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European Technical Assessment

ETA-23/0852
of 07.12.2023

General part

Technical Assessment Body issuing the European Technical Assessment

Österreichisches Institut für Bautechnik (OIB)
Austrian Institute of Construction Engineering

Trade name of the construction product

FormProtect shuttering kit

Product family to which the construction product belongs

Non load-bearing permanent shuttering kit based on panels of PVC

Manufacturer

FormProtect GmbH
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56424 Bannberscheid
GERMANY

Manufacturing plant

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This European Technical Assessment contains

40 pages including Annexes 1 to 5, 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

European Assessment Document (EAD) 340309-00-0305, "Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete".

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Specific parts

1 Technical description of the product

1.1 General

The European Technical Assessment – ETA – applies to a kit, the

FormProtect shuttering kit.

The FormProtect shuttering kit is a non load-bearing permanent shuttering kit based on elements made of extruded polyvinyl chloride (PVC). The elements are assembled on the construction site. Each element is slided into the adjacent elements. That way, a shuttering is built up, which is concreted to complete the wall. With the FormProtect shuttering kit straight and rounded walls can be constructed.

The shuttering elements under construction are loaded by the pressure from the fresh concrete. After hardening of the concrete core, the shuttering kit has no load-bearing function anymore. The shuttering elements of the shuttering kit then take over part of the insulating function of the wall, act as the substrate for additional finishes, and protect the concrete.

Basic colour of FormProtect shuttering kit is perl white. Further colours can be provided on request.

Further construction materials for completing the structure, such as concrete, reinforcement, pipes, ducts, door and wall ties, moisture proofing if required, etc. do not form part of the shuttering kit and, therefore, are not considered in the European Technical Assessment.

1.2 Shuttering elements

The shuttering elements are made of extruded polyvinyl chloride (PVC), mostly of hard PVC. Some parts of shuttering elements are made of plasticised (flexible) PVC (sealing lips at panel C and joiner D). All shuttering elements have a nominal thickness of 0.125 cm. The shuttering elements are:

- | | | |
|--|---|--------------------------|
| <ol style="list-style-type: none"> 1. Panel 2. Connector | } | main shuttering elements |
| 3. Accessories: | | |
| - Bracing (45°) | | |
| - Joiners | | |
| - Extension | | |

Representations and further details of the shuttering elements are given in Annex 2.

The FormProtect shuttering kit contains panels, linked across by connectors and accessories, see Table 1 and Table 2. Panels form the leaves of the shuttering and connectors provide resistance to the tensile load induced by pouring fresh concrete.

All shuttering elements are linked up by form-fitting interlock by sliding one into another. All shuttering elements have a project-related length.

Table 1: Main shuttering elements

Shuttering element	Function
Panel (for straight and/or rounded walls)	Shuttering leave
Connector	Transverse/across connecting internal and external shuttering leave Defines the thickness of wall

1.2.1 Panels

1.2.1.1 Panel A

Panel A is a shuttering element used as shuttering leave to construct:

- straight wall: as inner or as outer shuttering leave
- rounded wall: as inner shuttering leave.

Panel A can be trimmed in 50 mm steps.

For more details see Annex 2.

1.2.1.2 Panel C

Panel C is a shuttering element used as outer shuttering leave to construct a rounded wall. It has a sealing lip made of plasticised (flexible) PVC.

For more details see Annex 2.

1.2.2 Connectors

1.2.2.1 Connector B12

Connector B12 is used for construction of a straight or rounded wall with 30 cm thickness.

Connector B12 can be combined with the extension G or with the other connectors to construct walls of different thicknesses.

For more details see Annex 2.

1.2.2.2 Connector B8

Connector B8 is used for construction of a straight or rounded wall with a 20 cm thickness.

Connector B8 can be combined with the extension G or with the other connectors to construct walls of different thicknesses.

For more details see Annex 2.

1.2.2.3 Connector B2

Connector B2 is used for the extension of connectors B8 and B12. Thus, the wall thickness can be enlarged for further 50 mm.

For more details see Annex 2.

1.2.3 Accessories

Accessories are available to enhance jointing and stiffness of the shuttering. Accessories are listed in the Table 2.

Table 2: Accessories

Accessory	Function
Bracing (45°)	Web bracing profile
Joiners – for panels – for connectors – for inner/outer corners	Adapter for joints
Extension (of panel A)	for corner construction

The accessories' most important dimensions and drawings are given in Annex 2.

1.2.3.1 Bracing (45°)

Bracing E is 45° bracing used for bracing respectively preventing of the buckling of all wall forms.

For more details see Annex 2.

1.2.3.2 Joiners

Joiners are used for connecting of panels or connectors.

Joiner D is used for connecting of two adjacent panels. He has a sealing lip made of plasticised (flexible) PVC.

Joiner H is used for connecting of two adjacent connectors.

For more details see Annex 2.

1.2.3.3 Extension

Extension F is used after trimming of panel A. It is used for corner construction.

For more details see Annex 2.

1.3 Shuttering kit

The thickness of the concrete core of the wall is defined by the connectors given in Annex 2, and is in the range of 10 to 60 cm.

Shuttering system, see Annex 2, Figure 2, and Figure 3 is available as:

- Shuttering kit with thermal insulation material
- Shuttering kit without thermal insulation material

The thickness of the expanded polystyrene (EPS) that is used as thermal insulation material, is in the range of 5 to 20 cm. Thermal insulation material is mounted at the internal side of the shuttering kit prior to concreting.

The assembly of panels or at least one of them can be performed in such a way to provide insulation performance of the wall but does not contribute to its load-bearing capacity.

The height of the wall is defined by the length of the panels. Shape and length of the panels are given in Annex 2, Table 8.

For door and window openings see Annex 3, Figure 9 and Figure 10.

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

2.1 Intended use

The shuttering kit is intended to be used for the construction of external walls above or below ground and internal walls and partition walls, which are load bearing or non-load bearing, including those subject to fire regulations. In the area below ground, care shall be taken that there is appropriate moisture proofing and protection for the PVC against mechanical damage, taking into consideration the local conditions.

In particular the FormProtect shuttering kit is intended for the construction of walls, straight or curved in ground plan.

FormProtect shuttering kit is used in agricultural, industrial and residential buildings.

The height of the wall is defined by the length of the panels. To achieve the required wall height, bracing and scaffolding as per manufacturer's instructions are essential.

2.2 Assumptions

2.2.1 General

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on transport, storage, maintenance, replacement, and repair of the product, as he considers necessary.

2.2.2 Recommendations on packaging, transport and storage

The shuttering elements shall be protected against damage during transportation and storage. Depending on weather conditions, the shuttering elements shall be covered if necessary, in particular to avoid deterioration by UV-radiation. The specifications of the manufacturer's instructions shall be taken into account.

The shuttering elements may only be supplied as non-load-bearing, permanent shuttering components.

2.2.3 Installation

2.2.3.1 General

It is assumed that the FormProtect shuttering kit will be installed according to the manufacturer's instructions or – in absence of such instructions – according to the usual practice of the building professionals. An installation procedure to be applied in absence of standards and regulations in force at the place of use is given in Annex 4.

2.2.3.2 Assembly of the shuttering elements

For each structure, an assembly plan is to be drawn up that contains the order in which the individual shuttering elements are installed and the name of the individual shuttering elements. The assembly plan shall be available at the construction site.

Any unevenness and deviations from the horizontal of the subfloor shall be levelled out carefully before setting up the shuttering elements. Lintels are to be supported. After assembly, open joints shall be sealed. The reinforcement shall be installed according to the design, taking into account the required concrete cover. The instructions given by the manufacturer are to be observed.

The hollow shuttering kit shall be supported before concreting in accordance with manufacturer's instructions. The shuttering elements are used to contain fresh concrete as a permanent shuttering. During construction, they are subject to pressure of the fresh concrete. After hardening of the concrete core, the shuttering system has no load-bearing function anymore. In the works the FormProtect shuttering kit can provide an essential part of the thermal insulation of the wall if required. In this case a layer of expanded polystyrene (EPS) will be mounted on the inner side of the exterior shuttering panel before pouring the concrete. The finished wall can form the basis for additional finishes.

2.2.3.3 Concreting

The concrete shall be designed, manufactured, conveyed, and placed in accordance with the standards and regulations in force at the place of use. The weather conditions during concreting shall be considered. The concrete should have a consistency of at least F4 according to EN 206 and a maximum grain size of 8 to 16 mm. The shuttering elements are to be completely filled with concrete in a mutual multi-stage workflow. Concreting has to steadily follow the floor plan. During concreting, a concreting rate of approximately 1 m per hour in the vertical direction shall not be exceeded. The instructions given by the manufacturer are to be observed.

2.2.3.4 Ducts and services

If ducts and installations are located in the area of the concrete core, their influence on the stability, on the safety in case of fire and on the building physics characteristics of the wall shall be taken into account. The arrangement of horizontal slots in the concrete core shall be avoided as far as possible. The instructions given by the manufacturer are to be observed.

2.2.3.5 Finishes

Wall surfaces of the finished structure can be protected with appropriate internal and external finishes. Cladding or its substructure shall be fixed in the concrete core. The instructions given by the manufacturer are to be observed.

Suitable protection should be provided near radiators or other sources of high temperature where necessary; to prevent the shuttering panels of polyvinyl chloride (PVC) and a possibly applied insulation of expanded polystyrene (EPS) from overheating.

2.2.3.6 Fixing of objects

Fixing of objects in the shuttering panels is impossible for objects of important sizes and weight. The part of the fixings which is significant for the mechanical resistance shall be anchored in the concrete core. This applies in particular to kitchen cabinets, hot water boilers, railings of staircases and hand rails etc.

The instructions given by the manufacturer are to be observed.

2.3 Assumed working life

The European Technical Assessment is based on an assumed working life of the shuttering kit of 50 years, provided that the shuttering kit is subject to appropriate installation, use, and maintenance, see the Clauses 2.2.

The real working life may in normal use conditions be considerably longer without major degradation affecting the basic requirements for construction works¹.

¹ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works are subject, as well as on the particular conditions of design, execution, use, and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the working life indicated above.

The indications given as to the working life of the shuttering kit cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by the Technical Assessment Body, but are regarded only as a means for selecting the appropriate products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Essential characteristics of the product

The performance of the FormProtect shuttering kit for the essential characteristics is given in Table 3.

Table 3: Essential characteristics and performances of the product

No	Essential characteristic	Product performance
Basic requirement for construction works ² 1: Mechanical resistance and stability		
1	Resulting structural pattern	See Annex 1 and Clause 3.1.1.
2	Efficiency of filling	See Annex 1 and Clause 3.1.1.
3	Possibility of steel reinforcement	See Annex 1 and Clause 3.1.1.
Basic requirement for construction works 2: Safety in case of fire		
4	Reaction to fire	See Annex 1.
5	Resistance to fire	See Annex 1.
Basic requirement for construction works 3: Hygiene, health, and the environment		
6	Content, emission, and/or release of dangerous substances	See Annex 1 and Clause 3.1.2.
7	Water vapour permeability	See Annex 1.
8	Water absorption	See Annex 1.
—	Water tightness	Characteristic not assessed.
Basic requirement for construction works 4: Safety and accessibility in use		
—	Bond strength	Characteristic not assessed.
9	Resistance to impact load	See Annex 1.
10	Resistance to filling pressure	See Annex 1.
—	Safety against personal injuries by contact	Characteristic not assessed.
Basic requirement for construction works 5: Protection against noise		
—	Airborne sound insulation	Characteristic not assessed.
—	Sound absorption	Characteristic not assessed.

² Basic requirement for construction works as defined in Annex I of Regulation (EU) No 305/2011.

No	Essential characteristic	Product performance
Basic requirement for construction works 6: Energy economy and heat retention		
11	Thermal resistance	See Annex 1.
—	Influence of moisture transfer on insulating capacity of the wall	Characteristic not assessed.
12	Thermal inertia	See Annex 1.
Basic requirement for construction works 7: Sustainable use of natural resources		
—	No characteristic assessed.	—
Aspects of durability and serviceability		
13	Resistance to deterioration (chemical agents)	See Clause 3.1.3.
14	Resistance to normal use damages	See Clause 3.1.3

3.1.1 Mechanical strength and stability

The geometry of the load bearing concrete core of the FormProtect shuttering kit is a continuous wall type. The wall is only penetrated at individual points by the plastic webs of the connector profile, resulting in a continuous concrete core, see Annex 2.

Under the conditions given in clause 2.2.3, the shuttering kit is suitable to infill the concrete core, to position the ring anchor reinforcement at every floor as well as the reinforcement of lintels, parapets and individual columns of the concrete core.

3.1.2 Hygiene, health and the environment

The shuttering kit conforms to the requirements for the performance characteristics given in Annex 1, Table 6.

However, on dangerous substances the FormProtect shuttering kit conforms to EAD 340309-00-0305³. The applicant has submitted a written declaration stating the product is free of dangerous substances.

NOTE: In addition to specific clauses relating to dangerous substances in the European Technical Assessment, there may be other requirements applicable to the product falling within their scope, e.g. transposed European legislation and national laws, regulations and administrative provisions. These requirements also need to be complied with, when and where they apply.

3.1.3 Aspects of durability and serviceability

Durability and serviceability of the FormProtect shuttering kit are given under the conditions given in Clause 2.2 - Resistance to normal use damages. For resistance to deterioration regarding chemical agents, see Annex 1.

³ Standards and other documents referred to in the European Technical Assessment are listed in Annex 5.

3.2 Assessment methods

3.2.1 General

The assessment of the essential characteristics in Clause 3.1 of the permanent shuttering kit for the intended use, in relation to the requirements for mechanical resistance and stability, for safety in case of fire, for hygiene, health and the environment, for safety in use, and for energy economy and heat retention, as well as for durability and serviceability in the sense of the basic requirements for construction works № 1 to 4 and 6 of Regulation (EU) № 305/2011, has been made in accordance with EAD 340309-00-0305, Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete.

3.2.2 Identification

The European Technical Assessment for the FormProtect shuttering kit is issued on the basis of agreed data⁴ that identifies the assessed product. Changes to materials, to composition, or to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are introduced, as an amendment of the European Technical Assessment is possibly necessary.

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

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 98/279/EC the system of assessment and verification of constancy of performance to be applied to the VST permanent formwork system is System 2+. System 2+ is detailed in Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, point 1.3, and provides for the following items.

- (a) The manufacturer shall carry out
 - (i) an assessment of the performance of the construction product on the basis of testing (including sampling), calculation, tabulated values, or descriptive documentation of that product;
 - (ii) factory production control;
 - (iii) testing of samples taken at the manufacturing plant by the manufacturer in accordance with the prescribed test plan⁵.
- (b) The notified factory production control certification body shall decide on the issuing, restriction, suspension, or withdrawal of the certificate of conformity of the factory production control on the basis of the outcome of the following assessments and verifications carried out by that body
 - (i) initial inspection of the manufacturing plant and of factory production control;
 - (ii) continuing surveillance, assessment, and evaluation of factory production control.

⁴ The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik.

⁵ The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified factory production control certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

4.2 AVCP for construction products for which a European Technical Assessment has been issued

Manufacturers undertaking tasks under System 2+ shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Manufacturers shall therefore not undertake the tasks referred to in Clause 4.1, point (a) (i).

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

5.1 Tasks for the manufacturer

5.1.1 Factory production control

In the manufacturing plant, the manufacturer establishes and continuously maintains a factory production control. All data, procedures, and specifications adopted by the manufacturer are documented in a systematic manner in the form of instructions manual (user's guides) and process instructions. Purpose of factory production control is to ensure the constancy of performances of the FormProtect shuttering kit with regard to the essential characteristics.

The manufacturer only uses raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials are subjected to controls by the manufacturer before acceptance. Check of incoming materials includes control of inspection documents presented by the manufacturer of the raw materials.

The frequency of control and testing performed within factory production control as well as on the finished product is in accordance with the determined manufacturing process and the prescribed test plan. The factory production control's results of testing are recorded and evaluated. The records are kept at least for ten years after the product has been placed on the market and are presented to the notified factory production control certification body involved in continuous surveillance. On request the records are presented to Österreichisches Institut für Bautechnik. The records shall include at least.

- Designation of the product, the materials and components
- Type of control and testing
- Date of manufacture of the product and the date of the inspection of the product, materials or components
- Results of control and examination and, if applicable, comparison with requirements
- Name and signature of the person responsible for factory production control

If test results are unsatisfactory, the manufacturer immediately implements measures to eliminate the defects. Products or components that are not in conformity with the requirements are removed. After elimination of the defects, the respective test – if verification is required for technical reasons – is repeated immediately.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, including the certificate of conformity of the factory production control issued by the notified factory production control certification body, the manufacturer draws up the declaration of performance. Essential characteristics to be included in the declaration of performance for the corresponding intended use are given in Clause 3.1, Table 3.

Table 6: Performance of the FormProtect shuttering kit - continuation

BRCW	Essential characteristic	Assessment method	Level / Class / Description
3	Content, emission, and/or release of dangerous substances	EAD 340309-00-0305, clause 2.2.6	No dangerous substances, see clause 3.1.2
	Water vapour permeability		
	PVC panel	EAD 340309-00-0305, clause 2.2.7 and EN ISO 10456	$\mu = 50\ 000$
	Concrete core density 2 200 kg/m ³		$\mu = 120$
	Concrete core density 2 400 kg/m ³		$\mu = 130$
	Expanded polystyrene (EPS)		$\mu = 60$
Water absorption	EAD 340309-00-0305, clause 2.2.8 (for PVC: EN ISO 62, method 1)	2.2 g/m ² after 264 hours No capillary effect.	
4	Resistance to impact load	EAD 340309-00-0305, clause 2.2.11 and Annex B	Satisfactory
	Resistance to filling pressure		
	According to EN 15498 the Formprotect shuttering kit resist a concrete pressure $p_{max} = 0,028\text{ kN/mm}^2$ with a filling rate approximately 1 m per hour with a concrete density of up to 2500 kg/m ³ , for a concrete wall thickness of 25 cm.		
	Web tensile load, - both connectors together	EAD 340309-00-0305, clause 2.2.12.2.1.2	5 %-fractile = 569.23 N
	Characteristic value of the flexural strength of the shuttering leaf	EAD 340309-00-0305, clause 2.2.12.2.1.1	5 %-fractile = 71.54 N/mm ²

FormProtect shuttering kit

Annex 1

Characteristics of the shuttering kit

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Table 7: Resistance to deterioration (chemical agents) ¹⁾

Test liquid	Max.variation of mass after 16-weeks-storage at 40°C	Max.variation of volume after 16-weeks-storage at 40°C	Crack formation	Blistering	selective corrosion	occurrence of easily rub-off coating	sticky surface	exfoliation, distortion or other deformations	partial disintegration
—	ΔM %	ΔV %	—	—	—	—	—	—	—
Diluted/aqueous di-ammonium-phosphate – solution (JG)	0,2	0,1	A	A	A	A	A	A	A
Mixture of fermenting acid (S)	-0,7	0,5	A	A	A	A	A	A	A
Fatty acid methyl ester (FAME)	0,3	0,4	A	A	A	A	A	A	A
10%-sulfuric acid (H ₂ SO ₄)	0	0,1	A	A	A	A	A	A	A
Normal climate 23/50 (reference)	0	-0,1	A	A	A	A	A	A	A

Key:
A – free of visible defects according to EN ISO 175. EN ISO 26987 is not assessed.

Table 7: Resistance to deterioration (chemical agents) – continuation ¹⁾

Test liquid	Max. tensile load ²⁾ , mean value	Elongation at break ²⁾ , mean value	Difference in max. tensile load ²⁾	Difference in elongation at break ²⁾
—	[MPa]	[%]	[%]	[%]
Diluted/aqueous di-ammonium-phosphate –solution (JG)	—	—	+ 1.4	- 3.8
Mixture of fermenting acid (S)	—	—	+ 1.0	- 1.6
Fatty acid methyl ester (FAME)	—	—	- 4.5	- 16.0
10%-sulfuric acid (H ₂ SO ₄)	—	—	+1.6	- 3.1
Normal climate 23/50 (reference value)	36.50	3.18	—	—

²⁾ Testing by tensile test as per EN ISO 527-2. 50 mm/min.

¹⁾ The assessments of the resistance of the FormProtect shuttering kit given in Table 7 allow them to be used for tanks for liquid manure, slurry, silage and biogas plants.

FormProtect shuttering kit

Characteristics of the shuttering kit

Annex 1

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ANNEX 2 – SHUTTERING ELEMENTS

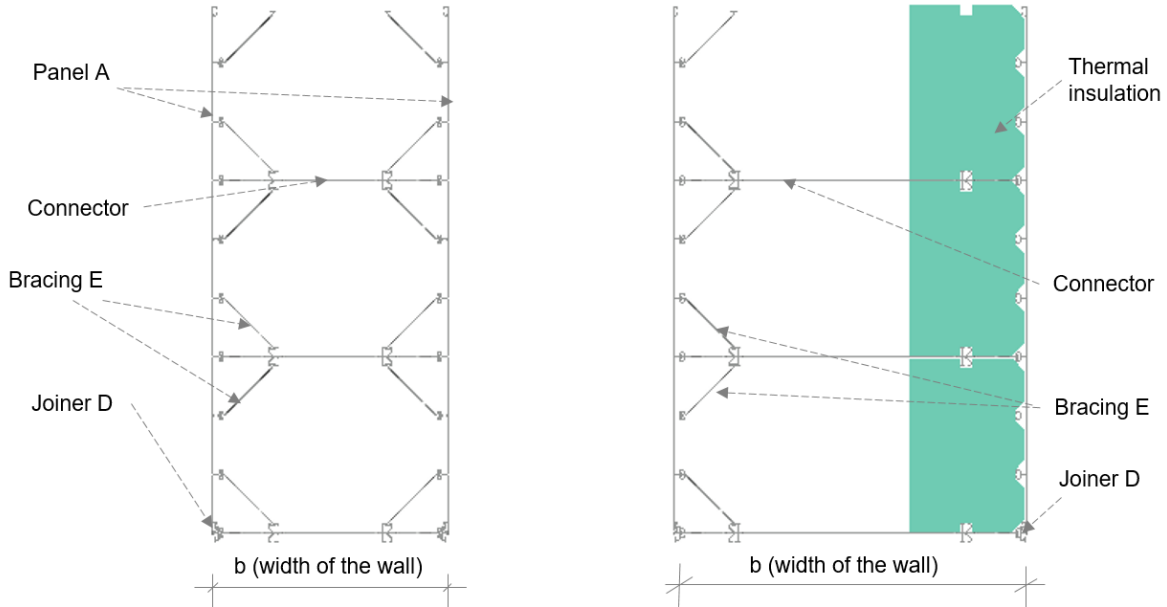


Figure 2: Shuttering elements of the FormProtect shuttering kit without (left) an with (right) thermal insulation – for straight walls

FormProtect shuttering kit

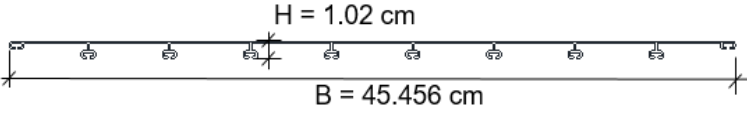
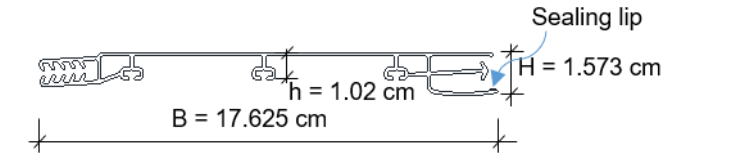
Shuttering elements

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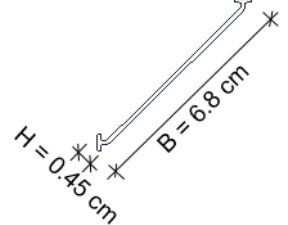
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Table 8: Panels ¹⁾

<p>Panel A $B^1) = 45.456$ cm <u>inner/outer</u> panel for straight or rounded wall, $H^2) = 1.02$ cm Length is project-specific.</p>	
<p>Panel C $B^1) = 17.625$ cm <u>outer</u> panel, $H^2) = 1.573$ cm, with Snap-Lock-Tight for rounded wall Length is project-specific.</p>	

- 1) B corresponds to the width of the shuttering element.
- 2) H corresponds to the height of the shuttering element.

Table 9: 45° bracing ¹⁾

<p>Bracing E 45° bracing (regular) $B^1) = 6.8$ cm, $H^2) = 0.45$ cm Length is project-specific.</p>	
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- 1) B corresponds to the width of the bracing.
- 2) H corresponds to the height of the bracing.

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<p>Shuttering elements</p>	

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Table 10: Connectors ¹⁾

<p>Connector B12 B¹⁾ = 29.156 cm connector (long) H²⁾ = 1.685 cm Length is project-specific.</p>	
<p>Connector B8 B¹⁾ = 18.996 cm connector (short) H²⁾ = 1.685 cm Length is project-specific.</p>	
<p>Connector B2 B¹⁾ = 3.8 cm flat connector (extension) H²⁾ = 0.55 cm Length is project-specific.</p>	

¹⁾ B corresponds to the width of the shuttering element.

²⁾ H corresponds to the height of the shuttering element.

Table 11: Joiners

<p>Joiner D Joiner for inner panels A (with a sealing lip)</p>	
<p>Joiner H Joiner for connectors</p>	
<p>Joiner F Joiner for inner/outer corners</p>	

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Table 12: Extensions

<p>Extension G Extension for inner panels</p>	
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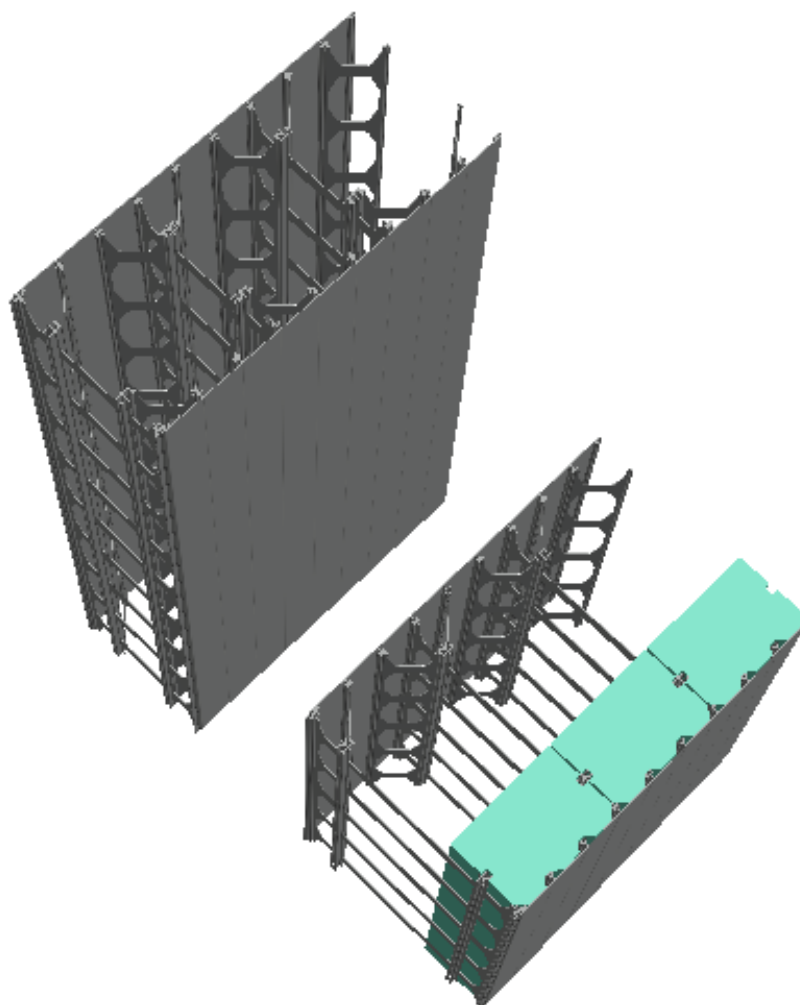


Figure 4: 3D view of a typical shuttering structure for construction of one flat wall - with and without thermal insulation

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<p>Shuttering elements</p>	

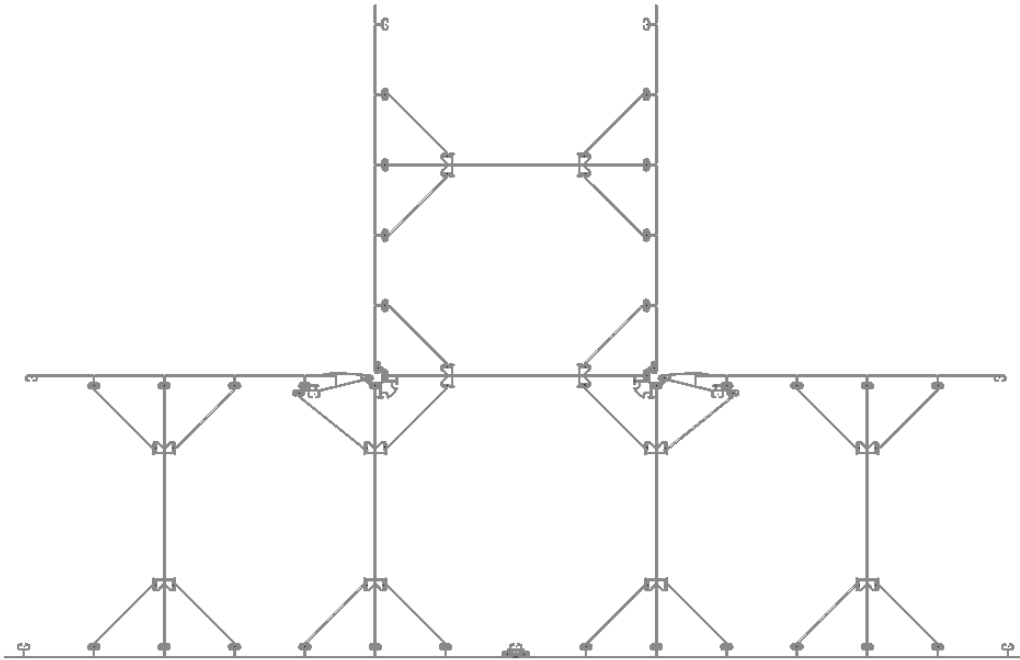


Figure 6: Exemplary connecting walls with FormProtect shuttering kit, without thermal insulation, cross section

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Connections, openings and corner assemblies

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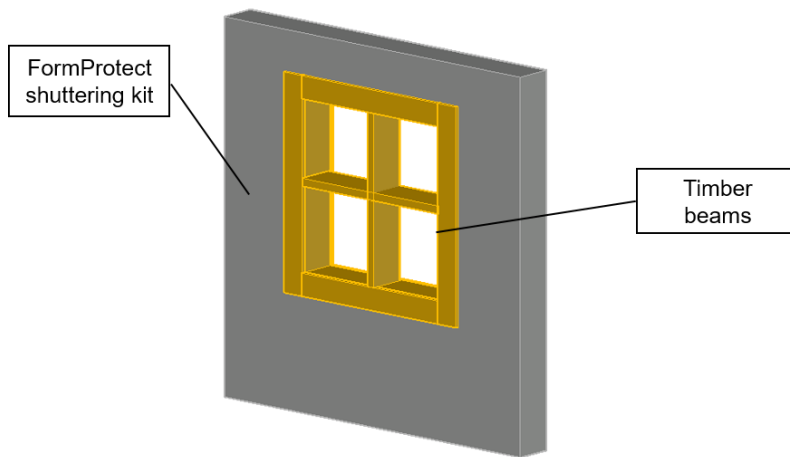


Figure 9: Exemplary installation of window opening

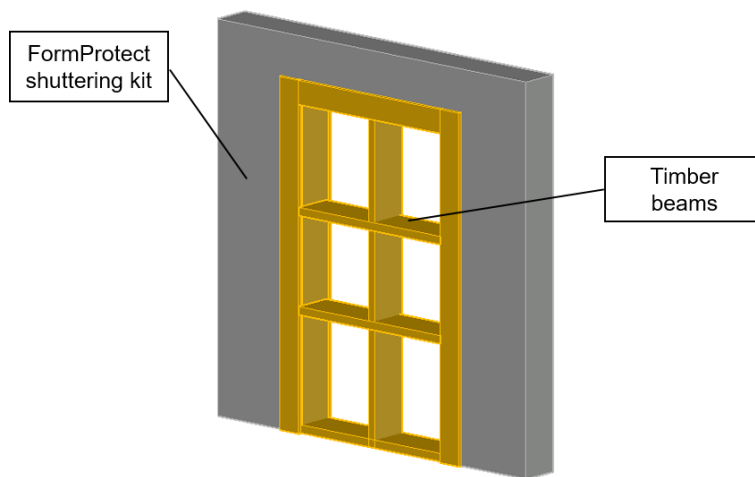


Figure 10: Exemplary installation of door opening

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ANNEX 4 – INSTALLATION PROCEDURE

to be applied in absence of standards and regulations valid in the place of use

1. General

- a) Only skilled and properly instructed personnel are to be employed for installation of the FormProtect wall elements and conveying and placing of concrete.

The safety-at-work and health protection regulations shall be observed throughout the whole construction process.

- b) An assembly plan shall be prepared for each structure, which contains the sequence in which the individual shuttering elements shall be installed and the designation of the individual shuttering elements. The assembly plan shall be available at the construction site.

2. Preparation of construction site

- a) The substructure where the shuttering system will be installed shall be swept clean.
- b) By chalk lines the position of the walls and openings is marked on the substructure and verified in accordance with the assembly plan by measuring of diagonals.
- c) The substructures' altitudes in the walls' zone are measured. Deviations from the horizontal are carefully levelled out by suitable means.

3. Positioning of the shuttering elements

d) General

The shuttering elements of the shuttering system are designed to provide a continuous load bearing concrete core, which is only perforated by regularly arranged PVC webs. The finished wall corresponds to a continuous wall type.

e) Shuttering elements

The shuttering elements shall be aligned into a vertical permanent shuttering. By means of e.g. formwork beams and diagonal bracing, the installed shuttering elements are secured to result a rigid formwork with plane surfaces which permits the construction of a vertical wall with a concrete core thickness as planned. The terminal plates must be supported against concrete pressure. All parts of the FormProtect shuttering kit can be trimmed in their length with an angle grinder. The panel A can be trimmed also in his width. For trimming of panels the special device for a multipurpose-cutter has been developed.

The manufacturer's installation instructions shall be followed.

f) Reinforcement

The reinforcement is installed according to the design of the structure. The detailing of the reinforcement shall be observed. Horizontal reinforcement steel bars shall be mounted in the punched-out fields of connectors. For the insertion of horizontal reinforcement the special tool shall be used, in order to avoid damaging of connectors. Afterwards, the vertical reinforcement shall be installed.

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By means of binding wire the vertical and the horizontal reinforcement are jointed. During the binding together, the horizontal reinforcement shall be lifted and shall run centrally through the punched-out fields of connectors.

The lifting of the horizontal reinforcement is very important, because the reinforcement-weight-stresses of the connectors of the FormProtect shuttering kit shall be avoided.

In the case of rounded walls, with the Snap-Lock-Tight of the outer panel C the perimeter of the outer shuttering ring can be adjusted to the inner shuttering ring.

The minimum and maximum distances between reinforcing bars should conform to EN 1992-series and the relevant standards and regulations in force at the place of use.

- g) The reinforcement of the walls shall provide ways for the concrete to be placed which are free from reinforcing steel and other installations. They shall permit filling device to be driven down to the bottom layer of the reinforcement.
- h) Before concreting, the shuttering of all walls of the storey is to be checked for alignment before clearance is given.

4. Concreting

i) Concrete

Concrete according to EN 206, concrete quality according to design of the structure. Strength class at least C16/20 and maximum C50/60; flow consistency class at least F4; maximum aggregate size 8 to 16 mm.

The use of flow concrete for filling is recommended. Dry and flow concrete: strength class at least C16/20; consistency class: F4; maximum aggregate size: 8 to 16 mm.

Wherever possible, concrete shall be purchased under an approved certification scheme where there is continuous inspection and testing according to the standards and regulations in force at the place of use. Ready-mix concrete shall be inspected according to EN 206, Annex C.

Weather conditions shall be considered in selecting the concrete. Until freeze stability (i.e., compressive strength of 5.0 N/mm²) is reached, concrete temperatures below + 5 °C shall be avoided. With ambient air temperatures between - 3 °C and + 5 °C, the concrete temperature should be at least + 5 °C.

j) Placing of concrete

The walls should be concreted steadily without interruption in several cycles. In the first concreting round the maximum height of the fresh concrete shall be maximum 60 cm. Afterwards, the maximum filling height of 40 cm to 50 cm corresponds with the maximum filling rate of approx. 1 m per hour. However, recommended approximately filling rate shall be between 0.8 m and 1.0 m per hour. During concreting, formation of concrete cones is to be avoided by small distances between the filling points.

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Segregation of the concrete during placing shall be avoided. In the case of free falling heights in excess of 2 m filling pipes or concrete hoses (max. diameter of 100 mm) are to be used, down just above the point of placing. Ways for placing the concrete shall be provided for reinforced walls.

If required, the concrete should be compacted with caution according to relevant standards and regulations in force at the place of use.

k) Construction joints

Walls should be concreted in layers without longer interruptions that would allow for hardening of the previously placed layer to a degree preventing adequate bonding of the layers. The construction joints shall be provided at the lower ceiling edge level.

Construction joints shall be avoided. If this is not possible in exceptional cases, any such joints shall be secured by means of splice bars with ribbed reinforcing steel. The splice bars are to be placed with a maximum clearance of 50 cm. The total cross-section of the splice bars shall be at least 1 / 2 000 of the cross-section of the concrete core to be connected, and there shall be at least two reinforcing steel bars, diameter of 8 mm, along a wall length of one metre. The splice bars shall reach at least 20 cm into each one of the adjacent concrete cores.

Laitance and loose concrete shall be removed and the surface of the joint should be pre-wetted adequately before concreting is continued.

l) Tolerances, ceilings

The concreted walls shall not deviate from vertical by more than 8 mm over a wall height of 3 m. Tolerances shall be according to relevant standards and regulations in force at the place of use. Floors may be supported onto the completely concreted walls only after sufficient strength of the concrete core has developed.

5. Finishing

Concrete residues (laitance and fines of the concrete) on surface are to be removed as soon as possible. The bracing and the supporting of the terminal plates are removed only after the prescribed stripping times when the wall and ceiling concrete has sufficiently hardened.

If necessary, the finish shall be applied shortly after final installation of the walls with FormProtect shuttering kit to avoid detrimental effects in particular by UV-radiation and weather.

If necessary, cladding or its substructure shall be anchored in the concrete core.

Only inorganic materials are to be used for cladding and/or plastering of the shuttering system. For fire protection reasons, this European Technical Assessment does not apply to organic finishes and linings.

Only thermal insulations according to European standards, European Technical Assessments or the relevant regulations in force at the place of use shall be applied. Furthermore the application of the thermal insulation materials shall be in accordance with the relevant standards and regulations in force at the place of use.

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ANNEX 5 – REFERENCE DOCUMENTS

EN 206 (2013) + A2 (03.2021)	Concrete. Specification, performance, production and conformity
EN 1992 – series	Eurocode 2: Design of concrete structures
EN 1602 (03.2013)	Thermal insulating products for building applications - Determination of the apparent density
EN 15498 (04.2008)	Precast concrete products - Wood-chip concrete shuttering blocks - Product properties and performance
EN 13163 (2012) + A2 (11.2016)	Thermal insulation products for buildings - Factory made expanded polystyrene (EPS) products – Specification
EN ISO 62 (02.2008)	Plastics - Determination of water absorption (ISO 62:2008)
EN ISO 175 (10.2010)	Plastics - Methods of test for the determination of the effects of immersion in liquid chemicals (ISO 175:2010)
EN ISO 527-2 (12.2012)	Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:2012)
EN ISO 6946 (07.2017)	Building components and building elements – Thermal resistance and thermal transmittance – Calculation methods (ISO 6946:2017)
EN ISO 10456 (12.2007) + AC (12.2009)	Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EN ISO 13786 (07.2017)	Thermal performance of building components - Dynamic thermal characteristics – Calculation methods (ISO 13786:2017, corrected version 2018-03)
EN ISO 26987 (02.2012)	Resilient floor coverings - Determination of staining and resistance to chemicals (ISO 26987:2008)

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Annex 5 – REFERENCE DOCUMENTS - continuation

EAD 340309-00-0305	European Assessment Document “Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete”
305/2011	Regulation (EU) № 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC, OJ L 88 of 4.4.2011, p. 5, amended by Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, OJ L 157 of 27.05.2014, p. 76 and Commission Delegated Regulation (EU) № 574/2014 of 21 February 2014, OJ L 159 of 28.05.2014, p. 41, Regulation (EU) 2019/1020 of the European parliament and of the council of 20 June 201, OJ L 169 of 25.06.2019, p. 1.
98/279/EC	COMMISSION DECISION of 5 December 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20(2) of Council Directive 89/106/EEC as regards non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and, sometimes, concrete, OJ L 127, 29.4.1998, p.26, amended by Commission Decision of 8 January 2001, OJ L 209 of 02.08.2001, p. 33.
568/2014	Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014 amending Annex V to Regulation (EU) № 305/2011 of the European Parliament and of the Council as regards the assessment and verification of the performance of construction products, Official Journal of the European Union European Communities № L 157 of 27.5.2014, p. 76.

FormProtect shuttering kit	Annex 5
Reference documents	of European Technical Assessment ETA-23/0852 of 07.12.2023