



**Technický a skúšobný ústav stavebný, n. o.**  
Building Testing and Research Institute  
Studená 3  
821 04 Bratislava  
Slovak Republic  
Phone: +421 2 49228101  
E-mail: [sternova@tsus.sk](mailto:sternova@tsus.sk)  
Website: [www.tsus.sk](http://www.tsus.sk)



## European Technical Assessment

**ETA 16/0325 – version 02**  
**of 31/07/2019**

### General Part

**Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011:** **Technický a skúšobný ústav stavebný, n. o.**

**Trade name of the construction product**

VARIANT-HAUS®

**Product family to which the construction product belongs**

Product area code: 4  
Non-load-bearing permanent shuttering system based on hollow blocks of insulating materials for construction of external walls, internal walls above or below ground, and partitions, for buildings

**Manufacturer**

VARIANT-HAUS-GROUP  
ICF Manufacturing & Sales GmbH  
Theodor-Heuss-Allee 112  
D 60486 Frankfurt/Main  
Germany

**Manufacturing plant**

POLYFORM, s.r.o.  
Terézie Vansovej 10  
065 03 Podolíneč  
Slovak Republic

**This European Technical Assessment contains**

46 pages including 2 annexes which form an integral part of this assessment.

**This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of**

ETAG 009, edition June 2002, used as European Assessment Document (EAD).

**This version replaces**

ETA 16/0325 – version 01, issued on 20/06/2016

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es) referred to above). However, partial reproduction may be made, with the written consent of the issuing Technical Assessment Body – Technický a skúšobný ústav stavebný, n. o. (TSÚS). Any partial reproduction has to be identified as such.

## Specific part

### 1 Technical description of the product

#### 1.1 General

The manufacturer shall ensure that the requirements in accordance with Clauses 1, 2, and 4 are made known to those involved in planning and execution. The Technical Information VARIANT-HAUS is deposited at TSÚS and shall be present at every construction site. If the manufacturer's instructions contain provisions which differ from those stated here, the specifications of the ETA shall apply.

After installation of the shuttering elements (see 4.2.2) the site-mixed or ready mixed concrete is brought in and compacted.

In end use conditions continuous type concrete walls of plain or reinforced concrete according to EN 1992-1-1 or corresponding national rules will be formed.

In end use conditions the EPS-shuttering leaves are the main part of the thermal insulation of the walls. Method of installation is presented in Annex 2.

#### 1.2 Definition of the system

The VARIANT-HAUS® is formwork comprising from factory assembled units, consisting of two expanded polystyrene (EPS) leaves mechanically fixed together using an arrangement of polystyrene or polypropylene spacers moulded into each leaf at production stage. Forms are white – STYROPOR® F 495 E or grey NEOPOR in colour. The modules VARIANT-HAUS® are forming nominal concrete core thickness of 150 mm.

The spacers are designed with slots to receive horizontal reinforcement built into the concrete core of wall. The sum of the cross-sectional areas of the polypropylene spacers is less than 1 % of the area of the concrete core. Length of the modules is 1 250 mm and all of which measure 250 mm in height.

Main dimensions and types of the shuttering elements are in the following Table 1 and Table 2.

**Table 1 – Main dimensions of the shuttering elements**

Wall type	Nominal thickness of the inner shuttering leaf [mm]	Nominal thickness of the concrete core [mm]	Nominal thickness of the outer shuttering leaf [mm]	Overall wall thickness (without rendering) [mm]	Overall wall mass (without rendering) [kg/m <sup>2</sup> ]
Standard	50	150	50	250	362
ISO block	50	150	150	350	364
ISO block plus	50	150	250	450	366

**Table 2 – Main types of the shuttering elements**

Element type	Thickness of						Length of shuttering element [mm]	Mass of shuttering element [g]	Annex
	inner shuttering leaf [mm]		concrete core [mm]		outer shuttering leaf [mm]				
	min.	max.	min.	max.	min.	max.			
VARIANT-HAUS® Standard ICF primary block E 01	45	50	150	160	45	50	1 250	961	1.1
VARIANT-HAUS® Standard ICF primary block E 01 G	45	50	150	160	45	50	1 250	1 087	1.2
VARIANT-HAUS® Standard ICF block with plastic tie E 02	45	50	150	160	45	50	1 250	875	1.3
VARIANT-HAUS® Standard ICF lintel block E 03	45	50	150	160	45	50	1 250	1 170	1.4
VARIANT-HAUS® Standard ICF ceiling element E 04	45	50	150	160	45	50	1 250	796	1.5
VARIANT-HAUS® Standard ICF half block E 06	45	50	150	160	45	50	1 250	600	1.6
VARIANT-HAUS® Standard ICF half block with plastic tie E 07	45	50	150	160	45	50	1 250	437	1.7
VARIANT-HAUS® Standard ICF bay block left + right E 08	45	50	150	160	45	50	373 + 273	525	1.8
VARIANT-HAUS® ISO block ICF primary block N 20	45	50	150	160	145	150	1 250	1 987	1.9
VARIANT-HAUS® ISO block ICF block with plastic tie N 21	45	50	150	160	145	150	1 250	1 812	1.10
VARIANT-HAUS® ISO block ICF ceiling element N 22	45	50	150	160	145	150	1 250	1 578	1.11
VARIANT-HAUS® ISO block ICF lintel block N 23	45	50	150	160	145	150	1 250	2 107	1.12
VARIANT-HAUS® ISO block plus ICF block with plastic tie N 31	45	55	140	160	245	255	1 250	2 924	1.13
VARIANT-HAUS® ISO block plus ICF primary block N 30	45	55	140	160	245	255	1 250	2 924	1.14
VARIANT-HAUS® ICF block E 09		40		70		40	1 250	815	1.15

**Table 3 – Accessories of the shuttering elements**

<b>Element type</b>	<b>Height of the element</b> [mm]	<b>Width of the element</b> [mm]	<b>Length of the element</b> [mm]	<b>Mass of shuttering element</b> [g]	<b>Annex</b>
VARIANT-HAUS® Standard ICF height compensation element E 05	35	250	1 250	173	1.16
VARIANT-HAUS® Standard ICF locking piece N 11A	119	50	160	39	1.17
VARIANT-HAUS® Standard ICF locking piece N 11 B	129	50	160	39	1.18
VARIANT-HAUS® Standard ICF locking piece N 12	250	50	160	56	1.19
VARIANT-HAUS® ICF edge protection upper	25	50	700	19	1.20
VARIANT-HAUS® ICF edge protection lower	25	50	700	19	
VARIANT-HAUS® ICF edge protection upper	25	50	500	13	1.21
VARIANT-HAUS® ICF edge protection lower	25	50	500	13	
VARIANT-HAUS® ISO block plus ICF height compensation element HCE 1	35	100	1 250	128	1.22
VARIANT-HAUS® ISO block plus ICF height compensation element HCE 2	125	100	1 250	458	1.23
VARIANT-HAUS® ISO block plus ICF height compensation element HCE 3	250	100	1 250	916	1.24

The upper and lower surfaces of the EPS forms incorporate small castellations so that adjoining forms effectively lock together without fixings. For better interlocking with render and concrete core the small castellations are at external and internal surface too.

The forms are interlocked and build up horizontally and vertically into a tight rigid formwork. The wall is formed by filling of the forms with concrete. The formwork is used in conjunction with concrete class C 16/20 (according to EN 206) to built plain concrete walls or in conjunction with concrete of classes in the range from C 20/25 to C 30/37 to built reinforced concrete walls. Class of slump  $\geq$  F2; recommended and maximum size of aggregate used in concrete walls is 32 mm. The concrete is possible to apply according to national rules.

The concrete can contain an admixture, which comply with EN 934-2: 2009+A1: 2012 to allow its placement by either rodding or free flow and eventually allow adequate time of concreting. For the intended use it is essential to protect the formwork against effects of the weather.

Components and finishes used in conjunction with the formwork, not covered by this document, are as follow:

- steel reinforcement (where required), should comply with applicable national rules;
- external rendering or external masonry or gypsum plasterboards according to EN 520+A1: 2010;
- internal finishing;
- brickwork/stonework wall ties according to EN 845-1: 2013;
- trestle supports.

## **2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)**

### **2.1 Intended use**

VARIANT-HAUS® is determined for the use in forming load-bearing and non-load-bearing internal or external walls. Once filled on site with concrete, the EPS formwork remains as a permanent part of the wall and so contributes to the overall thermal resistance of the completed wall construction. During the pouring of the concrete infill, the formwork resists the pressure of fresh concrete through the inherent strength and interlocking action of castellated horizontal joints and tying action of the spacers.

While using this system below ground, then according to applicable national rules, the waterproofing membrane should be provided on the external surface. The membrane should be applied in accordance with the manufacturer's installation instructions and should be protected from damage using an impact-resistant protective layer or sand blinding.

### **2.2 Manufacturing**

The VARIANT-HAUS® is produced in a heat-moulded chamber where the dimensions, castellations and spacer positions are controlled by the template of the mould. Tolerances for dimensional stability are maintained by curing the EPS forms in elevated-temperature places, in accordance with the agreed control plan. The shuttering elements are manufactured in accordance with the ETA using the manufacturing processes as identified in the inspection of the plant by the Technický a skúšobný ústav stavebný, n. o. (TSÚS) and laid down in the technical documentation.

### **2.3 Installation of the shuttering elements**

For information on installing the elements mentioned in this ETA in Clause 5 – Basic manufacturing process.

### **2.4 Packaging, transport and storage**

The VARIANT-HAUS® is protected by cardboard and wrapped in plastics foil marked by label. The material should be delivered in closed vehicle. The products should be protected against damage during storing. In case of long-run storing it should be kept in a closed or at least covered place. The elements are packed into 1 m<sup>3</sup> bales.

### **2.5 Use, maintenance and repair**

The control before concreting is necessary and replacement of damaged elements is recommended. If required after concreting then cutting out and face replacement or foam spray repair is advisable.

The recommendations on use, maintenance and repair in ETAG 009, Clause 7.5 shall be considered.

### **3 Performance of the product and reference to the methods used for its assessment**

#### **3.0 Characteristics of product**

The system's components are available in the range given in this ETA Clause 1.1 and have the characteristics listed in Annex 1.

For the shuttering leaves NEOPOR expanded polystyrene

EPS-EN 13163-T1-L1-W1-S2-P4-DS(70,-)1-BS200-DS(N)5-TR150-CS(10)150 according to EN 13163: 2008 is used. The EPS has a nominal density of 24 kg/m<sup>3</sup> with a nominal thermal conductivity of 0,030 W/(m·K).

For the shuttering leaves STYROPOR® F 495 E expanded polystyrene

EPS-EN 13163-T1-L1-W1-S2-P4-DS(70,-)1-BS150-DS(N)5-TR120-CS(10)120 according to EN 13163: 2008 is used. The EPS has a nominal density of 26 kg/m<sup>3</sup> with a nominal thermal conductivity of 0,033 W/(m·K).

The spacers are made from polypropylene TIPPLEN R 959 A. The minimal tensile strength of the polypropylene spacer is 1 250 N.

The minimal pull-out strength between spacers and EPS blocks is:

- 850 N for polypropylene spacer in STYROPOR® F 495 E leaves;
- 600 N for polypropylene spacer in NEOPOR leaves;
- 700 N for STYROPOR® F 495 E spacer in STYROPOR® F 495 E leaves.

The characteristic values, respective tolerances for the components of the system:

- density of the modules:  $\pm 10 \%$ ;
- length and width of the modules:  $\pm 0,6 \%$  or  $\pm 3 \text{ mm}$  (lower value is valid);
- height of the modules:  $\pm 2 \text{ mm}$ .

More information related to the material characteristics, dimensions and tolerances of the shuttering elements, composition of the components of the system, the manufacturing and quality control procedures are given in the technical documentation of the ETA archived in TSÚS.

The ETA is issued for the system on the basis of the product composition and agreed information held by the TSÚS.

Any intended changes to the components of the system or in the production process of the components, which could result in the different details that the details being held by the TSÚS, should be notified to the TSÚS before the changes are realised. The TSÚS will decide whether the changes affect the ETA and consequently the validity of the CE marking and whether further assessment and alterations to the ETA are required.

#### **3.1 Mechanical resistance and stability (BWR 1)**

##### **3.1.1 Resulting structural pattern**

According to concrete infill structural pattern, the walls made of VARIANT-HAUS® shuttering elements with polypropylene spacers are continuous type walls according to ETAG 009, Clause 2.2.

The walls made of VARIANT-HAUS® shuttering elements with EPS spacers are grid type walls according to ETAG 009, Clause 2.2.

### 3.1.2 Efficiency of filling

The requirements according to ETAG 009, Clause 5.1.2 are met through observation of the filling of the trial structure with concrete. The efficient filling without bursting of the shuttering and without voids or any uncovered reinforcement in the concrete core is satisfactorily met.

### 3.1.3 Possibility of steel reinforcement

The geometry of the voids and the arrangement of the spacers allow correct installation and provide appropriate covering of the reinforcement steel.

The instructions in the Technical Information VARIANT-HAUS are appropriate to install steel reinforcement for walls designed according to EN 1992-1-1 or corresponding national rules (see e.g. Annex 2).

The requirements according to ETAG 009, Clause 6.1.3 are met satisfactorily.

## 3.2 Safety in case of fire (BWR 2)

### 3.2.1 Reaction to fire

No performance assessed.

### 3.2.2 Resistance to fire

With the minimum thickness of the continuous concrete core of 150 mm and minimum concrete strength C 16/20 according to Table 1 of Annex C of ETAG 009, the fire-resistance class of walls with polypropylene spacers (continuous type walls) is for:

- load-bearing walls REI 120;
- non-load-bearing wall EI 120.

With the minimum thickness of the grid concrete core of 150 mm and minimum concrete strength C 16/20 according to Table 2 of Annex C of ETAG 009, the fire-resistance class of walls with EPS spacers (grid type walls) is for:

- load-bearing walls R 30.

With the minimum thickness of the concrete core of 70 mm, the fire resistance class of load-bearing and non-load-bearing walls is: No performance assessed.

Limitations of the grid concrete core shuttering:

#### a) Non-load-bearing wall

The ratio of clear height of wall  $l_w$  to concrete thickness  $t$  should not exceed:

- 40 in case of non-load-bearing wall and EI duration criteria less or equal to 60 minutes and,
- 25 in case of EI duration criteria more or equal to 90 minutes.

#### b) Load-bearing wall

The  $\mu_{fi}$  value, according to EN 1992-1-2<sup>1</sup>, shall not exceed 0,7.

The slenderness of the concrete infill shall not exceed 50.

NOTE The classification of the walls constructed with the shuttering system regarding to fire resistance are valid for walls without openings (for windows or doors for example). The walls will have to be exposed to the fire on only one side.

---

<sup>1</sup> EN 1992-1-2: 2004/AC: 2008 Eurocode 2: Design of concrete structures. Part 1-2: General rules. Structural fire design

### **3.3 Hygiene, health and environment (BWR 3)**

#### **3.3.1 Content and/or release of dangerous substances<sup>2</sup>**

According to the manufacturer's declaration, the formwork elements VARIANT-HAUS® do not contain hazardous substances, which are classified according to General ER 3 Checklist and listed in the "Indicative list of dangerous substances".

#### **3.3.2 Water vapour permeability**

The water vapour diffusion resistance coefficient of EPS according to EN 12086<sup>3</sup>;  $\mu = 43 \pm 10$ . The values for the water vapour diffusion resistance of concrete depending on density and type of concrete are tabulated in EN ISO 10456<sup>4</sup>.

#### **3.3.3 Water absorption**

The water absorption has been determined according to EN 1609<sup>5</sup> as short term water absorption by partial immersion is for STYROPOR® F 495 E and NEOPOR  $\leq 0,05 \text{ kg/m}^2$ .

The water absorption has been determined by observation of the finished shuttering elements during the filling too. Water absorption of shuttering in contact with fresh concrete or from internal or external sources not caused any damage and shuttering was dry out again during the evaporation period.

The requirements according to ETAG 009, Clause 6.3.3 are met satisfactory.

#### **3.3.4 Watertightness**

The "No performance assessed" option in ETAG 009, Table 3, is used.

### **3.4 Safety and accessibility in use (BWR 4)**

#### **3.4.1 Bond strength between the shuttering leaves and the concrete core**

The expanded polystyrene is bonded to the concrete by mechanical interlocking of the spacers running in the inner surfaces of the shuttering leaves and interlocking between small castellations on shuttering leaves. Minimal bond strength between the shuttering leaves and the concrete core is  $0,04 \text{ N/mm}^2$ , this is sufficient to meet the requirements in ETAG 004<sup>6</sup> Clause 6.1.4.1.3.

The requirements according to ETAG 009, Clause 6.4.1.3 are met satisfactory.

#### **3.4.2 Resistance to filling pressure**

The resistance to filling pressure has been determined by observation of the finished shuttering elements for both stages, during filling and on completion of the filling. The requirements in respect to cracking and failure of the system elements and horizontal bowing of shuttering are also satisfactorily met.

---

<sup>2</sup> In addition to the specific clauses relating to dangerous substances contained in this European Technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

<sup>3</sup> EN 12086: 2013 Thermal insulating products for building applications. Determination of water vapour transmission properties

<sup>4</sup> EN ISO 10456: 2008 Building materials and products. Hygrothermal properties. Tabulated design values and procedures for determining declared and design thermal values

<sup>5</sup> EN 1609: 2013 Thermal insulating products for building applications. Determination of short term water absorption by partial immersion

<sup>6</sup> ETAG 004: 2013 EOTA Guideline for External Thermal Insulation Composite Systems with rendering



The resistance to filling pressure has been determined by tests of tensile strength of spacer webs and flexural strength of the shells. The resistance to filling pressure was also determined by observation of lower sections of the shuttering during concreting.

The minimal tensile strength of the spacer and minimal pull-out strength between spacers and EPS blocks is:

- 850 N for polypropylene spacer in STYROPOR® F 495 E leaves;
- 600 N for polypropylene spacer in NEOPOR leaves;
- 700 N for STYROPOR® F 495 E spacer in STYROPOR® F 495 E leaves.

Resistance to filling pressure is sufficient for filling up to 1,00 m of height (4 lines of the shuttering) at once. Next section can be filled after achieve compressive strength of the previous section 2 N/mm<sup>2</sup>.

The requirements according to ETAG 009, Clause 6.4.2 are met satisfactory.

### **3.4.3 Safety against personal injury by contact**

As delivered on site the shuttering elements do not have sharp or cutting edges. Because of the soft surface of the shuttering leaves there is no risk of abrasion or cutting people.

The requirements according to ETAG 009, Clause 6.4.3 are met satisfactory.

## **3.5 Protection against noise (BWR 5)**

### **3.5.1 Airborne sound insulation**

The “No performance assessed” option in ETAG 009, Table 3, is used.

### **3.5.2 Sound absorption**

The “No performance assessed” option in ETAG 009, Table 3, is used.

## **3.6 Energy economy and heat retention (BWR 6)**

### **3.6.1 Thermal resistance**

In the following Table 4 there are listed the thermal resistances established on coefficient of thermal conductivities of base materials in dry condition for all wall types which are included in the system VARIANT-HAUS® (see Table 1 and 2). These values have been determined by numerical calculations. The influence of the spacer was taken into account by calculation the values. In these calculations the following thermal conductivities were used:

- test result according to EN 12667<sup>7</sup> of the expanded polystyrene NEOPOR 0,030 W/(m·K);
- test result according to EN 12667 of the EPS STYROPOR® F 495 E 0,033 W/(m·K);
- tabulated value according to EN ISO 10456 for the concrete 2,3 W/(m·K).

The design values of coefficient of thermal conductivities should be stated according to EN ISO 10456 for each particular application.

---

<sup>7</sup> EN 12667: 2001 Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance

**Table 4 – Thermal resistance values (calculated without plaster), heat transfer coefficient and equivalent thermal conductivities in dependence of the type of shuttering element and thickness of the outer layer of expanded polystyrene (in all cases the thicknesses of inner layers of expanded polystyrene are min. 45 mm and the thicknesses of concrete core are max. 160 mm)**

Type of shuttering element	VARIANT-HAUS® Standard			VARIANT-HAUS® ISO block			VARIANT-HAUS® ISO block plus		
	$R$ [m <sup>2</sup> ·K/W]	$U$ [W/(m <sup>2</sup> ·K)]	$\lambda_{eq}$ [W/(m·K)]	$R$ [m <sup>2</sup> ·K/W]	$U$ [W/(m <sup>2</sup> ·K)]	$\lambda_{eq}$ [W/(m·K)]	$R$ [m <sup>2</sup> ·K/W]	$U$ [W/(m <sup>2</sup> ·K)]	$\lambda_{eq}$ [W/(m·K)]
NEOPOR	3,11	0,322	0,0805	6,44	0,155	0,0543	9,77	0,102	0,0460
STYROPOR® F 495 E	2,83	0,353	0,0822	5,86	0,171	0,0597	8,89	0,112	0,0506

### 3.6.2 Influence of moisture transfer on insulating capacity of the wall

The “No performance assessed” option is used.

### 3.6.3 Thermal inertia

The values of heat capacity of concrete and expanded polystyrene are tabulated in EN 12524: 2002.

## 3.7 Sustainable use of natural resources (BWR 7)

### 3.7.1 Physical agent

As given in the designation code of the EPS material used (see 2.1.1) the dimensions of the shuttering leaves do not differ more than 3 % after exposing them for 48 h at 70 °C (DS(70,-)3).

The requirements according to ETAG 009, Clause 6.7.1.1 are met satisfactory.

### 3.7.2 Chemical agent

Corrosion protection

VARIANT-HAUS® does not contain any steel components.

The requirement "corrosion protection" according to ETAG 009, Clause 6.7.1.2 is met satisfactory.

### 3.7.3 Biological agent

The application of EPS as thermal insulating material for decades has shown that it sufficiently protects against fungi, bacteria, algae and insects.

EPS does not provide a food value and in general it does not contain voids suitable for habitation by vermin.

The requirements according to ETAG 009, Clause 6.7.1.3 are met satisfactory.

### 3.7.4 Resistance to normal use damage

The product will be protected in use by internal finishing and external applications against normal use impacts.

Incorporation of ducts

The instructions in the VARIANT-HAUS® Application Technique Guide of the ETA applicant are appropriate to produce horizontal perforations through the walls, which are necessary for the passing through ducts. Generally, ducts should be incorporated in twin shuttering elements prior to concreting.

Fixings for hanging objects

The anchorage of fixings for hanging objects in the shuttering leaves is not possible. Such fixings only shall be anchored in the concrete core.

The requirements according to ETAG 009, Clause 6.7.2 are met satisfactory.

#### 4 **Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base**

According to the European Commission Decision 97/556/EC amended by the European Commission Decision 2001/596/EC, the AVCP systems (further described in Annex V to Regulation (EU) No. 305/2011) given in the following table apply.

**Table 5 – Assessment and verification of constancy of performance system**

Product(s)	Intended use(s)	Level(s) or class(es) (Reaction to fire)	System(s)
VARIANT-HAUS®	VARIANT-HAUS® is determined for the use in forming load-bearing and non-load-bearing internal or external walls.	No performance assessed.	2+
<p><sup>(1)</sup> Products/materials for which a clearly identifiable stage in the production process result in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).</p> <p><sup>(2)</sup> Products/materials not covered by footnote (1).</p> <p><sup>(3)</sup> Products/materials that do not require to be tested for reaction to fire (e.g. Products/materials of Classes A1 according to Commission Decision 96/603/EC).</p>			

#### 5 **Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD**

In order to help the Notified Body to make an evaluation of conformity, the Technical Assessment Body issuing the ETA shall supply the information detailed below. This information together with the requirements given in EC Guidance Paper B will generally form the basis on which the factory production control (FPC) is assessed by the Notified Body.

This information shall initially be prepared or collected by the Technical Assessment Body and shall be agreed with the manufacturer. The following gives guidance on the type of information required:

##### 1) The ETA

Where confidentiality of information is required, this ETA makes reference to the manufacturer's technical documentation which contains such information.

##### 2) Basic manufacturing process

The shuttering elements are put together on site in layers without mortar or adhesive. The formwork shall build up a wall with staggered hollow blocks and the spacers shall be stacked.

The first line should be filled with concrete in half, than do the altitudinal fine setups and the walling should be continued only after the concrete had consolidated (the next day is recommend).

Covering for the protection of the element's castellated horizontal joints must be used during concreting.

The maximal filling high is 1 m (4 lines of the shuttering) at once. Next section can be filled after achieve compressive strength of the previous section app. 2 N/mm<sup>2</sup>. In this case is not necessary used support system for stabilization of the wall before concreting.

Horizontally passing ducts are to be installed according to the Technical Information VARIANT-HAUS and are to be taken into account when designing the wall.

Horizontal ducts situated inside the wall cores and running parallel to the wall surfaces are to be avoided. If absolutely necessary, these are to be taken into account when designing the wall.

Also vertical ducts in the concrete core shall be considered, if their diameter exceeds 1/6 of the thickness of the concrete core and the distance of the pipes is less than 2 m.

The necessary reinforcement according to static calculation also shall be installed in an appropriate way.

Further information is given in the Technical Information VARIANT-HAUS which forms a supporting document of the ETA.

### **Concreting**

The used fresh concrete shall be according to relevant parts of EN 206: 2013 controlled according to Annex C of this Standard. Whenever possible, concrete shall be purchased under an approved scheme with continuous certification and testing of the supplier. Where such schemes/controls are not available it is the responsibility of the purchaser of the concrete to ensure fitness for the purpose.

Vibrating equipment must be used with care. Further information is given in the Technical Information VARIANT-HAUS which forms a supporting document of the ETA.

### **Requirements**

The fitness for use of the system can be assumed if the elements are installed correctly in accordance with the following requirements:

- installation is carried out under the direction of personnel trained and qualified and verified as competent to install the product by the ETA holder or its agent;
- installation is in accordance with the Technical Information VARIANT-HAUS prepared for that purpose, and the appropriate tools are used;
- the specified products and accessories are used.

#### 3) Product and materials specifications

The manufacturer's documentation includes:

- detailed drawings (possibly including manufacturing tolerances);
- incoming (raw) materials specifications and declarations;
- references to European and/or international standards;
- technical data sheets.

4) Control Plan (as a part of FPC)

The manufacturer and the Technický a skúšobný ústav stavebný, n. o. have agreed a Control Plan which is deposited with the Technický a skúšobný ústav stavebný, n. o. in documentation which accompanies the ETA. The Control Plan specifies the type and frequency of checks/tests conducted during production and on the final product. This includes the checks conducted during manufacture on properties that cannot be inspected at a later stage and for checks on the final product.

In cases where the provisions of the European Technical Assessment and its Control Plan are no longer fulfilled, the Notified Body shall withdraw the certificate and inform Technický a skúšobný ústav stavebný, n. o. without delay.

**Technický a skúšobný ústav stavebný, n. o.**  
Building Testing and Research Institute  
Studená 3, 821 04 Bratislava, Slovak Republic

On behalf of the Technický a skúšobný ústav stavebný, n. o.  
Bratislava, 31 July 2019



prof. Ing. Zuzana Sternová, PhD.  
Head of Technical Assessment Body

**Annexes**

Annex 1 – Main types of the shuttering elements intended use

Annex 2 – Joint details