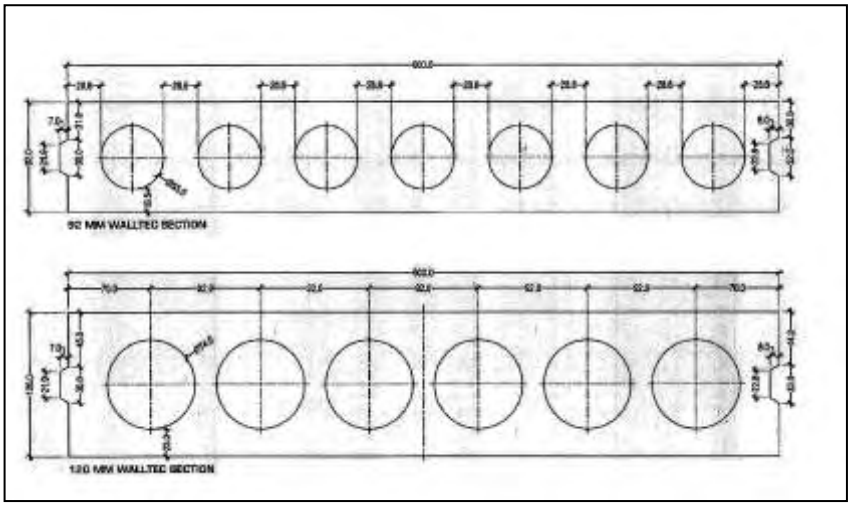
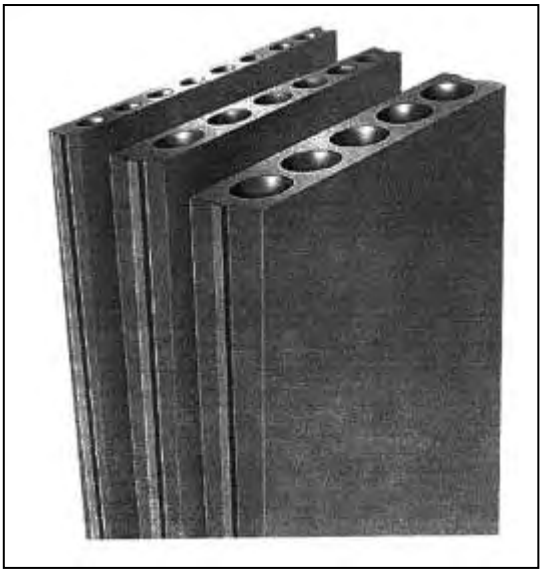
BMTPC
PACS
PERFORMANCE APPRAISAL CERTIFICATION

Walltec Hollowcore Concrete Wall

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:	Performance Appraisal Certificate No.
M/s B N Precast Pvt. Ltd. **Survey No. 322, Jalundra Mota Village, Opp Galudan Village,** **Naroda-Dehgam Road, Distt. Gandhinagar, Gujarat - 382305**	PAC No **1022-P/2015** Issue No. **01** Date of Issue: **16.11.2015**





bmtpc

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PERFORMANCE APPRAISAL CERTIFICATE

FOR

WALLTEC HOLLOWCORE CONCRETE WALL

ISSUED TO

M/s B N PRECAST PVT. LTD.

STATUS OF PAC 1022-P/2015

S.No.	Issue No.	Date of Issue	Date of renewal	Amendment		Valid up to (Date)	Remarks	Signature of authorized signatory
				No.	Date			
1.	2.	3.	4.	5.	6.	7.	8.	9.
1	1	16-11-2015	16-11-2016	--	--	15-11-2016		

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PART 1 CERTIFICATION

1.1 Certificate Holder: M/s B N Precast Pvt. Ltd.

Survey No. 322, Jalundra Mota Village,
Opp Galudan Village, Naroda-Dehgam Road,
Distt. Gandhinagar, Gujarat -- 382305
Tel: 02716-269169
Email: info@bnprecast.com

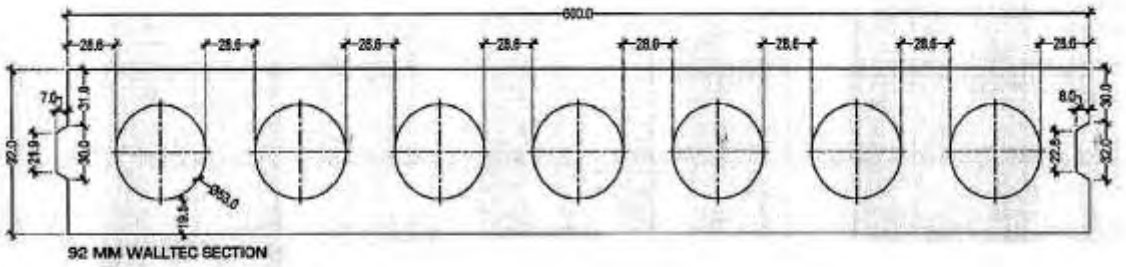
1.2 Description of Product

1.2.1 *Name of the Product* – Walltec Hollowcore Concrete Wall

1.2.2 *Brief Description* – Walltec wall panels are extruded non-load bearing concrete hollowcore wall panels manufactured in fully automated machines. Walltec wall panels are factory produced using light weight concrete made of river sand, crushed stone aggregate, light weight aggregate and Ordinary Portland cement. The concrete are extruded and cut while still wet to the requisite length. Curing and sealing are followed for 24 to 48 hours by stacking and palletizing after which the walls are watered and cured for a further period of 7 to 8 days. After 15 days the panels are ready for transportation to site.

Walls have cylindrical hollow cores incorporated with 7 No. 53 mm dia voids in the 92mm thickness and 6 No. 74 mm dia. voids for the 120 mm thickness panels. The corresponding nominal weight shall be 140 kg/m^2 and 170 kg/m^2 for 92 mm and 120 mm thick panels respectively. Hollows are incorporated in Walltec walls to reduce weight, facilitate mechanical, electrical and plumbing services through hollows, thereby increasing sound and thermal insulative properties. The sides of all panels are tongued and grooved to facilitate positive jointing.

Walltec walls do not require stone or wood sills/frames to level surfaces for windows and openings. Lintels need not be cast as panels may be placed horizontally as lintels wherever required. Wash basins, cup-boards, mirrors, paintings etc. may be hanged with regular plug screws. Details of the wall panels showing hollow cores is given in Fig. 1.



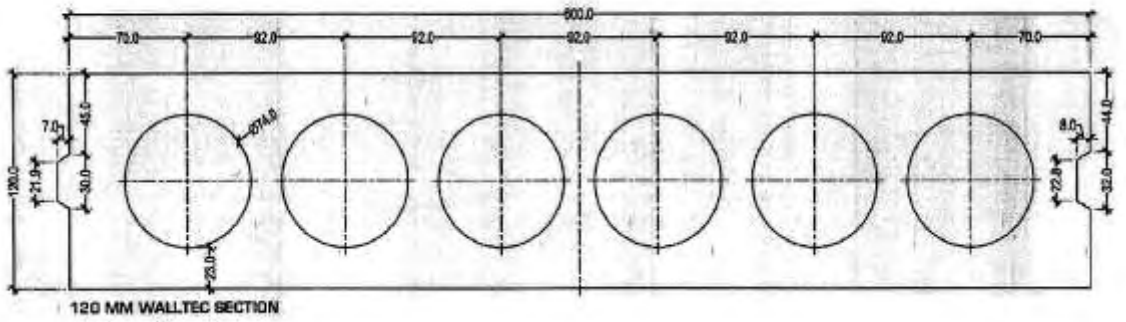


Fig. 1

1.2.3 Type and size

Walltec walls are produced in standard widths & thicknesses and in lengths to suit room height as per the details given below and shown in Figs. 2 & 3:

Wall width : 600 mm
Wall thickness : 92 mm & 120 mm
Wall Height : 2.40 m, 2.60 m, 2.85 m, 3.00 m, and 3.30 m
Weight : 92 mm : 140 kg/m^2, 120 mm :170 kg/m^2

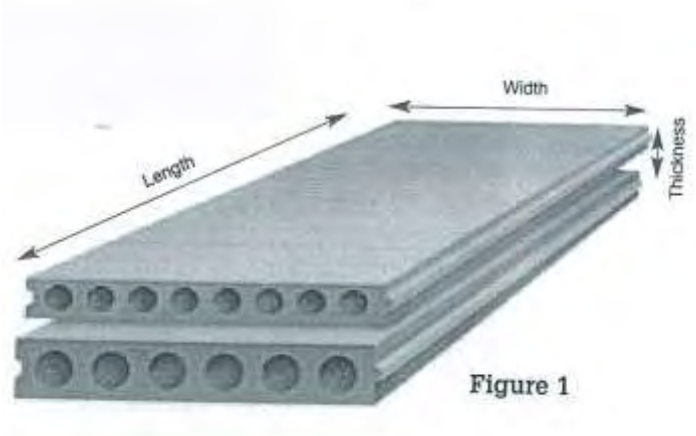


Fig. 2

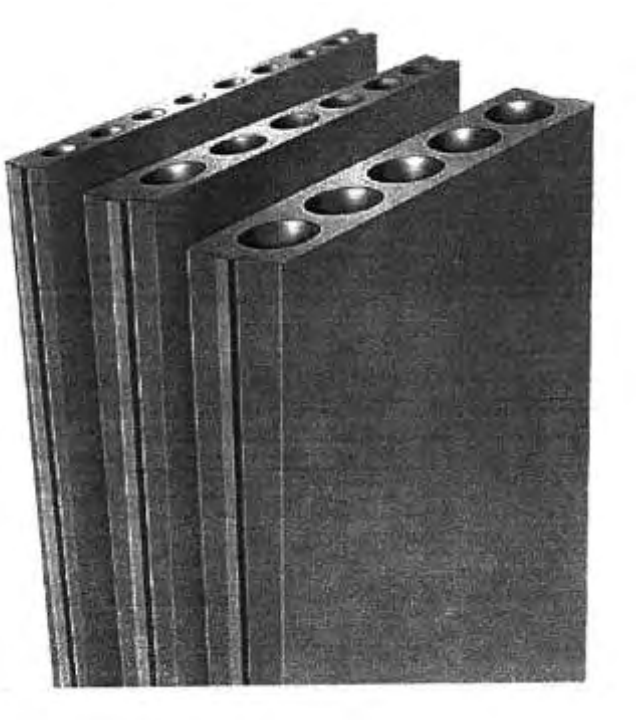


Fig. 3

Walltec walls use regular concrete of density 2350 kg/m^3 and Walltec Lite uses light weight concrete of density 1550 kg/m^3.

1.2.4 Tolerances

The panels shall be produced in accordance with the following tolerances:

Length	: ±10 mm,
Width	: ±3 mm,
Thickness	: ±3 mm,
Squareness of end	: ±6 mm
Differential bowing between adjacent panels of the same Length	:=15 mm

1.3 Assessments

1.3.1 *Scope of Assessment* – Suitability of Walltec wall for use as non-load bearing walls in buildings.

1.3.2 *Basis of Assessment* **–**

The assessment is based on the results & reports of

(i) Inspection of the factory

(ii) Inspection of the manufacturing equipment used

(iii) Assessment of quality assurance procedures implemented in the factory

(iv) Tests got done in independent laboratories viz Mukesh A Patel Technical Consultancy & Civil Engineering Lab., Gandhinagar,

Ashirwad Geo Tech Lab., Vadodara etc.by the manufacturer of the product.

(v) Test Report of the Acotec panels by M/s Acotec Oy, Filand.

(vi) Test Reports of the Light weight green wall panels by Setsco Services Pvt. Ltd. Singapore

(vii) Tests got done on the samples of the product collected by the IO during inspection of the plant from Mukesh A Patel Technical Consultancy & Civil Engg. Laboratory, an NABL Accredited Lab.

1.3.3 *Scope of Inspection* – Scope of inspection included the verification of production, performance and testing facilities at the factory including competence of technical personnel and status of quality assurance in the factory.

1.4 Manufacturing Machinery & Equipment

The firm has got fully mechanized Acotec Production Line of Elematic make and Concrete Batching Plant of Conmet make, Forklift, Tractor Front loader and Weighbridge for manufacture and shifting of Walltec Hollowcore Concrete Walls at its production unit. The components of these machines are given below:

I. Batching Plant

1. *Wet Mix Plant –capacity 60 m^3/hr with* 4 nos. in-line bins of 32 cum aggregate storage capacity
2. *Planetary Mixer* with compacted output of 1 cum/batch
3. *Aggregates weighing system* – with 4 load cells suspended at 4 points of the conveyor belt
4. *Sand bin moisture probe and Powder bin moisture probe*
5. *Pneumatically operated batching gates* – 6 nos. for aggregates (3 bin) and 2 nos. for sand (1 bin)
6. *Electrically operated Vibrator* for sand and powder bin
7. *Chevron Transfer conveyor* with carrier rollers
8. *Cement/filler weighing system*
9. *Electrically operated Vibrator* for cement/filler weigher
10. *Water weighing and Pump pressure-discharge system—by Flow meter, water sprinkler pipe line*
11. *Planetary Mixer with moisture sensor*
12. *Air compressor*
13. *Screw conveyor* for cement – 1no and Flyash-1no.
14. *PLC based Control system,* SCADA software

II.Acotec Line

1. *Concrete Feeding* -- concrete feeder

2. *Extruding, Cutting and Plate feeing* – Plate feeder, Plate feeder conveyor, Extruder, Cutter & Electrification
3. *Trimmer*
4. *Tipper and Recycling* – Belt conveyor and Tipper & recycling
5. *Stacking* -- Pallet conveyor, Stacker & Stack conveyor
6. *Restacking* -- Stack conveyor, Crossing station, Re-stacker, Roller conveyor, Transfer tables and Turning device
7. *Cleaning and oiling* – Plate conveyor and Cleaning and oiling
8. *Delivery* – Receiving conveyor and Chain conveyor

1.5 M*anufacturing Process*

The manufacturing process of Walltec wall panels is as follows:

1.5.1 *Raw Material*

Sieved River Sand, 6mm Stone Aggregate, AAC Waste shall be supplied to the plant by supplier where it shall be weighed and sieve analysis & silt content checked as per the quality assurance norms. Cement shall be supplied in closed bulkers directly from the manufacturers' plant and fed into cement silo directly using blower. AAC Waste shall be crushed and sieved in using crusher & sieve combo machine which also has a dust collector shall collect superfine particles and the crushed AAC aggregate (8mm and lower fineness) shall be fed directly into the LWA (light weight aggregate) aggregate bin which shall be equipped with a moisture probe.

1.5.2 *Concrete Mixing*

Concrete required shall be batched and mixed at an automatic batching and mixing plant with Planetary Pan Mixer and Moisture probes. The relatively dry aggregates shall be automatically weighed & batched into the mixer from Aggregate Bins. Two of the Aggregate bins shall be equipped with moisture probes to ascertain accurate weighing and water content calculation later in the final concrete mix. Afterwards cement and water shall be added into the mixture. A low water-cement ratio of about 0.3 ensures that concrete is zero-slump and gains about 70% of its design strength within 12-24 hours of casting. Moisture content of the mixed concrete shall also be automatically controlled and adjusted by the software thus ensuring consistent concrete mix at all times. The software auto adjusts for water content based on readings of the moisture probes. After mixing, the concrete batch shall be fed to the conveying system, which brings fresh concrete to the hopper of the Acotec Wall – line where Walltec-Walls shall be cast, cut, trimmed, stacked, pre-cured, restacked and strapped into bundles.

1.5.3 *Extrusion*

The Walltec-Wall elements shall be formed in a continuously operating extruder. The concrete shall be compacted onto thin base moulds, which support the products during the pre-curing time. Base moulds shall be automatically fed to the extruder as a continuous ribbon. The base mould length shall determine standard length of the products. There can simultaneously be maximum five plate lengths in the system. The extruder shall compact the concrete with extrusion screws against the packing bar and side walls. Top surface of the product shall be vibrated by a vibrating plate.

1.5.4 *Cutting*

After extruding, the products shall be cut according to the base mould length. A circular saw shall cut the fresh concrete on each base mould seam. Then the cut product together with the supporting plate shall be pulled to the stacker.

1.5.5 *Trimming*

When necessary, the fresh product shall be stopped at a specified point, where the manually adjusted circular saw cuts off the wanted trimming piece. Trimming length shall be max. 20 cm. The trimmed off concrete shall be recycled back to the extruder.

1.5.6 *Stacking*

Cut, fresh products shall be stacked into pre-curing stacks. Depending on the product thickness and weight each stack shall contain 4 to 10 products and base moulds. Stacks shall be supported by steel pallets, which are automatically fed underneath each stack.

1.5.7 *Pre-curing*

The stacks shall stay 12 to 24 hours in the pre-curing indoor storage area where natural pre-curing occurs for each stack which is covered with tarpaulin to stop any evaporation and moisture loss. The storage shall be an area where natural curing occurs. Product stacks shall be moved into and out from the stock area by a forklift.

1.5.8 *Restacking*

After pre-curing the products are strong enough to stand automatic handling. Products shall be separated from the base molds. Base molds shall be returned back to circulation trough a cleaning and oiling unit. The products shall be restacked to form delivery stacks with 4 - 10 products on top of each other. The stack shall be pushed against a wooden delivery pallet and turned on its side. Delivery stacks shall be strapped before transportation to delivery storage. Stacks must stay in

the delivery storage where they shall be kept moist by external manual water sprinkling for at least 7 days before transporting to a construction site after 15 days on a Truck or Flat-bed Trailer. Loading of trucks shall be done with Forklift or Hydraulic Cranes.

Manufacturing Process flow chart is given in Annex II.

1.6 Use of the Walltec walls & Its Limitations

1.6.1 *Uses*

These walls shall be used as non-load bearing walls/partition walls and compound/ boundary walls in residential/ commercial/ industrial/ institutional buildings.

1.6.2 *Limitations of Use*

1.6.2.1 For non-load bearing walls only. Not to be used as load bearing walls.

1.7 *Conditions of Certification*

1.7.1 *Technical Conditions* – Raw materials and the finished product shall conform to the requirements of the prescribed specifications.

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 the Annex I attached with this Certificate.

1.7.3 *Brochure/ Guidelines* – The Certificate holder shall provide detail instructions for laying of the walls.

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 the customer/ purchaser.

1.7.4.2 The Certificate holder shall implement the procedure included in the SQA. As part of PACS Certification he 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, Walltec wall panels 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 Walltec wall panels in accordance with the requirements specified in relevant Indian and other Standards. In addition it shall follow Company standards specifying requirements of various materials used in the manufacture of the product.

2.2 **Specifications of the Product and Performance Criteria**

2.2.1 *Technical Specifications*

2.2.1.1 *Raw materials*

i) OPC 53 grade cement shall conform to IS 12269:1987
ii) River sand and coarse aggregate 2-6 mm shall conform to IS 383:1970
iii) Flyash shall conform to IS 3812 (Part 1):2003
iv) Crushed Autoclaved Aerated Concrete (AAC) Waste

2.2.2 *Performance Criteria*

Walltec wall panels shall meet the following performance criteria:

S.No	Properties	Test Method	Requirements as per relevant Standards	
			92mm	120mm
1.	Dry density (kg/m^2)	IS 516:1959	140 min.	170 min.
1.	Flexural strength N/mm^2	IS 516:1959	2.4 max.	3.5 max.
2.	Compressive strength N/mm^2	IS 516:1959	15 min.	25 min.
3.	Moisture content (%)	IS 516:1959	4.8 max.	4.8 max.
4.	Impact strength (Falling weight) (N)	ISO 179 2: 1997	➢ 5	--
5.	Drying shrinkage (%)	IS 2185 (Part 1):1979	0.04 min.	0.04 min.
6.	Thermal conductivity (m^2.k/W)	IS 3346:1980	0.4 min.	> 0.4
7.	Sound transmission Class (dB)	IS 9901:1981	42 max.	44 max

2.3 Production & Inspection

P*roduction* – Walltec panels shall be machine made from expanded light weight aggregate, coarse sand and 53 grade Portland cement. These shall be free from crack and nodules of free lime. These shall have smooth rectangular faces with sharp corners and shall be uniform in colour.

Precast light weight hollow core wall panels shall be manufactured in Dry casting method. The units shall be made with tongue and groove joint. Section of the tongue rebate shall be 21.9 mm (top) x 30mm (bottom) x 7mm (deep) for entire thickness of 92mm and 120mm on one end of the panel and on other end of the panel, the size of groove rebate shall be of the size 22.8mm (top) x 32mm (bottom) x 8mm (deep). Panels shall have cylindrical hollow core incorporated with 7 No 53mm dia voids for 92mm thickness and 6 No. 74mm dia. voids in 120mm thickness. Faces of panels shall be flat, rectangular and smooth.

The concrete cube crushing strength shall not be less than 2.0 MPa. The average moisture absorption shall not be more than 5% by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per relevant IS. The density of the light weight concrete shall not be less than 1200 kg/cum.

2.3.2 *Adhesive*

High strength and tensile adhesion non-shrink cementations grout premixed property compound/void filling expanding polyurethane foam (PU) shall be used for vertical and horizontal joints of precast hollow core wall panels. Butt joints at corners shall be fixed with special frame anchors.

2.3.3 *Plumbing & Electrical*

Walltec panels shall have hollows of 53mm dia. in 92mm wall and 74mm dia. in 120mm wall to allow the passage of water pipes, electrical wiring, HVAC and hydraulic installations without making holes/chases. Plumbing and Electrical service fittings shall be pre-planned and shall be passed through hollow portions of the wall panels.

2.3.4 *Painting, Tiling and Cladding*

Painting shall be done directly or after applying a 2mm wall putty coat. Texture paint coat shall be directly applied to external surface for decorative effect.

All tiling and cladding shall be directly fixed using regular cement mortar or tile adhesive.

2.3.5 *Inspection* -- Inspection shall be done at appropriate stages of manufacturing process as given in Clause 1.5. The Walltec wall panels shall be stored properly 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 Selection & Installation

2.4.1 The user is responsible for the proper use of the product at site. PAC holder shall provide required guidance and instructions for usage of the product at site.

2.4.2 *Good practice for installing the product at site* – Walltec wall panels shall be used at site in accordance with the applicable specifications, instructions and guidelines of the manufacturer. The user shall also follow the Brochure of the product supplied by the manufacturer.

2.5 Storage and Transportation

i) Concrete panels shall be stored and stacked properly in such a way as to avoid any contact with moisture at site.

ii) Panels shall be stored up to two stacks on levelled ground or planks or other supports free from contact with ground and covered to protect against wetting.

iii) The panel stacks shall always be lifted from under pallet to other floor level with a lifting device.

iv) To move full panel around installation site, trolley or other device shall be used.

v) In case of single panel movement, simple wheel or wheel barrow shall be allowed. .

2.6 Sampling

2.6.1 *Lot*

All the walls of the same size, manufactured from the same material under similar conditions of production shall be grouped together to constitute a lot. The number of wall panels to be selected from each lot for dimensional requirements shall depend upon the size of the lot and shall be in accordance with col 1 & 2 of Table given below:

Lot size (1)	**First sample size (2)**	**Second sample size (3)**	**First rejection number (4)**	**Second rejection number (5)**
Up to 100	5	5	2	2

101 to 300	8	8	2	2
301 to 500	13	13	2	2
501 and above	20	20	3	4

The walls shall be selected from the lot at random.

2.6.2 *Criteria for Conformity*

All the walls selected at random in accordance with col 1 & 2 of the above Table shall be subjected to the dimensional requirements. A wall failing to satisfy any of the dimensional requirements shall be termed as defective. The lot shall be considered as conforming to the dimensional requirements if no defective is found in the sample and shall be rejected if the number of defectives is greater than or equal to the first rejection number. If the number of defectives is less than the first rejection number the second sample of the same size as taken in the first stage shall be selected from the lot at random and subjected to the dimensional requirements. The number of defectives in the first sample and second sample shall be combined and if the combined number of defectives is less than the second rejection number, the lot shall be considered as conforming to the dimensional requirements, otherwise not.

2.7 Installation Procedure

i) Only two stacks shall be put on top of each other during stocking and transportation.

ii) Panel stacks shall always be lifted from under wooden pallet with a lifting fork or belt.

iii) The panel stacks shall be moved by forklift or trolley to construction site. Individual panel may easily be moved by a simple wheel. Panels can also be moved manually by inserting a short tube (500mm) into the second hollow as handle. These shall always be transported sideways.

iv) Gluing agents (cement based adhesives) as per IS 9103:1999 shall be mixed as per the manufacturer's instructions.

v) The line of wall shall be marked on the floor and ceiling before start of installation.

vi) Guiding boards shall be fixed on the floor and ceiling. The guiding support will automatically align the wall when lifting the panels straight into upright position.

vii) The gluing agent shall be spread on the side of the already installed panel.

viii) Before the panel shall be lifted to upright position, it should be moved so that the panel bottom is as close as possible to its correct position. After that the panel shall be lifted to upright position.

ix) This panel shall be pushed against the previous panel (and move up and down) so that tongue and groove are carefully positioned against each other and gluing agent is squeezed out. Correct thickness of joint between two panels shall be 1 to 2 mm.

x) The panel shall be positioned to correct level by using wooden wedges at the bottom and top of the panel erected earlier. The height of the panel should be about 10 to 50 mm shorter than free-room height.

xi) The top joint shall be filled with polyurethane foam. Correct thickness of joint shall be 5 to 10 mm.

xii) Alternatively, when same gluing agent as in sides is used for top joint, the panel shall be pushed against ceiling so that gluing agent is squeezed out. Correct thickness of joint shall be 1 to 2 mm. The surplus gluing agent shall be removed from joints after installation.

xiii) Bottom joint of the panel shall be filled with mortar or concrete. Correct thickness of joint shall be 10 to 40 mm.

xiv) 'Shoulders' shall be sawed or flat steel bar for door top portion fixed to the panels next to the door. The door top piece shall be glued by using polyurethane foam or gluing agents. The joints should be as thin as possible.

xv) All corners shall be strengthened with nail plugs (3 per corner).

xvi) Paper or fibre tape shall be glued on to the corner joints and to the joints at a door top portion before plastering.

xvii) Flexible joints between panels shall be built after each 5 - 6m. Polyurethane foam or mineral wool may be used as elastic joint material.

xviii) The hollow boxes may be used for the cables and electrical boxes shall be fixed at the desired points after drilling.

xix) The panels need only a very thin skin coating (1-2 mm) before surface finishing. It may be easier to do with a wide trowel.

xx) All kinds of drilling and sawing can be easily made in the panels.

xxi) The necessary tools required for installation shall be hammer, saw, screw driver, level, meter rule, trowel, drill, trolley concrete cutter, steel bar, buckets and lifting bars.

Installation Guide along with the sketches is given in Annex III.

2.8 Critical Details for Use of Walltec Walls and Main Causes of Defects

2.8.1 *Critical Details for Use of Precast Panel Walls*

One of the critical problems faced by precast panel systems is the occurrence of hairline cracks at the joints between adjacent wall

panels. Some of the precautions are listed below to reduce such defects:

i) Installation with freshly cast concrete panels shall be avoided. This is because hydration of cement and evaporation of water create the stress within the young concrete, causing shrinkage.

ii) Gaps shall be provided between the walls and structures: 20 mm for top, 20 mm for bottom and 10mm for each side.

iii) It shall be ensured that the mix proportion of grout and water is according to suppliers' recommendations.

iv) Partial grouting to the horizontal gaps of the panels at the top and bottom shall be carried out immediately after the installation of wall panels to ensure the panels are temporarily secured.

v) Grouting of the vertical gaps between the wall panels immediately after installation shall be avoided. Grouting shall be carried after sufficient loadings from upper floors are added.

vi) Inspection shall be done to ensure that alignment of walls is in order before proceeding to grout the vertical joints and horizontal gaps.

vii) It shall be ensured that proper surface preparation is carried out with cleaning of the sides of wall panel and the face of structure that receives the wall panels.

viii) It shall be ensured that face of the structure is saturated before grouting to avoid rapid absorption of water during grouting.

ix) A layer of fiber mesh shall be provided over the joints as additional precaution against cracks, if required.

x) Vibration of the surroundings shall be minimized.

2.8.2 *Main Causes of Defects*

The main causes of cracks in the precast wall panels are:

a) Failure of jointing compound

- Actual shelf life of product has expired
- Incorrect mixing proportion of grout and water
- Surface area of the structure and the panels not properly cleaned
- Insufficient grout at joints
- Incorrect grout

b) Improper supervision/workmanship

- Correct method statement not followed
- Opening not grouted properly after chasing for services

c) Structural movement

- Vibration during construction
- Excessive loadings from the floors above

2.9 **Skills /Training needed for Installation –** No special skills other than normal skills of a mason shall be required for installation of these wall panels also. However, the PAC holder shall provide on request necessary guidance to the users at site, if required

2.10 **Guarantees/ Warranties provided by the PAC Holder**- The manufacturer shall furnish a guarantee up to installation of the wall panels, if it is in the scope otherwise the guarantee shall be up to delivery of the wall panels. A brochure giving relevant warrantee details shall be made available to the client.

2.11 Services Provided by the PAC Holder to the Customer

2.11.1 The PAC holder shall provide pre-sale advisory regarding the product. Customer/user may obtain from the PAC holder details of the advice that may be provided to him.

2.11.2 Users/Customers should ascertain from the PAC holder the type of service, the PAC holder is prepared to provide.

PART 3 BASIS OF ASSESSMENT AND BRIEF DESCRIPTION OF ASSESSMENT PROCEDURE

3.1 Basis of Assessment

3.1.1 *Factory Inspection*

The factory was inspected by the technical representative of the Council. During inspection the entire manufacturing process along with the equipment was inspected. The in-process inspection and the inspection of the finished product were in accordance with the SQA approved as a part of the requirements for grant of this PAC.

3.2 Laboratory Tests Done for Assessment

3.2.1 *Testing of samples -- T*he performance tests for Hollowcore wall panels have been carried out by M/s Mukesh A Patel Technical Consultancy & Civil Engg. Laboratory, an NABL Accredited Lab. on samples of the product collected by the IOs during inspection of the plant. The samples conform to the tests as per the performance characteristics and specifications given by the manufacturer.

S. No	Parameters	Test Method	Test Result
1.	Dry density (kg/m^3)	IS 516:1959	2020
2.	Compressive strength (N/mm^2)	IS 516:1959	3.89 (avg.)

3.	Flexural strength (N/mm^2) Longitudinal Transverse	IS 516:1959	 1.80 (avg.) 2.34 (avg.)
4.	Moisture content (%)	IS 516:1959	6.40 (avg.)
5.	Impact strength (N)	ISO 179-2:1997	More than 5
6.	Drying shrinkage (%)	IS 2185 (P-1):1979	0.04
7.	Thermal conductivity (m^2.k/W)	IS 3346:1980	0.40
8.	Sound transmission Class (dB)	IS 9901:1981	42

3.3 Supply of the Walltec wall Panels

Details of the Walltec wall Panels supplied by the manufacturer are given below:-

S.No.	Customer and Location	Quantity Supplied (m^2)	When supplied
1.	Shapoorji Pallonji & Co., Ahmrdabad	780.12	October, 2014
2.	Shaival reality Pvt. Ltd., Ahmedabad, Dahod	3013.80	July, 2014 to at present
3.	Goyal Developers, Ahmedabad	430.20	Nov.-Dec., 2014
4.	M B Patel Hospitals, Ahmedabad	497.64	November,2014
5.	Sarjeet Constructions, Ahmedabad	2542.80	September,2014
6.	Gadh Infrastructure Pvt. Ltd., Gandhinagar	1269.66	September,2014
7.	Arvee Labs (India), Bhavnagar	734.40	March 2015 to at present
8.	Innovative Precast Pvt. Ltd., Alwar & Delhi	1382.16	Feb. & March, 2015
9.	SMCC Construction India Ltd., Vithlapur	2541.73	March 2015 to at present
10.	Darshan Estate Corporation, Ahmedabad	2729.82	Oct.-Nov., 2014
11.	International Construction Consortium, Colombo, Sri Lanka	236.76	Feb.-April, 2015

PART 4 STANDARD CONDITIONS

The certificate holder shall satisfy the following conditions:

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

4.2 The product shall be continued to be manufactured according to and in compliance with the manufacturing specifications and quality assurance measures which applied at the time of issue or revalidation of this certificate. The Scheme of Quality Assurance separately approved shall be followed.

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

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

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

4.6 The product is appraised against performance provisions contained in the standards listed in Part-V. Provisions of any subsequent revisions or provisions introduced after the date of the certificate do not apply.

4.7 Where reference is made in this Certificate to any Act of Parliament of India, Rules and Regulations made there under, statutes, specifications, codes of practice, standards etc. of the Bureau of Indian Standards or any other national standards body and the International Organization for Standardization (ISO), manufacturer's company standards, instruction/manual etc., it shall be construed as reference to such publications in the form in which they were in force on the date of grant of this Certificate (and indicated in Part V to this Certificate)

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

4.9 The certificate holder agrees to provide to BMBA feedback on the complaints received, the redressal provided, and the time taken to provide redressal on complaint to complaint basis as soon as redressal is provided. BMBA agrees to provide the certificate holder the user feedback received by it, if any.

4.10 If at any time during the validity period, PACH is unable to fulfill the conditions in his PAC, he should on his own initiative suspend using the PAC and notify Chairman, TAC the date from which he has suspended its use, the reason for suspension and the period by which he will be able to resume. He shall not resume without the prior permission of BMBA. He shall also inform, simultaneously, his agents, licensees, distributors, institutional, government, public sector buyers, other buyers and all those whom he has informed about his holding the PAC. He shall also inform all those who buy his product(s) during the period of suspension. He shall provide to BMBA at the earliest the list of who have been so informed by him.

4.11 In granting this Certificate, BMBA takes no position as to:

(a) The presence or absence of patent or similar rights relating to the product;

(b) The legal right of the Certificate holder to market, install or maintain the product;

(c) The nature of individual installations of the product, including methods of workmanship.

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

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

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

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

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

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

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

Place: New Delhi
Date of issue 16/11/15

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

PART 5 LIST OF STANDARDS AND CODES USED IN ASSESSMENT

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

5.1.1 IS 383:1970 – Specifications for coarse and fine aggregates for concrete

5.1.2 IS 516:1959 – Method of test for strength of concrete

5.1.3 IS 2386(Part 3):1963 – Method of tests for aggregates for concrete

5.1.4 IS 3346:1980 – Method of determination of thermal conductivity of thermal insulation materials

5.1.5 IS 3812 (Part 1):2003 – Specifications for pulverized fuel ash for use as pozzolana in cement, cement mortar and concrete

5.1.6 IS 9103:1999 – Specifications for concrete admixtures

5.1.7 IS 9142:1979 – Specifications for artificial light weight aggregates for concrete masonry units

5.1.8 IS 9901:1981 –Measurement of sound insulation in buildings and building elements

5.1.9 IS 10500:2012 -- Drinking water

5.1.10 IS 12269:1987 – Specifications for 53 grade ordinary Portland cement

5.1.11 IS 15916:2011 – Code of practice for building design and erection using prefabricated concrete

5.1.12 ISO 179-2:1997 – Determination of charpy impact of plastics

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.

CERTIFICATION

In the opinion of Building Materials & Technology Promotion Council's Board of Agreement (BMBA), **Walltec Hollowcore Concrete Wall** bearing the mark manufactured by M/s B N Precast Pvt. Ltd. is satisfactory if used as set out above in the text of the Certificate. This Certificate **PAC No. 1022-P/2015** is awarded to **M/s B. N. Precast Pvt. Ltd., Gandhinagar.**

The period of validity of this Certificate is as shown on Page 1 of this PAC. This Certificate consists of a cover page and pages 1 to 32.

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

Embossing Seal of BMBA

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

Place: New Delhi
Date: 16.11.2015

PART 6 ABBREVIATIONS

Abbreviations

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

Performance Appraisal Certification Scheme - A Brief

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

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

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

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

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

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

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

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

ANNEX I

(Clause 1.6.2)

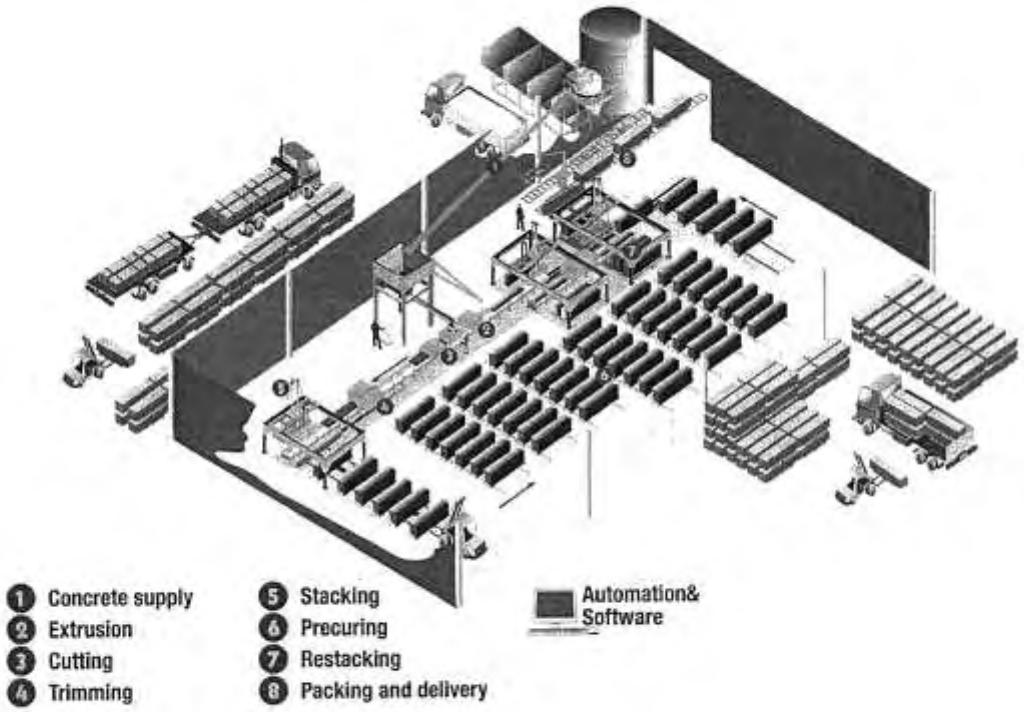
QUALITY ASSURANCE PLAN FOR WALLTEC CONCRETE HOLLOWCORE WALL PANELS

S. No.	Parameters to be inspected	Requirement Specified	Test Method	Frequency of Testing
	I. Raw Materials			
1.	O P Cement 53 Grade	OPC 53 as per IS12269:1987	Manufacturers test report	If required or if bulker not sealed
2.	Sand	Sieve Analysis Silt Content Specific Gravity Water Absorption	IS 383:1970 IS 2386:1963	Every truck
3.	Coarse Aggregate 2-6 mm	Sieve Analysis Silt Content Specific Gravity Water Absorption	IS 383:1970 IS 2386:1963	Every truck
4.	Lightweight Aggregate	As per IS 9142:2003	IS 9142:1979	Weekly
5.	Flyash	As per IS 3812 (P-1): 1979	IS 3812 (P-1):2003	If required
6.	Water	As per IS 10500:2012	IS 10500:2012	Yearly
	II. Hollowcore Concrete Wall			
1.	Wall Width (mm)	600 ± 3	Manually	Daily
2.	Wall Thickness (mm)	92 ± 3, 120 ± 3	Manually	Daily
3.	Wall Height (mm)	Up to 3300 mm ± 10	Manually	Daily
4.	Wall Weight (kg/m^2)	105 to 150	Weigh bridge	Monthly or at change of mix design
5.	Density (kg/m^3)	1700 to 2600	Batching plant report	Daily
6.	Water Absorption	5% max	IS 516:1959	Quarterly
7.	Cube Compressive Strength (MPa) at 28 days	20 min.	IS 516:1959	Daily
8.	Wall Compressive Strength (Mpa) at 28 days	4 min.	IS 516:1959	Half yearly or at change of mix design
9.	Wall Flexural Strength	1.5 min.	IS 516:1959	Half yearly or at change of mix design
10.	Thermal Conductivity	0.4 min.	Is 3346:1980	Half yearly or at change of mix design

ANNEX II

(Clause 1.6)

Manufacturing Process Flow Chart



The manufacturing process of the WallTec wall elements consists of 8 stages controlled by one unique automation system:

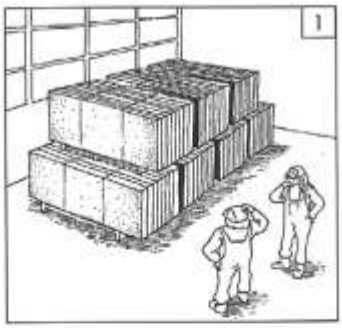
- Concrete supply (1)
- Extrusion (2)
- Cutting (3)
- Trimming (4)
- Stacking (5)
- Precuring (6)
- Restacking (7)
- Packing and delivery (8)

ANNEX III

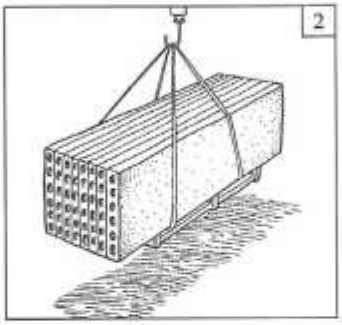
(Clause 2.7)

Installation Guide

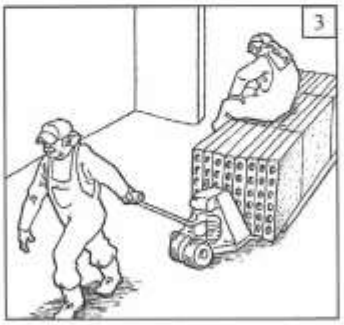
2



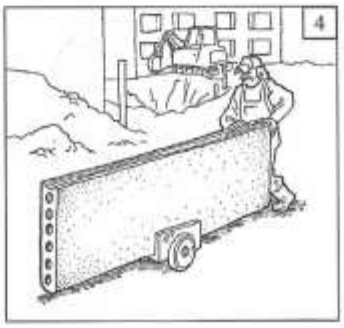
During stocking and transportation time it is possible to put only two stacks on top of each other. Stock yard should be level and panels should be protected against rain during stocking.



Panel stacks should always be lifted from under wooden pallet with a lifting fork or belt.



The WallTec-Panel stacks can easily be moved at construction site by a forklift or a trolley.

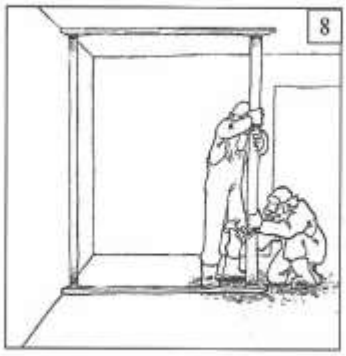


Individual WallTec-Panel can easily be moved by a simple wheel.

Panels can also be moved manually by inserting short steel tube (500 mm) into the **second** hollow as handle. Panels should always be transported sideways.

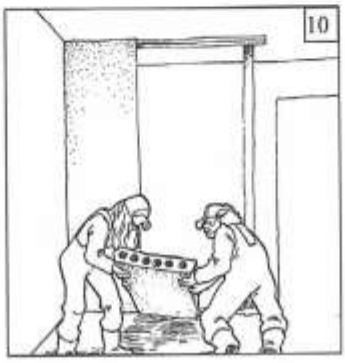
Gluing agents should be mixed carefully as according to manufacturer's instruction.

The line of wall is marked to the floor and ceiling before start of installation.

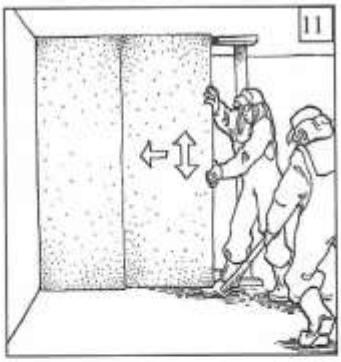


Guiding boards are fixed to the floor and ceiling. The guiding support will automatically align the wall when lifting the panels straight into upright position.

The gluing agent is spread on the side of the already installed WallTec-Panel.

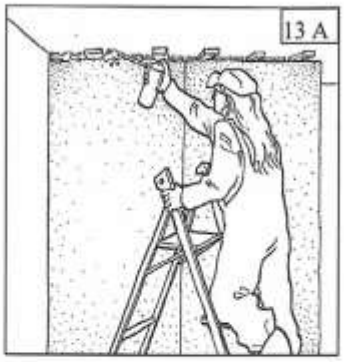


Before the WallTec-Panel is lifted to upright position it should be moved so that the Panel bottom is as close as possible to its correct position. After that the ACOTEC-PANEL is lifted to upright position by two men.

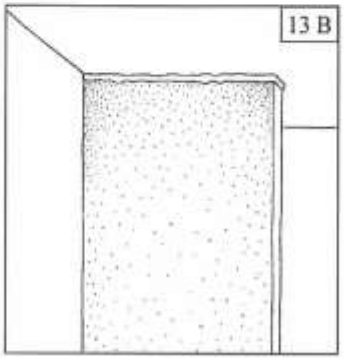


The WallTec-Panel should be pushed against the previous WallTec-Panel (and moved up and down) so that tongue and groove are carefully positioned against each other and gluing agent is squeezing out. Correct thickness of joint between two panels is 1-2 mm.

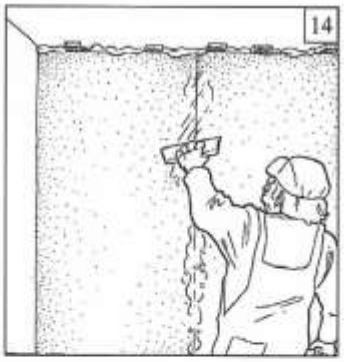
WallTec-Panel is positioned to correct level by using wooden wedges at the bottom and top of the ACOTEC-PANEL. The height of WallTec-Panel should be about 10 - 50 mm smaller than free room height.



The top joint is filled with polyurethan foam. Correct thickness of the joint is 5 - 10 mm.

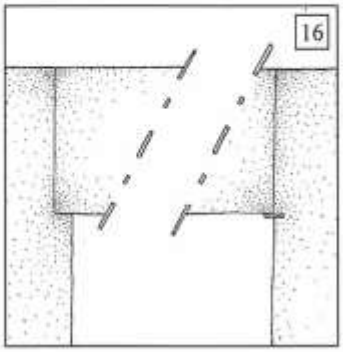


Alternatively, when same gluing agent as in sides is used for top joint , WallTec-Panel is pushed against ceiling so that gluing agent is squeezing out. Correct thickness of joint is 1 - 2 mm.

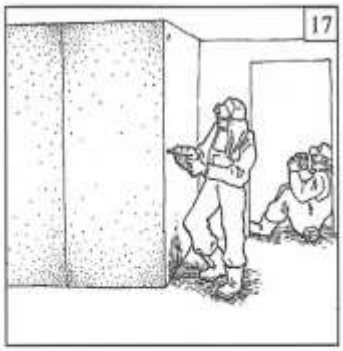


The surplus gluing agent is removed from joints right after installation.

Bottom joint of WallTec-Panel is filled with mortar or concrete. Correct thickness of joint is 10 - 40 mm.

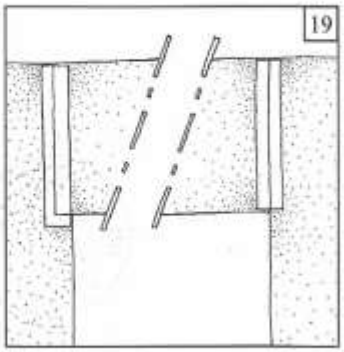


To the panels next to the door 'shoulders' are sawed or flat steel bar for door top piece fixed. The door top piece is glued by using polyurethan foam or gluing agents. Joints should be as thin as possible.

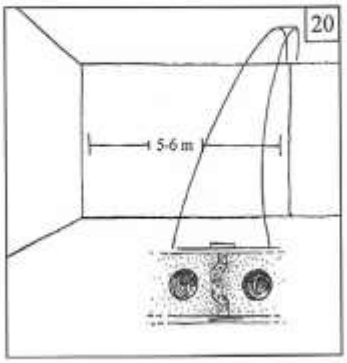


All corners should be strengthened with nail plugs (3/corner), for example HILTI HRD-H.

On to corner joints paper or class fiber tape should be glued before plastering .



On to the joints at a door top piece paper or class fibre tape should also be glued before plastering.

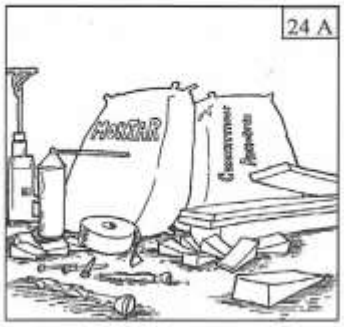


Flexible joints between WallTec-PANELS should be built after each 5 - 6 m. PU-foam or mineral wool can be used as elastic joint material.

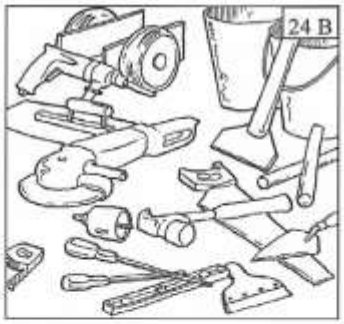
The hollow cores are used for leading through the cables and electrical boxes are drilled to any desired point.

WallTec-Panel wall needs only a very thin skim coating (1 - 2 mm) before surface finishing. It is easiest to do with a wide trowel.

All kinds of sawings and drilling are easy to make to the WallTec-Panel



Installation materials and accessories
Mortar, cementitious adhesive, lumber, nail plugs, wooden wedges, paper tape, PU-foam and mortar mixer.



Installation tools
Hammer, saw, screw driver, level, meter rule, trowel, drill, trolley or ACO-wheel, concrete cutter, installation steel bar, drill for electrical boxes, buckets and lifting bars.