BMTPC
PACS
PERFORMANCE APPRAISAL CERTIFICATION

STRAND WOVEN BAMBOO WOOD FLOOR TILES & WALL PANELS

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

Name and Address of Certificate Holder:
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Performance Appraisal Certificate No.
PAC No.: **1051-P/2020**
Issue No. **01**
Date of Issue: **09.01.2020**

bmtpc

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PERFORMANCE APPRAISAL CERTIFICATE

FOR

STRAND WOVEN BAMBOO WOOD FLOOR TILES & WALL PANELS

ISSUED TO

M/S ESES BIO WEALTH PVT LTD

STATUS OF PAC 1051-P/2020

S. No	Issue No.	Date of Issue	Date of renewal	Valid up to (Date)	Remarks	Signature of authorized signatory
1	2	3	4	5	6	7
1	1	13/01/2020	---	12/01/2021		
2			13/01/2021	12/01/2022		
			13/01/2022	12/01/2023		
			13/01/2023	12/01/2025		

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PART 1 CERTIFICATION

1.1 Certificate Holder: M/s ESES Bio Wealth Pvt. Ltd.
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1.2 Description of System

1.2.1 ***Name of the System – "Strand Woven Bamboo Wood Flooring, Wall Panels & Door /Window Frames"***

1.2.2 Brand Name – EF Wood

1.2.3 *Brief Description* - Bamboo Wood is an environment friendly product handcrafted from bamboo, the fastest growing plant on earth. It is manufactured by processing of bamboo poles i.e. boiling and carbonizing to remove food agents present in it to make it termite resistant. Further, the bamboo strands are dried in kilns and thereafter glued by phenolic adhesive. Finally this shall be compressed under very high and uniformly distributed pressure. Bamboo Wood is most versatile substitute of hardwood. It is a conversion of bamboo to wood Bamboo is one of the natural materials available for bamboo wood products and is an alternative to hard wood. Bamboo has a higher fiber rating than any other hard wood which gives it exceptional hard wearing qualities. Flooring and wall paneling are coated with UV coat while decking shall be coated with oil.

1.2.4 *Types of Bamboo wood*

1.2.4.1 Interior type

- Bamboo wood Flooring
  - It is suitable for the indoor area. This is shown in Fig.1.
- Wall Cladding/ Panelling
  - It is suitable for the walls.
- Door, Door frames & Window Frames
  - It is suitable for indoor area, shown in Fig.2.

1.2.4.2 Exterior type

- Bamboo wood
- Decking / Flooring
- It is suitable for outdoor area.
- Door, Door frames & Window Frames
- It is suitable for outdoor area.

1.2.5 Dimension of Bamboowood Product and Accessories are as follows:

1.2.5.1 Description of Products

Sl. No.	Products	Size L x W (mm)	Thickness (mm)
1	Bamboo Wood	2100x100	150
2	Bamboo Wood flooring	1050x100	14
3	Bamboo Wood Wall cladding	2100x100	10
4	Bamboo Wood Door	2050x900	25, 30, 32
5	Bamboo Wood Door frame and Window frame	2100x1000	140x50, 100x50, 100x38, 75x38

Fig. 1

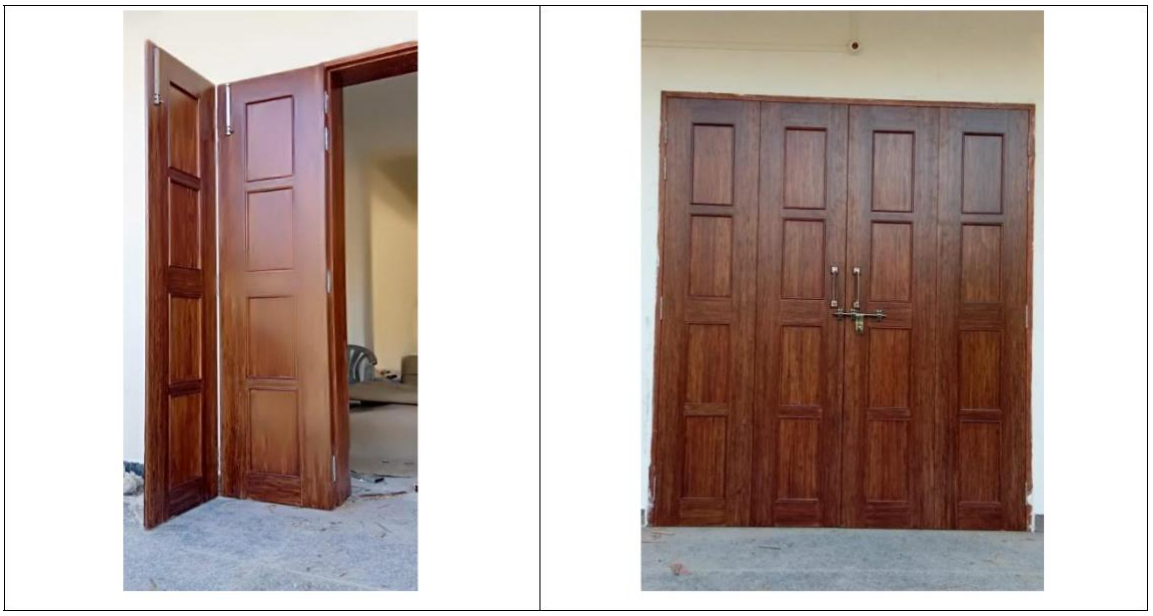


Fig. 2

Fig 3

1.2.5.2 Accessories

Sl. No.	Products	L x W (mm)	Thickness (mm)
1	Skirting	1050x100	14
2	T-mold	1050x50	10
3	Threshold	1050x50	10
4	Flat bit (half round both side)	2130x50	10
5	Quarter Round	2130x18	18

1.3 Manufacturing Process

1.3.1 The strand woven bamboo is hand selected from the cultivation areas by a team of experts of the firm. The bamboo is then carefully transported to the factory. The four stages of manufacturing process are as follows:

1.3.1.1 Primary

The bamboo is cleaned while its skin and knots are removed. It is then sliced into strips and crushed into strands – fibres that will come together for further treatment.

1.3.1.2 Secondary

The bamboo strands are then cured, naturally and artificially, for strength. These strands shall then be compressed to create bamboowood beams.

1.3.1.3 Tertiary

The beams are then smoothened out and sliced into different thicknesses for flooring, decking or wall cladding. The bamboowood planks shall return to be seasoned naturally and artificially (kiln dried) for high grade stability.

Based on the product requirement the sliced bamboo wooden planks are then processed accordingly. As well as different quality parameters are also to be ensured based on the design or drawing or Customer's requirement.

1.3.1.4 Finishing

The planks are then coated with UV coating. This process is repeated 9 times for ensuring durability and robustness for flooring and wall cladding, while bamboo wood door coated with PU coat and organic type wood preservative are used for Door Frame.

The manufacturing process Flow Chart is shown in **Annex. I**.

The manufacturing process is shown in Fig. 4.

Fig. 4

1.4 Assessment

1.4.1 Scope of Assessment

Scope of assessment included suitability of Bamboo wood & products to the specified requirements for use in buildings, houses, offices etc. as:

i) Bamboo Wood & Products.
ii) Flooring & Accessories
iii) Cladding & Accessories
iv) Door
v) Door & Window Frame.

1.4.2. Basis of Assessment

Assessment of the suitability of Bamboo wood is based on:

i) Inspection of the factory for production and quality assurance of the product.
ii) In house Lab Test Report of bamboo-wood tiles for various characteristics.
iii) Third Party Test Reports of Bamboo wood / Flooring / Cladding for various characteristics by KLUMPP, Singapore.

iv) Test Reports of Bamboo-wood flooring tiles to determine the formaldehyde content in the board by Perforator method by Centre for Testing & Evaluation of Wood Composites, IPIRTI Kolkata.

v) Test Reports of Bamboo-wood flooring tiles for various characteristics by Centre for Testing & Evaluation of Wood Composites, IPIRTI, Kolkata.

vi) Quality Assurance Scheme followed by the Certificate holder for process control.

1.5 Uses of Bamboo wood and its Limitations

1.5.1 Uses

Bamboo wood products shall be suited for the following uses:

1.5.1.1 Indoor

i) Home, office, mall etc. flooring with accessories
ii) Sport stadiums, Auditoriums etc. special floors with special installation requirements
iii) Paneling/cladding etc.
iv) Door, Door frames & Window Frames

1.5.1.2 Outdoor

i) Decks of any use
ii) Canopy, lawn area
iii) Portico, entrance etc.
iv) Door, Door frames & Window Frames

1.5.2 Limitations

i) Indoor products shall not be used for outdoor use and vice-versa
ii) There shall be difference in kind of finish for indoor and outdoor flooring

1.6 Conditions of Certification

1.6.1 *Technical Conditions*

i) Raw materials and the finished products shall conform to the requirements of the prescribed specifications.
ii) The products to be installed shall be in accordance with the specifications, manufacturing & installation process prescribed by the manufacturer.

1.6.2 Handling of User Complaints

1.6.2.1 The Certificate holder shall provide quick redressal to consumer/user complaints proved reasonable & genuine and within the conditions of warranty, if provided by it to customer/purchaser.

1.6.2.2 As part of PACS Certification, data shall be maintained on such complaints with a view to assess the complaint satisfaction and suitable preventive measures taken.

1.6.3 *Quality Assurance*

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

1.7 Certification

On the basis of assessment given in Part III of this Certificate & subject to the conditions of certification, use & limitations set out in this Certificate and if selected, installed & maintained as set out in Part I & II of this Certificate, the Bamboo wood products covered by this Certificate is fit for use 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 Bamboo wood products in accordance with the specifications, manufacturing & installation process prescribed by the manufacturer.

2.2 Performance Requirements and Products Specifications of Bamboo Wood

Bamboo wood is composite product made from Bamboo and Adhesives. Raw materials quality is very important for the performance of Product. Performance of product is checked by visual inspection, physical and mechanical testing.

2.3. Raw Materials

i) Bamboo shall be matured, fresh, have no pin holes, no decay, no de-colourisation
ii) Boric acid shall be of 99.5% purity
iii) Borax shall be of 99.5% purity
iv) Phenol shall have 99.9% dry mass w/w
v) Formalin shall be of 37% purity.
vi) Caustic soda shall have 99.9% dry mass w/w
vii) Hydrogen peroxide shall be of 50% concentration

2.4 Specification for Physical and Mechanical Strength of Flooring

i) Density shall be ≥ 1000 Kg/m^3 in accordance with IS 1708 (Part 2):1986

ii) Modulus of Rupture shall be ≥ 130 N/mm^2 in accordance with IS 1734 (Part II):1983 (RA2003)

iii) Modulus of elasticity shall be ≥ 17500 N/mm^2 in accordance with IS 1734 (Part II):1983 (RA2003)

iv) Flammability (time taken for second ignition) shall be ≥ 5 min in accordance with IS 1734 (Part 3):1983

v) Flame penetration (time taken for flame penetration from bottom to top surface) shall be ≥ 30 min in accordance with IS 1734 (Part 3):1983

vi) Rate of burning (time taken to lose weight from 70% to 30%) shall be ≥ 10 min in accordance with IS 1734 (Part 3):1983

2.5 Test Specification for UV coating

i) Gloss value shall be 30 ± 5% in accordance with DIN EN ISO 2813:1994

ii) Cross cut test shall be ≤ GT 2 in accordance with DIN EN ISO 2409:2007

iii) Abrasion resistance – initial point shall be > 100 cycle in accordance with DIN EN 438-2:1991 (500g load per wheel S 33)

iv) Abrasion resistance – initial point shall be > 550 cycle in accordance with DIN EN 438-2:1991 (500g load per wheel S 33)

v) Scratch resistance (pencil hardness) shall be ≥ 1H in accordance 10 with ISO 15184:2012 Scratch resistance (coin test) shall be ≥ 20 N in accordance with Hamburger planner

vi) Scratch resistance (surface) shall have No scratch as per Steel wool test, Type2

vii) Impact resistance shall be ≥ 2 N in accordance with DIN EN 438Part 2-12:2005

viii) Resistance to indentation shall be ≥ 1 N in accordance with DIN EN 438 Part 2-14:2005

ix) Chemical resistance shall be 5 in accordance with DIN 68861-1:2011

x) Heat resistance (cigarette test) shall be 6A in accordance with DIN 68861 – 6:2011

xi) In-flammability shall be B1 in accordance with DIN 4102 Part 14:1990

2.6 Laboratory Test and Field Tests

Mechanical and physical test of bamboo-wood flooring are performed in In-house lab for the product assessment and Filed equipment is used for Process assessment. List of Laboratory/ field equipment is attached in **Annex.**

2.7 Quality Assurance

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

2.8 Design parameter and Installation Procedure

2.8.1 Design Parameters

Data design parameters required for design where the product is used:

i) Floor plan
ii) Dimensional details
iii) Construction type for product required
iv) Ventilation provisions
v) Location
vi) Weather extreme high & low values of temperature and humidity

2.8.2 The Bamboo wood flooring shall be installed on the following types of sub-floor:

i) *Concrete sub-floor* – The desirable floor base shall be strong, dry and have no open cracks or water leakage,.
ii) *Plywood sub-floor* -- The desirable floor base shall be free from emission and properly installed on graded floor
iii) *Other sub-floor* -- The desirable floor base shall be standard batten, treated and seasoned sub-floor
iv) Flooring Installation process is shown in **Annexure.**

The sub-floor level shall be maintained at 'zero level'. There shall be no grease, oil, wax, dust and sand etc. on the sub-floor.

2.8.3 *Floating Floor Installation*

i) Floor shall be cleaned
ii) Underlay or high density foam shall be used
iii) The sheet shall be unrolled on the longest wall
iv) The sheet shall not be overlapped
v) The guide floor piece shall be placed first
vi) Expansion gap shall be left
vii) The guide shall be laid by nail down method
viii) Floor tiles shall be spread to normalize and colour sorting
ix) Rectangular alignment shall be checked
x) Floor tiles to be used next shall be aligned
xi) Two tiles shall be locked
xii) Same process shall be continued for next floor tile
xiii) The tiles shall be pushed to lock each other well by using controlled force

xiv) Floor tiles shall be laid & aligned continuously and locking process shall be repeated
xv) Guide shall be removed and tile placed in last
xvi) Skirting/moulding/quarter round shall be fixed
xvii) New floor shall be allowed to acclimatize for 24 hrs
xviii) The Bamboowood flooring can be fixed now.

2.8.4 *Nail down Floor Installation*

i) Floor shall be cleaned
ii) Anti-friction poly sheet shall be laid
iii) Guide line expansion joints shall be marked 6mm from end and 15mm sideways
iv) Floor tiles shall be spread to normalize and colour sorting
v) The guide shall be laid by nail down method
vi) The tiles shall be arranged and laid in regular or other design
vii) The tiles shall be pushed into each other
viii) The floor nailer shall be used to nail down tiles
ix) Expansion guide strips shall be removed
x) Skirting/moulding/quarter round shall be fixed
xi) New floor shall be allowed to acclimatize for 24 hrs
xii) The Bamboowood flooring can be fixed now.

2.8.5 *Glue Down Floor Installation*

i) Floor shall be cleaned
ii) Guide line expansion joints shall be marked 6mm from end and 15mm sideways
iii) The guide shall be laid by nail down method
iv) Floor tiles shall be spread to normalize and colour sorting
v) Glue shall be applied by using trowel
vi) Glue shall be used below room temperature
vii) Glue shall be used gradually and tiles shall be laid outwards
viii) The tiles shall be cleaned/wiped in case any glue mark seen/noticed
ix) The tiles shall not be cut over glue spread area
x) Soft roller shall be used to get an even and good bond between subfloor and tiles
xi) The glue shall be cleaned/wiped if it comes out on top
xii) Guide shall be removed and tile placed in last
xiii) Skirting/moulding/quarter round shall be fixed
xiv) New floor shall be allowed to acclimatize for 24 hrs
xv) The Bamboowood flooring can be fixed now.

2.8.6 Wall Cladding Installation Procedure.

i) Concrete wall : The desirable wall should be strong, dry, even and should not have any open cracks or water leakage

ii) Other sub wall: The desirable wall base should be standard batten, treated and seasoned sub-wall

2.8.7 Installation procedure

i) wall should be cleaned thoroughly
ii) Seasoned wooden bit should be fixed with the wall.
iii) Underlay of high density foam sheet should be used.
iv) Foam sheet should not overlap.
v) Mark straight line of wall to guide cladding with the help of plumb bob.
vi) Place the guide cladding first and nailed it to bit by using pneumatic nail gun.
vii) Cladding should be spread to normalize and colour sorting
viii) Take next cladding and make sure 2 mm expansion gap should be there between two cladding.
ix) Cladding should fix and align continuously.
x) Skirting and other accessories like quarter round, T-mold should be fixed.
xi) New wall should be allowed to acclimatize for 24 hrs.
xii) The bamboo wood can be fixed now.
xiii) Wall cladding installation diagram is attached in **Annex**.

2.8.8 Door Installation Procedure

2.8.8.1 Initial Steps:

i) Measure the Door Openings: With the help of a measuring tape, measure the height and width of the door openings. Write down the measurement in paper.

ii) Check the floor level: Check the floor for level and the jambs for plumb. Measure the exact amount that the flooring is off-level. The opposite jamb must be cut by this amount to level the door in the opening.

iii) Mark the door for trimming: Use a pencil/pen to apply the measurements.

iv) Generally, allow for a 2mm space between the door and the top & sides. The bottom of the door should be 6 – 12mm up from the floor. This is because your door will be going over a carpet, floor tiles, wooden floors, etc.

2.8.8.2 Alter the Door:

i) Trim the jamb: Mark and carefully cut the jamb on the high side with your saw machine. If you tend to cut more than ¼ inch from the jamb, you might need to trim the bottom of the door so that it conforms to the floor slope.

ii) Trim the door: With the help of P-80 sanding paper, plain up the pencil marks and sand the edges thoroughly until they are smooth. Keep in mind not to trim too much since it may reduce the thickness.

iii) Check if the door fits: With shallow wedges underneath the door and someone else to help you hold it up, place the door in the frame and see if it fits properly. If it doesn't, further trimming is needed until the door fits perfectly.

iv) Place the SS Hinges: Place the door on its side with the hinge side upwards.

v) Measure and mark 125mm (5″) from the top and bottom of the door. This mark represents the bottom of the SS hinge at the bottom of the door and top of the hinge at the top.

vi) Open a hinge and place it on the door in line with the mark you have just made. Draw around it with a pencil. Repeat this for the other hinge.

vii) Cut hinge recesses (mortises): Use a chisel to make shallow recesses in the door within the pencil marks. Strip away the surplus wood and trim the recess until the hinge is flush with the wood. Keep in mind not to chisel too much or else it will be very hard to fix.

viii) Drill Pilot Holes: With each hinge flap in its recess, mark the screw positions with a pencil/pen. Remove the hinges and use a drill bit that is slightly narrower than your screws to drill pilot holes where they are marked by the pencil. To center the pilot holes perfectly, use a 3mm bit available at any hardware store. When using a drill bit, drill through the hinge's screw holes with the hinge in its proper location on the door. Keep the bit perpendicular to the door.

2.8.8.3 Hanging the Door

i) Screw on the SS Hinges: The best way to do this is with a drill machine, but can also be accomplished with a screwdriver if necessary.

ii) Mark the Hinge positions on the frame: Place objects such as screwdrivers or shallow wedges at the bottom of the doorway. Let somebody hold the door in the

frame in exactly the position that you want it to hang. The hinge knuckles should be parallel with the frame. Draw around the hinges with a pencil/pen neatly.

iii) Chisel hinge recess: After carefully putting the door aside, cut mortises in the door frame in the same way that you did on the door itself. Hold the door against the frame again to test the placement and make sure the hinges are in level.

iv) Fixing hinges to the door frame: Mark pilot holes on the frame with a pencil/pen and then drill through these marks in the same way you did for the door. Put the drywall screws through the pilot holes to affix the hinges on the frame.

v) Test: Once the hinges are attached in both door and frame, open & close few times to check for any further obstructions. Make sure that the door opens and closes without any sounds (creeks). Installation Diagram shown in **Annex**

2.8.8.4. **Procedure of fixing Door Frame**

i) Fixing SS Clamps / Hold Fasts: We fix 03 (three) numbers of SS clamps / hold fasts on a side of bamboo wood door frame. For both side of a door frame will need **06** numbers of clamps / hold fasts. We suggest that you fix the clamps / hold fasts using good quality drywall screws instead of nails.

ii) Marking the Level: The purpose of level marking is to keep the top level of all doors same. So, we set a reference mark and take the level to all doors with the help of a measuring tape.

iii) Aligning Door Frame with Wall: The purpose of aligning bamboo wood door frame is when you have plaster on wall. The plaster surface and door frame will be in the same level. In addition, if you fix tiles in the wall then tiles surface and door frame will be in the same level. Hence, make sure the door frame is completely vertical with the help of plumb bob.

iv) Final Check: Before permanently fixing the frame with cement-concrete, finally check the alignment and top level of the door frame.

v) Fill with Cement-Concrete**:** If everything is set as per above instructions, fill the gaps all around the door frame with cement-concrete to bond with the masonry wall.

vi) Curing Period: Let the concreting portion cure naturally for a minimum of 7 days. Door frame installation diagram shown in **Annex.**

2.8.8.5 Decking Installation

i) Floor shall be cleaned

ii) Battens shall be placed with a gap of not more than 500mm
iii) Batten shall be nailed down into subfloor
iv) Clip shall be installed on the back of deck tile by 2.5mm dia. and 10mm long screw
v) First deck tile shall be installed
vi) Hole shall be drilled to fix 4mm screw
vii) Tile shall be fixed with batten by using clip and 2.5mm screw
viii) Same process shall be repeated to fix next deck
ix) New floor shall be allowed to acclimatize for 24 hrs
x) The Bamboowood flooring can be fixed now.
xi) Detailed installation guidelines along with illustrations are given in **Annex III.**

2.9 Maintenance Guidelines

2.9.1 Bamboo wood flooring shall be maintained by hardwood floor cleaners as recommended to ensure that floor stays looking good. It shall be ensured that hardwood floor cleaners are water base, non- toxic cleaner which has been designed for finished hardwood floors. Cleaner shall be used as per manufacturer's instructions.

2.9.2 *Types of Drying Methods for the Floors are as follows:*

2.9.2.1 *Dry mop*

Dirt and grit shall always be removed prior to cleaning Bamboo wood floors with an electrostatic dust control mop/ soft mop/ vacuum cleaner. Bristle broom shall be avoided.

2.9.2.2 *Dry spray*

The area of floor or the cleaning pad shall be mist with the hardwood floor cleaner.

2.9.2.3 *Wipe*

The floor shall be cleaned with a microfiber cloth or mop using a back and forth motion until it is dry. Soiled mop or cloth shall be replaced once it becomes soiled to avoid streaking.

2.9.3 Do's and Don'ts

2.9.3.1 Do's

i) The floor shall be cleaned regularly. Recommendations for cleaning the floor as a guide shall be as follows:
- Low frequented area (residential) – about every 2-4 weeks

- Medium frequented area (offices) – about every 1-2 weeks
- High frequented area (public places) – about every 1-2 days

ii) Spills shall be removed promptly

iii) Mats at exterior and interior doors shall be placed to trap sand and grit from incoming traffic

iv) Heavy furniture or appliances shall always be picked rather than sliding them across the floor

v) Any minor scratches or damage shall be repaired using hardwood flooring cleaners

2.9.3.*2* *Don'ts*

i) Do not steam mop or wet mop floor surface area after installation. Excess water can cause swelling

ii) Do not let sand, dirt or grit build up. They act like sandpaper and actually abrade and dull the floor finish.

2.10 Sampling

2.10.1 *Lot*

2.10.1.1 In any consignment all the flooring tiles of the same type, shape, size and manufactured from the same raw materials under relatively similar conditions of production shall be grouped together to form a lot for inspection.

2.10.1.2 Samples shall be collected and inspected from each lot separately to ascertain its conformity or otherwise to the requirement of the specification.

2.10.2 *Scale of Sampling*

2.10.2.1 The number of samples to be selected for the sample from a lot shall depend upon the size of the lot and shall be in accordance with the col 1, 2 and 3 of Table 1.

2.10.2.2 All the tiles in the sample shall be selected at random from the lot. In order to ensure randomness of selection, procedures given in IS 4905:1968 may be followed.

2.10.3 *Number of tests and criteria for conformity*

2.10.3.1 The no. of tiles in the first sample shall first be subjected to the routine tests.

If in the first sample the no. of defective tiles i.e. those failing to satisfy any one or more of the acceptance tests is equal to the corresponding

acceptance no. *a* (col 5), the lot shall be considered as conforming to the requirements of the routine tests. If the no. of defective tiles in the first sample is more than or equal to the corresponding rejection no. *r* (col 6), the lot shall be considered as not conforming. If the no. of defective tiles in the first sample lies between the corresponding values of *a & r*, a second sample (col 2 &3), shall be selected and subjected to the routine tests. If in the combined sample, the no. of defective tiles is less than or equal to the corresponding acceptance no. *a,* the lot shall be considered as conforming and if, the no. of defective tiles is more than or equal to the corresponding rejection no. *r*, the lot shall be considered as not conforming.

Table 1: Sample size

(Clause 2.5.3.1)

No. of tiles in the lot (1)	Sample (2)	Sample size (3)	Cumulative Sample size (4)	Acceptance Number (5)	Rejection Number (6)
Up to 100	First	5	5	0	0
	Second	10	15	1	2

2.11 Packing and Marking

2.11.1 Flooring tiles shall be packed in foam, one set of such tiles again wrapped in poly pack and expose to infrared shrinking tunnel for air tight packing. Pre-shrink wrapped tiles shall be placed into corrugated box which shall be made by using 180gsm, 3 ply, 13kg/cm^2, 20Bf paper; of wall thickness 4.5mm and 0.7kg/m^2 weight. Each box shall be marked with the following information:

a) Name of the manufacturer or trade mark
b) Lot or batch number; year of manufacture
c) Colour
d) Dimensions
e) Quantity in no., sq.m or sq.ft

2.12 Choosing Size and Thickness

Appropriate size and thickness of the flooring shall be chosen to suit the requirement of the work.

2.12.1 Life Cycle Cost

Since Bamboo wood manufacturing started few years ago in India, therefore life cycle costing is predicted by comparison of properties of bamboo wood with hard wood.

Properties	Hard Wood (Teak Wood)	Bamboo Wood
Physical	Density (sheer strength) – 0.7 g/cm3	Density (sheer strength) – 1.11 g/cm3
	Water Resistance is significantly low	It having high water resistance properties
Mechanical	Tensile Strength – 249.48 Kg/cm2	Tensile Strength - 4188.63 Kg/cm2
	Load Holding Capacity- 1754 kg/cm2	Load Holding Capacity- 2658.60 Kg/cm2
	Screw holding capacity is very less. Screw holding capacity - <200	Screw holding capacity is very high since bamboo wood is made up of long compact fibres. Once screwed, it will never come out. Screw Holding Capacity - > 322 Kg
Biological	No Termite Resistance	Termite Resistance
	No Borer Resistance	Borer Resistance

Mechanical, Physical and Biological properties of Bamboo wood has been tested as per IS 1708, IS 1734 and IS 2380 specification and passed its criteria, which clearly displays that the life span of bamboo wood is significantly higher and better than any other hard wood available.

As for as life cycle of bamboo wood is concerned, the technical properties of bamboo wood clearly stand ahead in term of durability and resistance against any hard wood.

The operational costs of producing bamboo wood products such as flooring, doors, door & window frame etc. are comparatively cost efficient and precise as compared to carpentry jobs undertaken manually.

The cost of maintaining bamboo wood products is generally low. This is because bamboo wood products are manufactured by using best quality matured bamboos only which guaranties superior quality. In addition, the imported coating material that is applied in flooring, wall cladding, doors etc. further enhances the durability of the products.

2.12.2 Environmental Concern

Bamboo being the fastest growing plant on Mother Earth makes its commercial uses at most sustainable and helps to control Environment deterioration and restore eco system rapidly. Binder uses of phenolic resin adds value to bamboo and educed frequent replacement of

end products and resulting less burden on environment and forestry.

North-East region of India blessed in natural abundance of Bamboo cultivation and commercial exploration of Bamboo makes it most desirable of environmental benefits as more you harvest grasses it replicates in multi folds. Northeast region comprises approx 40% of total bamboo plantation land area.

Another important aspect of bamboo and engineered bamboo products are being biodegradable. Also everything of bamboo being utilised, skin for mats weaving, dust for energy pallets and flesh for Bamboo wood industrial production. There is no environmental hazards coming out of bamboo, bamboo wood or products made thereafter. Bamboo is good but bamboo wood is best.

2.12.3 Social Benefits

i) Long lasting wealth creation for farming sector
ii) Creating new job opportunities within vicinity
iii) Improves skilling in large
iv) Checks migration issue
v) Women empowerment by providing special skills.
vi) Technical knowledge sharing with traditional practices makes it good for masses
vii) Socio economic improvement in locality
viii) More one harvest mature bamboo's good for social happiness.

2.13 Skilled /Training needed for Installation

EF Bamboowood flooring shall be installed by experienced carpenters in accordance with the technical literature and installation guidelines of the manufacturer.

2.14 Guarantees/Warranties provided by the PAC Holder

The manufacturer shall furnish a warranty for a period of 5 years from the date of completion of flooring to the original purchaser provided the flooring is installed strictly in accordance with the applicable specifications, instructions and guidelines of the manufacturer. A brochure giving relevant warrantee details shall be made available to the client.

2.15. Services provided by the PAC Holder to the Customer

In-house testing of formwork at regular intervals as per the Quality Control Assurance requirement shall be ensured by PAC Holder.

2.16 Manuals & Guidelines

All the manuals and guidelines etc. relating to Operation, Quality, Installation, Maintenance etc. shall be provided by the manufacturer.

2.17 **Responsibility**

Quality of installation of the flooring on site is the responsibility of the trade persons engaged by the agency.

PART 3: BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Assessment

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

3.1.2 The assessment of the system is based on the Bamboo wood products manufactured, used and installed as per statement given in the PAC. However, assessment of the suitability of flooring manufactured as flooring, decking and cladding in buildings, houses, offices etc. is based on:

i) Inspection of the factory for production and quality assurance of the product.
ii) Test Report of Bamboo wood products finish for Standard and Lifetime finishing for various characteristics got done by the manufacturer.
iii) Test Report of Bamboo wood products to determine the formaldehyde content in the board by Perforator method got done by the manufacturer.
iv) Test Report of Bamboo wood flooring tiles for various mechanical properties got done by the manufacturer.
v) Test Report of Bamboo wood flooring tile finish for natural finish, carbonized finish, satin finish and wall finish for various characteristics got done by the manufacturer from Friedrich Clump GmbH, Singapore.
vi) Quality Assurance Scheme followed by the Certificate holder for process control. Quality Assurance Plan followed is shown in Annex.

3.2 Laboratory Tests Performed for Assessment

3.2.1 *Testing of Samples by Foreign Laboratory by KLUMPP, Singapore*

3.2.1.1 *Floor finish -- Natural*

Laboratory Tests Performed for Assessment

Testing of Samples by Foreign Laboratory by KLUMPP, Singapore

A. BAMBOO WOOD FLOOR TILES

Sl. No.	TEST	INTERNATIONAL STANDARD	RESULTS	
			Residential	Commercial
1.	Gloss vale	DIN EN ISO 2813	29-31%	29-31%
2.	In flammability	DIN 4102-14:1990	B1	B1
3.	Chemical Resistance	DIN 68861 Part 1:2011	No Visible Change (Except Black/Blue Ink)	No Visible Change (Except Black/Blue Ink)
4.	Cross Cut Test	DIN EN ISO 2409	GT 0	GT 0
5.	Abrasion Resistance	DIN EN 438-2 (500G Load per wheel S33)	IP -200 CYCLE	IP -1550 CYCLE
6.	Scratch Resistance- Pencil Hardness	ISO 15184	5H	7H
7.	Scratch Resistance- Coin Test	Hamberger Planner	37N	43N
8.	Scratch Resistance- Surface	Steel wool test, Type-2	No Scratch	No Scratch
9.	Resistance to indentation	DIN EN 438 Part 2-14	2 Newton	3 Newton
10.	Impact Resistance	DIN EN 438 Part 2-12	5 Newton	8 Newton
11.	Heat Resistance- Cigarette Test	DIN 68861 Part 6:2011	6A	6A

B. BAMBOO WOOD WALL CLADDING

1.	Gloss vale	DIN EN ISO 2813	28-30%
2.	In flammability	DIN 4102-14:1990	B1
3.	Chemical Resistance	DIN 68861 Part 1:2011	No Visible Change (Except Black/Blue Ink)
4.	Cross Cut Test	DIN EN ISO 2409	GT 0
5.	Abrasion Resistance	DIN EN 438-2 (500G Load per wheel S33)	IP - 200 CYCLE
6.	Scratch Resistance- Pencil Hardness	ISO 15184	3H
7.	Scratch Resistance- Coin Test	Hamberger Planner	32N
8.	Scratch Resistance- Surface	Steel Wool Test, Type-2	No Scratch
9.	Resistance to indentation	DIN EN 438 Part 2-14	2 Newton
10.	Impact Resistance	DIN EN 438 Part 2-12	5 Newton
11.	Heat Resistance- Cigarette Test	DIN 68861 Part 6:2011	6A

PERFORMA FOR RECORD OF TEST RESULTS OF

A- BAMBOO WOOD FLOOR TILES

Laboratory Tests Performed for Assessment

Testing of Samples by Centre for Testing & Evaluation of Wood Composites, IPIRTI, Kolkata		
Density	IS: 1708 (Part 2) 1986	1118 kg/m3
Moisture Content	IS: 1734:1983 (RA2003) Part-1	7.13%
Hardness Test	IS 1708:1986 (Part- 10)	17.72 N/mm^2
Flammability, Minutes	IS 1734:1983 (RA2003) Part - 3	38 Minutes
Rate of Burning, Minutes	IS 1734:1983 (RA2003) Part - 3	27 Minutes
Flame Penetration, Minutes	IS 1734:1983 (RA2003) Part - 3	136 Minutes
Modulus of Elasticity (MOE),	IS: 1734:1983(RA 2003) Part-2	24762 N/mm^2
Modulus of Rupture (MOR),	IS: 1734:1983(RA 2003) Part-2	167.27 N/mm^2
Volatile Organic Compound	IS 13745:1993	13.70 mg/100gm
Termite Test	Lab Test - 6 month In Termite mound	No Attack
Borer Test	Lab test- 6 Months in Borer Box	No Attack

A- BAMBOO WOOD WALL CLADDING

Laboratory Tests Performed for Assessment

Testing of Samples by Centre for Testing & Evaluation of Wood Composites, IPIRTI, Kolkata		
Density	IS: 1708 (Part 2) 1986	1107 kg/m3
Moisture Content	IS: 1734:1983 (RA2003) Part-1	7.69%
Hardness Test	IS 1708:1986 (Part- 10)	16.74 N/mm^2
Flammability, Minutes	IS 1734:1983 (RA2003) Part - 3	29 Minutes
Rate of Burning, Minutes	IS 1734:1983 (RA2003) Part - 3	32 Minutes
Flame Penetration, Minutes	IS 1734:1983 (RA2003) Part - 3	96 Minutes
Modulus of Elasticity (MOE),	IS: 1734:1983(RA 2003) Part-2	20292 N/mm^2
Modulus of Rupture (MOR),	IS: 1734:1983(RA 2003) Part-2	140.72 N/mm^2

Volatile Organic Compound	IS 13745:1993	12.31 mg/100gm
Termite Test	Lab Test - 6 month In Termite mound	No Attack
Borer Test	Lab test- 6 Months in Borer Box	No Attack

NOTE ON QUALITY ASSURANCE PRACTICE

Quality Assurance Plan for Bamboo wood Flooring

Sl. No.	Parameter to be inspected	Requirement Specified	Test Method	Frequency of Testing
I	**Raw Material Test**			
1	Raw bamboo Inspection	Freshly Harvested	Physical & Measured	Daily/ load Basis
2	Phenol purity	99.90%	Titration method	Load Basis
3	Formalin Purity	36-37%	Titration method	Load Basis
4	Raw Material General	As Per Material Quality Report	Physical & Measured	Daily/ load Basis
II	**Phenol Formaldehyde Resin Routine Test**			
1	Specific Gravity	1.140-1.150	Sp. Gr. Meter	Every Charge Basis
2	Flow time	30±5	B-4 Cup (IS 3944)	Every Charge Basis
3	pH	10-11.5	Litmus Paper	Every Charge Basis
4	Solid Content	42-50%	Oven Dry Method	Every Charge Basis
III	**Flooring**			
A	***Routine Test***			
1	Density	≥1000	IS: 1708 (Part 2) 1986	Weekly
2	Modulus of Rupture (MOR),	≥ 130 N/mm^2	IS: 1734:1983 (RA2003) Part-2	Weekly
3	Modulus of Elasticity (MOE),	≥ 17500 N/mm^2	IS: 1734:1983 (RA2003) Part-2	Weekly
4	Hardness Test	≥ 800 Kg	IS 1708: 1986 (Part 10)	Weekly
5	Moisture Content	≤ 12%	IS: 1734:1983 (RA2003) Part-1	Weekly
B	***Specialized Test***			
1	Screw withdrawal Resistance (Face)	≥250	IS 2380 (Paft-14):1977	Half yearly/Yearly/ Needed Basis
2	Screw withdrawal Resistance (Edge)	≥200	IS 2380 (Paft-14): 1977	Half yearly/Yearly/ Needed Basis
3	Swelling Due to General absorption	≤ 8%	IS 2380(Part-17):1977	Half yearly/Yearly/ Needed Basis

4	Swelling Due to Surface absorption	≤ 4%	IS 2380(Part-17):1977	Half yearly/Yearly/ Needed Basis
5	Water Absorption	≤ 4 % (2 hr)	IS 2380(Part-17):1977	Half yearly/Yearly/ Needed Basis
		≤ 8% (24 hr)	IS 2380(Part-17):1977	
6	Termite Test	No Termite Attack	Lab Test - 6 month In Termite mound	Half yearly/Yearly/ Needed Basis
7	Borer Test	No Borer attack	Lab test- 6 Months in Borer Box	Half yearly/Yearly/ Needed Basis
8	Volatile Organic Compound	≤ 6.00 mg/100 g	IS 13745:1993	Half yearly/Yearly/ Needed Basis
9	Flammability	≥5 min	IS 1734:1983 (RA 2003) Part- 3	Half yearly/Yearly/ Needed Basis
10	Rate of burning	≥10 min	IS 1734:1983 (RA 2003) Part- 3	Half yearly/Yearly/ Needed Basis
11	Rate of Penetration	≥30	IS 1734:1983 (RA 2003) Part- 3	Half yearly/Yearly/ Needed Basis

IV FLOOR FINISH
Routine test

1	Cross Cut Test	DIN EN ISO 2409	≤GT2	Daily/ load basis
2	Scratch Resistance-Coin Test	Hamberger Planner	≥ 20 Newton	Daily/ load basis
3	Heat Resistance-Cigarette Test	DIN 68861 Part 6:2011	6A	Daily/ load basis

Type test

1	Gloss Value	DIN EN ISO 2813	30±5		Half yearly/Yearly/ Needed Basis
2	Abrasion Resistance	DIN EN 438-2 (500G Load per wheel S33)	IP > 100 cycle	Residential	Half yearly/Yearly/ Needed Basis
			IP> 550 cycle	commercial	
3	Scratch Resistance-Pencil Hardness	ISO 15184	≥ 2H		Half yearly/Yearly/ Needed Basis
4	Scratch Resistance-Coin Test	Hamberger Planner	≥ 20 Newton		Half yearly/Yearly/ Needed Basis
5	Scratch Resistance-Surface	Steel wool test, Type-2	No Scratch		Half yearly/Yearly/ Needed Basis
6	Impact Resistance	DIN EN 438 Part 2-12	≥ 2 Newton		Half yearly/Yearly/ Needed Basis
7	Resistance to indentation	DIN EN 438 Part 2-14	≥ 1 Newton		Half yearly/Yearly/ Needed Basis

8	Chemical Resistance	DIN 68861 Part 1:2011	No Visible Change	Half yearly/Yearly/ Needed Basis
9	Heat Resistance-Cigarette Test	DIN 68861 Part 6:2011	6A	Half yearly/Yearly/ Needed Basis
10	In flammability	DIN 4102-14:1990	B1	Half yearly/Yearly/ Needed Basis

3.2.2. *Testing of Samples by Centre for Testing & Evaluation of Wood Composites, IPIRTI, Bangalore*

3.2.2.1. *Test to determine the formaldehyde content in the board by Perforator method as per IS 13745:1993*

i) Type of the board : Bamboowood Floor Tiles
ii) Thickness of the board : 14.18mm
iii) Moisture content at the time of testing :5.52%
iv) Bulk density : 1151 kg/m^3
v) Perforator value : 9.1528 mg/100g of oven dry board

3.2.2.2 *Test to determine the mechanical properties*

S. No.	Tests	Indian Standard	Result
1.	Density	IS 1708 (Part 2 & 5):1986	*1156.9 kg/m^3*
2.	Modulus of Rupture	IS 1708 (Part 2 & 5):1986	*167.27 N/mm^2*
3.	Modulus of Elasticity	IS 1708 (Part 2 & 5):1986	*24762 N/mm^2*
4.	Flammability (time taken for second ignition)	IS 1734 (Part 3):1983	*38 min.*
5.	Flame penetration (time taken for flame penetration from bottom to top surface)	IS 1734 (Part 3):1983	*136 min.*
6.	Rate of burning (time taken to lose weight from 70% to 30%)	IS 1734 (Part 3):1983	*27 min.*
7.	Thermal conductivity	IS 3346:1980	*0.354 W/m-K*

Test results of the samples drawn by the IO during inspection on 19/08/19 are awaited.

3.2.2.3 *Test to determine the Termite, Borer and Mould attack*

Termite Test	Borer Test	Mould Test	Results		
			Termite	Borer	Mould
Samples were exposed for termite attack near mound for six months	Samples were exposed in plastic boxes for borer attack for three months	Samples were exposed in Incubation chamber for three months	No termite attack was noticed	No borer attack was noticed	Surface mould attack was noticed

3.3 Usage of the System

3.3.1 Details of the EF Bamboowood Flooring supplied by the manufacturer for use as flooring and cladding in buildings, houses, offices etc. is given below:-

Sl. No.	Agency	Location	Quantity	Period
1	Global Investor Summit, Advantage Assam, organized by Govt. of Assam, Appreciated by Hon'ble Prime Minister of India, Shri Narendra Modi	Guwahati, Assam	1500 Sq. Mtr Flooring	Feb -18
2	Airport Authority of India, At Jorhat Airport	Jorhat, Assam	520 Sq. Mtr Cladding	Nov - 18
3	Guwahati High Court, Under Pass	Guwahati, Assam	120 Sq. Mtr Cladding	Feb - 19
4	National Investigation Agency, Through NBCC	Sonapur, Assam	272 Sq. Mtr Cladding	Feb -19
5	Governor Residence (Raj Bhawan VVIP Room)	Guwahati, Assam	102 Sq. Mtr Flooring	March -19
6	Tribeni Construction Pvt. Ltd.	Guwahati, Assam	350 Pcs. Door Frame 400 Pcs. Door	March -19
7	Maharashtra Bamboo Development Board	Nagpur, Maharashtra	99 Sq. Mtr Flooring 56 Sq. Mtr Cladding	April - 19
8	Eastern Envo Protect (Assam Cancer Care Foundation)	Guwahati, Assam	35 Sq. Mtr Flooring & 55 Sq. Mtr Cladding	Jun -19
9	Alliance Concept Real Estate	Guwahati, Assam	74 Pcs Door Frame	Jun -19

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. Complete testing facilities shall be installed for in-process control.

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 clients with details of construction on six monthly basis.

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: 13.1.2020

Chairman TAC & for and on behalf of
Member Secretary, BMBA
Dr. Shailesh Kr. Agrawal
Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing and Urban Affairs, Govt. of India
Core 5A, 1st Floor, India Habitat Centre
Lodhi Road, New Delhi-110003

PART 5 LIST OF STANDARDS & CODES USED IN ASSESSMENT

IS: 875 (Part-1) -1987 (Reaffirmed 2008)	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures-Unit Weights of Building Materials and Stored Materials.
IS: 875 (Part-2) -1987 (Reaffirmed 2008)	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures-Imposed loads
IS: 875 (Part-3) -1987 (Reaffirmed 2003)	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures –Wind Loads
IS: 875 (Part-5) -1987 (Reaffirmed 2003)	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Special Loads and Load Combinations
IS: 456 -2000 (Reaffirmed 2005)	Code of Practice for Plain and Reinforced Concrete
IS: 1893 (Part-1) -2002	Criteria for Earthquake Resistant Design of Structures - Part 1: General Provisions and Buildings
IS: 13920-1993 (Reaffirmed 2008)	Ductile Detailing of reinforced concrete structures subjected to seismic forces –code of practice.
IS 16700-2017	Criteria for structural safety of Tall Concrete Buildings.
IS: 1904–1986 (Reaffirmed 2006)	Code of practice for Design & Construction of foundations in Soils: General Requirements.
IS: 1642-1989 (Reaffirmed 2000)	Code of practice for Fire Safety of Buildings (General): Details of Construction.
IS 2950 (Part 1):1981 (Reaffirmed 2008	Code of Practice for Design & Construction of raft foundation
IS 2974: 1992 (Part 3) (Reaffirmed 2006)	Code of Practice for Design & Construction of machine foundations.
IS 10262:2009	Guidelines for Concrete Mix Proportioning
ASTM C 518:2017	Standard test methods for steady state thermal transmission properties by means of heat flow meter apparatus
ASTM D 638:2014	Standard test methods for tensile properties of plastic
ASTM D 1621	Standard test methods for compressive properties of rigid cellular plastic
ASTM D 1622:2008	Standard test methods for apparent density of rigid cellular plastic
ASTM D 4226:2016	Standard test methods for impact resistance of rigid PVC building products
ASTM E 84:2007	Standard test methods for surface burning characteristics of building materials
ASTME119-2019	Standard test methods of tests of building construction and materials

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Strand Woven Bamboo Wood Floor Tiles & Wall Panels** bearing the mark manufactured by M/s ESES Bio Wealth Pvt. Ltd. is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No. 1051-P/2020** is awarded to **M/s ESES Bio Wealth Pvt Ltd, Morigaon (Assam).**

The period of validity of this Certificate is for a period of two years i.e. from **13.01.2023** to **12.01.2025** as shown on Page 1 of the PAC.

This Certificate consists of a cover page and pages 1 to 42.

Dr. Shailesh Kr Agrawal
Chairman, TAC
& Member Secretary, BMBA
Building Materials and Technology Promotion Council
Ministry of Housing and Urban Affairs, Govt. of India
Core 5A, 1st Floor, India Habitat Centre
Lodhi Road, New Delhi-110003

Embossing Seal of BMBA

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: 13-01-2023

PART 6 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 1.6.3)

BUILDING MATERIALS & TECHNOLOGY PROMOTION COUNCIL

Quality Assurance Plan for Bamboowood Flooring

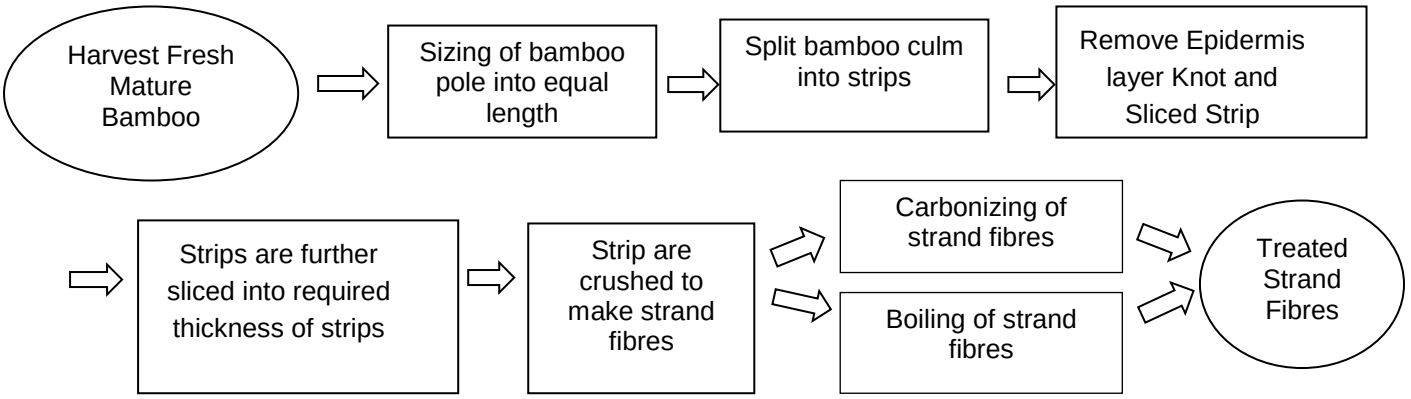
Sl. No.	Parameters to be inspected	Requirement Specified	Test Method	Frequency of Testing
I.	**Bamboowood Routine Test**			
1.	Raw Bamboo Inspection	Freshly harvested	Physical & measured	Daily/load basis
2.	Raw Material General	As per material quality report	Physical & measured	Daily/load basis
II.	**Phenol Formaldehyde Resin Routine Test**			
1.	Specific gravity	1.14-1.15	Sp. Gr. meter	Every charge basis
2.	Flow time	20-30 sec	B-4 Cup	Every charge basis
3.	Ph	10 -11.5	Ph digital meter	Every charge basis
4.	Solid content	42 - 50%	Oven dry method	Every charge basis
III.	**Flooring Routine Test**			
1.	Density	≥ 1100 Kg/m^3	IS 1708 (Part 2): 1986	Weekly
2.	Modulus of Rupture (MOR)	≥ 150 N/mm^2	IS 1708 (Part 5): 1986	Weekly
3.	Modulus of Elasticity (MOE)	≥ 17500 N/mm^2	IS 1708 (Part 5): 1986	Weekly
4.	Hardness Test	≥ 800 Kg	IS 1708 (Part 10): 1986/ASTM D 1037	Weekly
5.	Moisture Content (oven dry method)	≤ 12%	IS 1708 (Part 1): 1986/ASTM D 4442	Weekly
Type Test				
1.	Thermal Conductivity	≤ 0.50 W/m-K	IS 3346:1980	Half yearly/ yearly/ need basis
2.	Volatile organic compound (oven dry method)	≤ 6.00 mg/100g	IS13745:1993	Half yearly/ yearly/ need basis
3.	Termite test	No termite attack	Lab test--6 months in termite mound	Yearly/ need basis
4.	Borer test	No borer attack	Lab test -- 3 months in borer box	Yearly/ need basis
5.	Flame penetration	≥ 30 min	IS 1734 (Part 3) : 1983	Yearly/ need basis
6.	Water absorption	≤ 4% (2 hrs),	IS 2380:1981	Weekly

		≤ 8% (24 hrs)		
7.	Swelling due to general absorption	≤ 8%	IS 2380:1981	Weekly
8.	Swelling due to surface absorption	≤ 4% (2 hrs), ≤ 8% (24 hrs)	IS 2380:1981	Weekly
9.	Screw withdrawal resistance (Flat face)	≥ 250 Kg	IS 2380:1981	Weekly
10.	Screw withdrawal resistance (Edge)	≥ 200 Kg	IS 2380:1981	Weekly
11.	Flammability	≥ 5 min	IS 1734 (Part 3) : 1983	Yearly/ need basis
12.	Rate of burning	≥ 10 min	IS 1734 (Part 3) : 1983	Yearly/ need basis
IV. Flooring Finish				
Routine Test				
1.	Gloss value	30 ± 5%	DIN EN ISO 2813	Daily/load basis
2.	Scratch resistance	No scratch	Coin test	Daily/load basis
3.	Heat resistance (Cigarette test)	6A	DIN 68861 Part 6	Daily/load basis
Type Test				
1.	Cross cut test	≤ GT 2	DIN EN ISO 2409	Half yearly/ yearly/ need basis
2.	Scratch resistance (Coin test)	≥ 20 N	Hamburger planner	Half yearly/ yearly/ need basis
3.	Abrasion resistance	IP > 100 cycle	DIN EN 438-2 (500 g load per wheel S 33)	Half yearly/ yearly/ need basis
4.	Abrasion resistance	IP > 6000 cycle	ASTM D 4060 (500 g load per wheel CS 17)	Half yearly/ yearly/ need basis
5.	Scratch resistance (pencil hardness)	≥ 1H	ISO 15184	Half yearly/ yearly/ need basis
6.	Scratch resistance (surface)	No scratch	Steel wool test, Type 2	Half yearly/ yearly/ need basis
7.	Impact resistance	≥ 2 N	DIN EN 438 Part 2-12	Half yearly/ yearly/ need basis
8.	Resistance to indentation	≥ 1 N	DIN EN 438 Part 2-14	Half yearly/ yearly/ need basis
9.	Chemical resistance	5	DIN 68861 Part 1	Half yearly/ yearly/ need basis
10.	Inflammability	B1	DIN 4102 Part 14	Half yearly/ yearly/ need basis

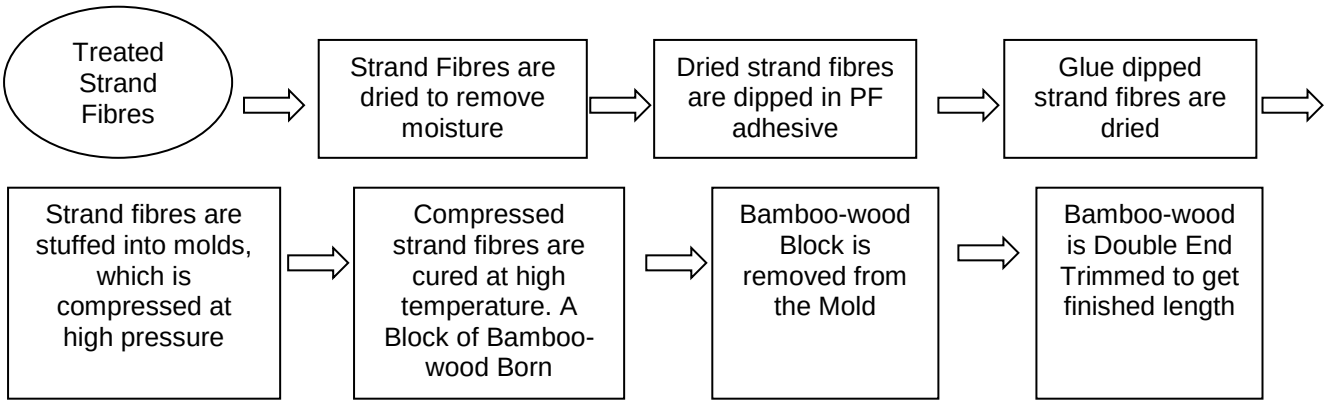
ANNEX II
(*Clause 1.6.3)*

PROCESS FLOW CHART

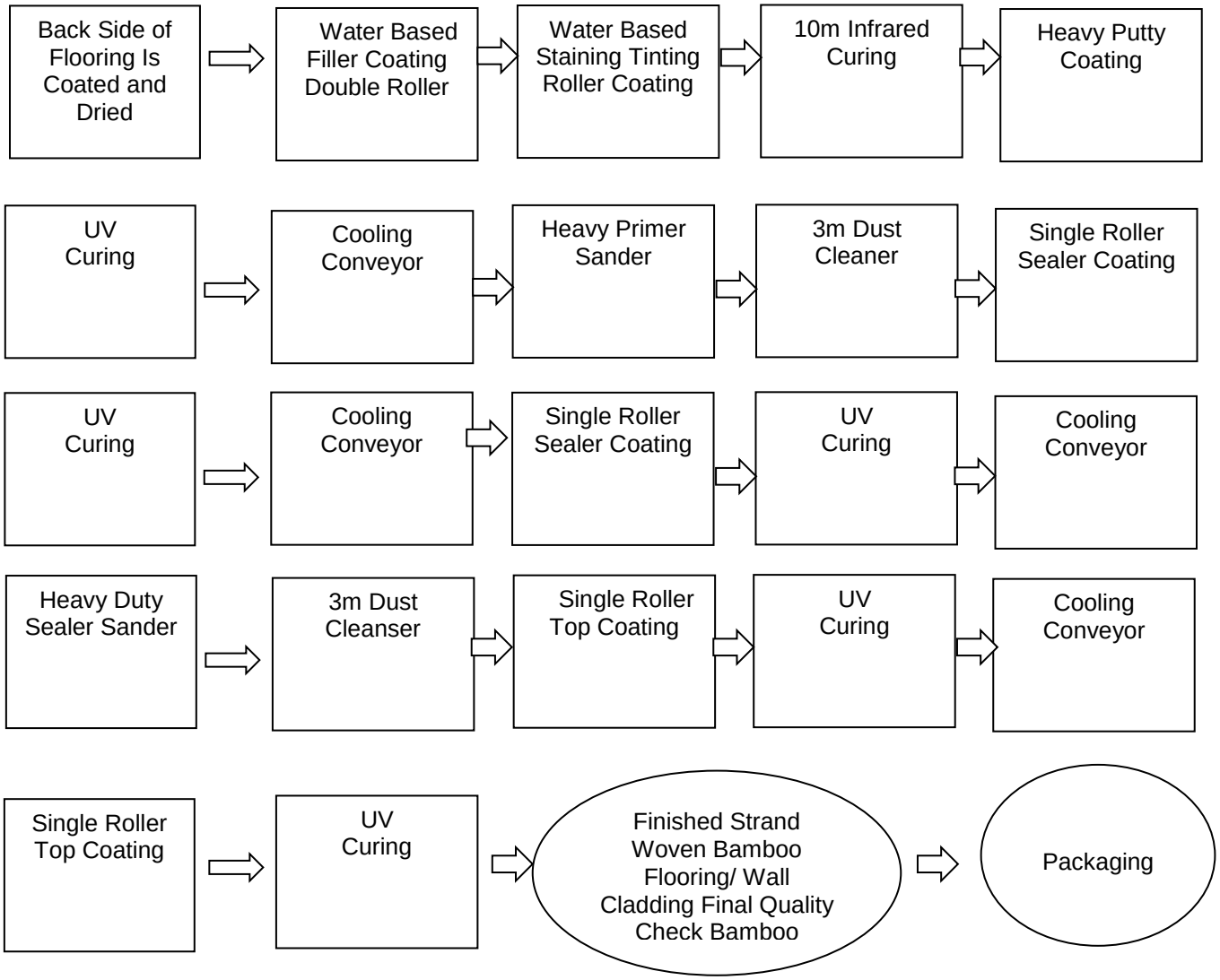
Primary Processing Flow Chart



Secondary Processing Flow Chart



Finishing Process Flow Chart

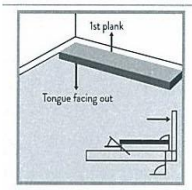
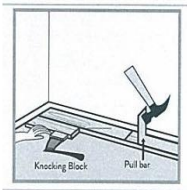


ANNEX III

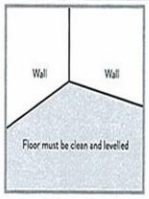
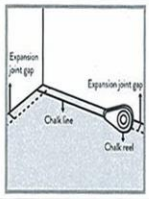
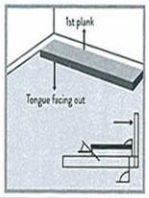
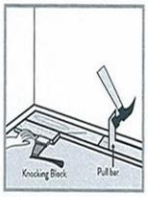
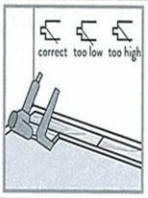
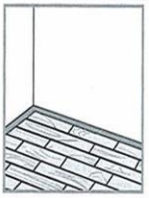
(Clause 2.3)

INSTALLATION PROCEDURE

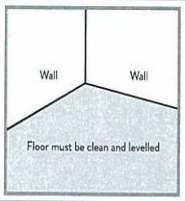
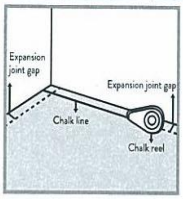
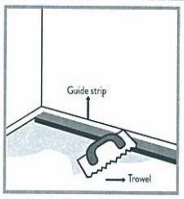
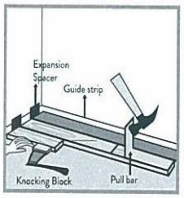
FLOATING FLOOR INSTALLATION :-

	▸ CLEAN FLOOR
	▸ USE UNDERLAY OR HIGH DENSITY FOAM ▸ UNROLL THE SHEET ON THE LONGEST WALL ▸ DO NOT OVERLAP THE SHEET
	▸ PLACE GUIDE FLOOR PIECE FIRST ▸ LEAVE EXPANSION GAP ▸ LAY GUIDE BY NAIL DOWN METHOD
	▸ SPREAD FLOOR TILES TO NORMALIZE AND COLOUR SORTING ▸ MAKE SURE RECTANGULAR ALIGNMENT
	▸ ALIGN NEXT FLOOR TILES ▸ LOCK TWO TILES AS SHOWN ▸ CONTINUE SAME FOR NEXT FLOOR TILE
	▸ PUSH TILES TO LOCK EACH OTHER WELL BY USING CONTROLLED FORCE ▸ CONTINUE LAY AND ALIGN FLOOR TILES AND REPEAT LOCKING PROCESS
	▸ REMOVE GUIDE AND PLACE TILE IN LAST ▸ PLACE SKIRTING/ MOULDING/ QUARTER ROUND

NAIL DOWN FLOOR INSTALLATION :-

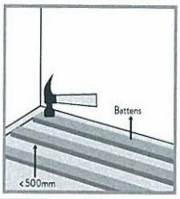
	▸ CLEAN FLOOR ▸ LAY DOWN ANTI FRICTION POLY SHEET
	▸ MARK GUIDE LINE EXPANSION JOINTS 6MM FROM END & 15MM SIDEWAYS
	▸ SPREAD FLOOR TILES TO NORMALIZE AND COLOUR SORTING ▸ LAY GUIDE TILE BY NAIL DOWN
	▸ ARRANGE AND LAY TILES IN REGULAR OR CHOICE OF DESIGN ▸ PUSH TILES INTO EACH OTHER
	▸ USE FLOOR NAILER TO NAIL DOWN TILES
	▸ REMOVE EXPANSION GUIDE STRIPS ▸ PLACE SKIRTING/ MOULDING/ QUARTER ROUND
	▸ ALLOW NEW FLOOR TO ACCLIMATIZE FOR 24HRS ▸ EPITOME BAMBOOWOOD FLOORING IS READY TO USE

GLUE DOWN FLOOR INSTALLATION :-

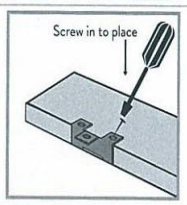
	▸ CLEAN FLOOR
	▸ MARK GUIDE LINE EXPANSION JOINTS 6MM FROM END & 15MM SIDEWA ▸ LAY GUIDE BY NAIL DOWN METHOD
	▸ SPREAD FLOOR TILES FOR NORMALIZE AND COLOUR SORTING ▸ USE TROWEL TO APPLY GLUE AS SHOWN ▸ USE GLUE BELOW ROOM TEMPERATURE
	▸ SPREAD GLUE GRADUALLY AND LAY TILES OUTWARDS ▸ CLEAN/ WIPE TILES IN CASE ANY GLUE MARK SEEN/ NOTICED ▸ DO NOT CUT TILES OVER GLUE SPREAD AREA
	▸ USE SOFT ROLLER TO GET AN EVEN AND GOOD BOND BETWEEN SUB FLOOR AND TILES ▸ CLEAN/ WIPE GLUE IF COMES OUT ON TOP
	▸ REMOVE GUIDE AND PLACE TILE IN LAST ▸ PLACE SKIRTING/ MOULDING/ QUARTER ROUND

DECKING INSTALLATION :-

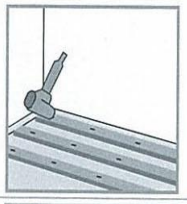
- CLEAN FLOOR



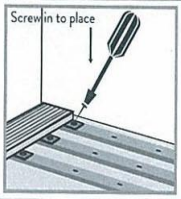
- PLACE BATTENS WITH A GAP OF NOT MORE THAN 500MM
- NAIL DOWN BATTEN INTO SUBFLOOR



- INSTALL CLIP ON THE BACK OF DECK TILE BY 2.5MM DIA AND 10MM LONG SCREW



- INSTALLATION OF FIRST DECK TILE
- DRILL HOLE TO FIX 4MM SCREW DOWN



- USE CLIP TO FIX TILE WITH BATTEN DOWN
- USE 2.5MM SCREW
- REPEAT THE SAME TO FIX NEXT DECK

- INSTALL NEXT DECK LIKE SHOWN HERE