



## European Technical Approval ETA-07/0210

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	isorast	
Zulassungsinhaber <i>Holder of approval</i>	isorast-Passivhaus-Produkte GmbH Chattenpfad 30 65232 Taunusstein-Hambach DEUTSCHLAND	
Zulassungsgegenstand und Verwendungszweck  <i>Generic type and use of construction product</i>	Nicht lasttragender verlorener Schalungsbausatz "isorast" mit Schalungselementen aus EPS  <i>Non load bearing shuttering kit "isorast" based on shuttering elements of EPS</i>	
Geltungsdauer: <i>Validity:</i>	vom <i>from</i>	11 September 2007
	bis <i>to</i>	11 September 2012
verlängert <i>extended</i>	vom <i>from</i>	11 September 2012
	bis <i>to</i>	11 September 2017
Herstellwerk <i>Manufacturing plant</i>	Schlaadt Plastics GmbH, Schwalbacher Str. 123, 65391 Lorch	

Diese Zulassung umfasst  
*This Approval contains*

35 Seiten einschließlich 19 Anhänge  
*35 pages including 19 annexes*

## 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 products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - *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 1998<sup>4</sup>, as amended by Article 2 of the law of 8 November 2011<sup>5</sup>;*
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>;
  - 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.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 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.

<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12

<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1

<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25

<sup>4</sup> *Bundesgesetzblatt Teil I 1998*, p. 812

<sup>5</sup> *Bundesgesetzblatt Teil I 2011*, p. 2178

<sup>6</sup> 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/ products and intended use

#### 1.1 Definition of the construction product

The shuttering system "isorast" is a non load-bearing permanent shuttering kit based on shuttering elements of expanded polystyrene (EPS - trademark "Neopor") connected with EPS spacers (Type 1) or steel spacers (Type 2) (see Annex 1 as overview) applicable as formwork for plain and reinforced concrete walls cast in-situ. The shuttering system comprises standard shuttering elements and special shuttering elements (Annexes 2 and 3) as well as shuttering elements with increased sound absorption (Annex 4), special elements (see Annexes 5 to 7) and accessory parts (Annexes 8 and 9). The prefabricated shuttering system is delivered on site. The shuttering elements are used for internal and external load-bearing walls.

The accessory parts are end elements, height adjuster elements and oriel / curved edge height adjuster elements.

The special elements are interior wall end elements, arch elements, arch connection elements, shuttering elements of type 2 with a concrete core thickness of 202.5 mm or 265 mm, 18 cm-interior wall elements, 25 cm-curved edge elements, cantilever elements, oriel elements, lintel elements, elements with increased sound absorption, floor edge elements, roller jalousie housing.

#### 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 subject to fire regulations.

When using this type of construction below ground a waterproofing according to applicable national rules shall be provided depending on whether water not exerting pressure or water exerting pressure is to be dealt with. The waterproofing shall be protected from mechanical damage by an impact-resistant protective layer.

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 packing, 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 producer, 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 the effects of adverse weather conditions.

### 2 Characteristics of products and methods of verification

#### 2.1 Characteristics of products

##### 2.1.1 General

The kit consists of standard shuttering elements, accessory parts and special elements; see clauses 2.1.2, 2.1.3 and 2.1.4.

These elements correspond to the information and drawings given in Annexes 1 to 9.

## 2.1.2 Standard shuttering elements

The prefabricated shuttering system consists of inner and outer shuttering leaves and spacers of EPS („NEOPOR“) (Type 1) or spacers of steel (Type 2) which is delivered on site.

The thickness of the inner shuttering leaf is in all cases 55 mm and the thickness of the outer shuttering leaf varies between 55 mm, 117.5 mm, 180 mm and 242.5 mm.

The thickness of the concrete core is either 140 mm (achieved by standard elements with spacer Type 1 and 2) or 202.5 mm and 265 mm (both achieved by special elements only with steel spacer Type 2).

The shuttering element allows plain and reinforced concrete wall. Table 1 shows the possible thicknesses of a load-bearing wall.

The system includes various shuttering elements with the same height of 250 mm. The standard elements with spacers of EPS (Type 1) are 750 mm or 1500 mm long and the standard elements with spacers of steel (Type 2) are 1250 mm long.

All elements have the same castellated joints (groove and tongue). The groove and tongue joints are arranged all over the horizontal, bottom and top edges of the elements. The joints design ensures stable joining of element layers in both directions: longitudinal and transversal direction of the wall.

All elements of the system have vertical dovetailed grooves on the surfaces of the inner and outer shuttering leaves.

In the inner surfaces the groove ribs serve as mechanical fixing of the shuttering leaves to the concrete. One inner groove has a minimum width of 20.5 mm and a depth of 8 mm and the distance between the grooves is 62.5 mm at the most.

The shuttering elements can be cut to length every 62.5 mm. A system of vertical dovetailed grooves inside the shuttering elements (grid dimension of 62.5 mm) has been arranged to fix end elements. In all shuttering elements there are these grooves, regardless of the wall thickness, core thickness and the type of spacers used.

There are also shuttering elements for indented use as non load-bearing interior wall elements with spacers of steel having a concrete core thickness of 77.5 mm and shuttering leaf thickness of 55 mm for inner and outer side, see Annex 3, as well as special elements for increasing the sound absorption (see Annex 4).

For the shuttering leaves of a density of a minimum of 24.5 kg/m<sup>3</sup> and a maximum of 29.0 kg/m<sup>3</sup>, respectively a mean value of about 27 kg/m<sup>3</sup>, expanded polystyrene EPS-EN 13163-T2-L2-W2-S2-P4-DS(70,-)3-BS200-DS(N)5-TR100 according to EN 13163 is used.

The wire of the elements with spacers of steel (Type 2) has a minimum tensile strength of 690 MPa and a minimum wire thickness of 4.95 mm.

The material characteristics, dimensions and tolerances of the shuttering elements not indicated in Annexes 2 to 7 are given in the technical documentation<sup>7</sup> of the ETA.

<sup>7</sup> The technical documentation of the ETA is deposited with DIBt 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.

Table 1: Load-bearing wall thickness of standard elements

Element-Type		according to Annex	Internal leaf [mm]	Concrete core [mm]	External leaf [mm]	Wall thickness [mm]
Type 1	25 cm-element	2	55.0	140.0	55.0	250.0
	31 cm-element				117.5	312.5
	37 cm-element				180.0	375.0
	43 cm-element				242.5	437.5
Type 2	25 cm-element	3	55.0	140.0	55.0	250.0
	31 cm-element				117.5	312.5
	37 cm-element				180.0	375.0
	43 cm-element				242.5	437.5
	055-203-055			202.5	55.0	312.5
	055-203-118				117.5	375.0
	055-203-180				180.0	437.5
	055-203-243				242.5	500.0
	055-265-055			265.0	55.0	375.0
	055-265-118				117.5	437.5
	055-265-180				180.0	500.0
	055-265-243				242.5	562.5

### 2.1.3 Accessory parts

The accessory parts are:

- end elements (see Annex 8) and
- height adjuster elements and oriel / curved edge height adjuster elements (see Annex 9).

These parts correspond to the drawings given in Annexes 8 and 9.

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

### 2.1.4 Special elements

The special elements are:

- interior wall end elements, only available with EPS spacers (see Annex 2),
- arch elements, only available with EPS spacers (see Annex 2),
- arch connection elements, only available with EPS spacers (see Annex 2),
- shuttering elements with a concrete core thickness of 202.5 mm or 265 mm, only available with steel spacers (see Annex 3),
- 18 cm-interior wall element, only available with steel spacers (see Annex 3),
- 25 cm-curved edge elements, only available with steel spacers (see Annex 3),
- cantilever elements, only available with steel spacers (see Annex 3),
- oriel elements, right and left, only available with steel spacers (see Annex 3),
- 31 cm-interior oriel elements, right and left, only available with steel spacers (see Annex 3),
- elements with increased sound absorption, only available with steel spacers (see Annex 4),

- interior door lintel elements (see Annex 5),
- exterior lintel elements, only available with steel spacers (see Annex 5),
- floor edge elements, only available with steel spacers (see Annex 6) and
- roller jalousie housing (roller shutter box elements) (see Annex 7).

These EPS elements are designed in the same manner as described above, see clause 2.1.2.

The special elements consist of EPS, it is the same material used for shuttering elements specified in clause 2.1.2. The wire of steel spacers for the special elements is 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 shuttering elements or blocks of insulating materials and sometimes concrete", edition June 2002.

The ETA is issued for the shuttering kit "isorast" on the basis of agreed information, deposited with Deutsches Institut für Bautechnik (DIBt), 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 DIBt before the changes are introduced. DIBt 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 (ER) 1: Mechanical resistance and stability**

#### **2.2.2.1 Resulting structural pattern**

In end use conditions walls made of shuttering elements with EPS spacers (Type 1) form walls of a grid type according to ETAG 009, clause 2.2, sub-item 2.

In end use conditions walls made of shuttering elements with steel spacers (Type 2) form walls of a continuous type according to ETAG 009, clause 2.2, sub-item 1.

#### **2.2.2.2 Efficiency of filling**

Considering the instructions of clause 4.2 and the installation guide of the manufacturer the 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 satisfactorily.

#### **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 (see e. g. Annex 12).

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

## 2.2.3 Essential Requirement (ER) 2: Safety in case of fire

### 2.2.3.1 Reaction to fire<sup>8</sup>

The expanded polystyrene material fulfils the conditions for Class E according to EN 13501-1.

### 2.2.3.2 Resistance to fire

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

According to ETAG 009, Annex C, Table 1, for a continuous type of load-bearing wall only with steel spacers and a minimum concrete strength of C16/20, the system meets the criteria "REI" according to Table 2.

Table 2: Determination of "REI" of load-bearing walls

Thickness of concrete core [mm]	According to ETAG 009, Annex C, Table 1	REI
140.0	second column, the line before last	90
202.5	second column, last line	120
265.0	second column, last line	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 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.
- The walls shall on both sides either be plastered/rendered or at least the joints on both sides shall be sealed with plastering/rendering mortar. The mortar for plastering/rendering or for sealing shall be based on inorganic aggregates, gypsum, cement or lime or on suitable combinations of these three binders.
- The walls are exposed to fire only on one side.

For walls constructed with shuttering elements with EPS spacers (type 1, grid type) the "No performance determined" option in ETAG 009, Table 3 is used.

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

<sup>8</sup>

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

## 2.2.4 Essential Requirement (ER) 3: Hygiene, health and environment

### 2.2.4.1 Content and/or release of dangerous substances<sup>9</sup>

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

### 2.2.4.2 Water vapour permeability

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

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

## 2.2.5 Essential Requirement (ER) 4: Safety in use

### 2.2.5.1 Bond strength between the shuttering leaves and the concrete core

The expanded polystyrene is bonded to the concrete by mechanical interlocking of the dovetail sections running vertically in the inner surfaces of the shuttering leaves over the whole elements height with a horizontal distance of a maximum of 62.5 mm. The considered dovetails have a minimum width of 20.5 mm and a depth of 8 mm. Calculation shows that the flexural strength of EPS edges of dovetails (here: BS200, designation code of EPS material, according clause 2.1.2) is sufficient to guarantee a mechanical interlock between the layer EPS and concrete core. The minimum bond strength according to ETAG 004, clause 6.1.4.1.3 between these layers should be assumed as 40 kPa. The calculated safety factor is nearly 1.50. For calculation the edge of dovetails are considered as 2 mm cantilevers.

The requirements according to ETAG 009, clause 6.4.1.3 are met satisfactorily.

### 2.2.5.2 Resistance to filling pressure

To resist the pressure of fresh concrete the bending tensile strength of the shuttering leaves shall be more than 200 kPa (see also designation code of EPS in clause 2.1.2) and

a) the pull-out strength of the EPS spacers (Type 1) more than 624 N respectively

b) the pull-out strength of the steel spacers (Type 2) more than 575 N.

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

### 2.2.5.3 Safety against personal injury by contact

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

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

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

## 2.2.6 Essential Requirement (ER) 5: Protection against noise

### 2.2.6.1 Airborne sound insulation

The "No performance determined" option in ETAG 009, Table 3 is used for shuttering elements according Table 1, see Annexes 1 to 3.

Laboratory measurements of the airborne sound insulation of partition walls erected by the special acoustic elements according Annex 4 have been carried out. Table 3 shows the weighted sound reduction index according to EN ISO 717-1.

<sup>9</sup>

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.



Table 3: Airborne sound insulation of partition walls erected by elements according Annex 4 (only for special acoustic elements)

Wall construction	$R_w$ [dB]
Wall thickness: 25 cm One side: gypsum plaster: 15 mm Other side: gypsum plaster: 24 mm	51
Wall thickness: 25 cm One side: gypsum plaster: 18 mm Other side: gypsum plaster: 27 mm	53
Wall thickness: 31.25 cm One side: gypsum plaster: 12.5 mm Other side: gypsum plaster: 12.5 mm	53

#### 2.2.6.2 Sound absorption

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

### 2.2.7 Essential Requirement (ER) 6: Energy economy and heat retention

#### 2.2.7.1 Thermal resistance

Assuming a nominal value of thermal conductivity  $\lambda_D = 0.032 \text{ W}/(\text{m}\times\text{K})$  for the expanded polystyrene and for concrete infill of  $\lambda_D = 1.35 \text{ W}/(\text{m}\times\text{K})$  (according to EN ISO 10456) the shuttering elements with a definite concrete core of 140 mm and a thickness for the external shuttering leaf of 55 mm, 117.5 mm, 180 mm and 242.5 mm the nominal value of thermal resistance  $R_D$  of the complete wall in end use conditions (with concrete infill but without rendering) has been determined by numerical calculations (finite differences and EN ISO 6946) taking the influence of the EPS spacers and steel spacers into account. The calculation shows that the influence of an EPS spacer is marginal.

Table 4 gives the nominal values of the thermal resistance  $R_D$  and for information the overall influence factor to determine the influence of the steel respectively EPS spacers on the nominal value of thermal resistance  $R_D$ .

Table 4: Nominal values of thermal resistance  $R_D$  (calculated with concrete core but without rendering) depending on the thickness of the outer layer of expanded polystyrene and for information the overall influence factor

Spacer type and (spacer material) of shuttering element according to Annex 1	Thickness of the internal shuttering leaf [mm]	Concrete core [mm]	Thickness of the external shuttering leaf [mm]	Nominal value of thermal resistance $R_D$ according to EN ISO 6946 [(m <sup>2</sup> ×K)/W]	For information: Overall influence factor
1 (EPS)	55.0	140.0	55.0	3.49	1.025
2 (Steel)		140.0		2.88	0.845
1 (EPS)		140.0	117.5	5.44	1.015
2 (Steel)		140.0		4.85	0.905
1 (EPS)		140.0	180.0	7.40	1.010
2 (Steel)		202.5		6.80	0.930
1 (EPS)		140.0	242.5	9.35	1.005
2 (Steel)		265.0		8.76	0.945

The planner shall consider e.g. accessory parts and special elements made of steel (see clause 2.1) as thermal bridges, where relevant, for determination of the thermal resistance.

#### 2.2.7.2 Heat capacity

The values for heat capacity 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 material used (see clause 2.1.2) the dimensions of the shuttering leaves do not differ more than 3 % after exposing them for 48 h at 70 °C.

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

##### Chemical agent

Spacers of Type 1 are made of EPS. There is no corrosion of this type of spacer in concrete.

The steel spacers (Type 2) are only necessary for the resistance to pressure of fresh concrete. After hardening of the concrete, the bond between concrete and shuttering leaves is given by the dovetail sections running vertically on the inner surfaces of shuttering leaves (see clause 2.2.5.1).

Therefore the requirement "corrosion protection" according to ETAG 009, clause 6.7.1.2 is met satisfactorily.

##### Biological agent

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

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

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

#### 2.2.8.2 Resistance to normal use damage

##### 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.

##### Fixings for hanging objects

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

### 3 Evaluation and attestation of conformity and CE marking

#### 3.1 System of attestation of conformity

According to Decision 98/279/EC of 5 December 1997<sup>10</sup> amended by Decision 2001/596/EC<sup>11</sup> of the European Commission system 2+ of attestation of conformity applies.

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 test 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 initial materials stated in the technical documentation of this European technical approval.

<sup>10</sup> Official Journal of the European Communities L /127 of 24.04.1998

<sup>11</sup> Official Journal of the European Communities L /209 of 08.01.2001

The factory production control shall be in accordance with the control plan of 11 September 2007 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.<sup>12</sup>

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

#### 3.2.1.3 Other tasks for 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 shuttering kits according to ETA G009 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 bodies

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 address of the producer (legal entity responsible for the manufacture)
- 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-07/0210
- the number of the guideline ETAG 009 for European technical approval
- Reaction to fire: Class E 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)
- Protection against noise (see clause 2.2.6)

<sup>12</sup>

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.

- the designation code of the expanded polystyrene according to EN 13163: EPS-EN 13163-T2-L2-W2-S2-P4-DS(70,-)3-BS200-DS(N)5-TR100 (see clause 2.1.2)
- the nominal value of the thermal resistance  $R_D$  of the shuttering leaves (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 and 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 respectively 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 brought in and compacted.

In end use conditions concrete walls of a continuous type<sup>13</sup> of plain or reinforced concrete respectively concrete walls of a grid type 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 is shown in Annex 14.

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 shall be shifted of at least a quarter of the element length to the vertical joints of the previous layer (see Annexes 10 to 11).

<sup>13</sup> see ETAG 009, clause 2.2

Furthermore for walls constructed with shuttering elements with EPS spacers (Type 1), these EPS spacers shall be put on top of each other.

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

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

Subsequently, according to the installation guide of the manufacturer, the walls shall be interlocked to floor height, leveled and fastened to the scaffolding supports (push pull props) (see Annex 13).

The scaffolding supports shall be arranged at a maximum distance of 1.50 m, to be connected over the entire wall height with the shuttering elements and fastened to the floor (see Annex 13).

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

Rectangular wall corners shall be formed with shuttering elements with EPS spacers according to Annex 10 and with shuttering elements with steel spacers according to Annex 11. Wall junctions shall be formed according to Annex 10 (EPS spacers) and Annex 11 (steel spacers).

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 within the lower consistency range F3 when compacted by vibration and within the upper consistency range F3 when compacted by poking.

For walls with elements with EPS spacers (Type 1), the minimum aggregate size shall be at least 4 mm; respectively the maximum aggregate size shall not exceed 8 mm. For walls with elements with steel spacers (Type 2), the minimum aggregate size shall be at least 4 mm; respectively the maximum aggregate size 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 at the works and in the proper handling of the shuttering system.

The maximum filling height amounts to 0.75 m at a concreting velocity of 1.0 m/h.

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

Horizontal cold joints shall be arranged preferably at the height of the floor. If day joints can not be avoided before reaching the floor height vertical composite reinforcement bars shall be installed. The composite reinforcement shall comply with the following requirements:

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

Before the further placing of concrete, cement laitance and detached / loose concrete shall be removed and the day 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 brought in concrete can combine well with the older concrete.

If no cold joint is planned, placing of concrete in layers may only be interrupted if the concrete layer brought in 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 the already compacted lower concrete layer.

The concrete may fall freely only to a height of 2.0 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 pouring shall 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 shall not deviate from the plumb line more than 5 mm per running meter wall height.

The slabs 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 shall be installed according to the installation guide of the manufacturer and shall be taken into account when designing the wall.

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

Also vertical ducts in the concrete core shall be considered, if their diameter exceeds 1/6 of the thickness of the concrete core and the distance of the pipes is less than 2.0 m.

#### **4.2.5 Reworking and finishes**

Walls of the type "isorast" shall be protected by finishes. 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 requirement of ETAG 004. 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 leaves.

#### **4.2.6 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. If necessary, the influence of the fixing to the reduction of the thermal resistance shall be considered according to EN ISO 6946.

### **5 Indications to the manufacturer**

#### **5.1 Packaging, transport and storage**

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

**5.2 Use, maintenance, repair**

Regular checks should be carried out on render 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.

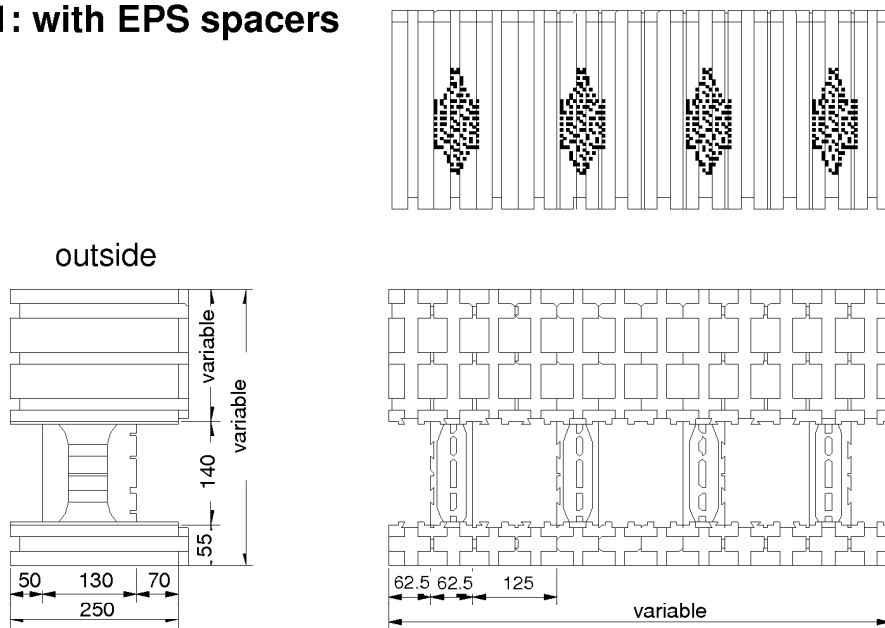
The shuttering elements have to be protected against high temperature, overheating and intensive exposure to weather and UV radiation. If necessary, the shuttering elements have to be covered.

Georg Feistel  
Head of Department

*beglaubigt:*  
Schwab

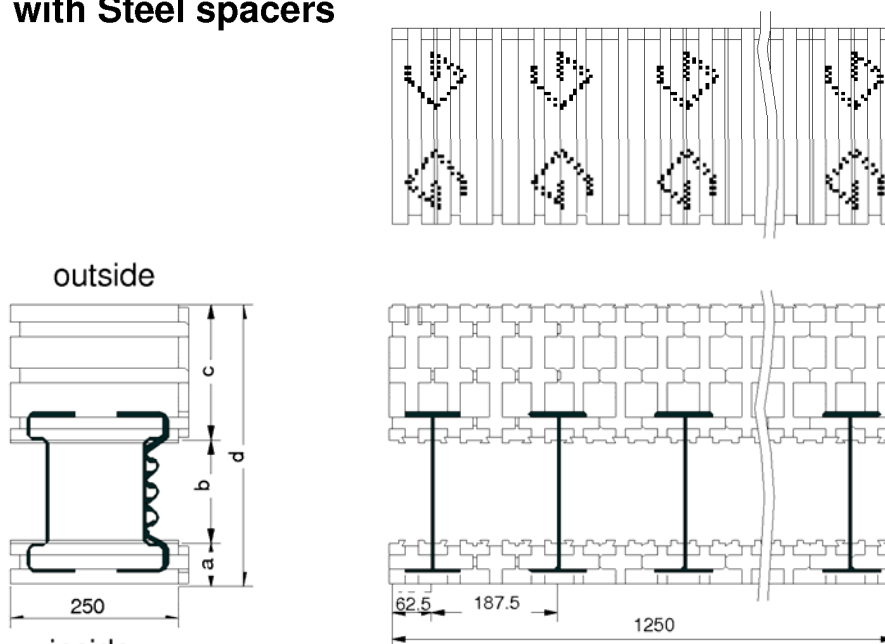


### Type 1: with EPS spacers



(for details see annex 2)

### Type 2: with Steel spacers



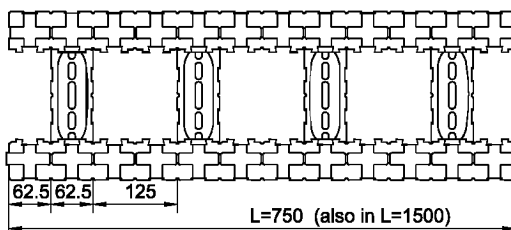
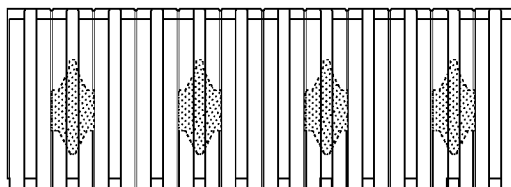
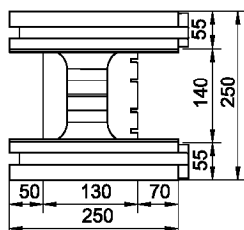
(for details see annex 3)

without scale, dimensions are given in [mm]

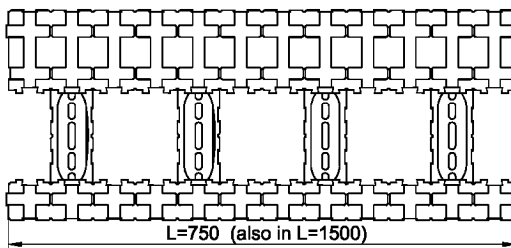
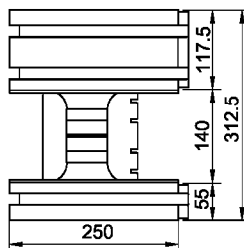
isorast

Overview of the shuttering standard elements Type 1 and Type 2  
(Schematic description of shuttering elements made of EPS)

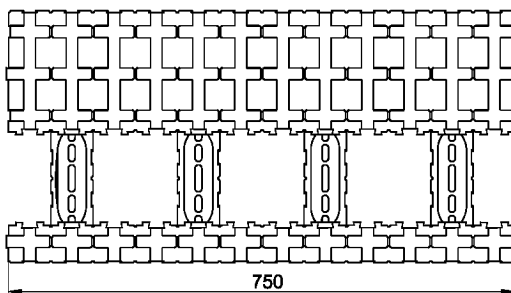
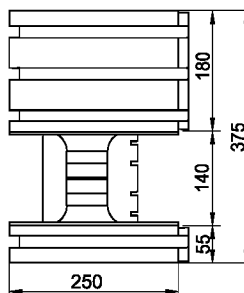
Annex 1



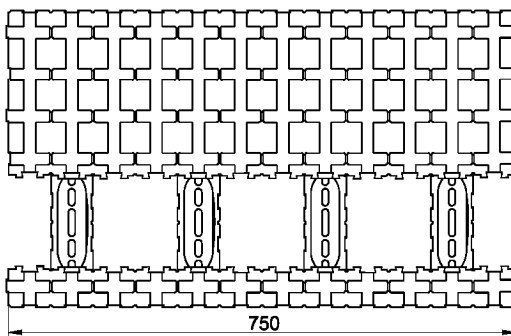
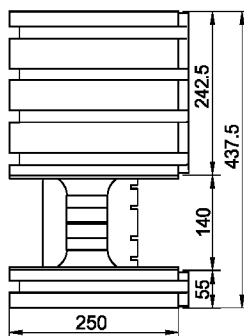
25cm-element



31cm-element



37cm-element



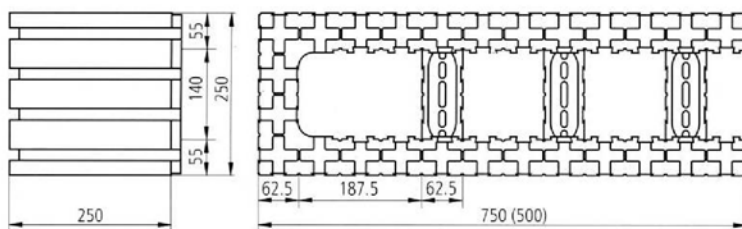
43cm-element

without scale, dimensions are given in [mm]

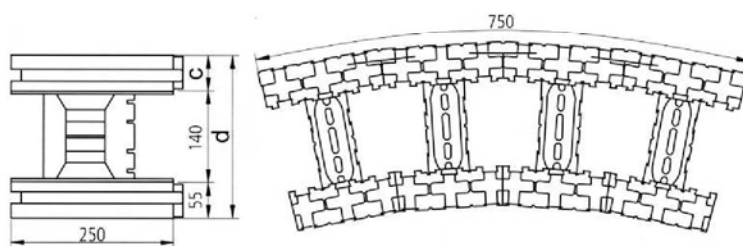
isorast

EPS standard shuttering elements with EPS spacers – Type 1

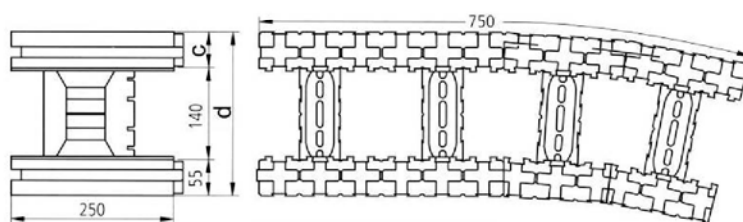
Annex 2.1



25cm-interior wall end element



Arch element



Arch connection element

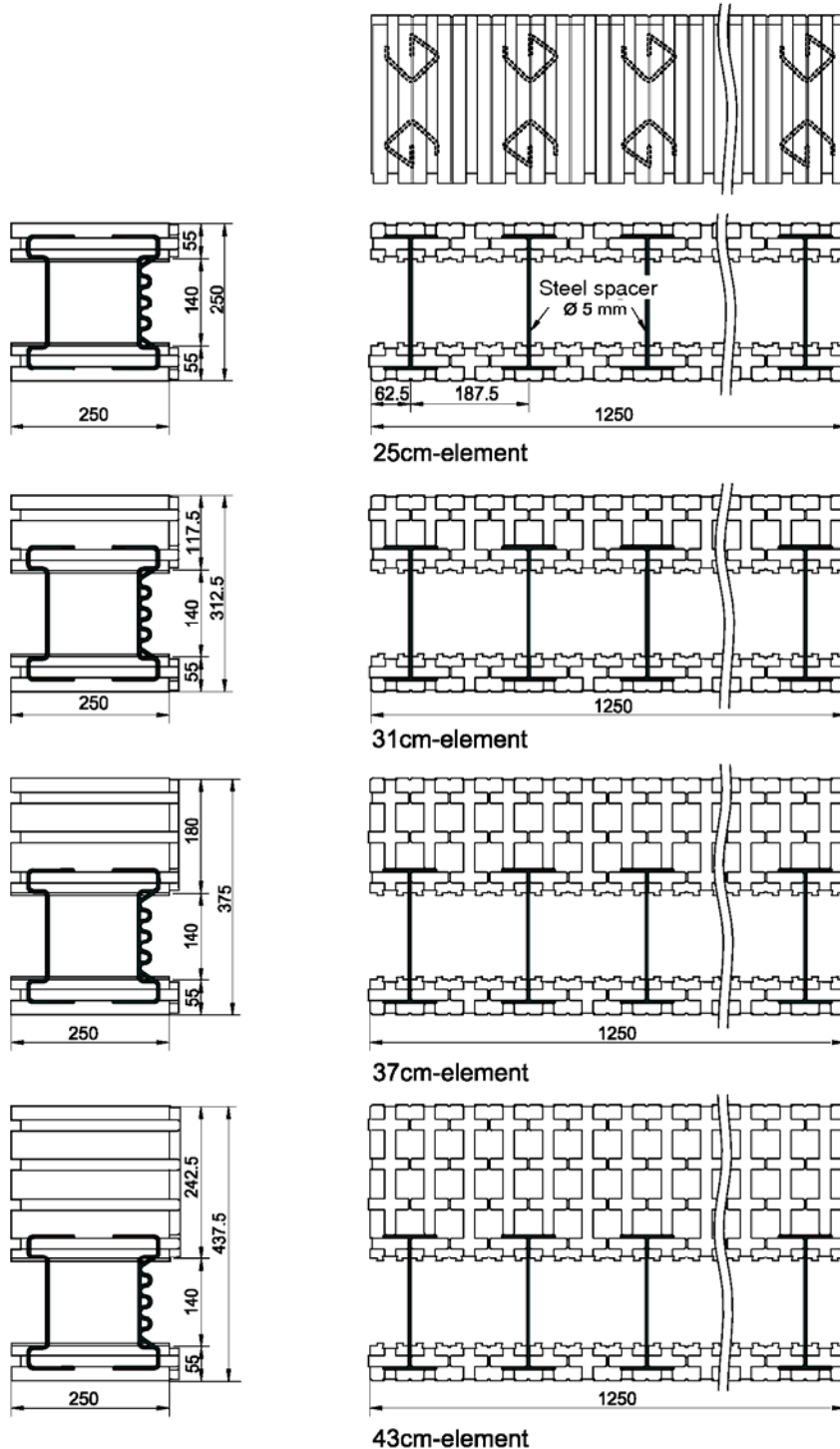
Type	c [mm]	d [mm]
25cm-arch element	55.0	250.0
25cm-arch connection element		
31cm-arch element	117.5	312.5
31cm-arch connection element		
37cm-arch element	180.0	375.0
37cm-arch connection element		
43cm-arch element	242.5	437.0
43cm-arch connection element		

without scale, dimensions are given in [mm]

isorast

EPS special shuttering elements with EPS spacers – Type 1

Annex 2.2

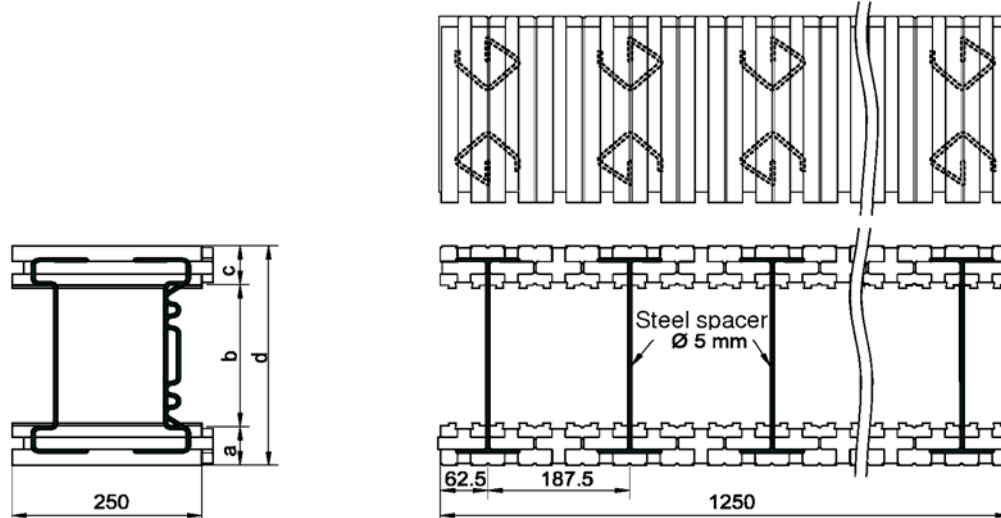


without scale, dimensions are given in [mm]

isorast

EPS standard shuttering elements with steel spacers – Type 2

Annex 3.1



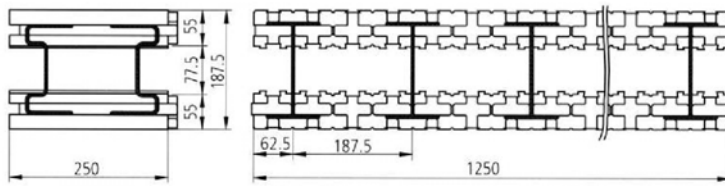
Type	a [mm]	b [mm]	c [mm]	d [mm]
Type 2 / 055-203-055	55.0	202.5	55.0	312.5
Type 2 / 055-203-118	55.0	202.5	117.5	375.0
Type 2 / 055-203-180	55.0	202.5	180.0	437.5
Type 2 / 055-203-243	55.0	202.5	242.5	500.0
Type 2 / 055-265-055	55.0	265.0	55.0	375.0
Type 2 / 055-265-118	55.0	265.0	117.5	437.5
Type 2 / 055-265-180	55.0	265.0	180.0	500.0
Type 2 / 055-265-243	55.0	265.0	242.5	562.5

without scale, dimensions are given in [mm]

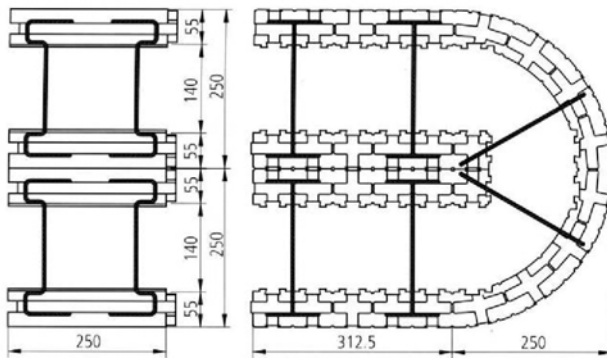
isorast

EPS special shuttering elements with steel spacers – Type 2  
(larger concrete core)

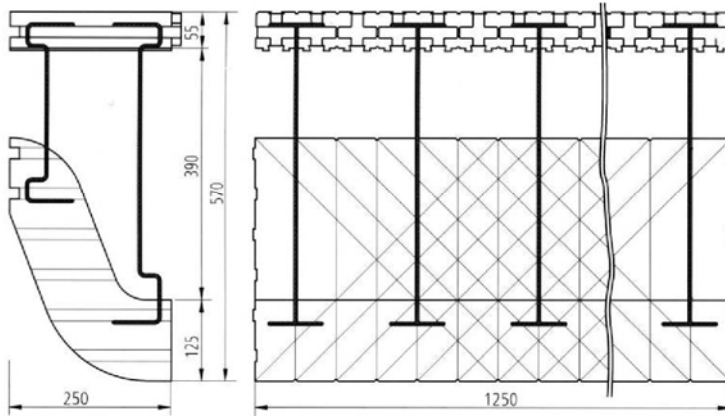
Annex 3.2



18cm-interior wall element



25cm-curved edge element



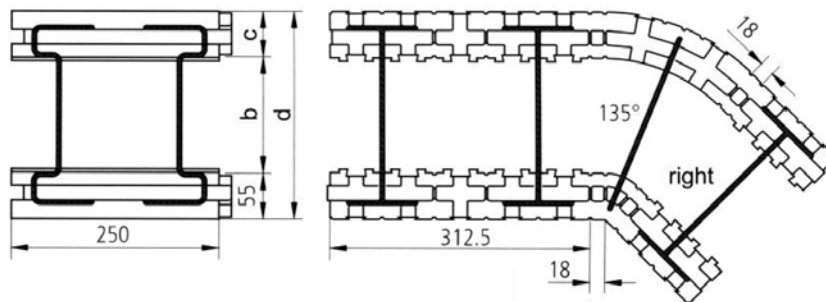
Cantilever element

without scale, dimensions are given in [mm]

isorast

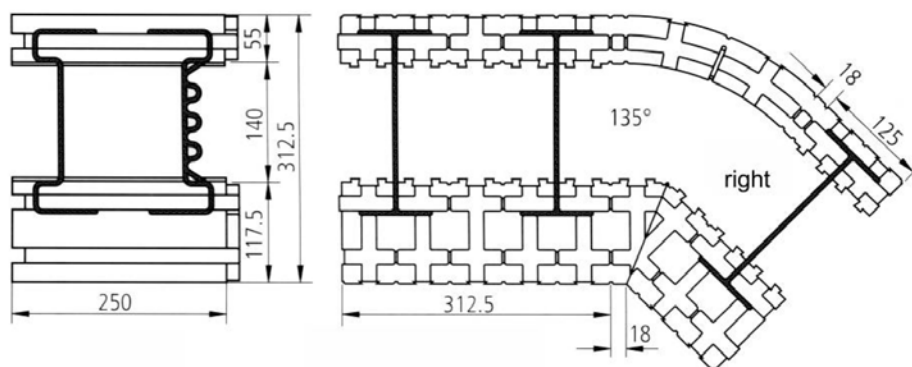
EPS special shuttering elements with steel spacers – Type 2

Annex 3.3



Oriel element, left and right

Type	b [mm]	c [mm]	d [mm]
25cm-oriel element	140.0	55.0	250.0
31cm-oriel element	140.0	117.5	312.5
37cm-oriel element	140.0	180.0	375.0
43cm-oriel element	140.0	242.5	437.0
31cm/202-oriel element	202.5	55.0	312.5
37cm/202-oriel element	202.5	117.5	375.0
43cm/202-oriel element	202.5	180.0	437.5



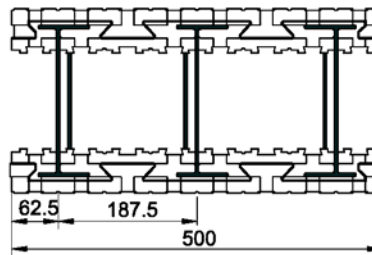
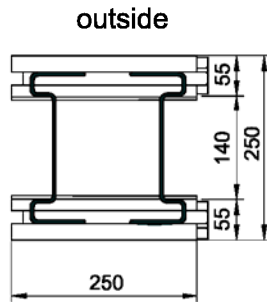
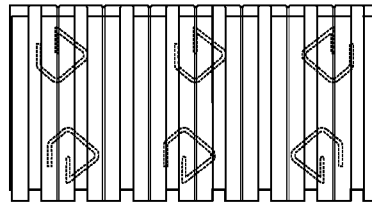
31cm-interior oriel element, left and right

without scale, dimensions are given in [mm]

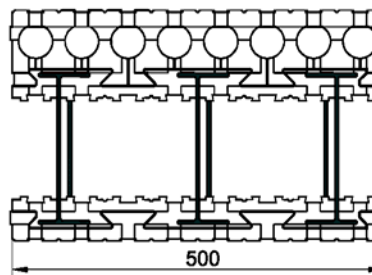
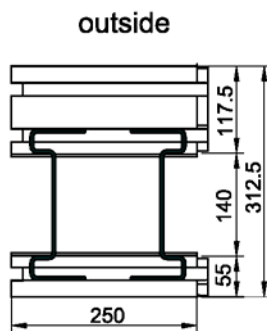
isorast

EPS special shuttering elements with steel spacers – Type 2

Annex 3.4



25cm acoustic element



31cm super acoustic element

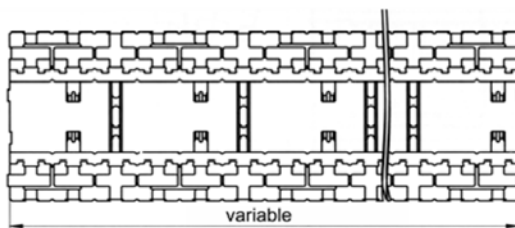
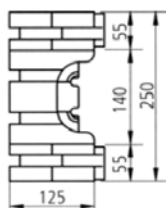
without scale, dimensions are given in [mm]

isorast

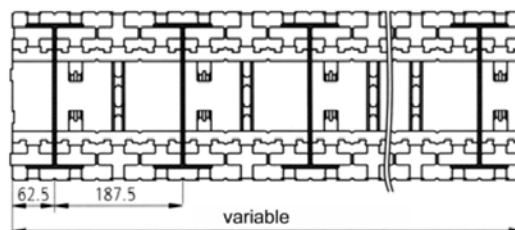
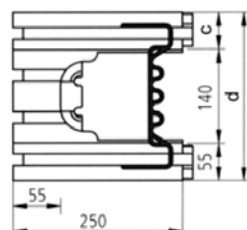
EPS shuttering elements with increased sound absorption

Annex 4

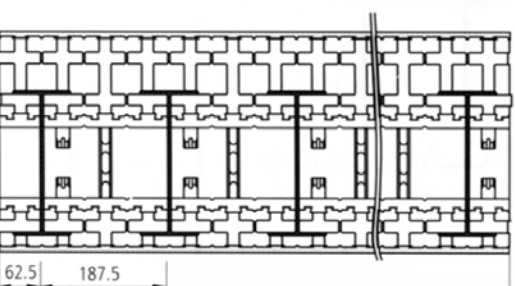
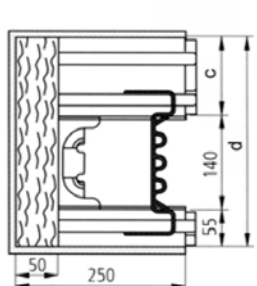




Interior door lintel element



Lintel element



Lintel element "S"

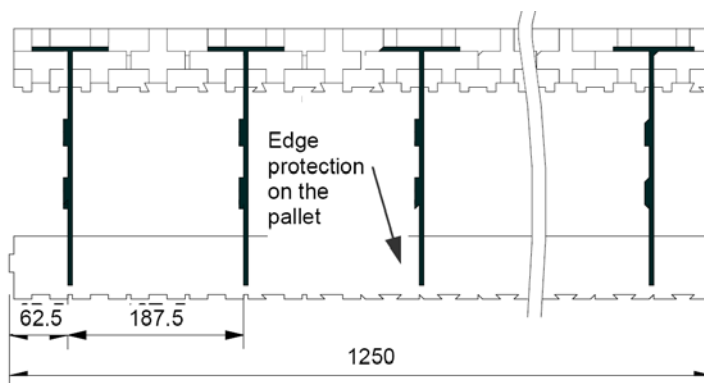
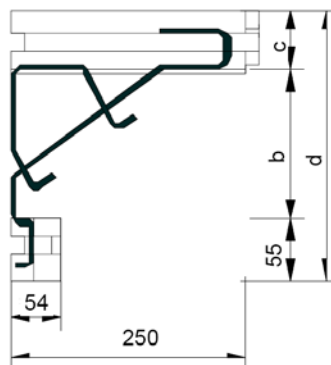
Type	c [mm]	d [mm]
25cm-lintel element	55.0	250.0
31cm-lintel element	117.5	312.5
31cm-lintel element „S“		
37cm-lintel element	180.0	375.0
37cm-lintel element „S“		
43cm-lintel element	242.5	437.0
43cm-lintel element „S“		

without scale, dimensions are given in [mm]

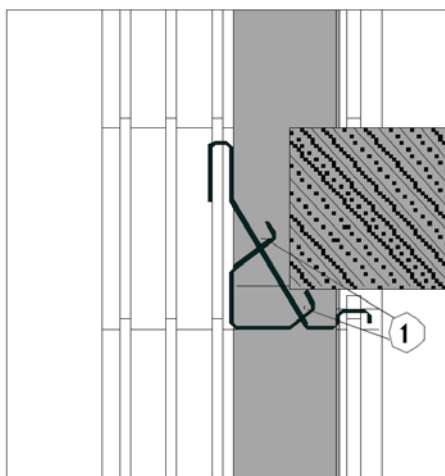
isorast

Special elements: Lintel elements

Annex 5



Type	b [mm]	c [mm]	d [mm]
25cm-floor edge element	140.0	55.0	250.0
31cm-floor edge element	140.0	117.5	312.5
37cm-floor edge element	140.0	180.0	375.0
43cm-floor edge element	140.0	242.5	437.5
31cm/202-floor edge element	202.5	55.0	312.5
37cm/202-floor edge element	202.5	117.5	375.0
43cm/202-floor edge element	202.5	180.0	437.5
50cm/202-floor edge element	202.5	242.5	500.0



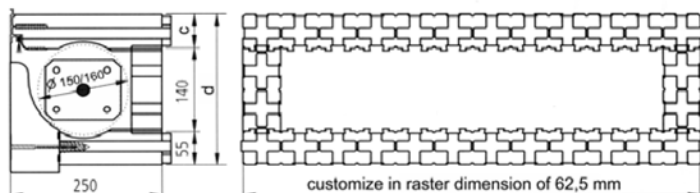
Side view of floor edge elements

without scale, dimensions are given in [mm]

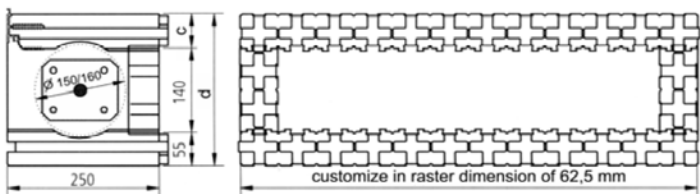
isorast

Special elements: Floor edge elements

Annex 6

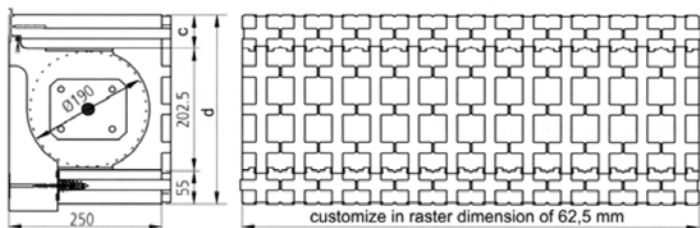


Roller jalousie housing „Ri“  
(interior inspection)

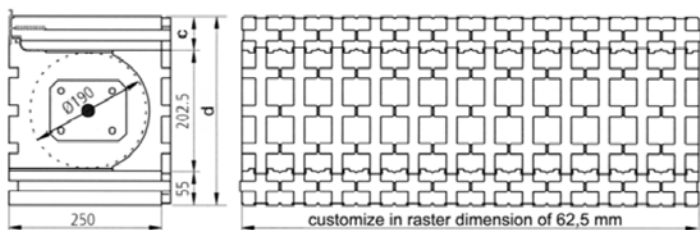


Roller jalousie housing „Ra“  
(exterior inspection)

Type	c [mm]	d [mm]	Interior diameter [mm]
25cm-roller jalousie housing „Ri“, $\varnothing 150$	55.0	250.0	150.0
25cm-roller jalousie housing „Ra“, $\varnothing 150$			
31cm-roller jalousie housing „Ra“, $\varnothing 150$	117.5	312.5	160.0
37cm-roller jalousie housing „Ra“, $\varnothing 160$	180.0	375.0	
43cm-roller jalousie housing „Ra“, $\varnothing 160$	242.5	437.5	



Roller jalousie housing „Ri“  
(interior inspection)



Roller jalousie housing „Ra“  
(exterior inspection)

Type	c [mm]	d [mm]	Interior diameter [mm]
31cm-roller jalousie housing „Ri“, $\varnothing 190$	55.0	312.5	190
31cm-roller jalousie housing „Ra“, $\varnothing 190$			
37cm-roller jalousie housing „Ri“, $\varnothing 190$	180.0	375.0	
37cm-roller jalousie housing „Ra“, $\varnothing 190$			
43cm-roller jalousie housing „Ri“, $\varnothing 190$	242.5	437.5	
43cm-roller jalousie housing „Ra“, $\varnothing 190$			

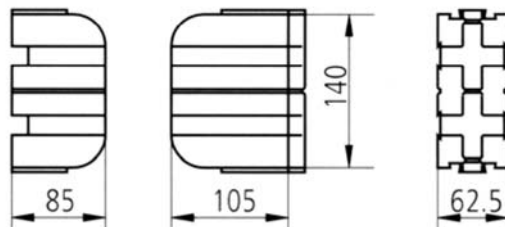
without scale, dimensions are given in [mm]

isorast

Special elements: Roller jalousie housing

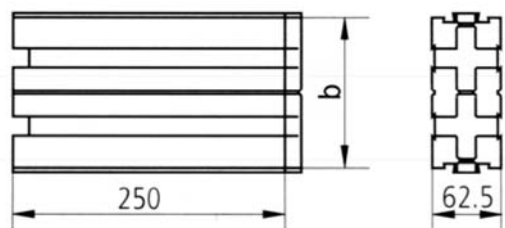
Annex 7

### Type 1: with EPS spacers



Type 1 / 140-end element

### Type 2: with Steel spacers



Type 2 / End element

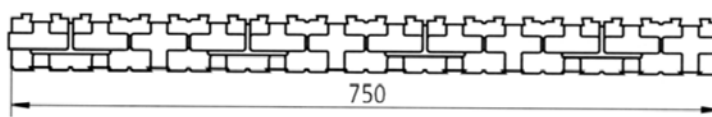
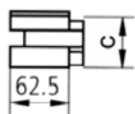
Type	b [mm]
Type2 / 77-end element	77.5
Type2 / 140-end element	140.0
Type2 / 202-end element	202.5
Type2 / 265-end element	265.0

without scale, dimensions are given in [mm]

isorast

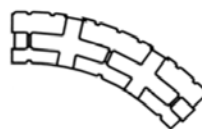
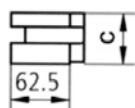
Accessory parts: End element

Annex 8



Height adjuster element

Type	c [mm]
Height adjuster element	55.0
43cm-height adjuster element	242.5



Oriel/curved edge height adjuster element

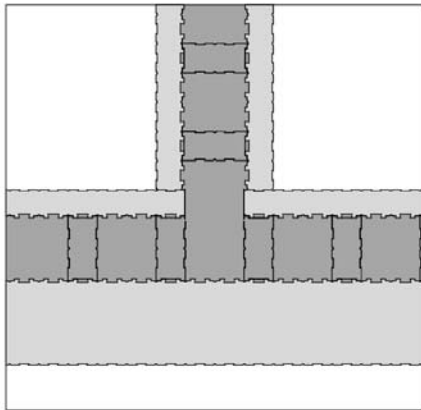
Type	c [mm]
25cm-oriel/curved edge height adjuster element	55.0
31cm-oriel height adjuster element	117.5
37cm-oriel height adjuster element	180.0
43cm-oriel height adjuster element	242.5

without scale, dimensions are given in [mm]

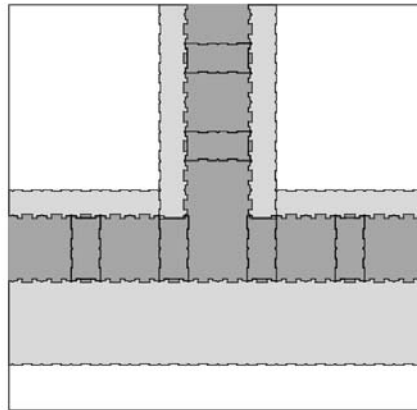
isorast

Accessory parts: Height adjuster element

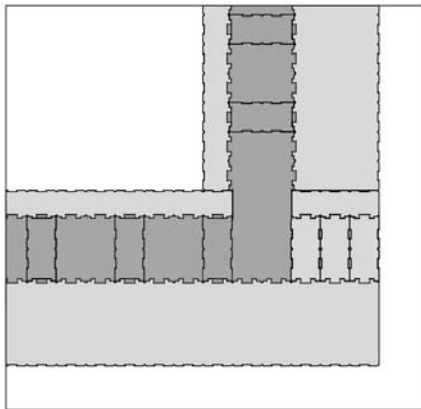
Annex 9



T-connection: 1. layer



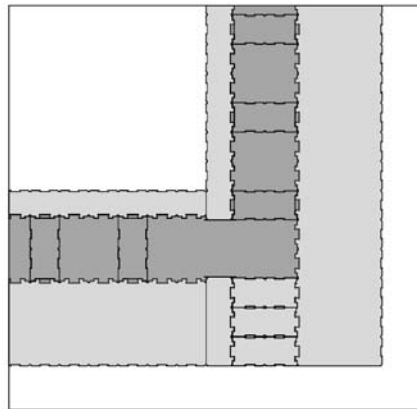
2. layer



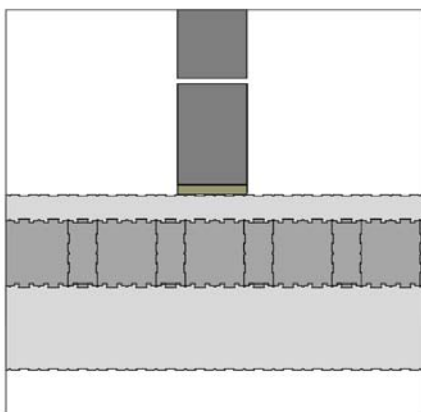
Corner connection: 1. layer

Hint:

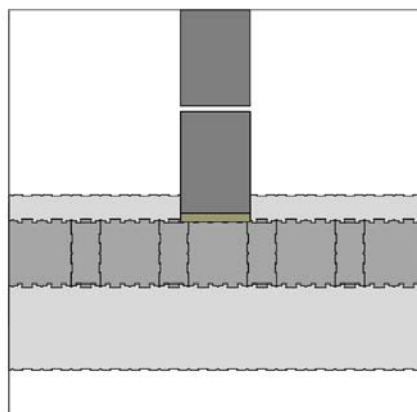
- always put wires on top of each other



2. layer



Masonry not fixed with concrete



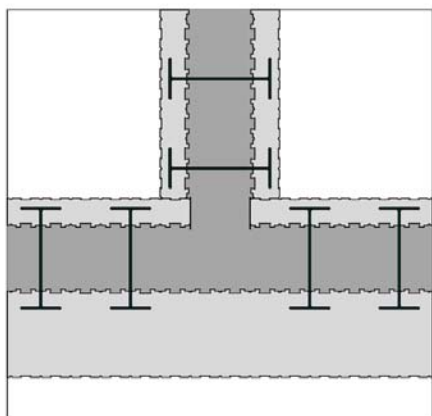
Masonry fixed with concrete

without scale

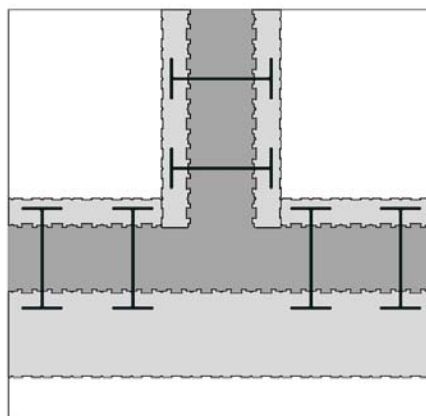
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T connections and corner connections of shuttering elements with EPS spacers (Type 1)

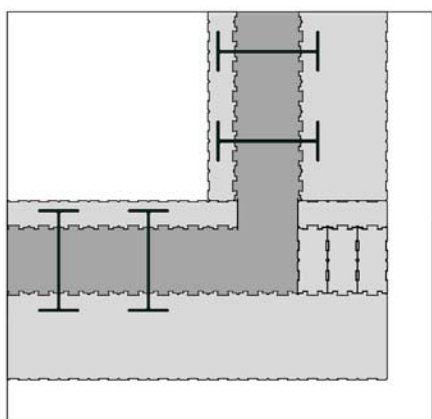
Annex 10



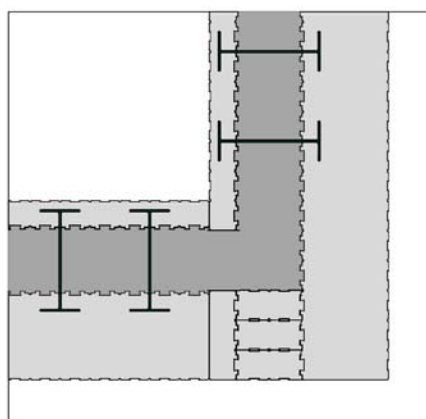
T-connection: 1. layer



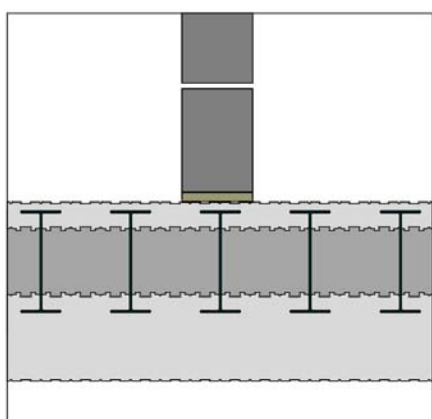
2. layer



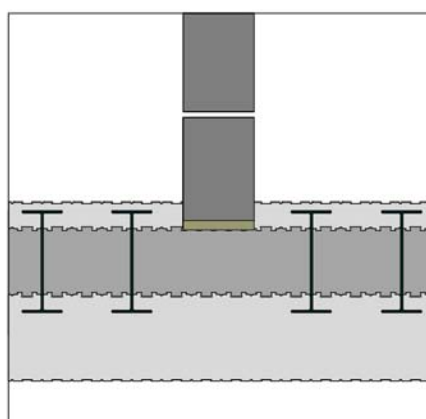
Corner connection: 1. layer



2. layer



Masonry not fixed with concrete



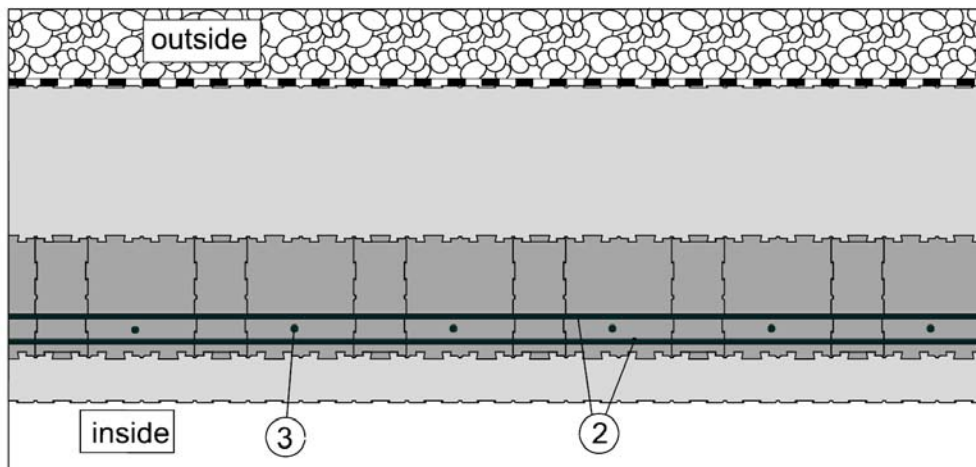
Masonry fixed with concrete

without scale

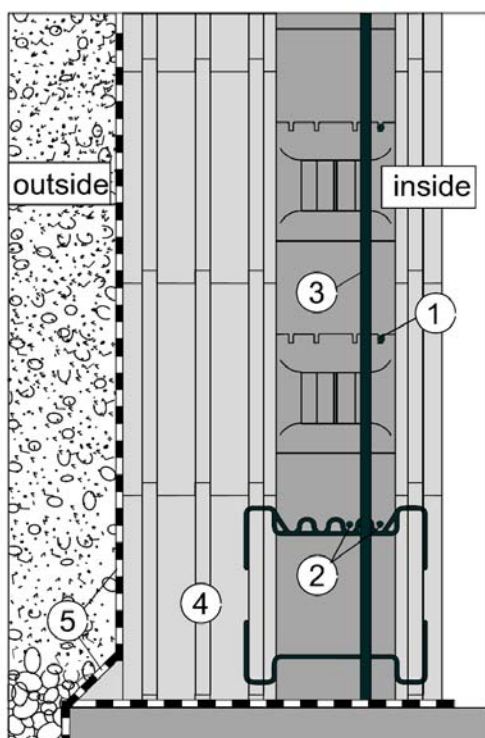
isorast

T connections and corner connections of shuttering elements with steel spacers (Type 2)

Annex 11



Cross section of an exterior basement wall with reinforcement according to static calculation



Vertical cut

- ① Transverse reinforcement, according to static calculation
- ② Transverse reinforcement in 1<sup>st</sup>, 5<sup>th</sup> and last row twice for fixation.
- ③ Vertical reinforcement, according to static calculation
- ④ Bottom row with steel spacers
- ⑤ Wall sealing

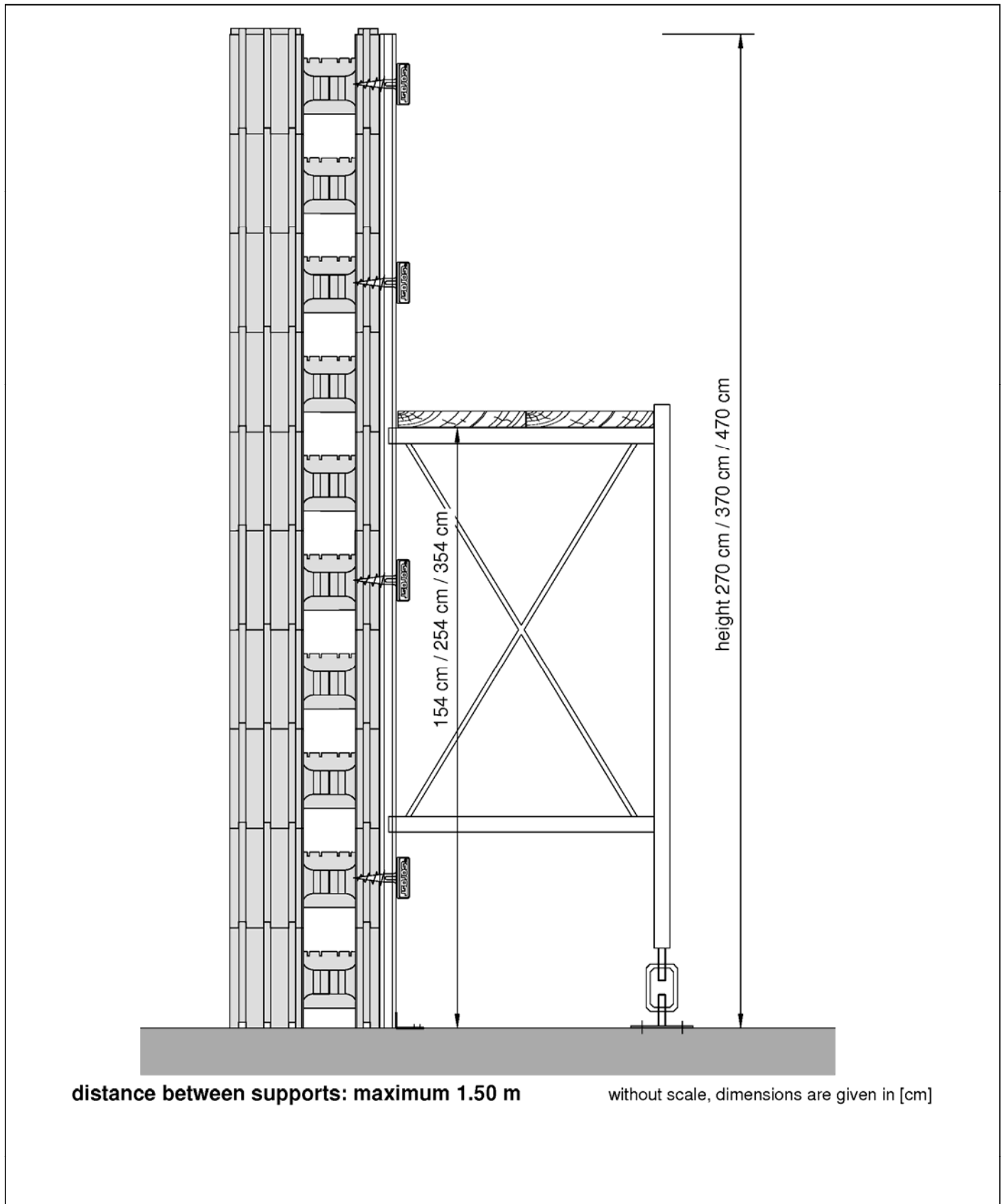
without scale

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Possible reinforcement in exterior basements walls made of shuttering elements with EPS spacers or steel spacers

Annex 12





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Mounted scaffolding with supports	

Type		according to Annex	Spacer material	Wall thickness $d$	Core thickness $d_k$	Area of concrete core in plan view per meter wall length	Assumed weight of shuttering elements without rendering for $\gamma_{\text{EPS}} = 0.3 \text{ kN/m}^3$	Assumed weight of wall with concrete infill without rendering and $\gamma_{\text{Concrete}} = 25 \text{ kN/m}^3$	Area of horizontal concrete beam from wall of grid type $A_R$			
				[cm]	[cm]	[m <sup>2</sup> /m]	[kg/m <sup>2</sup> ]	[kg/m <sup>2</sup> ]	[cm <sup>2</sup> ]			
Type 1	25cm-element	2	EPS	25.00	14.00	0.0933	3.8	312	154			
	31cm-element			31.25		0.0933	5.7	314	154			
	37cm-element			37.50		0.0933	7.6	315	154			
	43cm-element			43.75		0.0933	9.4	317	154			
Type 2	25cm-element	3	Steel	25.00	14.00	0.1363	6.4	356	--			
	31cm-element			31.25		0.1363	8.3	358	--			
	37cm-element			37.50		0.1363	10.2	360	--			
	43cm-element			43.75		0.1363	12.0	362	--			
	055-203-055			31.25	20.25	0.1988	6.8	513	--			
	055-203-118			37.50		0.1988	8.7	515	--			
	055-203-180			43.75		0.1988	10.6	517	--			
	055-203-243			50.00		0.1988	12.4	519	--			
	055-265-055			37.50	26.50	0.2613	7.2	670	--			
	055-265-118			43.75		0.2613	9.1	672	--			
	055-265-180			50.00		0.2613	11.0	674	--			
	055-265-243			56.25		0.2613	12.8	676	--			
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	Design values for the standard shuttering elements according to Annex 2 and 3											

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	2008	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 717-1	1996 + A1:2006	Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation
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
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"
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List of standards and guidelines		