



European Technical Approval ETA-10/0143

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	MAGU WS, MAGU ICF, MAGU Isocoffrage
Zulassungsinhaber <i>Holder of approval</i>	MAGU Bausysteme GmbH Im Dreiangel 2 78183 Hüfingen DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck <i>Generic type and use of construction product</i>	Nicht lasttragendes verlorenes Schalungssystem "MAGU WS" bestehend aus EPS-Schalungselementen <i>Non-load bearing permanent shuttering kit "MAGU WS" based on shuttering elements of EPS</i>
Geltungsdauer: <i>Validity:</i>	vom <i>from</i> bis <i>to</i> 8 May 2013 8 May 2018
Herstellwerk <i>Manufacturing plant</i>	MAGU Bausysteme GmbH Im Dreiangel 2 78183 Hüfingen DEUTSCHLAND

Diese Zulassung umfasst
This Approval contains

30 Seiten einschließlich 7 Anhänge
30 pages including 7 annexes

Diese Zulassung ersetzt
This Approval replaces

ETA-10/0143 mit Geltungsdauer vom 03.09.2010 bis 03.09.2015
ETA-10/0143 with validity from 03.09.2010 to 03.09.2015

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998⁴, as amended by Article 2 of the law of 8 November 2011⁵;*
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶;
 - Guideline for European technical approval of "Nonload-bearing permanent shuttering systems based on hollow blocks or panels of insulating materials and sometimes concrete", ETAG 009.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
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- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

¹ Official Journal of the European Communities L 40, 11 February 1989, p. 12
² Official Journal of the European Communities L 220, 30 August 1993, p. 1
³ Official Journal of the European Union L 284, 31 October 2003, p. 25
⁴ *Bundesgesetzblatt Teil I 1998*, p. 812
⁵ *Bundesgesetzblatt Teil I 2011*, p. 2178
⁶ Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the construction product

1.1 Definition of the construction product

1.1.1 General

The shuttering system "MAGU WS" (for all German-speaking countries, "MAGU ICF" in English speaking countries and "MAGU Isocoffrage" in French-speaking countries, henceforth referred to as "MAGU WS") is a non load-bearing permanent shuttering kit based on standard shuttering elements (see Annex 1), special elements (see Annex 2) and accessory parts (see Annex 3) applicable as formwork for plain and reinforced concrete walls cast in-situ.

The shuttering elements (see Annex 1) consist of shuttering leaves of expanded polystyrene (EPS shuttering leaves) and spacers of polypropylene (PP spacers).

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

Finishes are not part of the shuttering system "MAGU WS".

1.1.2 Standard shuttering elements

The standard shuttering elements (see Annex 1) consist of inner and outer shuttering leaves of expanded polystyrene (EPS shuttering leaves) and spacers of polypropylene (PP spacers). These components are assembled on site.

The EPS shuttering leaves are one-layered and the PP spacers provide thicknesses of the concrete core of 140 mm, 160 mm, 190 mm and 240 mm and thicknesses of the wall in the range of 250 mm to 500 mm, as indicated in Table 1. The thickness of the inner EPS shuttering leaf is 55 mm and the thickness of the outer EPS shuttering leaf is in the range of 55 mm, 105 mm, 155 mm, 205 mm, 255 mm and 305 mm. Standard shuttering elements with the same thickness (55 mm) of the inner and outer shuttering leaf are also used for internal walls. The length of all standard shuttering elements is 1200 mm and the height is 300 mm.

The following types of standard shuttering elements are available:

Table 1: Wall thicknesses of the standard shuttering elements according to Annex 1

Type	Thickness of the wall	Thickness of concrete core	Thickness of EPS shuttering leaves	
			inner	outer
	[mm]	[mm]	[mm]	[mm]
WS 25/14-30-120	250	140	55	55
WS 30/14-30-120	300	140	55	105
WS 35/14-30-120	350	140	55	155
WS 40/14-30-120	400	140	55	205
WS 45/14-30-120	450	140	55	255
WS 50/14-30-120	500	140	55	305
WS 27/16-30-120	270	160	55	55
WS 32/16-30-120	320	160	55	105
WS 37/16-30-120	370	160	55	155
WS 42/16-30-120	420	160	55	205
WS 30/19-30-120	300	190	55	55
WS 35/19-30-120	350	190	55	105
WS 40/19-30-120	400	190	55	155
WS 45/19-30-120	450	190	55	205
WS 35/24-30-120	350	240	55	55
WS 40/24-30-120	400	240	55	105
WS 45/24-30-120	450	240	55	155
WS 50/24-30-120	500	240	55	205

The top and the bottom of each EPS shuttering leaf incorporate an interlocking arrangement to form a tight joint (see Annexes 1 to 3).

T-slots, at 200 mm centres, are also incorporated in the top and bottom of the EPS shuttering leaves to receive the PP spacers.

The surfaces are generally smooth. There are also tapered vertical grooves on the inside face of each EPS shuttering leaf. These element-high dovetail grooves on the inside face provide a mechanical interlock between EPS shuttering leaves and concrete core (see clause 2.2.5.1) and additionally form locks for end stops, lintel bottom leaves and parapet leaves..

The vertical ends of the EPS shuttering leaves form a tight joint. Sealing foam is used to seal these vertical joints, where required, and to fill in gaps caused by inaccuracy of foundation level to between any of the formed joints.

The standard shuttering elements are dry laid in staggered vertical joints (masonry bond).

The formwork requires alignment and support during concrete placing (see Annex 6).

The system can be used to construct straight walls.

The standard shuttering elements are interlocked and built up horizontally and vertically into a tight and rigid formwork. The wall is formed by filling of the standard shuttering elements with concrete. The formwork is used in conjunction with concrete class C16/20 (according to EN 206-1) to build plain concrete walls or in conjunction with concrete of classes in the range from C20/25 to C50/60 (according to EN 206-1) to build reinforced concrete walls.

1.1.3 Special elements

Special elements (see Annex 2) are also part of the shuttering system. Special elements are designed in the same manner as the standard shuttering elements described above, see clause 1.1.2.

1.1.3.1 Floor edge elements (Annex 2)

The floor edge elements form a frame to avoid overflow of concrete while concreting ceilings.

Floor edge elements consist of precasted (factory-made) shuttering elements of an outer EPS shuttering leaf and PP spacers. The PP spacers of the floor edge elements are integrated on site into the T-slots on the top of the inner and outer EPS shuttering leaves.

1.1.3.2 Roller shutter box elements (Annex 2)

Roller shutter box elements are used to protect the roller assembly.

The roller shutter box elements require support during concrete placing. The supports may only be removed when the concrete core has sufficiently hardened

1.1.4 Accessory parts

Accessory parts (see Annex 3) are also part of the shuttering system.

1.1.4.1 End stops (Annex 3.1)

End stops are used to lock walls at the lateral end between the inner and outer EPS shuttering leaves.

1.1.4.2 Lintel bottom leaves (Annex 3.1)

Lintel bottom leaves are used to lock walls at the lower end between the EPS shuttering leaves.

The lintel bottom leaves requires support during concrete placing. The supports may only be removed when the concrete core has sufficiently hardened

1.1.4.3 Parapet leaves (Annex 3.1)

Parapet leaves are used as insulation on top of the EPS shuttering leaves.

1.1.4.4 Height adjuster pieces (Annex 3.2)

Height adjuster pieces are used to adjust height differences up to 50 mm between the EPS shuttering leaves.

1.1.4.5 Corner leaves (Annex 3.2)

Corner leaves are used to lock the outer EPS shuttering leaves at wall corners.

1.2 Intended use

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 2: Product with no direct contact to (e. g. covered products) but possible impact on indoor air.
- Category S/W 3: Product with no contact to and no impact on soil water, ground- and surface water.

The provisions made in this European technical approval are based on an assumed working life of the shuttering kit of at least 50 years, provided that the conditions laid down in clauses 4.2, 5.1 and 5.2 for the packaging, transport, storage, installation, use, maintenance and repair are met. 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.

For the intended use it is essential to protect this type of construction against effects of weather.

2 Characteristics of product and methods of verification

2.1 Characteristics of product

2.1.1 General

The shuttering kit "MAGU WS" consists of the following elements:

- standard shuttering elements,
- special elements and
- accessory parts.

see clauses 2.1.2, 2.1.3 and 2.1.4.

2.1.2 Standard shuttering elements

The standard shuttering elements (composed of EPS shuttering leaves and PP spacers) correspond to the information and drawings given in Annex 1.

The EPS shuttering leaves are made of expanded polystyrene (EPS) EPS-EN 13163-T2-L2-W2-S2-P4-DS(70,-)3-BS250-CS(10)150-DS(N)5-DLT(2)5-TR150 according to EN 13163 composed of polystyrene particle foam with graphite.

The density ρ of the expanded polystyrene is at least 25 kg/m³ and at most 30 kg/m³.

The design value of thermal conductivity of the expanded polystyrene is 0,032 W/(m×K).

The spacers are moulded of plastic (polypropylene PP).

The density ρ of the spacers of polypropylene (PP spacers) is 1,39 kg/cm³.

The tensile strength of the PP spacers shall be at least 1900 MPa. The pull-out strength between the PP spacers and the EPS shuttering leaves shall be at least 470 N.

The material characteristics, dimensions and tolerances of the standard shuttering elements not indicated in Annex 1 are given in the technical documentation⁷ of the ETA.

2.1.3 Special elements

The special elements correspond to the information and drawings given in Annex 2. The special shuttering elements are:

- floor edge elements and
- roller shutter box elements.

Special elements are designed in the same manner as the standard shuttering elements described above, see clause 1.1.2.

The special elements consist of EPS and PP spacers, it is the same material used for standard shuttering elements specified in clause 2.1.2.

2.1.4 Accessory parts

The accessory parts correspond to the information and drawings given in Annex 3. The accessory parts are:

- end stops,
- lintel bottom leaves,
- parapet leaves,
- height adjuster pieces and
- corner leaves.

The accessory parts consist of EPS, it is the same material used for standard shuttering elements specified in clause 2.1.2.

2.2 Methods of verification

2.2.1 General

The assessment of the fitness of the shuttering system for the intended use has been made in compliance with ETAG 009, Guideline for European technical approval of "Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete", edition June 2002.

The ETA is issued for the shuttering kit "MAGU WS" on the basis of agreed information, deposited with Deutsches Institut für Bautechnik, which identifies the shuttering kit that has been assessed and evaluated. Changes to the production process, the kit or the components which could result in this deposited information being incorrect, shall be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA, and, if so, whether further assessment and/or alterations to the ETA shall be necessary.

2.2.2 Essential Requirement 1: Mechanical resistance and stability

2.2.2.1 Resulting structural pattern

In end use conditions walls made with shuttering elements "MAGU WS" are walls of a continuous type according to ETAG 009, clause 2.2.

⁷ The technical documentation of the ETA is deposited with Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

2.2.2.2 Efficiency of filling

Considering the instructions of clause 4.2 and the installation guide of the manufacturer an efficient filling without bursting of the shuttering and without voids or any uncovered reinforcement in the concrete core is possible.

The requirements according to ETAG 009, clause 6.1.2 are met.

2.2.2.3 Possibility of steel reinforcement

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

The requirements according to ETAG 009, clause 6.1.3 are met.

2.2.3 Essential Requirement 2: Safety in case of fire

2.2.3.1 Reaction to fire⁸

Shuttering elements "MAGU WS" made of expanded polystyrene (EPS) fulfil the requirement of Class F according to EN 13501-1.

2.2.3.2 Resistance to fire

The walls will be exposed to fire on one site only.

According to ETAG 009, Annex C, Table 1, for a continuous type of load-bearing walls ("REI") or non load-bearing walls ("EI") and a minimum concrete strength of C16/20, the system meets the criteria "REI" and "EI" according to Table 2.

Table 2: Determination of "REI" of load-bearing walls and "EI" of non load-bearing walls

Minimum thickness of concrete core [mm]	"REI"	"EI"
140	90	120
160	120	120
190	120	120
240	120	120

The preconditions for this classification are:

- The design of the building has to take into consideration the secondary effects of fire. Especially constraints, introduced by thermal strain, should be sufficiently low and appropriate building joints should be foreseen. The rules, valid in place of use, govern. Structural requirements on work in normal conditions, valid in the place of use, may require larger dimensions. Concrete cover for the reinforcement has to be observed according to the rules valid in the place of use.
- A normal weight concrete as defined in EN 206-1 or EN 1992-1-1 shall be used. As far as European standards EN 206-1 or EN 1992-1-1 are not in force, an equivalent concrete according to national rules, valid in the place of use, is acceptable. The strength class of concrete shall be between C16/20 and C50/60 according to EN 206-1. In lack of availability of European standard EN 206-1, alternatively a concrete according to national rules, valid in the place of use, with a compressive strength which fits in the interval given above, is also considered as appropriate.

⁸ A European reference fire scenario for facades has not been laid down. In some Member States the classification of permanent shuttering systems according to EN 13501-1 might not be sufficient for the use in facades. An additional assessment of permanent shuttering systems according to national provisions (e.g. on the basis of a large scale test) might necessary to comply with Member States regulations, until the existing European classification system has been completed.

Note: The classification of walls constructed with the shuttering system "MAGU WS" regarding to fire resistance are valid only for walls without openings (for windows or doors for examples).

2.2.4 Essential Requirement 3: Hygiene, health and environment

2.2.4.1 Content and/or release of dangerous substances

The chemical composition of the shuttering system/kit must comply with the data deposited with Deutsches Institut für Bautechnik.⁹

Due to the chemical composition of the shuttering system "MAGU WS", the product does not contain dangerous substances according to Council Directive 67/548/EEC, Regulation (EC) No 1272/2008 and/or the "Indicative list on dangerous substances" of the EGDS (expert group on dangerous substances of the European Commission) with the exception of hexabromocyclododecane (HBCDD) and dicumyl peroxide.

The content of HBCDD is < 1 % by weight.

The content of dicumyl peroxide is < 1 % by weight.

Note: For dangerous substances falling under the scope of the CPD for which:

- no assessment and verification methods are given in this ETA,

or

- the "No performance determined" option is declared,

or

- the chosen verification and assessment method does not comply with the regulatory requirement of a particular Member State,

there might be the necessity for an additional assessment at national level.

2.2.4.2 Water vapour permeability

The tabulated design value of the water vapour resistance factor of expanded polystyrene (EPS), according to EN ISO 10456 is $\mu = 60$.

The values of the water vapour resistance factor of concrete depending on type and density are tabulated in EN ISO 10456.

Using these values the verification of the annual moisture balance or the maximum amount of interstitial condensation according to EN ISO 13788 will be on the safe side.

2.2.4.3 Water absorption

The requirements according to ETAG 009, clause 6.3.3 are met.

2.2.4.4 Watertightness

Because finishes are not part of the shuttering system "MAGU WS" the "No performance determined" option in ETAG 009, Table 3 is used.

2.2.5 Essential Requirement 4: Safety in use

2.2.5.1 Bond strength between EPS shuttering leaves and concrete core and resistance to impact load

Under end use conditions the EPS shuttering leaves are durable fixed by PP spacers. The bond strength is at least equal to the resistance of the EPS shuttering leaves against the pressure of fresh concrete, see clause 2.2.5.2, furthermore the vertical element-high dovetail grooves on the inside face of each EPS shuttering leaf provide a mechanical interlock between EPS shuttering leaves and concrete core.

⁹

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, 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 Directive, these requirements need also to be complied with, when and where they apply.

Concrete walls (without consideration of the finishes), constructed with shuttering system "MAGU WS" and designed according EN 1992-1-1 respectively in lack of availability of EN 1992-1-1 according national design rules, lead to the assumption that concrete core insures an adequate resistance of the complete wall under normal used impact loads.

The requirements according to ETAG 009, clause 6.4.1 are met.

2.2.5.2 Resistance to pressure of fresh concrete

To resist the pressure of fresh concrete the bending tensile strength of the EPS shuttering leaves shall be at least 250 kPa, see designation code "BS250" of EPS in clause 2.1.2.

The tensile strength of the PP spacers shall be at least 1900 MPa. The pull-out strength between the PP spacers and the EPS shuttering leaves shall be at least 470 N.

The requirements according to ETAG 009, clause 6.4.2 are met.

2.2.5.3 Safety against personal injury by contact

Delivered on site the shuttering elements do not have sharp or cutting edges.

Because of the soft surface of the EPS shuttering leaves there is no risk of abrasion or of cutting people.

The requirements according to ETAG 009, clause 6.4.3 are met.

2.2.6 Essential Requirement 5: Protection against noise

2.2.6.1 Airborne sound insulation

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

2.2.6.2 Sound absorption

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

2.2.7 Essential Requirement 6: Energy economy and heat retention

2.2.7.1 Thermal resistance

The declared value of thermal resistance $R_{D,element}$ of the shuttering elements in end use conditions (with concrete core without rendering) is the sum of the declared value of thermal resistance of the EPS shuttering leaves $R_{D,EPS}$ and the concrete core $R_{D,concrete}$. The declared value of thermal resistance of the EPS shuttering leaves $R_{D,EPS}$ shall be calculated in accordance with EN ISO 6946 with a design value of thermal conductivity of the EPS shuttering leaves of $\lambda = 0,032 \text{ W}/(\text{m}\times\text{K})$ according to EN 13163, clause 4.2.1. The declared value of thermal resistance of the concrete core $R_{D,concrete}$ shall be calculated in accordance with EN ISO 6946 with a value of thermal conductivity of the concrete core $\lambda = 2,10 \text{ W}/(\text{m}\times\text{K})$ depending on the density ρ tabulated in EN ISO 10456 and without considering the influence of the PP spacers by an reduction factor.

Table 3: Declared value of thermal resistance $R_{D,element}$ of the shuttering elements in end use conditions (with concrete core without rendering) depending on the thickness of the outer EPS shuttering leaves and of the concrete core, without considering the influence of the PP spacers by an reduction factor

Type	Thickness of the wall	Thickness of concrete core	Thickness of EPS shuttering leaves		Value of thermal resistance $R_{D,element}$
			inner	outer	
	[mm]	[mm]	[mm]	[mm]	[(m ² K)/W]
WS 25/14-30-120	250	140	55	55	3,50
WS 30/14-30-120	300	140	55	105	5,06
WS 35/14-30-120	350	140	55	155	6,62
WS 40/14-30-120	400	140	55	205	8,19
WS 45/14-30-120	450	140	55	255	9,75
WS 50/14-30-120	500	140	55	305	11,31
WS 27/16-30-120	270	160	55	55	3,51
WS 32/16-30-120	320	160	55	105	5,07
WS 37/16-30-120	370	160	55	155	6,63
WS 42/16-30-120	420	160	55	205	8,20
WS 30/19-30-120	300	190	55	55	3,52
WS 35/19-30-120	350	190	55	105	5,09
WS 40/19-30-120	400	190	55	155	6,65
WS 45/19-30-120	450	190	55	205	8,21
WS 35/24-30-120	350	240	55	55	3,55
WS 40/24-30-120	400	240	55	105	5,11
WS 45/24-30-120	450	240	55	155	6,67
WS 50/24-30-120	500	240	55	205	8,23

The planner shall consider the metal parts of the system as thermal bridges, where relevant, for determination of the declared value of thermal resistance $R_{D,element}$.

2.2.7.2 Influence of moisture transfer on insulating capacity of the wall

Using the values of clause 2.2.4.2 the verification of the annual moisture balance or the maximum amount of interstitial condensation according to EN ISO 13788 will be on the safe side.

2.2.7.3 Heat capacity

The values of the heat capacity c of concrete and expanded polystyrene are tabulated in EN ISO 10456.

2.2.8 Aspects of durability and serviceability

2.2.8.1 Resistance to deterioration

Physical agent

As given in the designation code "DS(70,-)3" of the EPS (see clause 2.1.2) the relative changes of the EPS shuttering leaves in length, width and thickness under specified temperature and humidity conditions shall not exceed 3 % after exposing them for 48 h at 70 °C, according to EN 13163.

The requirements according to ETAG 009, clause 6.7.1.1 are met.

Chemical agent

Spacers are made of plastic (polypropylene PP). There is no corrosion of the PP spacers in concrete.

The finishes of the wall are not part of the ETA. Determination of the cleaning agent of the surface is not possible.

The requirements according to ETAG 009, clause 6.7.1.2 are met.

Biological agent

The application of EPS as thermal insulation material for decades has shown that it is sufficiently protected 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 shuttering system "MAGU WS" does not contain any biocides.

The requirements according to ETAG 009, clause 6.7.1.3 are met.

2.2.8.2 Resistance to normal use damage

Normal use impacts

Concrete walls (without consideration of the finishes), constructed with shuttering system "MAGU WS" and designed according EN 1992-1-1 respectively in lack of availability of EN 1992-1-1 according national design rules, lead to the assumption that concrete core insures an adequate resistance of the complete wall under normal used impact loads.

The requirements according to ETAG 009, clause 6.7.2.1 are met.

Incorporation of ducts

The instructions in the installation guide of the manufacturer are appropriate to produce horizontal perforations through the walls, which are necessary for passing through ducts, see clause 4.2.4.

The requirements according to ETAG 009, clause 6.7.2.2 are met.

Fixing of objects

Fixing of objects in the EPS shuttering leaves is not possible. The part of fixings which is significant for the mechanical resistance shall be inside the concrete core.

The requirements according to ETAG 009, clause 6.7.2.3 are met.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 98/279/EC of 5 December 1997¹⁰ amended by the Decision 2001/596/EC¹¹ of the European Commission system 2+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

- (a) Tasks for the manufacturer:
 - (1) initial type-testing of the product;
 - (2) factory production control;
 - (3) testing of samples taken at the factory in accordance with a prescribed control plan.
- (b) Tasks for the approved body:
 - (4) certification of factory production control on the basis of:
 - initial inspection of factory and of factory production control;
 - continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Initial type-testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European technical approval may be used unless there are changes to the product, in the production line or plant. In such cases the necessary initial type-testing shall be agreed between Deutsches Institut für Bautechnik and the manufacturer involved.

3.2.1.2 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan of 12 August 2010 which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.¹²

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

¹⁰ Official Journal of the European Communities L 127 of 24 April 1998

¹¹ Official Journal of the European Communities L 209 of 8 January 2001

¹² The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See clause 3.2.2.

3.2.1.3 Other tasks of the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in clause 3.1 in the field of non load-bearing shuttering systems in order to undertake the actions laid down in clause 3.2.2. For this purpose, the control plan referred to in clauses 3.2.1.2 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

3.2.2 Tasks for the approved body

The approved body shall perform the

- initial inspection of factory and of factory production control and
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the control plan.

The frequency of the inspections by the approved bodies shall be performed in accordance with section II of control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall always be affixed on packaging and on the accompanying commercial documents. The letters "CE" shall be followed by the identification number of the approved certification body and be accompanied by the following additional information:

- the name and the address of the manufacturer (legal entity responsible for the manufacturer)
- the last two digits of the year in which the CE marking was affixed
- the number of the EC certificate for the factory production control
- the number of the European technical approval ETA-10/0143
- the number of the guideline ETAG 009 of the European technical approval
- the designation code of the expanded polystyrene according to EN 13163 (see clause 2.1.2)
- Reaction to fire: Class according to EN 13501-1 (see clause 2.2.3.1)
- Resistance to fire: Class according to EN 13501-2 in dependence of minimum thickness of the concrete core (see clause 2.2.3.2)
- Water vapour permeability (see clause 2.2.4.2)
- Protection against noise (see clause 2.2.6)
- the declared value of thermal resistance $R_{D,element}$ of the shuttering elements with concrete core and without rendering (see clause 2.2.7.1)

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The shuttering elements are manufactured in accordance with the provisions of the European technical approval using the automated manufacturing process as identified during the inspection of the plant by Deutsches Institut für Bautechnik and the approved body and laid down in the technical documentation.

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Installation

4.2.1 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 installation guide is deposited with Deutsches Institut für Bautechnik 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 clause 4.2.2) site mixed or ready mixed concrete is placed and compacted (see clause 4.2.3).

In end use conditions concrete walls of a continuous type¹³ (see clause 2.2.2.1) of plain or reinforced concrete will be formed according to EN 1992-1-1 or according to corresponding national rules.

For structural design purposes the thickness of the wall and the weight per unit area without rendering are shown in Annex 6.

In end use conditions the EPS shuttering leaves are the main part of the thermal insulation of the walls.

The design values of thermal resistance respectively the design values of thermal conductivity shall be laid down according to the relevant national provisions.

4.2.2 Installation of the shuttering elements

The shuttering elements are put together on site in layers without mortar or adhesive. To receive stable floor high formworks the vertical joints between two elements of one layer have to be shifted of at least a quarter of the element length, better a half of the element length, to the vertical joints of the previous and next layer (see Annex 4.1).

The PP spacers are assembled on site into the inner and outer EPS shuttering leaves to reach complete shuttering elements. The PP spacers shall be stacked (one upon the other) to avoid segregation of concrete.

First of all two layers of the entire floor plan are to be interlocked according to the installation guide of the manufacturer.

¹³ see ETAG 009, clause 2.2

Afterwards levelling to the subsoil is performed (foundation, bottom, ground floor and ceiling). Voids between the EPS shuttering leaves and the uneven subsoil are to be sealed with PU foam before concreting.

Subsequently, according to the installation guide of the manufacturer, the shuttering elements are to be interlocked to floor height, levelled and fastened to the push pull props (see Annex 5).

The push pull props shall be arranged with a distance of 1,0 m to maximum 1,50 m to be connected over the entire wall height with the shuttering elements and to be fastened to the floor (see Annex 5).

The necessary reinforcement according to static calculation shall also be installed according to the instructions in the installation guide provided by the manufacturer.

Rectangular corners and T-walls are to be formed according to Annexes 4.2 and 4.3. Typical wall junctions are to be formed according to Annex 4.4.

Further information is given in the installation guide.

4.2.3 Concreting

For the production of normal concrete EN 206-1 shall apply. The consistency of concrete shall be at least within the lower consistency range F3 when compacted by vibration and at least within the upper consistency range F3 when compacted by poking.

The maximum aggregate size shall be at least 8 mm and shall not exceed 16 mm.

Furthermore the concrete shall have rapid or medium strength development according to EN 206-1, Table 12.

Placing the concrete shall be performed only by persons who were instructed in the works and in the proper handling of the shuttering system.

Placing the concrete shall be performed in layers of maximum 0,75 m at a maximum concreting rate of 1 m/h.

If equivalent national rules are not available the following instructions shall be considered:

Horizontal cold joints are to be arranged preferably at the height of the floor. If cold joints cannot be avoided within the height between the floors, vertical starter bars shall be installed. The starter bars shall meet the following requirements:

- Two adjacent starter bars shall not be situated in the same plane parallel to the surface of the wall.
- The distance between two starter bars in wall direction shall be at least 10 cm and not larger than 50 cm.
- The total section area of the starter bars shall not be less than 1/2000 of the section area of the concrete.
- Anchorage length of the starter bars on both sides of the cold joint shall be at least 20 cm.

Before the further placing of concrete, cement laitance and detached / loose concrete shall be removed and the cold joints shall be sufficiently pre-wetted. At the time of concreting the surface of the older concrete shall be slightly moist, so that the newly placed concrete can combine well with the older concrete.

If no cold joint is planned, placing of concrete in layers may only be interrupted until the concrete layer placed last has not yet set so that a good and even bond is still possible between the two concrete layers. When using internal vibrators the vibrating cylinder shall still penetrate into the already compacted lower concrete layer.

The concrete may fall freely only up to a height of 2 m, beyond that the concrete shall be cohered by discharge pipes or concreting tubes with a diameter of 100 mm at the most and shall be led shortly before the place of installation.

Cones from placing concrete are to be avoided by short distances of the places of fill in.

Planning shall allow for sufficient spaces in the reinforcement for discharge pipes or concreting tubes.

After concreting the walls may not deviate from the plumb line more than 5 mm per running meter wall height.

The ceiling shall only be placed on walls made of shuttering elements when the concrete core has sufficiently hardened.

4.2.4 Ducts crossing and situated inside the wall

Horizontally passing ducts are to be installed according to the installation guide of the manufacturer and are to be taken into account when designing the wall.

Horizontal ducts situated inside the concrete cores and running parallel to the wall surfaces shall 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 ducts is less than 2 m.

4.2.5 Reworking and finishes

Walls of the type "MAGU WS" are to be protected by finishes (e. g. rendering, plasters, cladding, panelling, coatings). Finishes are not part of the kit and therefore not considered in this ETA. Preferably for external surfaces the rendering systems used should meet the requirements of ETAG 004. The cladding respectively panelling or their substructures shall be anchored in the concrete core. The execution of the rendering shall be performed according to applicable national rules.

The protection by finishes should be implemented preferably within one month after erecting the load-bearing structure, because of the detrimental influence of weather and UV radiation on the surface of the EPS shuttering leaves.

4.2.6 Fixing of objects

Fixing of objects in the EPS shuttering leaves is not possible. The part of fixings which is relevant for the mechanical resistance shall be inside the concrete core. The influence of the fixing to the reduction of the declared value of thermal resistance $R_{D,element}$ shall be considered according to EN ISO 6946.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

The shuttering elements have to be protected against damage, soiling and intensive action of water during transport and storage. If necessary the shuttering elements shall be covered.

5.2 Use, maintenance, repair

Regular checks should be carried out on renderings and finishes to ensure that any damage is detected and repaired as soon as possible.

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

The shuttering elements have to be protected against high temperature, overheating and intensive exposure to weather and UV radiation. If necessary, the shuttering elements have to be covered.

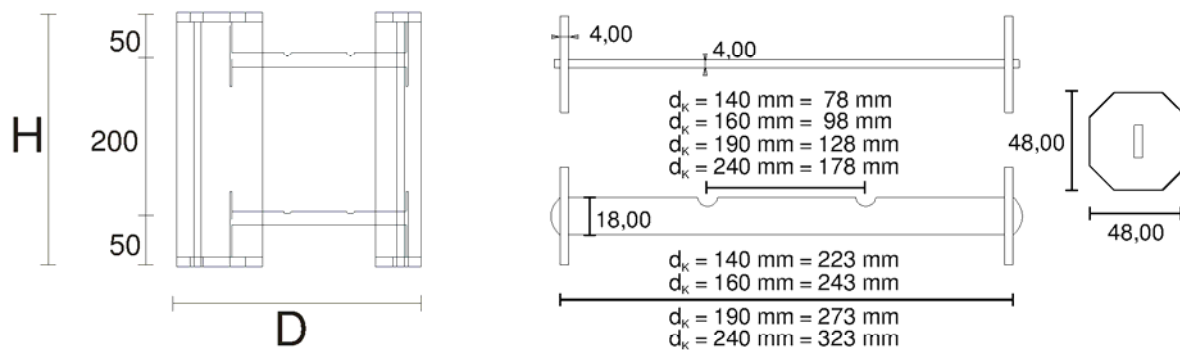
Uwe Bender
Head of Department

beglaubigt:
Schwab

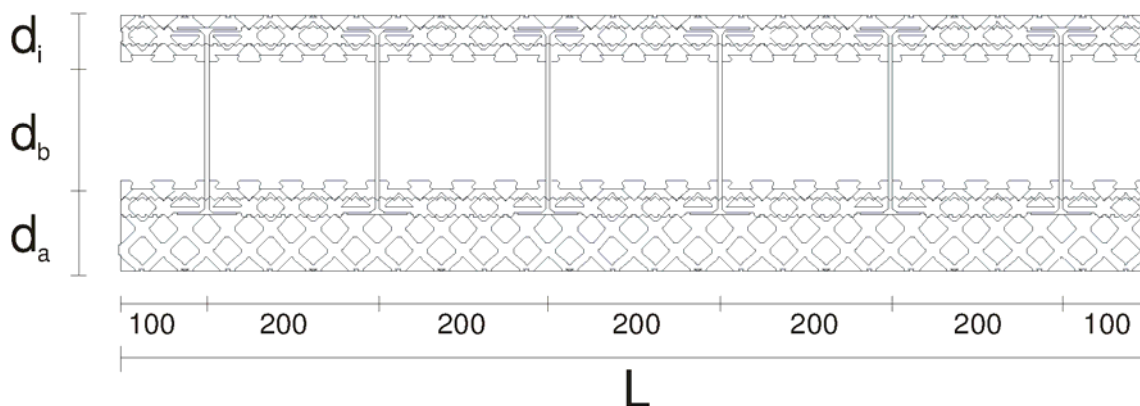
Standard shuttering element

Spacer of polypropylene

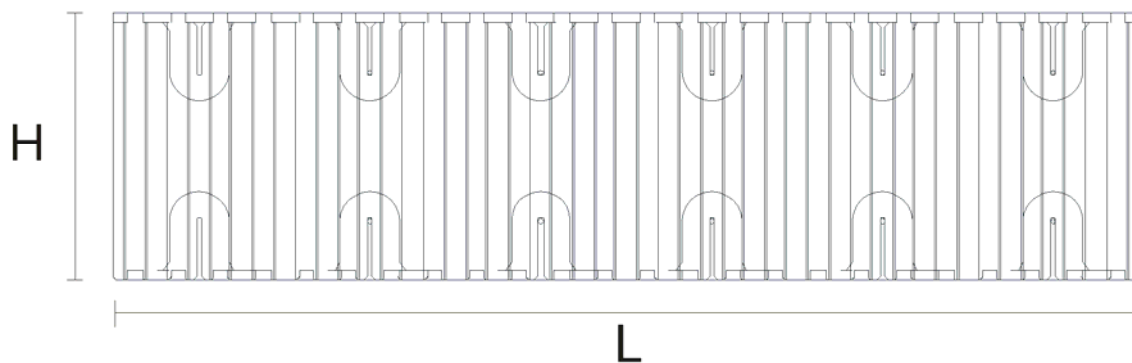
Cross section



Top view



Side view



all dimensions in [mm]

MAGU WS, MAGU ICF, MAGU Isocoffrage

Standard shuttering elements with spacers of polypropylene (PP spacers)

Annex 1.1

Type of standard shuttering elements	Length of spacers	Thickness of the wall	Height	Length	inner EPS	Thickness of the concrete core	outer EPS
	L_s	D	H	L	d_i	$d_K = d_b$	d_a
WS 25/14-30-120	215	250	300	1200	55	140	55
WS 30/14-30-120	215	300	300	1200	55	140	105
WS 35/14-30-120	215	350	300	1200	55	140	155
WS 40/14-30-120	215	400	300	1200	55	140	205
WS 45/14-30-120	215	450	300	1200	55	140	255
WS 50/14-30-120	215	500	300	1200	55	140	305
WS 27/16-30-120	235	270	300	1200	55	160	55
WS 32/16-30-120	235	320	300	1200	55	160	105
WS 37/16-30-120	235	370	300	1200	55	160	155
WS 42/16-30-120	235	420	300	1200	55	160	205
WS 30/19-30-120	265	300	300	1200	55	190	55
WS 35/19-30-120	265	350	300	1200	55	190	105
WS 40/19-30-120	265	400	300	1200	55	190	155
WS 45/19-30-120	265	450	300	1200	55	190	205
WS 35/24-30-120	315	350	300	1200	55	240	55
WS 40/24-30-120	315	400	300	1200	55	240	105
WS 45/24-30-120	315	450	300	1200	55	240	155
WS 50/24-30-120	315	500	300	1200	55	240	205

all dimensions in [mm]

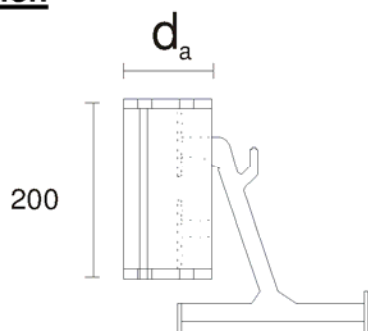
MAGU WS, MAGU ICF, MAGU Isocoffrage

Standard shuttering elements with spacers of polypropylene (PP spacers):
Dimensions of the standard shuttering elements

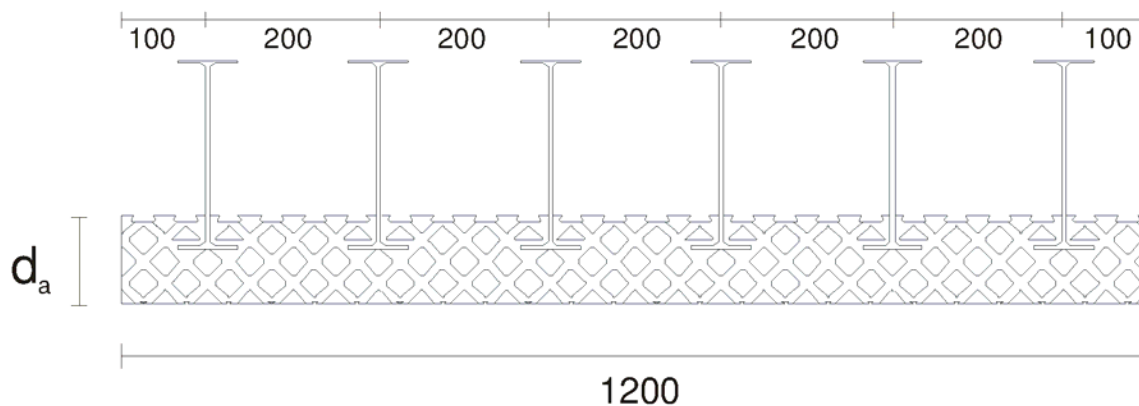
Annex 1.2

Floor edge element

Cross section

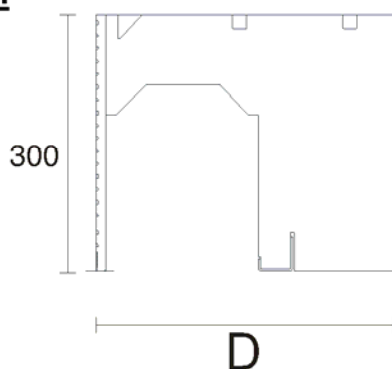


Top view



Roller shutter box element

Cross section



all dimensions in [mm]

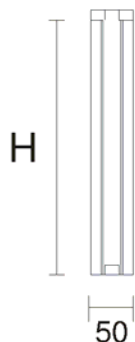
MAGU WS, MAGU ICF, MAGU Isocoffrage

Special elements:
Floor edge elements and Roller shutter box elements

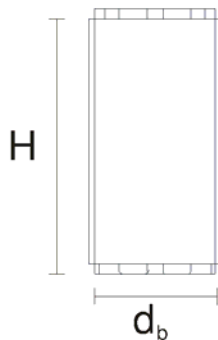
Annex 2

End stop

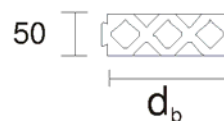
Cross section



Side view



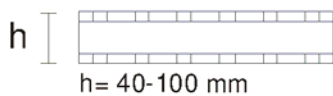
Top view



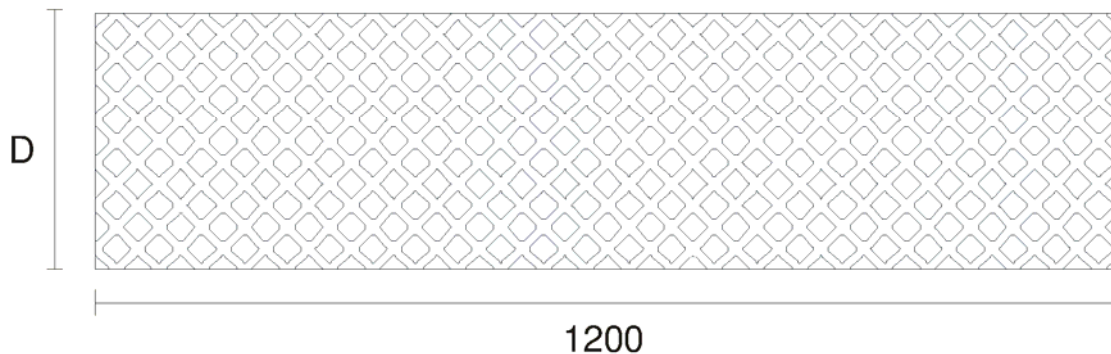
Lintel bottom leaf

Parapet leaf

Cross section



Top view



all dimensions in [mm]

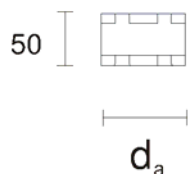
MAGU WS, MAGU ICF, MAGU Isocoffrage

Accessory parts:
End stops, Lintel bottom leaves and Parapet leaves

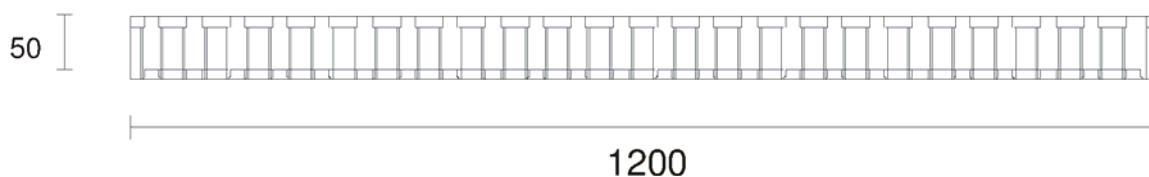
Annex 3.1

Height adjuster piece

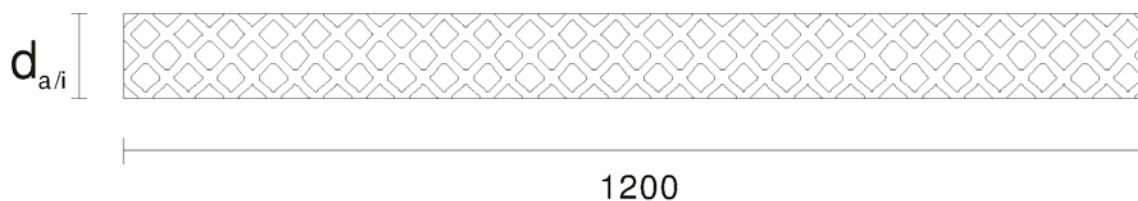
Cross section



Side view



Top view



Corner leaf

Top view



Side view



all dimensions in [mm]

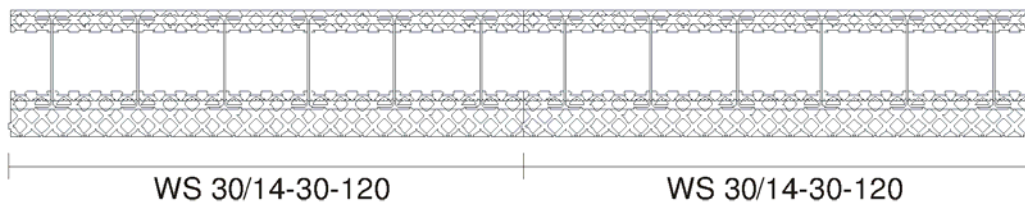
MAGU WS, MAGU ICF, MAGU Isocoffrage

Accessory parts:
Height adjuster pieces and Corner leaves

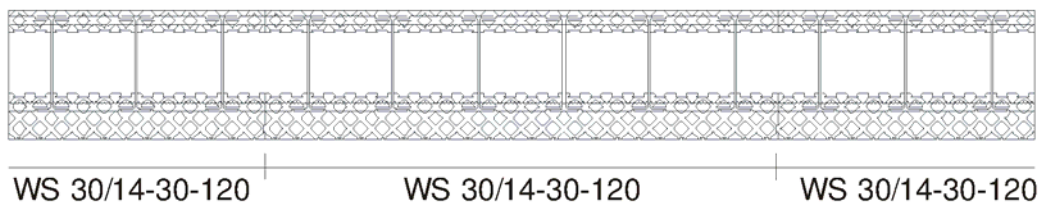
Annex 3.2

Top view

1st layer



2nd layer



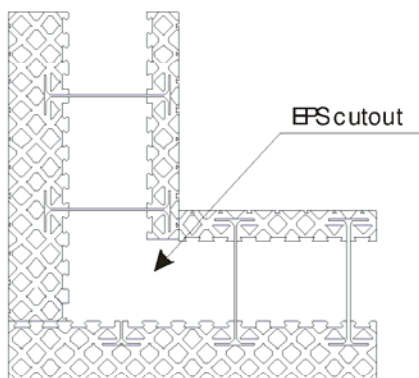
MAGU WS, MAGU ICF, MAGU Isocoffrage

Structure of layers of straight walls
(using the example of the standard shuttering element WS 30/14-30-120)

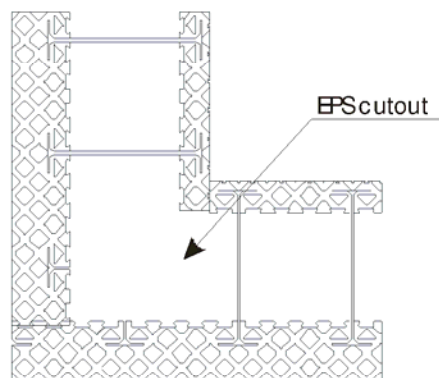
Annex 4.1

Top view

1st layer

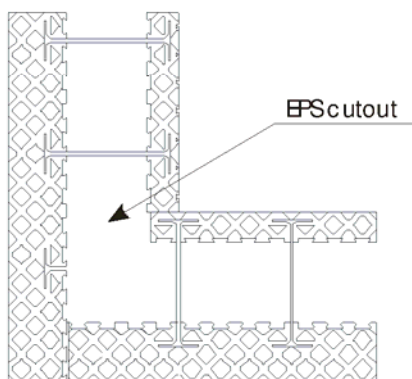


$d_b = 140 \text{ mm}, 160 \text{ mm}$

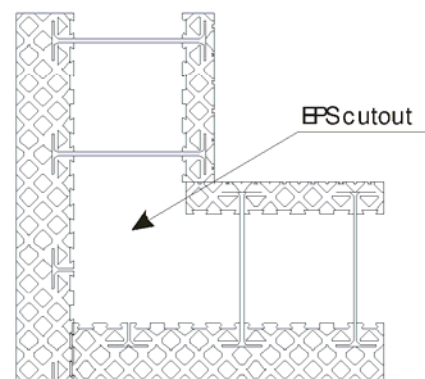


$d_b = 190 \text{ mm}, 240 \text{ mm}$

2nd layer



$d_b = 140 \text{ mm}, 160 \text{ mm}$

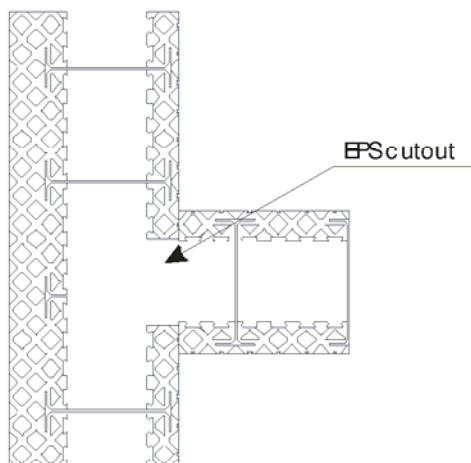


$d_b = 190 \text{ mm}, 240 \text{ mm}$

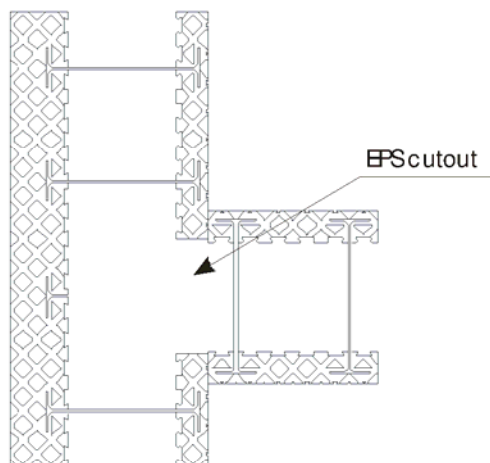
Note: When constructing rectangular corners with a combination of different thicknesses of the concrete core ($d_b = 140; 160; 190$ or 240 mm) it has to be ensured that the PP-spacers of every n -layer and of every $(n+1)$ -layer are superimposed on the other in a vertical alignment.

Top view

1st layer

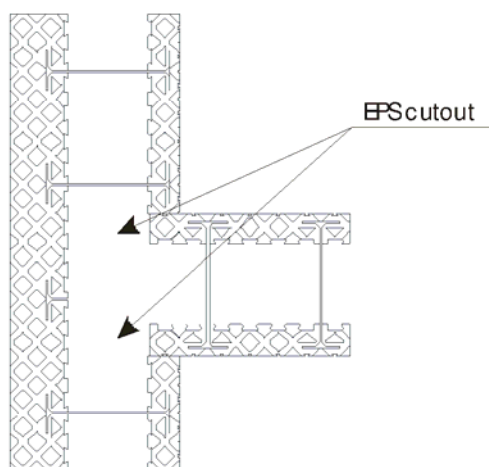


$d_b = 140 \text{ mm}, 160 \text{ mm}$

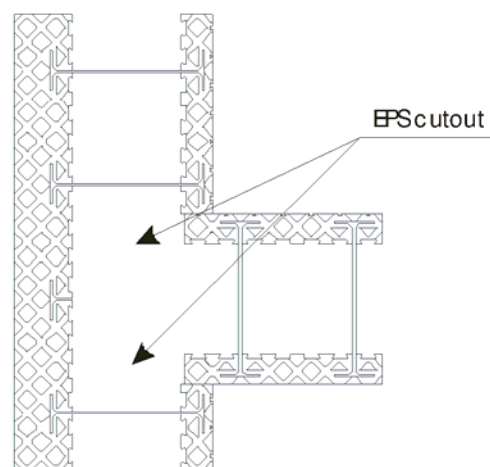


$d_b = 190 \text{ mm}, 240 \text{ mm}$

2nd layer



$d_b = 140 \text{ mm}, 160 \text{ mm}$



$d_b = 190 \text{ mm}, 240 \text{ mm}$

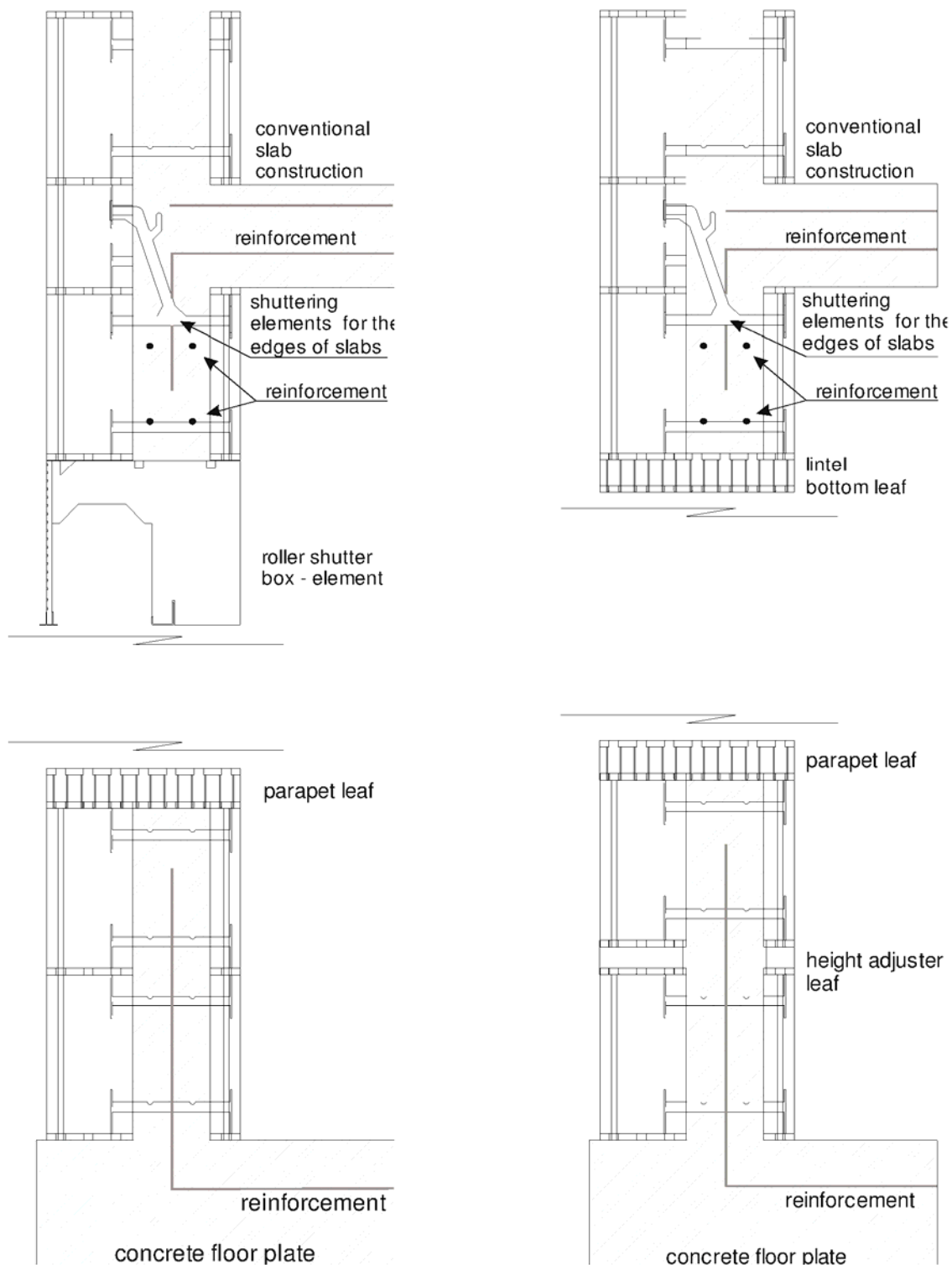
Note: When constructing T-walls with a combination of different thicknesses of the concrete core ($d_b = 140; 160; 190$ or 240 mm) it has to be ensured that the PP-spacers of every n-layer and of every (n+1)-layer are superimposed on the other in a vertical alignment.

MAGU WS, MAGU ICF, MAGU Isocoffrage

Structure of layers of T-walls

Annex 4.3

Cross section



Electronic copy of the ETA by DIBt: ETA-10/0143

MAGU WS, MAGU ICF, MAGU Isocoffrage

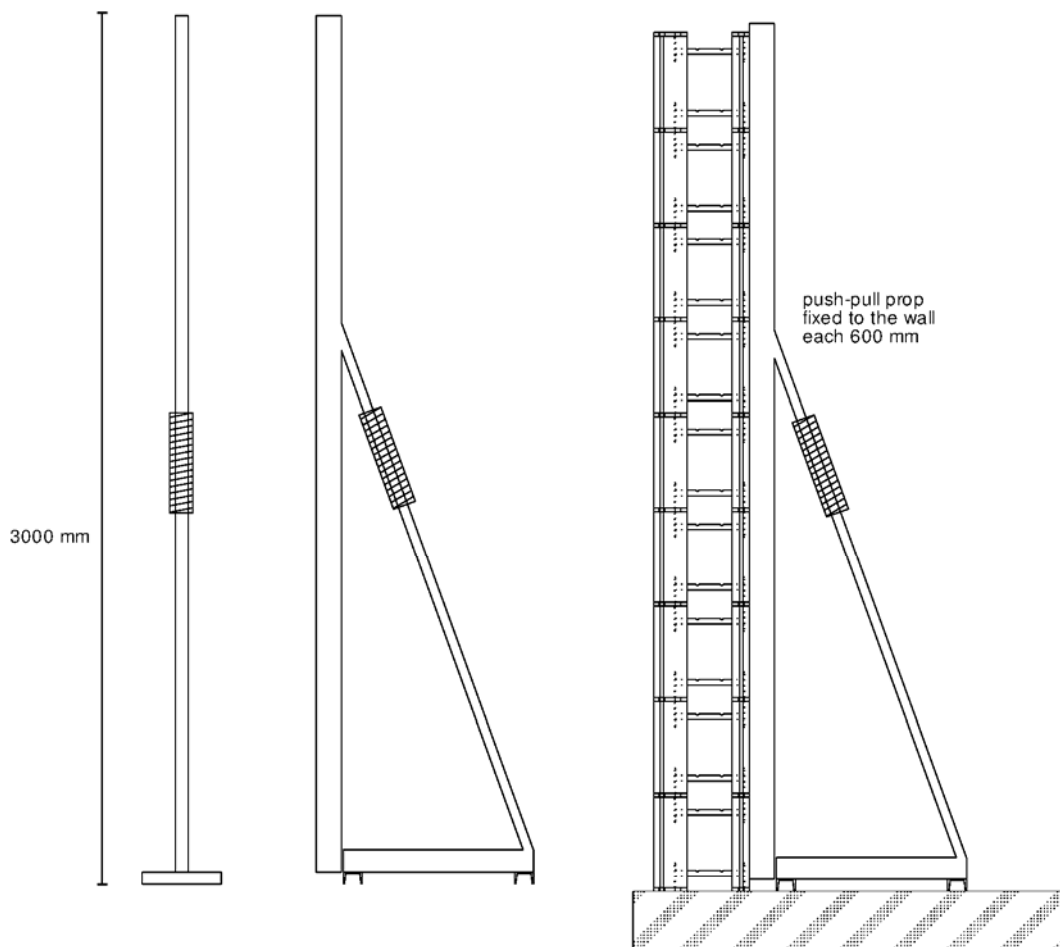
Typical wall junctions

Annex 4.4

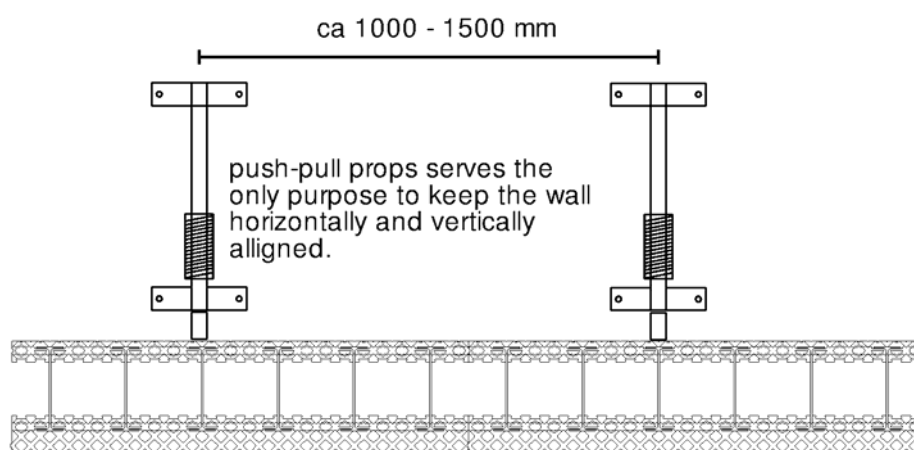
Lengthwise view

Side view

Cross section



Top view



Electronic copy of the ETA by DIBt: ETA-10/0143

MAGU WS, MAGU ICF, MAGU Isocoffrage

Push pull props

Annex 5

Type of standard shuttering elements	Thickness of the wall	Thickness of the concrete core	Area of concrete core per meter wall length	Volume of the concrete core per m ² wall area	Assumed weight of the shuttering elements without rendering $\rho_{\text{EPS}} = 30 \text{ kg/m}^3$	Assumed weight of the shuttering elements in end use conditions (with concrete core without rendering) $\rho_{\text{Concrete}} = 2500 \text{ kg/m}^3$
	[mm]	[mm]	[m ² /m]	[m ³ /m ²]	[kN/m ²]	[kN/m ²]
WS 25/14-30-120	250	140	140	0,140	0,0437	3,54
WS 30/14-30-120	300	140	140	0,140	0,0587	3,56
WS 35/14-30-120	350	140	140	0,140	0,0737	3,57
WS 40/14-30-120	400	140	140	0,140	0,0947	3,59
WS 45/14-30-120	450	140	140	0,140	0,1037	3,60
WS 50/14-30-120	500	140	140	0,140	0,1187	3,62
WS 30/19-30-120	300	190	190	0,190	0,0450	4,79
WS 27/16-30-120	270	160	160	0,160	0,0450	4,04
WS 32/16-30-120	320	160	160	0,160	0,0600	4,06
WS 37/16-30-120	370	160	160	0,160	0,0750	4,07
WS 42/16-30-120	420	160	160	0,160	0,0900	4,09
WS 35/19-30-120	350	190	190	0,190	0,0580	4,81
WS 40/19-30-120	400	190	190	0,190	0,0750	4,82
WS 45/19-30-120	450	190	190	0,190	0,0900	4,84
WS 35/24-30-120	350	240	240	0,240	0,0470	6,05
WS 40/24-30-120	400	240	240	0,240	0,0620	6,06
WS 45/24-30-120	450	240	240	0,240	0,0770	6,08
WS 50/24-30-120	500	240	240	0,240	0,0917	6,09
MAGU WS, MAGU ICF, MAGU Isocoffrage					Annex 6	
Thickness of the wall and weight per m ² of standard shuttering elements						

standards and guidelines	issue	title
EN 206-1	2000	Concrete - Part 1: Specification, performance, production and conformity
EN 1992-1-1	2004 + AC:2010	Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
EN 13163	2012	Thermal insulation products for buildings - Factory made products of expanded polystyrene (EPS) - Specification
EN 13501-1	2007 + A1:2009	Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests
EN 13501-2	2007 + A1:2009	Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services
EN ISO 6946	2007	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method
EN ISO 10456	2007 + AC:2009	Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EN ISO 13788	2001	Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods
ETAG 004	2011	Guideline for European technical approval of "External thermal insulation composite systems with rendering"
ETAG 009	2002-06	Guideline for European technical approval of "Non load bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete"
MAGU WS, MAGU ICF, MAGU Isocoffrage		Annex 7
List of standards and guidelines		