

Characteristics of product

The shuttering kit "ISORAST" consists of the following elements:

- standard shuttering elements,
- special shuttering elements,
- shuttering elements with increased sound absorption,
- special elements and
- accessory parts.

see clauses 1., 2., 3., 4. and 5.

1. Standard shuttering elements

The standard shuttering elements (composed of EPS shuttering leaves and EPS spacers (Type 1) respectively wire spacers (Type 2)) correspond to the information and drawings given in Annexes A3.1 and A4.1 to A4.2.

The following types of standard shuttering elements are available:

Table A1: Wall thicknesses of the standard shuttering elements

Type			according to Annex	Thickness of the wall	Thickness of concrete core	Thickness of EPS shuttering leaves	
						inner	outer
				[mm]	[mm]	[mm]	[mm]
Spacers	EPS (Type 1)	25 cm-Element	A3	250,0	140,0	55,0	55,0
		31 cm-Element		312,5			117,5
		37 cm-Element		375,0			180,0
		43 cm-Element		437,5			242,5
	Wire (Type 2)	25 cm-Element	A4	250,0	140,0	55,0	55,0
		31 cm-Element		312,5			117,5
		37 cm-Element		375,0			180,0
		43 cm-Element		437,5			242,5
		055-203-055		312,5	202,5		55,0
		055-203-118		375,0			117,5
		055-203-180		437,5			180,0
		055-203-243		500,0			242,5
		055-265-055		375,0	265,0		55,0
		055-265-118		437,5			117,5
		055-265-180		500,0			180,0
		055-265-243		562,5			242,5

The top and the bottom of each EPS shuttering leaf incorporate an interlocking arrangement to form a tight joint (see Annexes A2 to A4).

The surfaces are generally smooth. There are also tapered vertical grooves on the inside and outside face of each EPS shuttering leaf.

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Installation

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These element-high dovetail grooves on the inside face provide a mechanical interlock between EPS shuttering leaves and concrete core (see clause 3.4.1) and additionally form locks for end stops.

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 B7).

The system can be used to construct straight, arched and angled (135°-angle) 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) 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) to build reinforced concrete walls.

The EPS shuttering leaves are made of expanded polystyrene (EPS) EPS-EN 13163-T(1)-L(2)-W(2)-S(2)-P(5)-DS(70,-)3-BS200-DS(N)5-TR100 according to EN 13163 composed of polystyrene particle foam with graphite (NEOPOR® 2400 made by BASF).

The density ρ of the expanded polystyrene is at least 24,5 kg/m³ and at most 29 kg/m³ respectively the mean value is 27 kg/m³.

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

The nominal diameter of the spacers made of steel wire (wire spacers (Type 2), see e.g. Annex A4.1) shall be at least 4,95 mm.

The tensile strength of the wire spacers (Type 2) shall be at least 690 MPa. The pull-out strength between spacers and the EPS shuttering leaves shall be at least

- 624 N with EPS spacers (Type 1) respectively
- 575 N with wire spacers (Type 2).

The material characteristics, dimensions and tolerances of the standard shuttering elements not indicated in Annexes A3.1 and A4.1 to A4.2 are given in the technical documentation¹ of the ETA.

2. Special shuttering elements

The special shuttering elements correspond to the information and drawings given in Annexes A3.2 and A4.2 to A4.4. The special shuttering elements are:

- interior wall end elements,
- arch elements,
- arch connection elements,
- interior wall elements,
- curved edge elements,
- cantilever elements and
- oriel elements.

Special shuttering elements are designed in the same manner as the standard shuttering elements described above, see clause 1.

The special shuttering elements consist of EPS and EPS spacers (Type 1) respectively wire spacers (Type 2). It is the same material used for standard shuttering elements specified in clause 1.

¹ The technical documentation of the ETA is deposited with Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the notified bodies involved in the assessment and verification of constancy of performance, is handed over to the approved bodies.

3. Shuttering elements with increased sound absorption

The shuttering elements with increased sound absorption correspond to the information and drawings given in Annex A5. The special shuttering elements are:

Shuttering elements with increased sound absorption are designed in the same manner as the standard shuttering elements described above, see clause 1.

The special shuttering elements consist of EPS and wire spacers (Type 2). It is the same material used for standard shuttering elements specified in clause 1.

4. Special elements

The special elements correspond to the information and drawings given in Annexes A6 to A8. The special shuttering elements are:

- interior door lintel elements,
- lintel elements,
- 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.

The special elements consist of EPS and EPS spacers (Type 1) respectively wire spacers (Type 2), it is the same material used for standard shuttering elements specified in clause 1.

5. Accessory parts

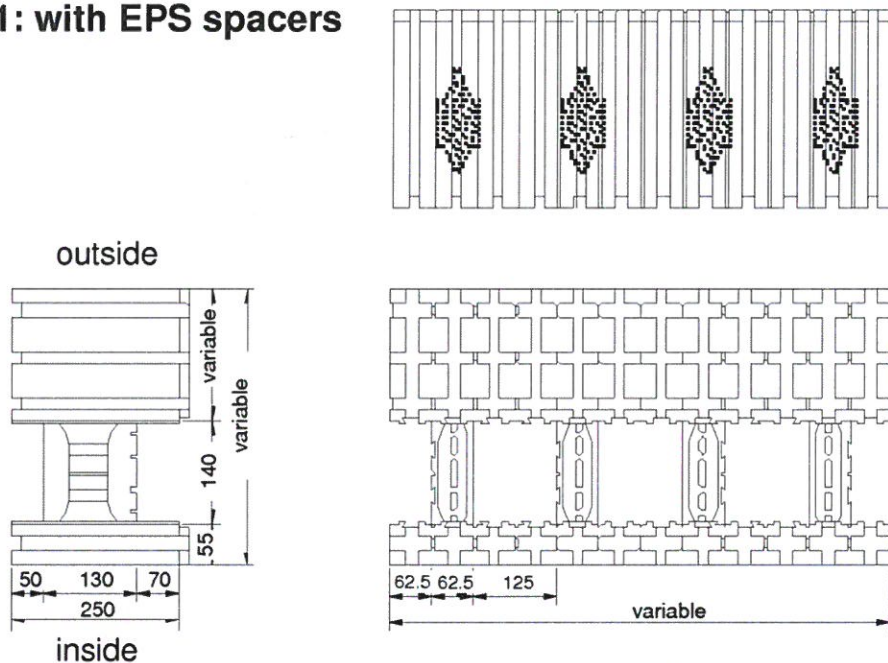
The accessory parts correspond to the information and drawings given in Annexes A9 and A10. The accessory parts are:

- end stops with EPS spacers (Type 1),
- end stops with wire spacers (Type 2),
- straight height adjuster pieces and
- height adjuster pieces for oriel elements and curved edge elements.

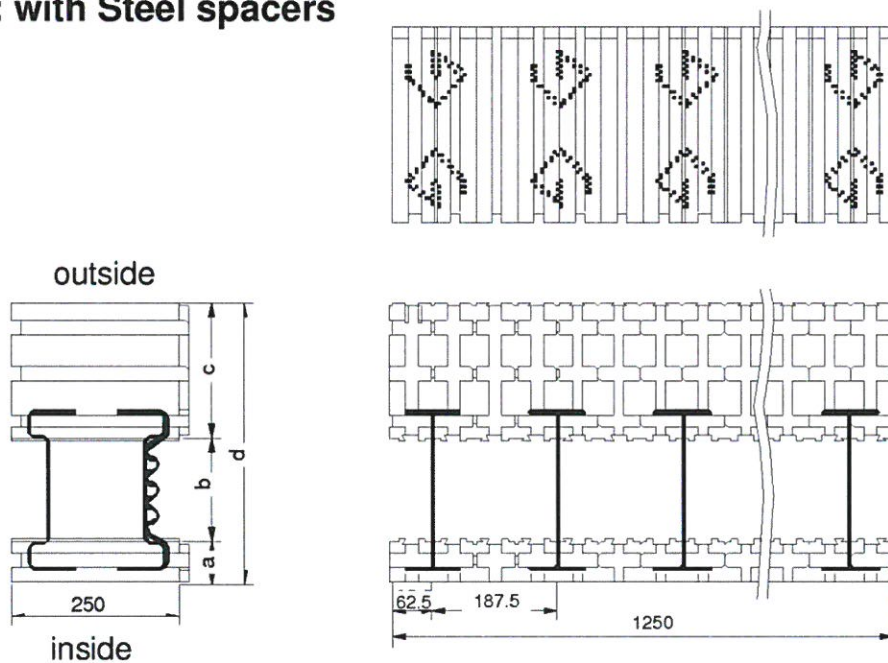
The accessory parts consist of EPS, it is the same material used for standard shuttering elements specified in clause 1.

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Installation	

Type 1: with EPS spacers



Type 2: with Steel spacers

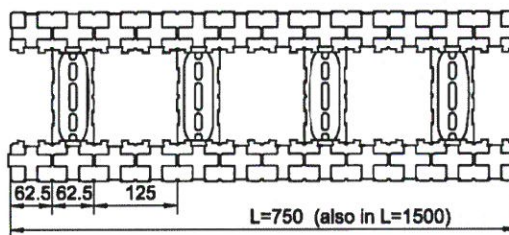
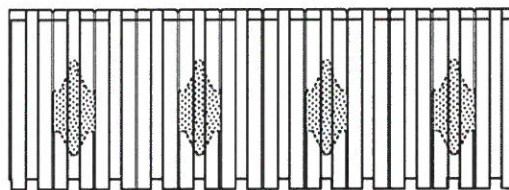
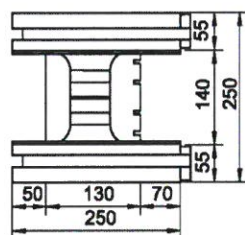


without scale, dimensions are given in [mm]

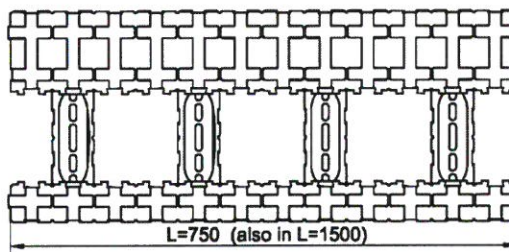
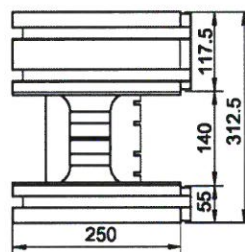
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Overview of the standard shuttering elements with
EPS spacers (Type 1) respectively wire spacers (Type 2)
(Schematic description of shuttering elements made of EPS)

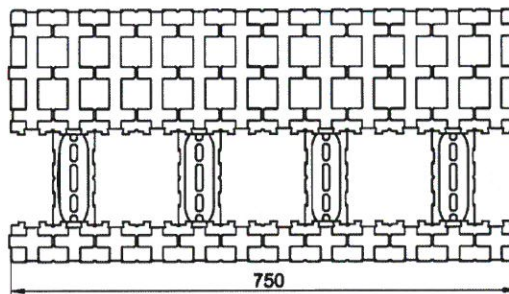
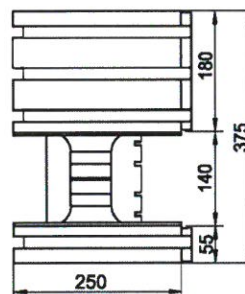
Annex A2



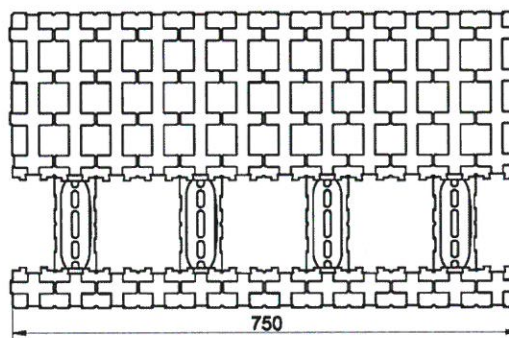
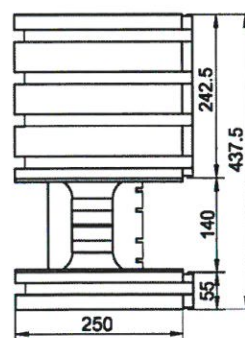
25cm-element



31cm-element



37cm-element



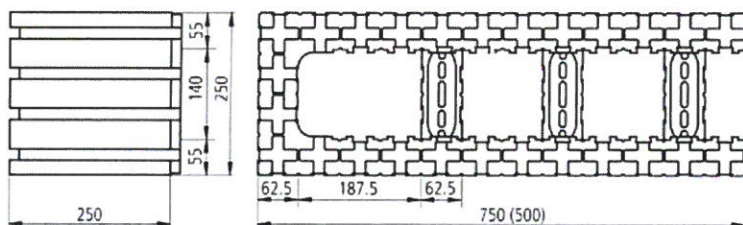
43cm-element

without scale, dimensions are given in [mm]

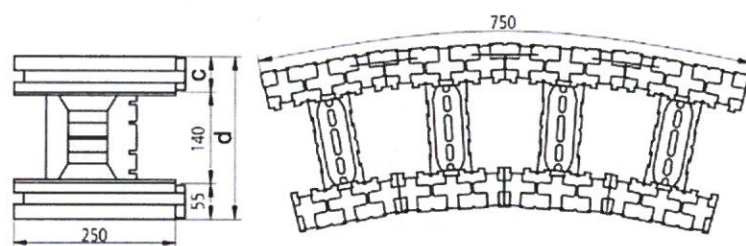
ISORAST

Standard shuttering elements with EPS spacers (Type 1)
Thickness of the concrete core 140 mm

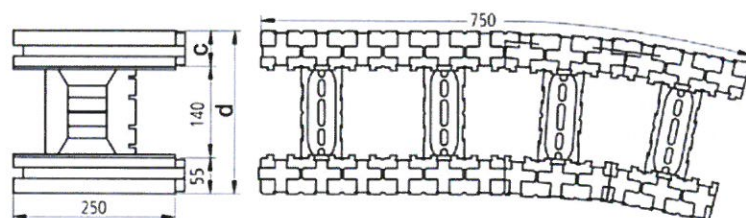
Annex A3.1



25cm-interior wall end element



Arch element



Arch connection element

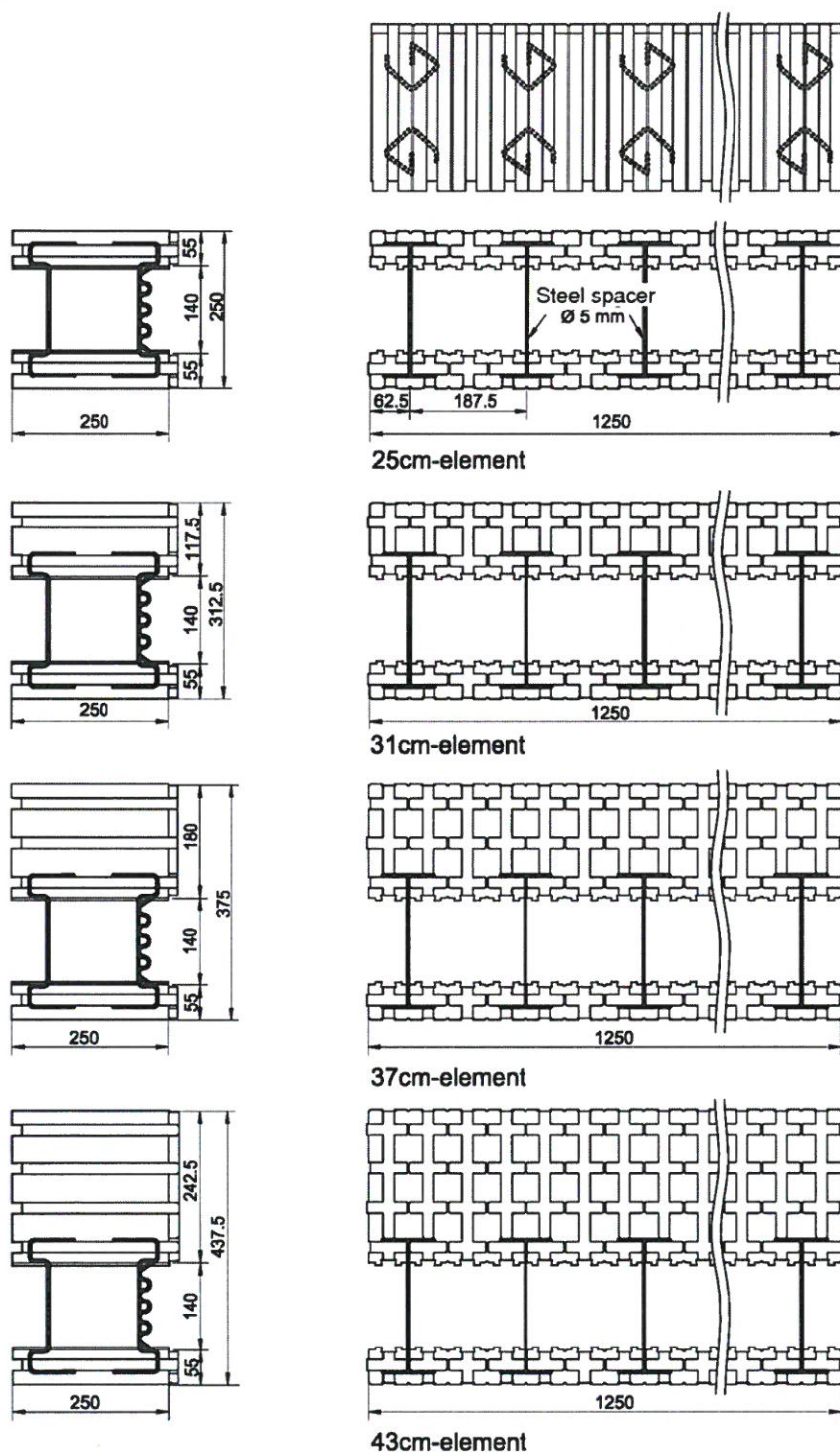
Type	c [mm]	d [mm]
25cm-arch element	55.0	250.0
25cm-arch connection element		
31cm-arch element	117.5	312.5
31cm-arch connection element		
37cm-arch element	180.0	375.0
37cm-arch connection element		
43cm-arch element	242.5	437.0
43cm-arch connection element		

without scale, dimensions are given in [mm]

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Special shuttering elements with EPS spacers (Type 1):
Interior wall end elements, arch elements and arch connection elements

Annex A3.2

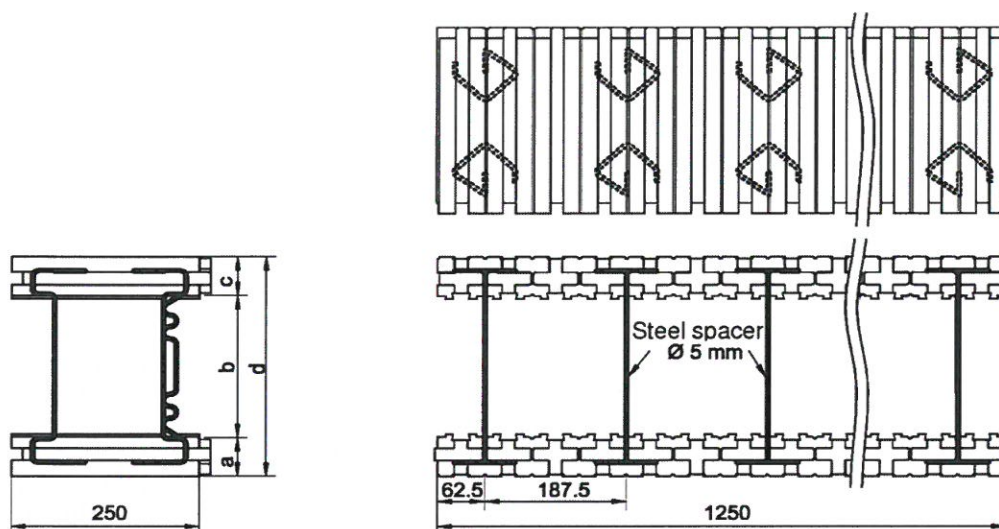


without scale, dimensions are given in [mm]

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Standard shuttering elements with wire spacers (Type 2)
Thickness of the concrete core 140 mm

Annex A4.1



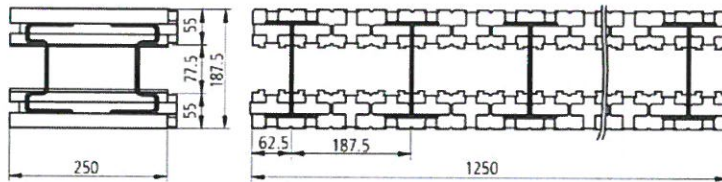
Type	a [mm]	b [mm]	c [mm]	d [mm]
Type 2 / 055-203-055	55.0	202.5	55.0	312.5
Type 2 / 055-203-118	55.0	202.5	117.5	375.0
Type 2 / 055-203-180	55.0	202.5	180.0	437.5
Type 2 / 055-203-243	55.0	202.5	242.5	500.0
Type 2 / 055-265-055	55.0	265.0	55.0	375.0
Type 2 / 055-265-118	55.0	265.0	117.5	437.5
Type 2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

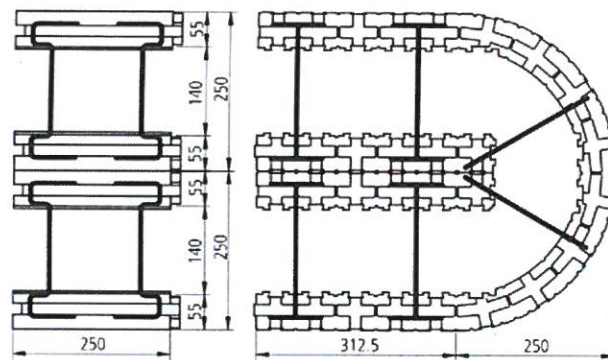
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Standard shuttering elements with wire spacers (Type 2)
Thicknesses of the concrete core 202,5 mm and 265 mm

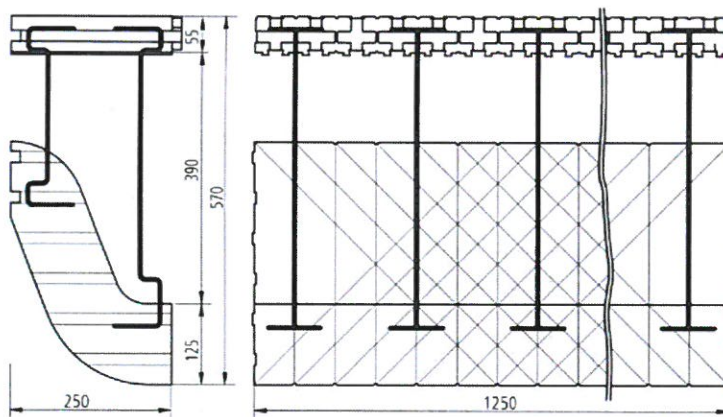
Annex A4.2



18cm-interior wall element



25cm-curved edge element



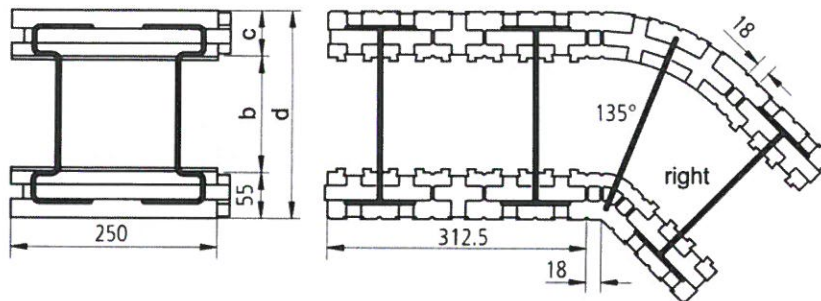
Cantilever element

without scale, dimensions are given in [mm]

ISORAST

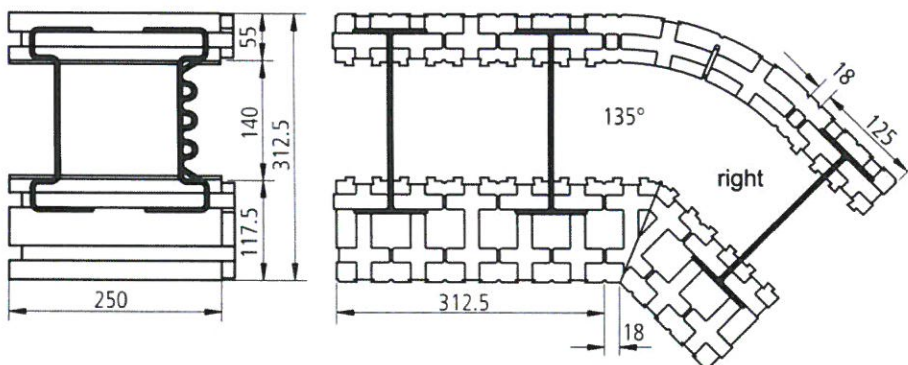
Special shuttering elements with wire spacers (Type 2):
Interior wall elements, curved edge elements and cantilever elements

Annex A4.3



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



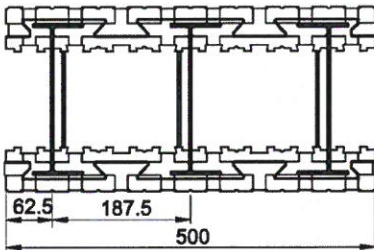
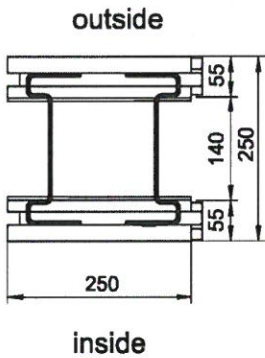
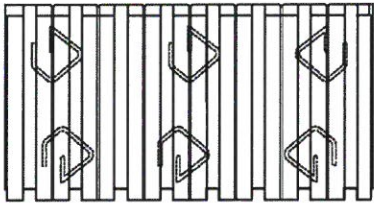
31cm-interior oriel element, left and right

without scale, dimensions are given in [mm]

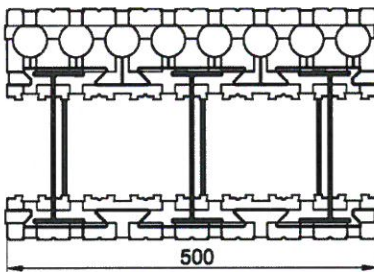
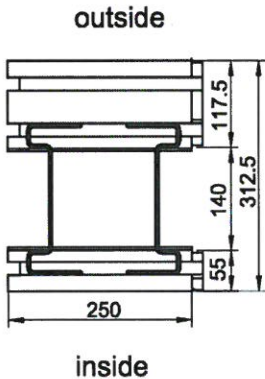
ISORAST

Special shuttering elements with wire spacers (Type 2):
Oriel elements

Annex A4.4



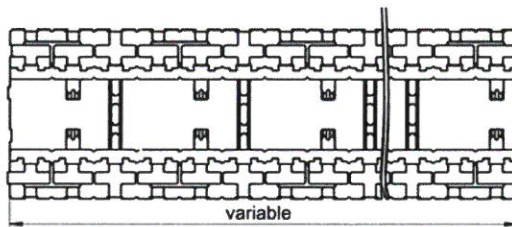
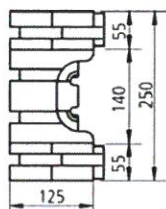
25cm acoustic element



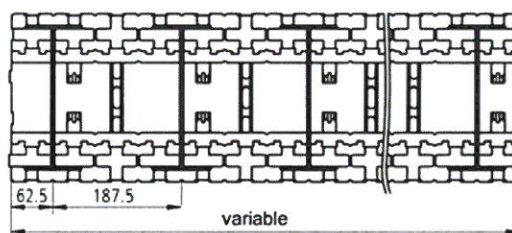
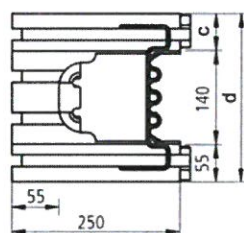
31cm super acoustic element

without scale, dimensions are given in [mm]

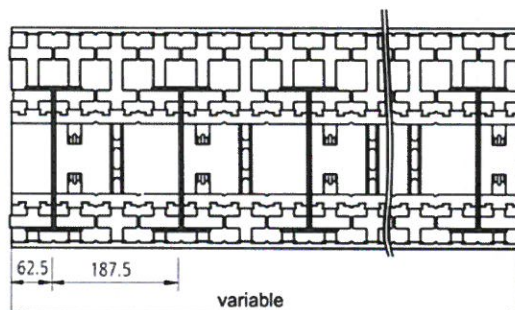
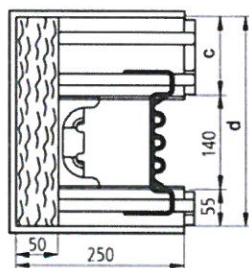
ISORAST	Annex A5
Shuttering elements with increased sound absorption	



Interior door lintel element



Lintel element



Lintel element "S"

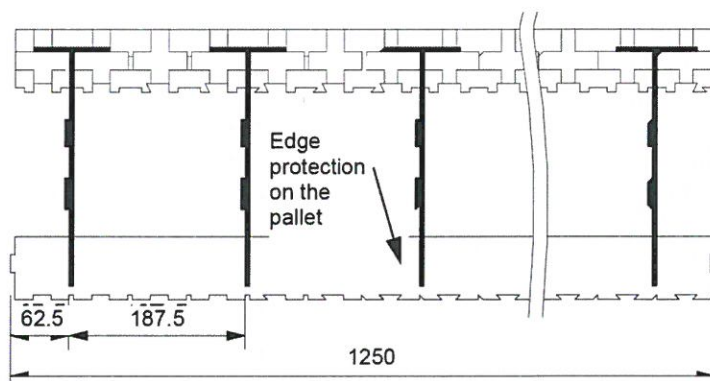
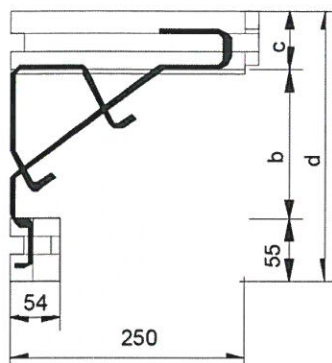
Type	c [mm]	d [mm]
25cm-lintel element	55.0	250.0
31cm-lintel element	117.5	312.5
31cm-lintel element „S“		
37cm-lintel element	180.0	375.0
37cm-lintel element „S“		
43cm-lintel element	242.5	437.0
43cm-lintel element „S“		

without scale, dimensions are given in [mm]

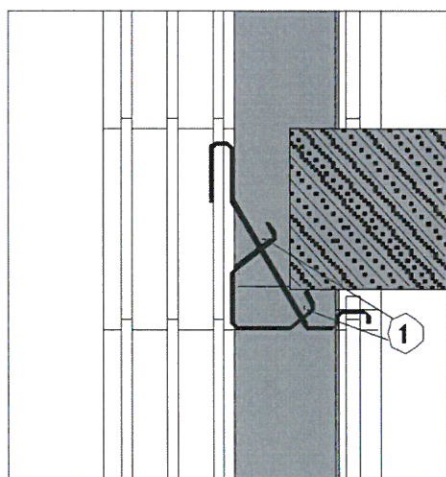
ISORAST

Special elements:
Interior door lintel elements and Lintel elements

Annex A6



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



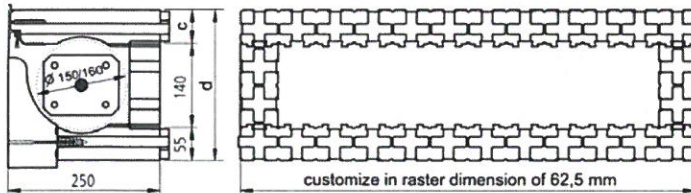
Side view of floor edge elements

without scale, dimensions are given in [mm]

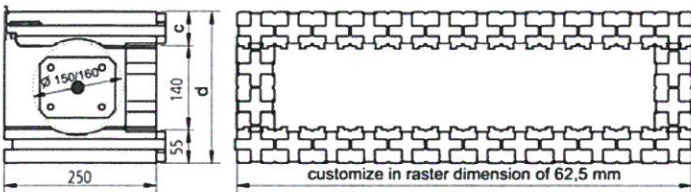
ISORAST

Special elements:
Floor edge elements

Annex A7

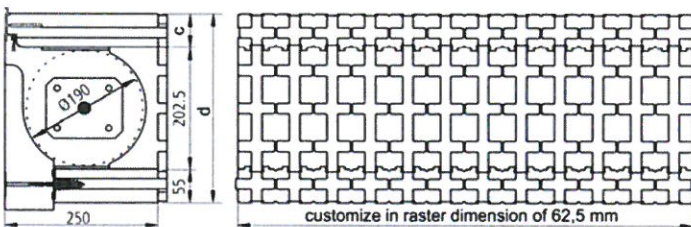


Roller jalousie housing „Ri“
(interior inspection)

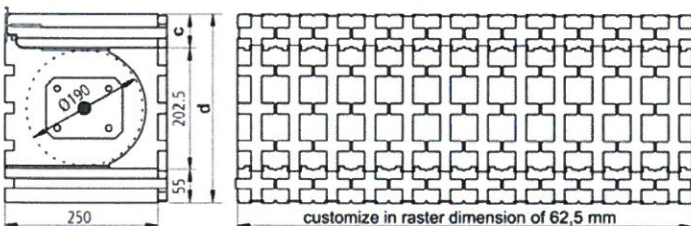


Roller jalousie housing „Ra“
(exterior inspection)

Type	c [mm]	d [mm]	Interior diameter [mm]
25cm-roller jalousie housing „Ri“, ø 150	55.0	250.0	150.0
25cm-roller jalousie housing „Ra“, ø 150			
31cm-roller jalousie housing „Ra“, ø 150	117.5	312.5	160.0
37cm-roller jalousie housing „Ra“, ø 160	180.0	375.0	
43cm-roller jalousie housing „Ra“, ø 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“, ø 190	55.0	312.5	190
31cm-roller jalousie housing „Ra“, ø 190			
37cm-roller jalousie housing „Ri“, ø 190	180.0	375.0	
37cm-roller jalousie housing „Ra“, ø 190			
43cm-roller jalousie housing „Ri“, ø 190	242.5	437.5	
43cm-roller jalousie housing „Ra“, ø 190			

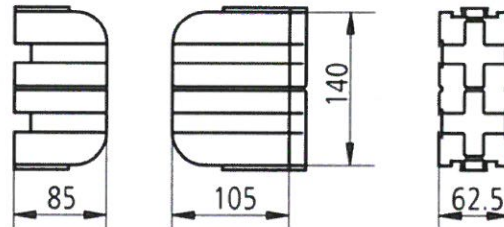
without scale, dimensions are given in [mm]

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Special elements:
Roller shutter box elements

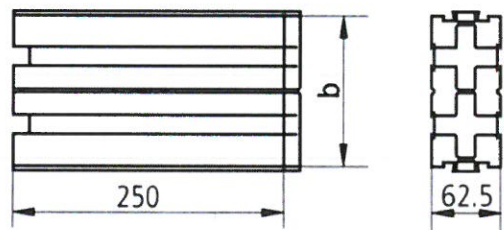
Annex A8

Type 1: with EPS spacers



Type 1 / 140-end element

Type 2: with Steel spacers



Type 2 / End element

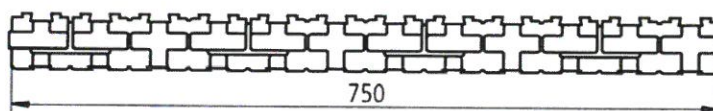
Type	b [mm]
Type2 / 77-end element	77.5
Type2 / 140-end element	140.0
Type2 / 202-end element	202.5
Type2 / 265-end element	265.0

without scale, dimensions are given in [mm]

ISORAST

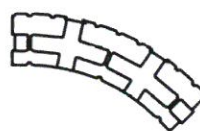
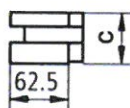
Accessory parts:
End stops with EPS spacers (Type 1) respectively wire spacers (Type 2)

Annex A9



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]

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Accessory parts:
Straight height adjuster pieces and
Height adjuster pieces for oriel elements and curved edge elements

Annex A10

Installation

1. General

The manufacturer shall ensure that the requirements in accordance with clauses 1, 3 and this Annex 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 2.) site mixed or ready mixed concrete is placed and compacted (see clause 3.).

In end use conditions concrete walls of a grid type respectively continuous type² (see clause 3.1.1) 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 B8.

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.

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 Annexes B4 and B5).

Furthermore for walls constructed with shuttering elements with EPS spacers (Type 1), the spacers shall be superimposed on the other in a vertical alignment.

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

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 B7).

The push pull props shall be arranged with a maximum distance of 1,50 m to be connected over the entire wall height with the shuttering elements and to be fastened to the floor (see Annex B7).

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 typical wall junctions of shuttering elements with EPS spacers (Type 1) are to be formed according to Annex B4 and of shuttering elements with wire spacers (Type 2) are to be formed according to Annex B5.

Further information is given in the installation guide.

3. Concreting

For the production of normal concrete EN 206 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.

²

see ETAG 009, clause 2.2

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, Table 16.

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. For arched and angled walls made with shuttering elements the concreting rate shall not exceed 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. 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.

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5. Reworking and finishes

Walls of the type "ISORAST" 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.

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.

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Installation

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standards and guidelines		issue	title
EN	206	2013+A1:2016	Concrete - Specification, performance, production and conformity
EN	1992-1-1	2004+AC:2010+A1:2014	Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
EN	13163	2012+A2:2016	Thermal insulation products for buildings - Factory made 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	2016	Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services
EN ISO	717-1	2013	Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation
EN ISO	6946	2017	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"
ISORAST			Annex B2
List of standards and guidelines			

Information on the determination of the declared value of the thermal resistance under end-use conditions (with concrete, without plaster)

The declared value of the thermal resistance of the EPS leafs $R_{D,EPS}$ shall be calculated in accordance with EN ISO 6946. For the declared value of the thermal conductivity of the EPS λ_{EPS} , the value according to 3.6.1 shall be used. For the thermal conductivity of the concrete $\lambda_{concrete}$, the value from EN ISO 10456, Table 3 can be used. The density of the used concrete shall be taken into account.

Taking into account the inhomogeneity possible for the system "ISORAST" (lower thermal conductivity of the EPS leafs compared to the concrete for type 1 and higher thermal conductivity of the wire spacers than the concrete for type 2), the increase (type 1) and reduction factors (type 2) compared to the homogenous layer calculations may be determined.

In Table 1 this is done for a core of unreinforced concrete of the density of 2000 kg/m³. The corresponding thermal conductivity of this concrete according to EN ISO 10456 is $\lambda_{concrete} = 1,35 \text{ W/(m K)}$. The plaster was disregarded in these calculations.

Table 1: Declared value of the thermal resistance $R_{D,element}$ of the shuttering elements under end use conditions (with a core of concrete without reinforcement of the density of $\rho = 2000 \text{ kg / m}^3$ and a thermal conductivity according to EN ISO 10456, Table 3 of $\lambda_{concrete} = 1.35 \text{ W / (m K)}$, without plaster) in dependence on the thickness of the external EPS shuttering. The increase (in the case of shuttering elements with EPS bars) or reduction factors (in the case of shuttering elements with wire spacers) in comparison to a calculation with homogenous layers are given in the last column.

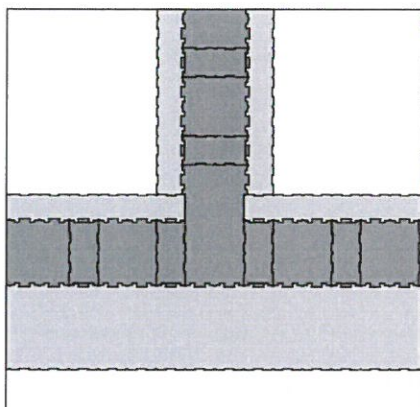
Type of spacers (material of spacers) of the shuttering elements	Thickness of concrete core	Thickness of EPS shuttering leaves		Declared value of thermal resistance $R_{D,element}$	Increase or reduction factor
		inner	outer		
	[mm]	[mm]	[mm]	[(m ² ×K) / W]	
Type 1 (EPS)	140,0	55,0	55,0	3,49	1,025
Type 2 (wire)	140,0			2,88	0,845
Type 1 (EPS)	140,0		117,5	5,44	1,015
Type 2 (wire)	140,0			4,85	0,905
Type 1 (EPS)	140,0		180,0	7,40	1,010
Type 2 (wire)	202,5			6,80	0,930
Type 1 (EPS)	140,0		242,5	9,35	1,005
Type 2 (wire)	265,0			8,76	0,945

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

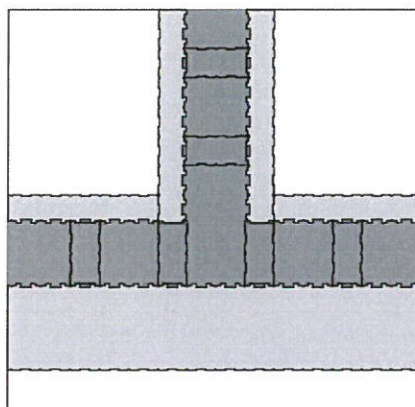
ISORAST

Information on the determination of the thermal resistance

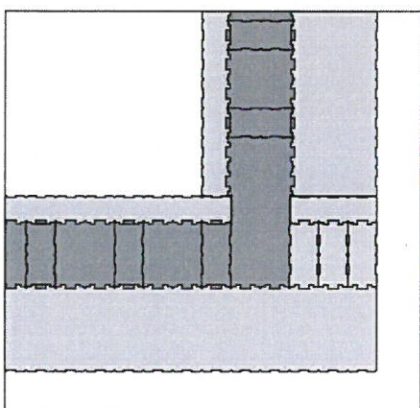
Annex B3



T-connection: 1. layer



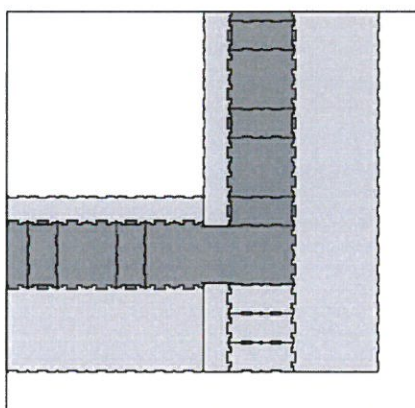
2. layer



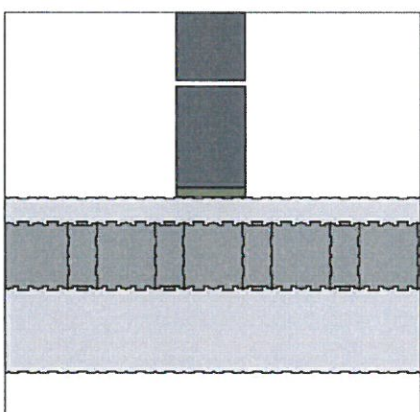
Corner connection: 1. layer

Hint:

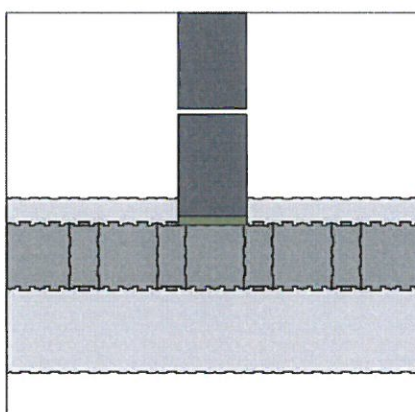
- always put wires on top of each other



2. layer



Masonry not fixed with concrete



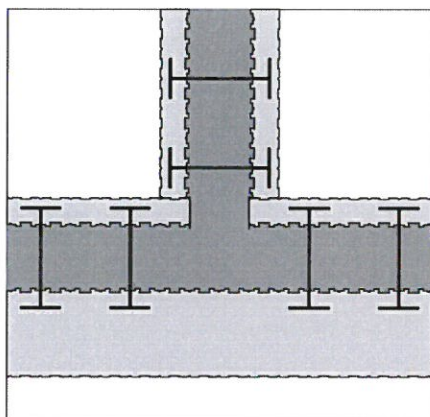
Masonry fixed with concrete

without scale

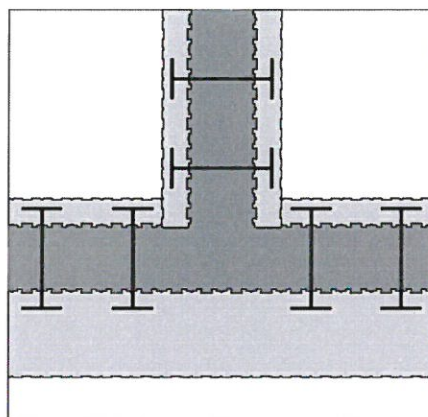
ISORAST

Rectangular corners and typical wall junctions of shuttering elements with
EPS spacers (Type 1)

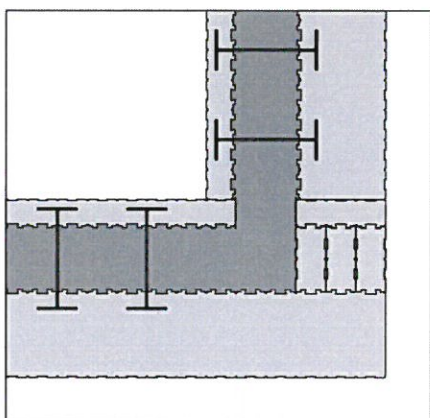
Annex B4



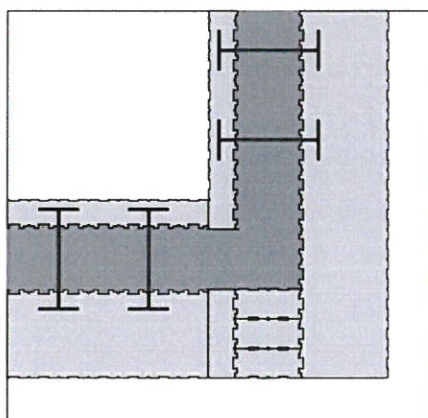
T-connection: 1. layer



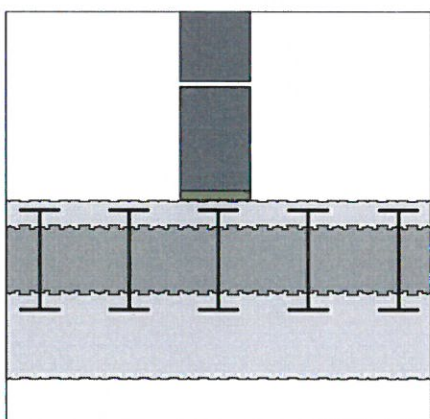
2. layer



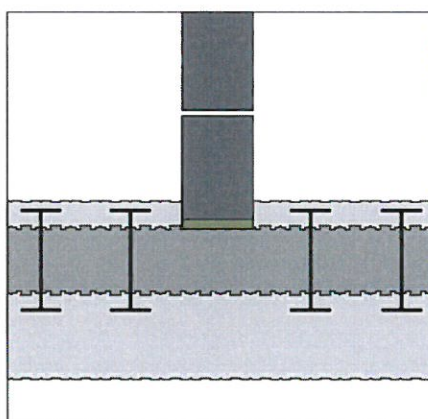
Corner connection: 1. layer



2. layer



Masonry not fixed with concrete



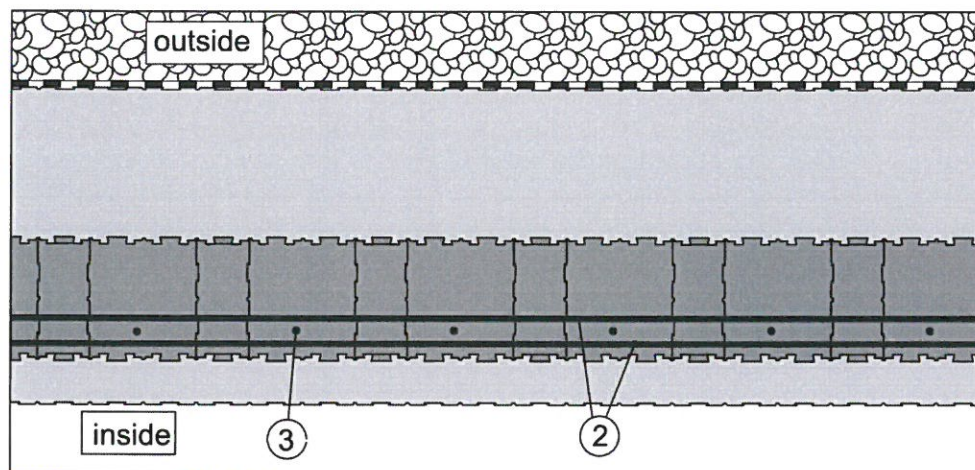
Masonry fixed with concrete

without scale

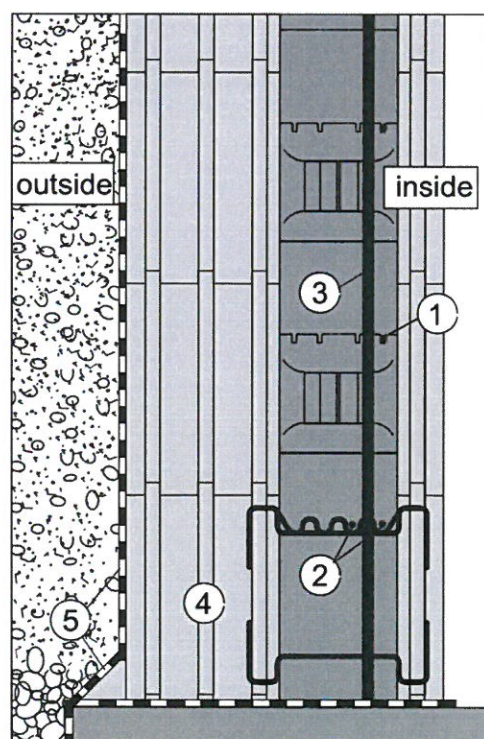
ISORAST

Rectangular corners and typical wall junctions of shuttering elements with wire spacers (Type 2)

Annex B5



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



Vertical cut

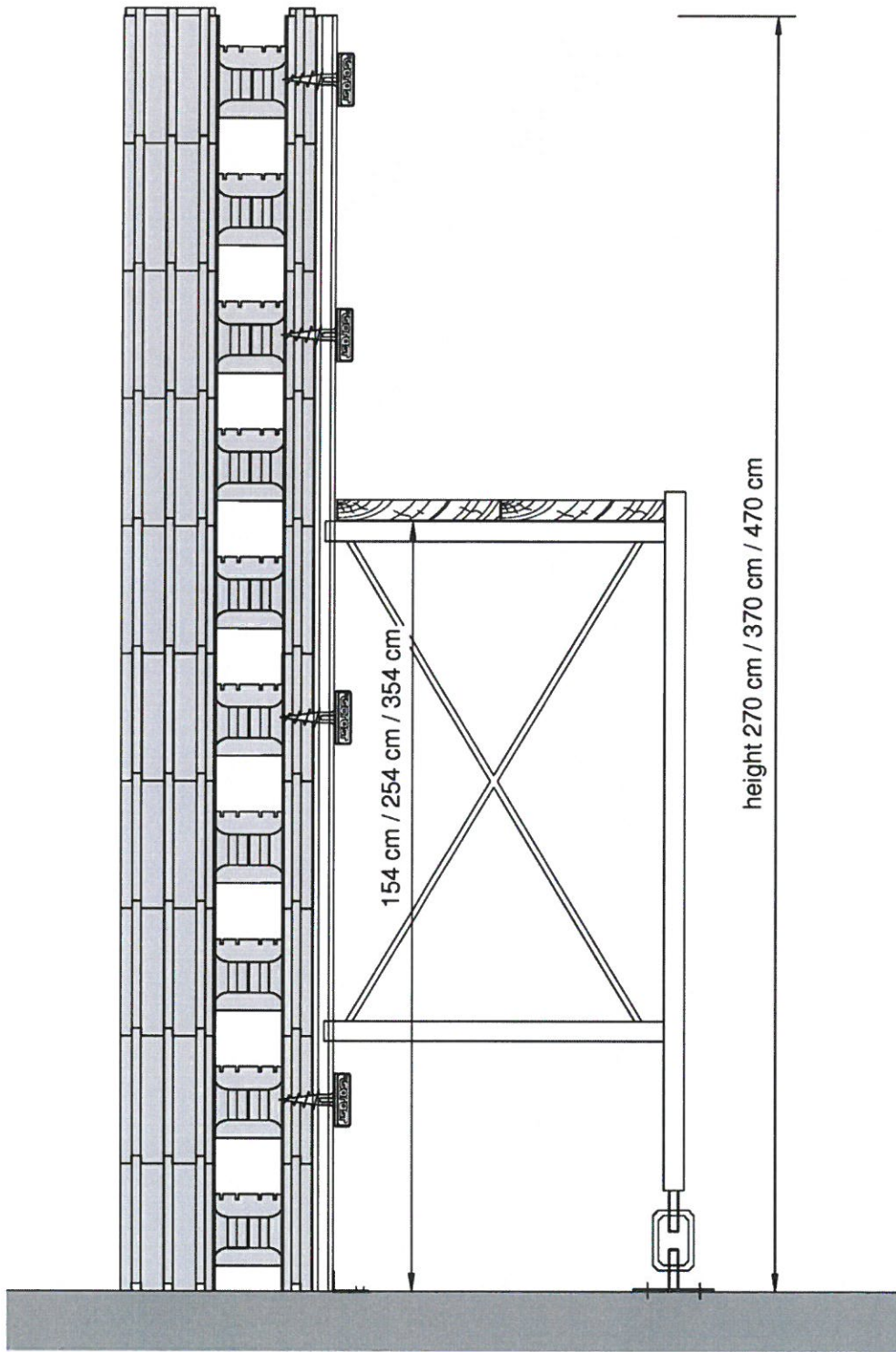
- ① Transverse reinforcement, according to static calculation
- ② Transverse reinforcement in 1st, 5th and last row twice for fixation.
- ③ Vertical reinforcement, according to static calculation
- ④ Bottom row with steel spacers
- ⑤ Wall sealing

without scale

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Possible reinforcement of external walls of basements made of shuttering elements with EPS spacers (Type 1) respectively wire spacers (Type 2)

Annex B6



The horizontal distance between push pull props: maximum 1,5 m without scale, dimensions are given in [cm]

ISORAST	Annex B7
Mounted push pull props	

Type		according to Annex	Thickness of the wall	Thickness of the concrete core	Area of concrete core per meter wall length	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) $\rho_{\text{Concrete}} = 25 \text{ kN/m}^3$	Area of horizontal concrete ribs A_R
			[cm]	[cm]	[m ² /m]	[kN/m ²]	[kN/m ²]	[cm ²]
EPS (Type 1)	25 cm-Element	A3	25,00	14,00	0,0933	0,038	3,12	154
	31 cm-Element		31,25		0,0933	0,057	3,14	154
	37 cm-Element		37,50		0,0933	0,076	3,15	154
	43 cm-Element		43,75		0,0933	0,094	3,17	154
Wire (Type 2)	25 cm-Element	A4	25,00	14,00	0,1363	0,064	3,56	--
	31 cm-Element		31,25		0,1363	0,083	3,58	--
	37 cm-Element		37,50		0,1363	0,102	3,60	--
	43 cm-Element		43,75		0,1363	0,120	3,62	--
	055-203-055		31,25	20,25	0,1988	0,068	5,13	--
	055-203-118		37,50		0,1988	0,087	5,15	--
	055-203-180		43,75		0,1988	0,106	5,17	--
	055-203-243		50,00		0,1988	0,124	5,19	--
	055-265-055		37,50	26,50	0,2613	0,072	6,70	--
	055-265-118		43,75		0,2613	0,091	6,72	--
	055-265-180		50,00		0,2613	0,110	6,74	--
	055-265-243		56,25		0,2613	0,128	6,76	--

ISORAST		Annex B8
Thickness of the wall and weight per m ² of standard shuttering elements		