



Approval body for construction products and types of construction

**Bautechnisches Prüfamt** 

An institution established by the Federal and Laender Governments



## European Technical Assessment

ETA-23/0358 of 4 December 2023

English translation prepared by DIBt - Original version in German language

#### **General Part**

Technical Assessment Body issuing the European Technical Assessment:

Trade name of the construction product

Product family

to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment contains

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

Deutsches Institut für Bautechnik

**BEWI IFC System** 

Product area code: 34

Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete.

and sometimes concrete

UAB Baltijos polistirenas S. Lozoraicio g. 15 A, Garliava KAUNO RAJ.

LITAUEN

UAB Baltijos polistirenas S. Lozoraicio g. 15 A, Garliava KAUNO RAJ. LITAUEN

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

340309-00-0305

Z25318.23



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#### Specific part

#### 1 Technical description of the product

#### 1.1 Definition of the construction product

The shuttering system "BEWI" is a non-load-bearing permanent shuttering kit consisting of shuttering elements and accessory parts (see Annexes A3 to A10) applicable as formwork for plain and reinforced concrete walls cast in-situ.

The shuttering elements are generally used as non-loadbearing formwork for external as well as internal load-bearing walls.

Finishes are not part of the "BEWI" shuttering system.

The structural evaluation of the concrete core is not covered by this document.

#### 1.2 Shuttering elements

There are two different versions of the BEWI shuttering kit:

- Standard kit and
- PLUS kit.

In both versions the shuttering leaves are made of high density, expanded polystyrene (EPS) according to EN 13163:2012 + A2:2016.

The shuttering elements are interlocked and build up horizontally and vertically into a tight and rigid formwork. The blocks are dry laid in staggered vertical joints (brick bond). The wall is formed by filling of the shuttering elements with concrete. The formwork is used in conjunction with concrete of classes in the range from C16/20 to C50/60 (according to EN 206:2013 + A1:2016) erecting plain concrete walls or in conjunction with concrete of classes in the range from C20/25 to C50/60 (according to EN 206:2013 + A1:2016) building reinforced concrete walls.

The top and the bottom surfaces of each EPS shuttering leaf incorporate an interlocking arrangement to form a tight joint (see Annex A3 to A9).

The vertical surfaces at the outside of the shuttering leaf are generally smooth with element-high slight vertical grooves. At the surfaces forming the face of the wall these groves are at 50 mm centres. At the surfaces forming the vertical joint between two blocks the surface allows for a tongue and groove connection forming a tight but unsealed joint.

The shuttering leaf surface facing the concrete is structured by 20 mm wide grooves forming a dovetail joint. The dovetails are centred at 50 mm, three in a row.

The system can be used to construct straight walls with 90 degree angles.



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#### 1.2.1 Standard kit

The Standard kit (Annex A3 - A5) is characterised by internal walls being monolithically connected with the shuttering leaves. The internal walls are also made of EPS. The solid block cannot be disassembled.

Table 1: elements Standard Kit (Annex A3 - A5)

standard kit					
		thickness			
elements	dimensions	inner leaf	concrete core	outer leaf	wall
	Ixhxt	[mm]	[mm]	[mm]	[mm]
MC main wall blocks					
ML lintel blocks					
MC/ML 50	1250x300x250	50	150	50	250
MC/ML 100	1250x300x300	50	150	100	300
MC/ML 150	1250x300x350	50	150	150	350
MC/ML 200	1250x300x400	50	150	200	400
MP ceiling block					
MP 50	1250x300x250	-	115+45	45	250
MP 100	1250x300x300	_	115+45	95	300
MP 150	1250x300x350	-	115+45	145	350
MP 200	1250x300x400	-	115+45	195	400

The finished wall, being built with the standard kit, may be 250, 300, 350 or 400mm thick, while the thickness of the concrete core remains at 150 mm. One shuttering leaf is 50 mm, the thickness of the second shuttering leaf determines the final wall thickness. It can be 50, 100, 150 or 200 mm thick. Each Block is 300 mm high and 1250 mm long.

Lintel Blocks and Ceiling Support Blocks are part of the BEWI Standard Shuttering kit, both types of elements are 300 mm high and 1250 mm long.

The dimensions of the ceiling support block differ from the main block allowing for a continuous transition of reinforcement and concrete into the slab.

The shuttering leaf surface facing the concrete is structured by 20 mm wide grooves forming a dovetail joint. The dovetails are centred at 50 mm, three in a row. At 250 mm centres the internal walls are placed (see Annex A3).

Wall junctions and corners are executed with butt joints, an according sketch is shown in figures 1 and 2, Annex B1. At the intersection of the walls, in each layer the shutter leaf gets removed along the length of the concrete core of the perpendicular wall. Hence allowing for unobstructed concrete flow.

The concrete infill structural pattern of the standard kit resembles a grid.

#### 1.2.2 PLUS kit

The blocks of the PLUS kit (Annex A8 and A9) comprise of the two EPS shuttering leaves being connected by plastic spacers according to annex A1. The spacers are moulded from high density plastic (polyethylene, HDPE spacer). When moulding the PLUS Blocks spacer are already put in place. PLUS blocks are not assembled on site.



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Each shuttering leaf is one-layered, the minimum thickness is 50mm. The second shuttering leaf can be 50, 150, or 250 mm thick. The concrete core is always 150 mm thick, creating walls with an overall thickness of 250, 350 or 450 m.

Each PLUS Block is 300 mm high. There are straight Main Wall Blocks with a length of 1000 mm and Corner Wall Blocks PLUS with edge lengths of 800/900/1000 mm and 400/500/600 mm. The Corner Blocks are available as left and right corner.

Wall junctions are executed with butt joints (see figures 1 and 2 in Annex B1). In each layer the shutter leaf gets removed at the joint allowing for unobstructed concrete flow.

The shuttering leaf surface facing the concrete is structured by 20 mm wide grooves forming a dovetail joint. The dovetails are centred at 50 mm, three in a row. At 200 mm centres the HDPE -spacers are placed, at the spacer location there are no groves (see Annex A8 and A9).

Steel reinforcement can be fixed directly to the HDPE spacer web.

The concrete infill structural pattern of the PLUS kit resembles a continuous wall.

Table 2: elements PLUS Kit (Annex A8 and A9)

PLUS kit					
			thickn	ess	
elements	dimensions	inner leaf	concrete core	outer leaf	wall
	lxhxt[mm]	[mm]	[mm]	[mm]	[mm]
MC PLUS		main wall b	lock PLUS		
MC 50 PLUS	1000x300x250	50	150	50	250
MC 150 PLUS	1000x300x350	50	150	150	350
MC 250 PLUS	1000x300x450	50	150	250	450
MC PLUS K corner wall block PLUS					
MC 50 PLUS K	800x300x400	50	150	50	250
MC 150 PLUS K	900x300x500	50	150	150	350
MC 250 PLUS K	1000x300x600	50	150	250	450

#### 1.3 Accessory parts

### 1.3.1 BEWI Plugs, Types OB and OH (Annex A6)

The BEWI Plugs are to be used with the Standard Blocks extending the internal walls to block height, creating an internal barrier for the concrete flow.

#### 1.3.2 BEWI Insert Element OC (Annex A7)

The BEWI Insert Elements are used with Standard Blocks and PLUS Blocks for closing off the cross section full height. It is used for building corners or large-scale openings like doors or windows.

### 1.3.3 BEWI Additional Element BEWI PLUS (Annex A7)

The additional element is used for MC 250 PLUS walls, since there are no specific lintel or ceiling support blocks. The additional Element BEWI PLUS is used for extending the external leaf of the ML 200 or MP 200 block.



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#### 1.4 EPS Material

For the shuttering leaves, expanded polystyrene products according to EN 13163:2012 + A2:2016 with a declared value for the thermal conductivity of  $\lambda_D$  = 0,031 W/(m·K) and the following designation code is used:

EPS-EN 13163-L(2)-W(2)-T(1)-CS(10)150-BS250-TR280

## 2 Specification of the intended use in accordance with the applicable European Assessment Document

The kit is intended to be used for the construction of internal walls as well as external walls above or below ground which are load-bearing (structural) or non load-bearing (non structural), including those which are subjected to fire regulations.

When using this type of construction below ground a waterproofing according to applicable national rules shall be provided depending on whether non pressing water or pressing water is to be dealt with. The waterproofing shall be protected from mechanical damage by an impact resistant protective layer.

According to EOTA TR 034 the following use categories apply:

- Category IA 3: Product with no contact to indoor air.

The performance given in Section 3 are only valid if the shuttering elements are used in compliance with the specifications and conditions given in Annex A1.

The verification and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the shuttering kit of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right 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 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance	
Resulting structural pattern		
Standard Block	Grid type according to EAD 340309-00-0305, chapter 1.3.3	
PLUS Block	Continuous type according to EAD 340309-00-0305, chapter 1.3.3	
Efficiency of filling	see Annex B1	
Possibility of steel reinforcement	see Annex B1	



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

Essential characteristic	Performance		
Reaction to fire			
EPS Blocks	Class E according to EN 13501-1:2018		
	With a density of 29 kg/m³ ± 15 % (25-33 kg/m³)		
HDPE-spacer	No performance accessed		
Influence of the shuttering kit on the fire resistance			
Standard Block	R30 according to EAD 340309-00-0305,		
(grid type)	Annex A Table A2		
PLUS Block	REI120 according to EAD 340309-00-0305,		
(continuous type)	Annex A Table A1		

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

Essential characteristic	Performance		
Content, emission and/or release of dangerous substances			
Substances, classified as Carc. 1A/1B <sup>a)</sup>			
Substances, classified as Muta. 1A/1B <sup>a)</sup>	None of these raw materials are actively used in the manufacture of the construction product. <sup>b) c)</sup>		
Substances, classified as Acute Tox. 1, 2, 3; Repr. 1A/1B; STOT SE 1 and STOT RE 1 a)	manaractare of the concuraction product.		
Use scenarios regarding BWR 3:			
IA 3	Declared release scenario		
S/W2; S/W3	No performance accessed		
Water vapour permeability of the EPS leaves	μ = 70-120 according to EN 12086:2013		
Water absorption of the EPS leaves	<4 % according to EN ISO 16535:2019		
Water tightness	No performance accessed		
	(finishes are not part of the shuttering kit)		

a) In accordance with Regulation (EC) No 1272/2008
b) Active use is the targeted use of substances to achieve specific product properties. Substances that are present as impurities and/or as a secondary component in the product are therefore not to be regarded as "actively used".

c) Assessment based on the detailed manufacturers' statements on dangerous substances.



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

Essential characteristic	Performance	
Bond strength	see Annex B2	
Standard Block	> 450 kPa according to EN 1607:2013	
PLUS Block	> 420 kPa according to EN 1607:2013	
Resistance to impact load	no performance assessed	
Resistance to filling pressure	see Annex B2	
Safety to personal injuries	The shuttering elements do not have sharp or cutting edges. Due to the soft surfaces of the shuttering leaves, there is no risk of abrasion or of cutting to people.	

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

Essential characteristic	Performance
Airborne sound insulation	no performance assessed
Sound absorption	no performance assessed

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

Essential characteristic	Performance
Thermal resistance of the wall (EPS shuttering elements filled with concrete)	See table 1 in Annex B3
Thermal inertia	no performance assessed

#### 3.7 Aspects of durability

Built-in finishes are not part of the assessed shuttering kit.

Essential characteristic	Performance
Resistance to deterioration	no performance assessed

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

In accordance with EAD No. 340309-00-0305, the applicable European legal act is Decision 98/279/EC as amended by Commission Decision 2001/596/EC of 8 January 2001.

The system to be applied is: 2+



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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 4 December 2023 by Deutsches Institut für Bautechnik

Dr.-Ing. Lars Eckfeldt beglaubigt:
Head of Section Groth



#### Installation / manufacturer's instructions

#### General

The manufacturer shall ensure that the installation guide is known to those involved in planning and execution. The installation guide is deposited at DIBt and shall be present at every construction site.

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

In end use conditions concrete walls of grid type<sup>1</sup> (Standard kit) and continuous type<sup>1</sup> (PLUS kit) 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.

#### Reworking and finishes

Walls of the type "BEWI" are to be protected by finishes. Finishes are not part of the kit and therefore not considered in this ETA.

Preferably for external surfaces the used rendering systems should meet the requirements of EAD 040083-00-0404. Execution of the rendering shall be performed according to applicable national rules.

### Fixing of objects

Fixing of objects in the shuttering leaves is not possible, the part of fixings which is significant for the mechanical resistance shall be in the concrete. The influence of the fixing to the reduction of the thermal resistance has to be considered according to EN ISO 6946:2018.

1 see EAD 340309-00-0305 chapter 1.3.3	
BEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"	
Installation	Annex A1
mstanation	
Z43800.23	8.03.05-16/22

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## Standards and guidelines

standard guideline		issue	title
EN	1992-1-1	2011-01 +A1:2015-03	Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings;
EN	13163	2012 + A2:2016	Thermal insulation products for buildings – Factory made expanded polystyrene (EPS) products – Specification
EN	206	2013 + A1:2016	Concrete – specification, performance, production and conformity
EN	13501-1:	2018	Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests
EN	12086	2013	Thermal insulating products for building applications - Determination of water vapour transmission properties
EN ISO	16535	2019	Thermal insulating products for building applications - Determination of long-term water absorption by immersion
EN ISO	6946	2018-03	Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods

BEWI IFC SystemBEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

List of standards and guidelines used

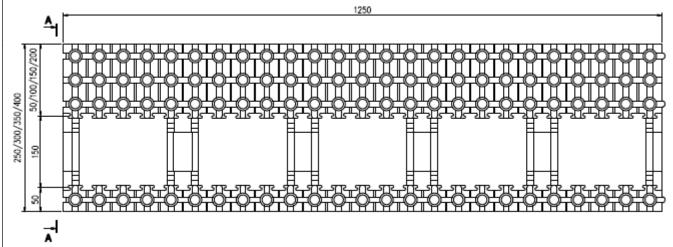
Annex A2

Z43800.23 8.03.05-16/22

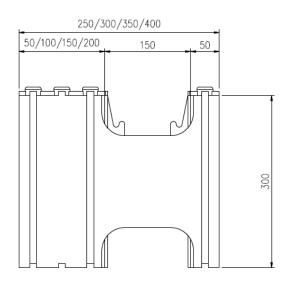


## BEWI main wall block - MC50 / 100 / 150 / 200

#### Plan view



Cross Section A-A



elements	dimensions	outer leaf
	lxhxt[mm]	t [mm]
MC 50	1250x300x250	50
MC 100	1250x300x300	100
MC 150	1250x300x350	150
MC 200	1250x300x400	200

Thickness inner leaf t = 50mm concrete core t = 150mm

Sketches not to scale All dimensions in [mm]

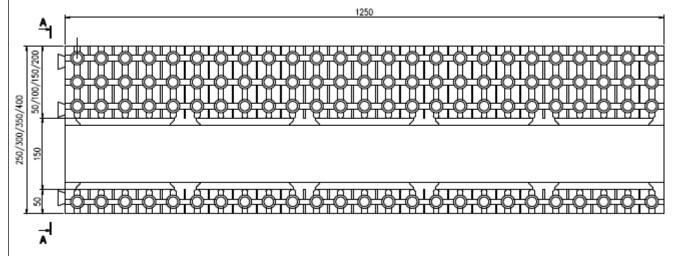
BEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

BEWI standard kit - main wall block – type MC t = 250/300/350/400mm

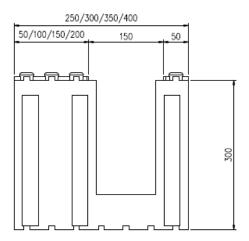


## BEWI lintel block - ML50 / 100 / 150 / 200

#### Plan view



#### Cross Section A-A

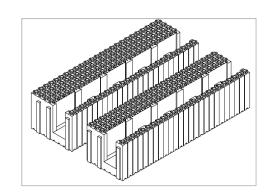


elements	dimensions	outer leaf
	l x h x t [mm]	t [mm]
ML 50	1250x300x250	50
ML 100	1250x300x300	100
ML 150	1250x300x350	150
ML 200	1250x300x400	200

Thickness

inner leaf t = 50mm

concrete core t = 150mm



Sketches not to scale All dimensions in [mm]

BEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

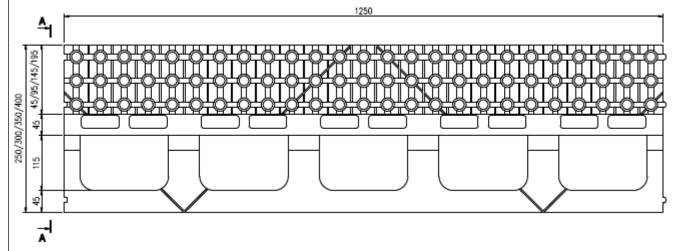
BEWI standard kit - lintel block - type ML

t = 250/300/350/400mm

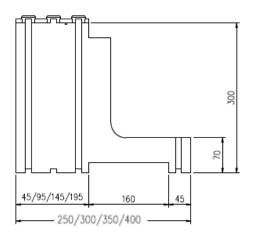


## BEWI ceiling support block - MP 50 / 100 / 150 / 200

Plan view



Cross Section A-A



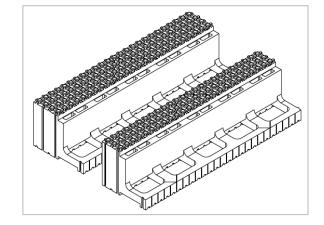
elements	dimensions	outer leaf
	lxhxt[mm]	t [mm]
MP 50	1250x300x250	45
MP 100	1250x300x300	95
MP 150	1250x300x350	145
MP 200	1250x300x400	195

Constant dimensions

inner leaf t = 45 mm

h = 70mm

concrete core t = 115 + 45 mm



Sketches not to scale All dimensions in [mm]

BEWI IFC SystemBEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

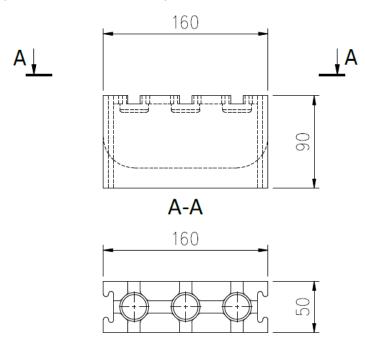
BEWI standard kit - ceiling support block - type MP

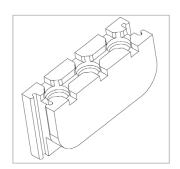
t = 250/300/350/400mm



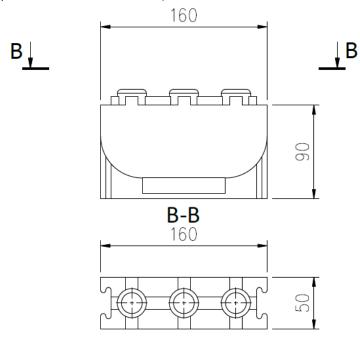
## BEWI plugs OB and OH

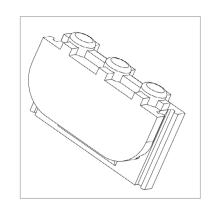
Type OB – cross section and plan view





Type OH - cross section and plan view



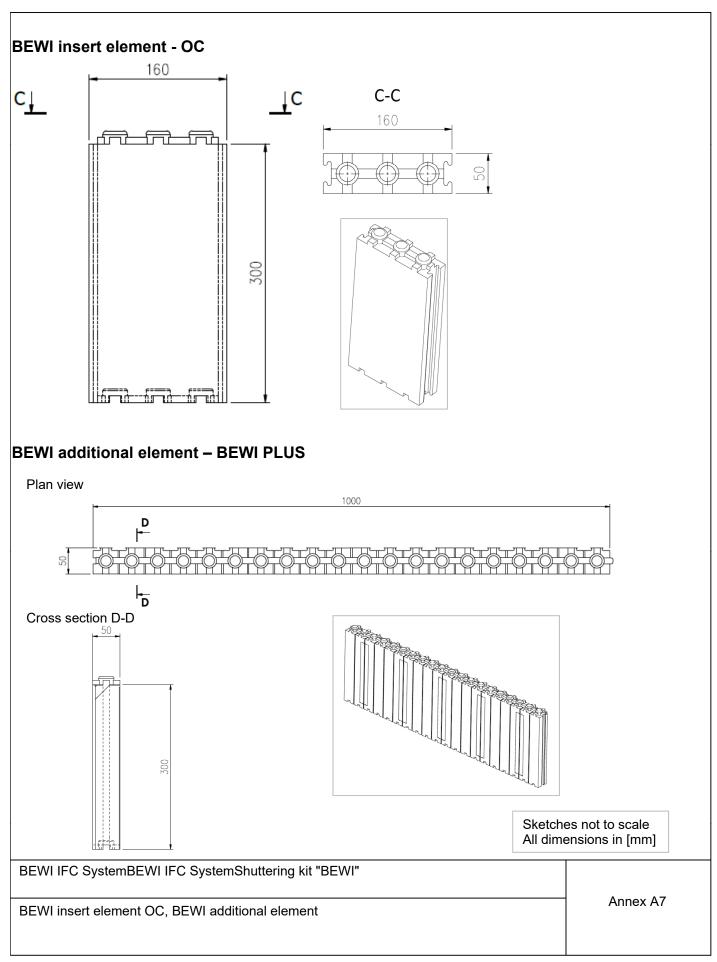


Sketches not to scale All dimensions in [mm]

BEWI IFC SystemBEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

BEWI plug – types OB, OH I/h/t = 160/90/50mm

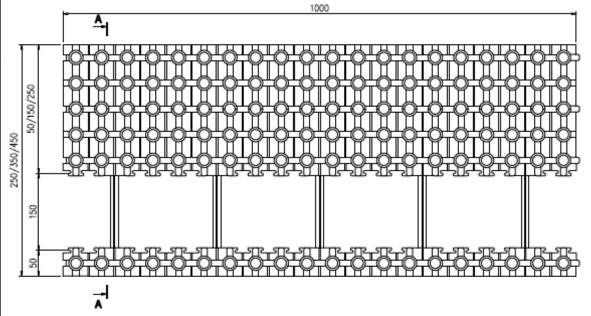




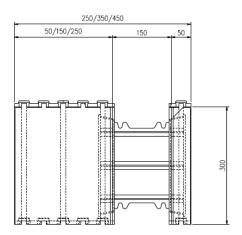


## BEWI main wall block PLUS - MC \_\_ Plus



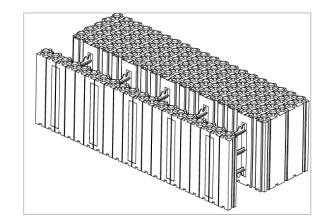


#### Cross Section A-A



elements	dimensions	outer leaf
	l x h x t [mm]	t [mm]
MC 50 PLUS	1000x300x250	50
MC 150 PLUS	1000x300x350	150
MC 250 PLUS	1000x300x450	250

Thickness inner leaf t = 50 mmt = 150mm concrete core



Sketches not to scale All dimensions in [mm]

BEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

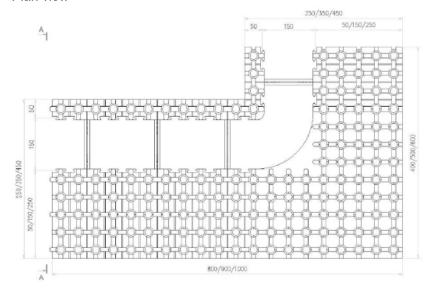
BEWI PLUS kit - main wall block PLUS - MC \_\_ Plus

t = 250/350/450mm

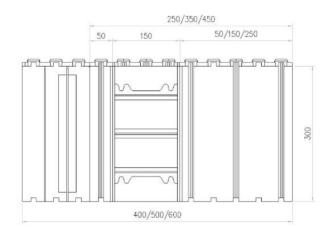


## BEWI corner wall block PLUS (left and right) – MC \_\_ Plus K

#### Plan view

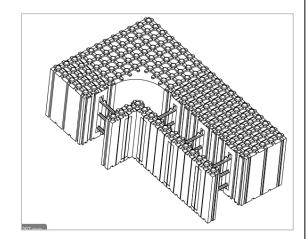


### Cross Section A-A



elements	dimensions	outer leaf	
	l x h x t [mm]	t [mm]	
MC 50 PLUS K	800x300x400	50	
MC 150 PLUS K	900x300x500	150	
MC 250 PLUS K	1000x300x600	250	

Thickness inner leaf t = 50 mm concrete core t = 150 mm



Sketches not to scale All dimensions in [mm]

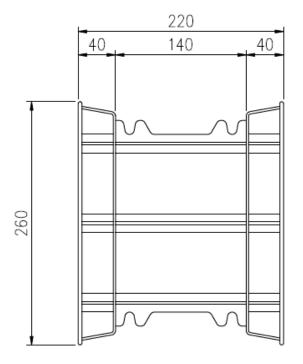
BEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

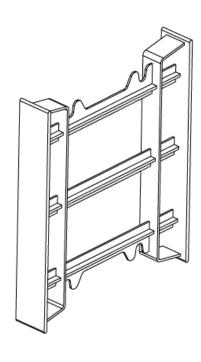
BEWI PLUS kit - corner wall block PLUS - MC  $\_$  Plus K t = 250/350/450mm

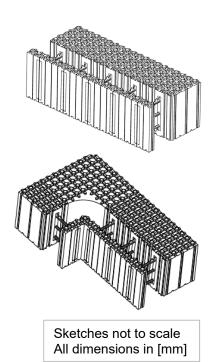


## Spacer for BEWI PLUS kit

# Plastic tie of BEWI main wall PLUS and corner wall block PLUS







BEWI IFC SystemBEWI IFC SystemShuttering kit "BEWI"

BEWI PLUS kit - PP tie / spacer

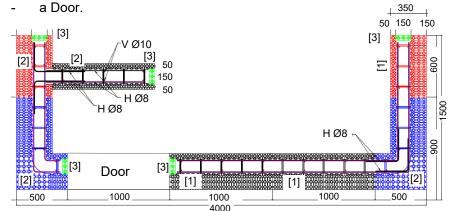
Annex 10



#### Description to BWR 1

A trial structure according to EAD 340309-00-0305, section 2.2.2 was erected. This structure comprised both element types: Standard blocks and PLUS blocks. The used elements are part of the 150-series. The structure incorporated reinforcement and following specifics:

- Corners
- T-junction of walls
- a Window and



V Ø10 - Ø10mm vertical reinforcement bars

H Ø8 - Ø8mm horizontal reinforcement bars

- 1 Standard blocks
- 2 PLUS blocks
- 3 OC element

Figure 1: sketch Layer 1 of trial structure, sketch

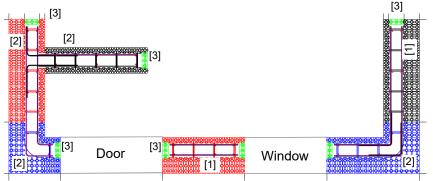


Figure 2: sketch Layer 4 of trial structure, sketch

All dimensions in mm Sketches not to scale

The concrete used is EN 206-C16/20-XC1(LT)-Cl0,40-Dmax16, S3. A maximum of 4 layers of elements were filled with concrete in one step.

For placing reinforcement national rules and guidelines shall prevail.

The following conclusions can be drawn:

## Efficiency of filling

Considering the instructions of Annex A1 and the installation guide of the ETA holder the tight and complete filling of the shuttering wall and an appropriate setting and hardening of the concrete is possible.

#### Possibility of steel reinforcement

The instructions in the installation guide of the ETA holder are appropriate to install steel reinforcement for walls according to EN 1992-1-1 or corresponding national rules

Shuttering kit "BEWI"	
Description of Performance to BWR 1	Annex B1

Z85257.23 8.03.05-16/22



#### Description to BWR 4

#### **Bond Strength**

The shuttering leaves are single layered, hence the is no determination of the bond strength between shuttering leaves.

The EPS shuttering leaf is bonded to the concrete by mechanical interlocking of the T guides [figure 2.2.10.2.1 (b) in EAD 340309-00-0305, chapter 2.2.10.2]. The T-guides run vertically, full height on the inner surfaces of the leaf at 5 cm centres.  $\sigma_{mt}$  cls is determined by calculation, using  $\sigma_{mt}$ .

 $\sigma_{mt, csl} = . \sigma_{mt} * A_{ml} / A$   $\sigma_{mt} = 280 \text{ kPa}$  (determined by testing according to EN 1607)

Standard Block (figure 3)  $\sigma_{mt, csl} > 450$  kPa according to EN 1607 PLUS Block (figure 4)  $\sigma_{mt, csl} > 420$  kPa according to EN 1607

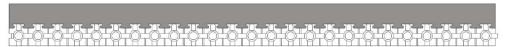


Figure 3: sketch bond Standard Block leaf and concrete

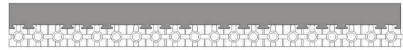


Figure 4: sketch bond PLUS Block leaf and concrete

#### Resistance to filling pressure

The Standard Blocks resist a concrete pressure of  $p_{\text{max}} = 0.023$  MPa The PLUS Blocks resist a concrete pressure of  $p_{\text{max}} = 0.028$  MPa

BEWI IFC System Shuttering kit "BEWI"	
Description of Performance to BWR 4	Annex B2

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### Description to BWR 6

The values in Table 1 are determined for the wall, consisting of EPS shuttering elements filled with concrete.

Table 1: Thermal resistance R<sub>D</sub> in m<sup>2</sup>K/W according to EN ISO 6946/ EN ISO 10211\*)

System / eleme	nt	R <sub>D</sub> in m²K / W For a thickness of the outer leaf [mm] of / [resulting wall thickness in mm]				
Standard kit		50 / [250] 100 / [300] 150 / [350] 200 / [400]				
	MC	3,193	4,700	6,240	7,741	
	ML	3,335	4,864	6,409	7,912	
	MP	1,515**)	3,030**)	4,545**)	6,060**)	
PLUS kit		50 / [250]		150 / [350		250 / [450]
MC _	_ Plus (K)	3,090		6,121		9,151
Additional Elements						
Additional elements, insert elements, plugs $R_D = 1,151 \text{ m}^2\text{K} / \text{W}$						

<sup>\*)</sup> The thermal resistance has been determined by using a value of  $\lambda_D$  = 0.033 W/(m· K) for the thermal conductivity of the EPS layers and  $\lambda_D$  = 2.5 W/(m· K) for the concrete infill. Surface resistances  $R_{\rm si}$  and  $R_{\rm se}$  according to EN ISO 6946, chapter 6.7.1.2 are not considered.

BEWI IFC SystemShuttering kit "BEWI"	
Description of Performance to BWR 6	Annex B3

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<sup>\*\*)</sup> declared value for the outer leave, resistance of the slab is omitted