief Evaluation Report of Surface Spread of Flame carried out on 50mm thick PUF panel as per BS 476-Part 7 by CBRI, Roorkee in 2011.
 - (v) Falling Hammer Impact Test carried out on 25mm thick PUF panel as per IS 2380(Part 10): by CBRI, Roorkee in 2011.
 - (vi) Density of PUF as per IS 7888:1976 by Shriram Institute for Industrial Research, Delhi in 2011
 - (vii) Test Report of various tests carried out on 50mm thick PUF panel as per IS 11239 (Part 2):1985 and IS 101 (Part 3/Sec 2):1989 by Aglow Quality Control Lab, Kolkata, NABL in 2017.
 - (viii) Test Results of two samples carried out on 40mm thick PUF panel as per IS 12436:1988 and IS 11239 (Part 12):1985 by PEC University of Technology, Chandigarh in 2017.
- **3.3.2** Testing of samples of 40mm, 80mm & 100mm thick panels collected by the IO at Nalagarh, Baddi (HP) for carrying out the tests by Bharat Test House, Delhi. However, the test results of 80mm thick panels are given below:

S. No.	Parameters	Test Method	Requirements	Results
1.	Density	ASTM D 1622	40±2 kg/m ³	40.2 kg/m ³
2.	Compressive	IS 11239 (Part	≥ 210 KPa	235.6 Kpa
	strength at 10%	11):1985		
3.	Dimensional	IS 11239 (Part	2% max.	< 0.5%
	stability	3):2009		
4.	Closed cell	IS 11239 (Part	85% min.	92.5%
	content	5):2009		
5.	Thermal	ASTM D 564	0.023 W/m.K	0.021 W/m.K
	conductivity		@10°C max.	
6.	Water	IS 11239 (Part	2% max.	< 0.2%
	absorption	9):1988		
	@100% RH			
7.	Water vapour	IS 11239 (Part	5.5 ng/pasm	3.9 ng/pasm
	permeability	4):2014	max.	max.

8.	Tensile strength	ASTM D 1623	$2.5 kg/cm^2$	3.1 kg/cm ²
			min.	
9.	Flexural	IS 11239 (Part	3.0 kg/cm^2	3.7 kg/cm^2
	strength	10):1985		
10.	Salt spray test	IS 14246:2013	There shall be	Test in
	300h		no defect	progress
11.	Horizontal	IS 11239 (Part	< 125mm	48mm
	burning	12):1988		

3.4 Execution of Projects

The manufacturer, as reported, has supplied/involved in the execution of the projects as per the details given below:

S. No.	Name & location of Project/Client	Quantity Executed (sq. m.) Approx.	Year of Construction
1.	Construction of pre- engineered buildings with roofing for 14 elevated stations for DMRC, Delhi	8000	2011
2.	Construction of pre- engineered buildings with roofing & cladding for DMRC, Delhi	15000	2011
3.	Construction of shops etc. of RCF Raebareli with roofing, cladding & partition walls for IRCON	36480	2011
4.	Construction of stores etc. of RCF Raebareli with roofing, cladding & partition walls for IRCON	15000	2011
5.	Construction of workshops under NVEQF with roofing, cladding & partition walls for SSA, Haryana	7000	2014
6.	Construction of Sub- health centers in MP with roofing, cladding & partition walls for NRHM, Bhopal	23136	2014
7.	Construction of pre- engineered buildings of RCF Raebareli with roofing, cladding &	8450	2015

	partition walls for IRCON		
8.	Supply & fixing of Inverter and Switch gear rooms at Mundra, Gujarat by Adani Power Ltd.	14300	2016
9.	Construction of Sub- health centers with roofing & cladding for Govt. of Rajasthan	15680	2016
10.	Supply of PUF Panels to Tata Projects Ltd., at Kanpur (UP) for Power Grid Corporation,	15000	2016
11.	Supply and Installation of panels for construction of a Warehouse for Hero Motorcorp of 10 m height at Neemrana (Rajasthan)	10,000	2018

PART 4 STANDARD CONDITIONS

This 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_____ Chairman Shelleen Kr. Agarwal Member Grandbart (Materials and Technology Promotion Council Ministry of Housing & Urban Poverty Alleviation, (Govt. of India) Core 5A, 1st Floor, India Habital Centre, Lodhi Road, New Delhi-110 003

PART 5 LIST OF STANDARDS & CODES USED IN ASSESSMENT

- **5.1** These Standards are referred for carrying out particular tests 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 801:1975 (Reaffirmed 2010)** Code of practice for use of cold formed light gauge steel structural members in general building construction
- 5.1.3 IS 875 (Parts1 to 3):1987/2015 Code of Practice for design loads (other than earthquake) for buildings & structures
- **5.1.4 IS1893 (Part 1):2016** Criteria for earthquake resistant design of structures
- **5.1.5 IS 1904:1986 (Reaffirmed 2010)** Code of practice for design and construction of foundations in soils: general requirements.
- 5.1.6 IS 2062:2011 (Reaffirmed 2016) Specifications for hot rolled medium & high tensile structural steel
- 5.1.7 IS 2380 (Part 10):1977 (Reaffirmed 2013) Falling hammer impact test
- **5.1.8 IS 3346: 1980 (Reaffirmed 2017)** Method of determination of thermal conductivity of thermal insulation materials
- 5.1.9 IS 7888:1976 (Reaffirmed 2008) Methods of test for Polyurethane Foam
- 5.1.10 IS 11239 (Part 1, 3, 4, 11 & 12):2009/1985/1988/2014 -- Method of tests for rigid cellular thermal insulations
- **5.1.11 IS 12436:1988 (Reaffirmed 2017)** Specifications for Performed Rigid Polyurethane foam for thermal insulation
- **5.1.12 IS 14246:2013 --** Specifications for continuously pre-painted galvanized steel sheets and coils
- **5.1.13 ISO 2796:1986** Cellular plastics -- Test method for dimensional stability of rigid materials
- **5.1.14 ISO 2896:2001** -- Cellular plastics --Test method for water absorption of rigid materials
- 5.1.15 IS 16700:2017 Criteria for structural safety of tall concrete buildings
- **5.1.16 ASTM C518** -- Standard test method for steady state thermal transmission properties by means of heat flow meter apparatus.
- 5.1.17 ASTM D1621- Standard test method for compressive properties of rigid

cellular plastics

- **5.1.18 ASTM D1622** Standard test method for apparent density of rigid cellular plastics
- **5.1.19 ASTM D1623** Standard test method for adhesion properties of rigid cellular plastics
- 5.1.20 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

- 1. Review of structural design and drawings of a Lecture hall for BMSIGL at Bihar considering wind load, seismic load etc. complete duly vetted by NIT Kurukshetra, Haryana
- 2. Review of structural design and drawings of one BHK Prefab Unit Project at Joshimath, Uttarakhand considering wind load, seismic load etc. complete duly vetted by NIT Kurukshetra (Haryana)
- 3. Test Report of various tests carried out on 80mm thick PUF panel as per IS 12436:1988 by Bharat Test House, Delhi in 2011, 2012 & 2015.
- 4. Brief Evaluation Report of Ignitability Evaluation carried out on 50mm thick PUF panel as per BS 476-Part 5 by CBRI, Roorkee in 2011.
- 5. Brief Evaluation Report of Fire Propagation of carried out on 50mm thick PUF panel as per BS 476-Part 6 by CBRI, Roorkee in 2011.
- 6. Brief Evaluation Report of Surface Spread of Flame carried out on 50mm thick PUF panel as per BS 476-Part 7 by CBRI, Roorkee in 2011.
- 7. Falling Hammer Impact Test carried out on 25mm thick PUF panel as per IS 2380 (Part 10):1977 by CBRI, Roorkee in 2011.
- 8. Density of PUF as per IS 7888:1976 by Shriram Institute for Industrial Research, Delhi in 2011
- 9. Test Report of various tests carried out on 50mm thick PUF panel as per IS 11239 (Part 1):2009 and IS 101: (Part3/Sec2):1989 by Aglow Quality Control Lab, Kolkata, NABL in 2017.
- 10. Test Results of two samples carried out on 40mm thick PUF panel as per IS 12436:1988 and IS 11239 (Part 12):1988 by PEC University of Technology, Chandigarh in 2017.

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Continuous Sandwich** (**PUF) Panel with Steel Structure** bearing the mark manufactured by M/s Jindal Mectec Pvt. Ltd. is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No. 1038-S/2018** is awarded to **M/s Jindal Mectec Pvt. Ltd., Gurgaon (Haryana)**.

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 39.

Dr. Shailesh Kr. Agarwal Chairman, TAC & Member Secretary, BMBA Building Materials and Technology Promotion Council inistry of Housing & Urban Poverty Alleviation, (Govt. of India)



Building Materials and Technology Promotion Council Ministry of Housing & Urban Poverty Alleviation, (Govt. of India) On benalf or Or MAN TECor Board of Mgreement, 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: **30.3.2018**

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
ΙΟ	Inspecting Officer
MS	Member Secretary of BBA
PAC	Performance Appraisal Certificate
РАСН	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 (T AC) 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 A

(Clause 1.7.2)

QUALITY ASSURANCE PLAN FOR CONTINUOUS SANDWICH (PUF) PANELS

S.	Parameters	Requirement	Test Method	Frequency
NO	tobe	Specified		of Testing
-	inspected			
	. Raw Materials	01 11 1 0		
1.	Pre-coated	Shall be free	Shall conform to IS	For every
	GI Sheet	from any	277:2003	batch
	Visual	surface defects		
2.	Mechanical,	Shall conform to	Shall conform to IS	Once in a
	Chemical &	18: 14246:2013	: 14246:2013	month
	Coating			
	properties of			
	GI Sheet	01 11 1	<u></u>	5
3.	PU Chemical	Shall be as per	Shall be as per	For every
		manufacturer's	manufacturer's	batch
		specifications	specifications	
4.	Polyol Glue	Shall be as per	Shall be as per	For every
		manufacturer's	manufacturer's	batch
		specifications	specifications	
2.	CSP			T
1.	Thickness	Shall be within	Measurement with	Every two
		tolerance limit	Vernier	months
		of ±1mm		
2.	PUF Density	Shall not be less	IS 11239(Part 2):	Every two
		than 40Kg/m ³	1985	months
3.	Thermal	Should be ≤0.02	ASTM C 518-98	Every six
-	Conductivity	W/mK		months
4.	Compressive	110-210 KPa	ASTM D1621-94	Every six
	Strength			months
5.	Tensile	370 KPa	ISO 1926:2005	Every six
	Strength			months
6.	Dimensional	0.1% @-30°C	ISO 2796:1986	Every six
	Stability			months
7.	Water	0.2% max.	ISO 2896:2001	Every six
	Absorption			months
8.	Horizontal	Less than	IS 11239 (Part 12):	Every six
	Burning	125mm	2008	months
9.	Fire Property	Self-	BS 476 (Part 5)	Every Year
		extinguishing		
10.	Water	5.5ng/pasm	IS 11239 (Part 4):	Every six
	vapour		2014	months
	transmission			

ANNEX B

(Clause 2.6)

MANUFACTURING PROCESS FLOW CHART



ANNEX C

(Clause 2.6.3.5)

FIXING DETAILS



Roof Panel – Trapezoidal View



Typical Eave Details





Typical Ridge Details





Fig. Ceiling Panel Handling Detail with Truss

Canopy Corner Detail



ANNEX D

(Clause 3.4)

PHOTOGRAPHS OF COMPLETED PROJECTS





Sub-Health Centre NRHM, Rajasthan

Hero Neemrana, Rajasthan



Hero Neemrana, Rajasthan



Madhusilica, Bhavnagar (Gujarat)



Boarding School of Seventh Day Adventist, Manipur LMRC-Lucknow