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for construction products



## European Technical Assessment

**ETA-07/0235**  
**of 7 July 2026**

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Trade name of the construction product

Product family  
to which the construction product belongs

Manufacturer

Manufacturing plant

This European Technical Assessment  
contains

This European Technical Assessment is  
issued in accordance with Article 95(4) of  
Regulation (EU) 2024/3110, on the basis of

This version replaces

Deutsches Institut für Bautechnik

permanent shuttering kit "DuoTherm"

Non-load bearing permanent shuttering kit "DuoTherm"  
based on shuttering elements of EPS

DuoTherm Entwicklungs-Vertriebs mbH  
Am Himmelfeld 2  
56410 Montabaur  
DEUTSCHLAND

Schaumaplast Sachsen GmbH  
Gewerbestraße 12  
01681 Nossen  
DEUTSCHLAND  
Beck & Heun GmbH  
Steinstraße 4  
35794 Mengerskirchen-Waldernbach

44 pages including 37 annexes which form an integral  
part of this assessment

EAD 340309-00-0305

ETA-07/0235 issued on 26 February 2026

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## Specific Part

### 1 Definition of the product and intended use

#### 1.1 Definition of the construction product

The shuttering system "DuoTherm" is a non load-bearing permanent shuttering kit based on standard shuttering elements (see Annex A2), special shuttering elements and accessory parts applicable as formwork for plain and reinforced concrete walls cast in-situ.

The shuttering elements consist of:

- shuttering leaves of expanded polystyrene (EPS),
- spacers of steel (steel spacers),
- reinforcing wire mesh and
- anchor tubes of polypropylene (PP tubes).

An overview of all components of the kit is given in Annex A14.

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

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

#### 1.2 Shuttering elements

##### 1.2.1 Standard shuttering elements

The standard shuttering elements (see Annex A2) consist of inner and outer standard shuttering leaves (see 1.3.1 and Annex A1, 3.1) of expanded polystyrene (EPS) and spacers (see 1.4.5 and Annex A1, 4.5) fixed by anchor tubes (see 1.4.4 and Annex A1, 4.4). These components are assembled on site.

The shuttering leaves are one-layered. The spacers provide thicknesses of the concrete core of 142 mm and 192 mm, as indicated in Table 1 of Annex A1. The thickness of the inner shuttering leaf is 54 mm and the range for the thickness of the outer shuttering leaf is either 54 mm, 104 mm, 204 mm, 254 mm or 304 mm. The length of the standard shuttering elements is 1000 mm and the height is 250 mm (see Annex A2).

The system can be used to construct straight and angled walls (90°- and 135°-angles).

Steel reinforcement can be fixed directly to the steel spacer web. The maximum centre distance of steel spacers in longitudinal direction of the standard shuttering elements shall be 125 mm, see Annexes A2 to A5.

The shuttering elements are interlocked and build up horizontally and vertically into a tight and rigid formwork. The wall is formed by filling of the shuttering elements with concrete. The shuttering 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.

##### 1.2.2 Special shuttering elements

The special shuttering elements consist of inner and outer special shuttering leaves (see 1.3.2 and Annex A1, 3.2) of expanded polystyrene (EPS). With regard to all other aspects, they are constructed analogously to the standard shuttering elements described above (see 1.2.1 and Annex A1, 3.1).

### **1.3 Shuttering leaves**

#### **1.3.1 Standard shuttering leaves**

The standard shuttering leaves of expanded polystyrene (EPS) include:

- BS01 in Annex A3,
- BS40 in Annex A4,
- BS47, BS48 and BS49 in Annex A5.

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

The surfaces of the shuttering leaves are generally smooth. There are also vertical grooves on the inside face of each shuttering leaf. These element-high grooves on the inside face provide a mechanical interlock between shuttering leaves and concrete core (see 3.4 of this ETA).

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

#### **1.3.2 Special shuttering leaves**

The special shuttering leaves of expanded polystyrene (EPS) include:

- outer corner leaves  
(BS03, BS04 in Annex A6, BS11 And BS12 in Annex A7, BS41 and BS42 in Annex A9, BS44 and BS45 in Annex A10),
- internal corner leaves  
(BS05, BS06 in Annex A6, BS25, BS26 in Annex A8, BS46 in Annex A9),
- levelling leaves  
(BS07, BS08, BS15, BS16 in Annex A3, BS17 in Annex A4).

The special shuttering leaves are of the same material and external appearance as the standard shuttering leaves (see Annex A1, 5.1).

### **1.4 Accesory parts**

#### **1.4.1 Lintel leaves (BS10 in Annex A13)**

The lintel leaves (BS10 in Annex A13) are used for the shuttering bottoms of the lintels. They are of the same material and external appearance as the standard shuttering leaves (see 1.3.1 and Annex A1, 5.1).

#### **1.4.2 Front leaves (BS02 in Annex A13)**

The front leaves are used for sealing the front part of shuttering elements. They are of the same material and external appearance as the standard shuttering leaves (see 1.3.1 and Annex A1, 5.1).

#### **1.4.3 End leaves (BS09, BS22 in Annex A13)**

The end leaves are used as shuttering for the opened narrow sides at corners, door openings and blunt-ended inside walls. They are installed vertically in the opened ends of the shuttering elements. They are of the same material and external appearance as the standard shuttering leaves (see 1.3.1 and Annex A1, 5.1).

#### **1.4.4 Anchor tubes (BS50 in Annex A11)**

Anchor tubes (see BS50 in Annex A11) are parts of all shuttering elements. The task of the PP tubes is to connect the steel spacers without metal tubes with the inner and outer shuttering leaves.

#### 1.4.5 Spacers

Spacers are parts of all shuttering elements. There are two different types of spacers:

- steel anchors (see BS51, BS58, BS59 in Annex A11 and BS60, BS64, BS65 in Annex A12) with or without metal tubes and
- reinforcing wire mesh (see BS57, BS57K in Annex A11 and BS66, BS66K in Annex A12).

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

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

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

The performance given in Section 3 are only valid if the shuttering elements are used in compliance with the specifications and conditions given in Annex B1.

The verification and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the shuttering kit of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

### 3.1 Mechanical resistance and stability (BWR 1)

| Essential characteristic           | Performance                                                    |
|------------------------------------|----------------------------------------------------------------|
| Resulting structural pattern       | Continuous type according to EAD 340309-00-0305, chapter 1.3.3 |
| Efficiency of filling              | see Annex C1                                                   |
| Possibility of steel reinforcement | see Annex C1                                                   |

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

| Essential characteristic                               | Performance                     |
|--------------------------------------------------------|---------------------------------|
| Reaction to fire                                       |                                 |
| EPS                                                    | Class E according to EN 13501-1 |
| Steel spacer                                           | No performance assessed         |
| Reinforcing wire mesh                                  | No performance assessed         |
| PP-tubes                                               | No performance assessed         |
| Influence of the shuttering kit on the fire resistance |                                 |
| Continuous wall with Standard Elements                 | No performance assessed         |

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

| Essential characteristic                                                                        | Performance                                                                                                    |
|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Content, emission and/or release of dangerous substances                                        |                                                                                                                |
| Substances classified as Carc. 1A/1B <sup>a)</sup>                                              | None of these raw materials are actively used in the manufacture of the construction product. <sup>b) c)</sup> |
| Substances classified as Muta. 1A/1B <sup>a)</sup>                                              |                                                                                                                |
| Substances classified as Acute Tox. 1, 2, 3; Repr. 1A/1B; STOT SE 1 and STOT RE 1 <sup>a)</sup> |                                                                                                                |
| Use scenarios regarding BWR 3:                                                                  |                                                                                                                |
| IA 3                                                                                            | Product with no contact to indoor air                                                                          |
| S/W 3                                                                                           | Product with no contact to soil water, ground- and surface water.                                              |
| Water vapour permeability                                                                       | See Annex C2 for grey material<br>No performance assessed for white material                                   |
| Water absorption                                                                                | No performance assessed<br>(finishes are not part of this ETA)                                                 |
| Water tightness                                                                                 |                                                                                                                |

<sup>a)</sup> In accordance with Regulation (EC) No 1272/2008

<sup>b)</sup> Assessment based on the detailed manufacturers' statements on dangerous substances

<sup>c)</sup> Active use is the targeted use of substances to achieve specific product properties. Substances that are present as impurities and/or as a secondary component in the product are therefore not to be regarded as "actively used".

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

| Essential characteristic       | Performance                                                                                                                                                                                    |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bond strength                  | see Annex C3                                                                                                                                                                                   |
| Resistance to impact load      |                                                                                                                                                                                                |
| global resistance              | see Annex C3                                                                                                                                                                                   |
| local resistance               | No performance assessed                                                                                                                                                                        |
| Resistance to filling pressure | bending tensile strength of the shuttering leaves<br>≥ 250 kPa<br>(see also designation code of EPS in Annex A1, chapter 5.1)<br>pull-out forces see Annex C3                                  |
| Safety to personal injuries    | When delivered on site the shuttering elements do not have sharp or cutting edges.<br>Due to the soft surfaces of the shuttering leaves, there is no risk of abrasion or of cutting to people. |

### 3.5 Protection against noise (BWR 5)

| Essential characteristic  | Performance             |
|---------------------------|-------------------------|
| Airborne sound insulation | No performance assessed |
| Sound absorption          | No performance assessed |

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

| Essential characteristic | Performance                          |
|--------------------------|--------------------------------------|
| Thermal resistance       |                                      |
| White EPS                | See Annex C4 and table 1 in Annex B2 |
| Grey EPS                 | See Annex C4 and table 2 in Annex B2 |
| Thermal inertia          | No performance assessed              |

### 3.7 Aspects of durability

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

| Essential characteristic    | Performance                               |
|-----------------------------|-------------------------------------------|
| Resistance to deterioration |                                           |
| Physical agent              | DS(70,-)3 to EN 13163<br>See Annex C5     |
| Chemical agent              | Built-in finishes are not part of the ETA |

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

In accordance with EAD No 340309-00-0305, January 2019, the applicable European legal act is Decision 98/279/EC as amended by Commission Decision 2001/596/EC of 8 January 2001.

The system to be applied is: 2+

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

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

Issued in Berlin on 7 July 2026 by Deutsches Institut für Bautechnik

Dr.-Ing. Lars Eckfeldt  
Head of Section

*beglaubigt:*  
Groth

## Characteristics of shuttering kit

The shuttering system "DuoTherm" is a non load-bearing permanent shuttering kit based on standard shuttering elements (see Annex A2), special shuttering elements and accessory parts applicable as formwork for plain and reinforced concrete walls cast in-situ.

The shuttering elements consist of:

- shuttering leaves of expanded polystyrene (EPS shuttering leaves),
- spacers of steel (steel spacers),
- reinforcing wire mesh and
- anchor tubes of polypropylene (PP tubes).

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

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

### 1 Standard shuttering elements

The standard shuttering elements (see Annex A2) consist of inner and outer standard shuttering leaves (see Annex A1, 3.1) of expanded polystyrene (EPS) and spacers (see Annex A1, 4.5) fixed by anchor tubes (see Annex A1, 4.4). These components are assembled on site.

The shuttering leaves are one-layered. The spacers provide thicknesses of the concrete core of 142 mm and 192 mm, as indicated in Table 1. The thickness of the inner EPS shuttering leaf is 54 mm and the range for the thickness of the outer shuttering leaf is 54 mm, 104 mm, 204 mm, 254 mm or 304 mm. The length of the standard shuttering elements is 1000 mm and the height is 250 mm (see Annex A2).

Table 1: Wall thicknesses of the standard shuttering elements

| walltype | according Annex | Thickness of the wall | Thickness of concrete core | Shuttering leaves |       |        | Longitudinal centre distance of steel spacers |
|----------|-----------------|-----------------------|----------------------------|-------------------|-------|--------|-----------------------------------------------|
|          |                 |                       |                            | Thickness         |       | Height |                                               |
|          |                 |                       |                            | inner             | outer |        |                                               |
|          |                 | [mm]                  | [mm]                       | [mm]              | [mm]  | [mm]   | [mm]                                          |
| 25-es    | A2              | 250                   | 142                        | 54                | 54    | 250    | 125                                           |
| 30-es    |                 | 300                   | 142                        | 54                | 104   | 250    | 125                                           |
| 40-es    |                 | 400                   | 142                        | 54                | 204   | 250    | 125                                           |
| 45-es    |                 | 450                   | 142                        | 54                | 254   | 250    | 125                                           |
| 52-es    |                 | 500                   | 142                        | 54                | 304   | 250    | 125                                           |
| 30/1-st  |                 | 300                   | 192                        | 54                | 54    | 250    | 125                                           |
| 35/1-st  |                 | 350                   | 192                        | 54                | 104   | 250    | 125                                           |
| 45/1-st  |                 | 450                   | 192                        | 54                | 204   | 250    | 125                                           |
| 50/1-st  |                 | 500                   | 192                        | 54                | 254   | 250    | 125                                           |
| 55/1-st  |                 | 550                   | 192                        | 54                | 304   | 250    | 125                                           |

permanent shuttering kit "DuoTherm"

Characteristics of shuttering kit

Annex A1  
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## 2 Special shuttering elements

The special shuttering elements consist of inner and outer special shuttering leaves (see Annex A1, 3.2) of expanded polystyrene (EPS). With regard to all other aspects, they are constructed analogously to the standard shuttering elements described above.

## 3 Shuttering leaves

### 3.1 Standard shuttering leaves

The standard shuttering leaves of expanded polystyrene (EPS) include:

BS01 in Annex A3, BS40 in Annex A4, BS47, BS48 and BS49 in Annex A5.

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

The surfaces of the shuttering leaves are generally smooth. There are also vertical grooves on the inside face of each EPS shuttering leaf. These element-high grooves on the inside face provide a mechanical interlock between EPS shuttering leaves and concrete core (see Annex A1, 3.4.1).

In addition, marks are provided on the surface of the standard shuttering leaves at a distance of 12.5 cm, so that, if necessary, the shortening of the lengths of the formwork wall at any multiple of 12.5 cm is possible.

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

### 3.2 Special shuttering leaves

Special shuttering leaves of expanded polystyrene (EPS) include:

- outer corner leaves (BS03, BS04 in Annex A6, BS11 and BS12 in Annex A7, BS41 and BS42 in Annex A9, BS44 and BS45 in Annex A10),
- internal corner leaves (BS05, BS06 in Annex A6, BS25, BS26 in Annex A8, BS46 in Annex A10),
- levelling leaves (BS07, BS08, BS15, BS16 in Annex A3, BS17 in Annex A4).

The special shuttering leaves are of the same material and external appearance as the standard shuttering leaves (see Annex A1, 5.1).

## 4 Accessory parts

### 4.1 Lintel leaves (BS10 in Annex A13)

The lintel leaves (BS10 in Annex A13) are used for the shuttering bottoms of the lintels. They are of the same material and external appearance as the standard shuttering leaves (see Annex A1, 5.1).

### 4.2 Front leaves (BS02 in Annex A13)

The front leaves are used for sealing the front part of shuttering elements. They are of the same material and external appearance as the standard shuttering leaves (see Annex A1, 5.1).

permanent shuttering kit "DuoTherm"

Characteristics of shuttering kit

Annex A1  
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#### 4.3 End leaves (BS09, BS22 in Annex A13)

The end leaves are used as shuttering for the opened narrow sides at corners, door openings and blunt-ended inside walls. They are installed vertically in the opened ends of the shuttering elements. They are of the same material and external appearance as the standard shuttering leaves (see Annex A1, 5.1).

#### 4.4 Anchor tubes (BS50 in Annex A11)

Anchor tubes (see BS50 in Annex A11) are parts of all shuttering elements. The task of the PP tubes is to connect the steel spacers without metal tubes with the inner and outer shuttering leaves.

#### 4.5 Spacers

Spacers are parts of all shuttering elements. There are two different types of spacers:

- steel anchors (see BS51, BS58, BS59 in Annex A11 and BS60, BS64, BS65 in Annex A12) with (connection wall floor plate) or without (connection wall-ceiling plate) metal tubes and
- reinforcing wire meshes (see BS57, BS57K in Annex A11 and BS66, BS66K in Annex A12).

### 5 Material

#### 5.1 Standard shuttering leaves, special shuttering leaves, lintel leaves, face and end leaves

The shuttering leaves are made of  
EPS-EN 13163-T(1)-L(2)-W(2)-S(2)-P(5)-DS(N)5-DS(70,-)3-BS250-TR150  
composed of polystyrene particle foam made with the granule BASF Styropor F 315 R (material white) or BASF Neopor F2400 (material gray).

The density  $\rho$  of the expanded polystyrene is , depending on the material:

material white: 31 – 33 kg / m<sup>3</sup>

material gray: 30 - 32 kg / m<sup>3</sup>

The nominal value of the thermal conductivity is also material dependent:

material white: 0,035 W / (m K).

material gray: 0,032 W / (m K).

#### 5.2 Accessory parts

##### 5.2.1 Anchor tubes

Anchor tubes are made of polypropylene (PP tubes, trade name: "NOVOLEN"). The minimum wall thickness of the anchor tubes is 1 mm.

##### 5.2.2 Spacers

The spacers are made of galvanized steel. The minimum thickness of the wires of the steel anchors and the reinforcing wire meshes is 4,15 mm (Annexes A11 and A12).

permanent shuttering kit "DuoTherm"

Characteristics of shuttering kit

Annex A1  
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front view

side view

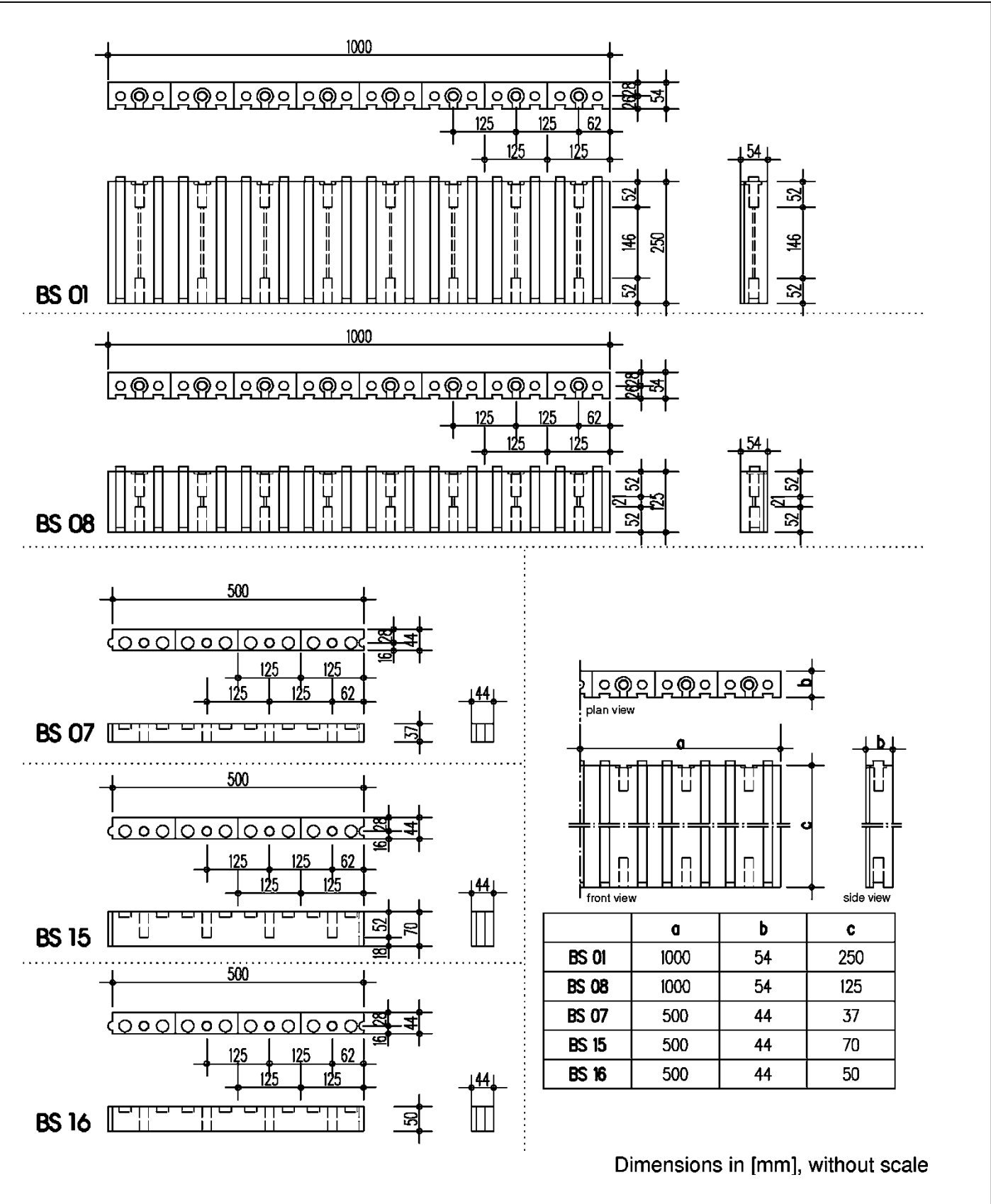
plan view

[mm]

| type         | core thickness | EPS thickness external | EPS thickness internal | height of the element | wall thickness | BS-element external | BS-element anchor tube | BS-element reinforcing wire mesh | BS-element standard anchor | BS-element internal |
|--------------|----------------|------------------------|------------------------|-----------------------|----------------|---------------------|------------------------|----------------------------------|----------------------------|---------------------|
|              | <b>a</b>       | <b>b<sub>e</sub></b>   | <b>b<sub>i</sub></b>   | <b>c</b>              | <b>e</b>       |                     |                        |                                  |                            |                     |
|              | [mm]           | [mm]                   | [mm]                   | [mm]                  | [mm]           |                     |                        |                                  |                            |                     |
| 25-es wall   | 142            | 54                     | 54                     | 250                   | 250            | BS 01               | BS 50                  | BS 57                            | BS 51                      | BS 01               |
| 30-es wall   | 142            | 104                    | 54                     | 250                   | 300            | BS 40               | BS 50                  | BS 57                            | BS 51                      | BS 01               |
| 40-es wall   | 142            | 204                    | 54                     | 250                   | 400            | BS 47               | BS 50                  | BS 57                            | BS 51                      | BS 01               |
| 45-es wall   | 142            | 254                    | 54                     | 250                   | 450            | BS 48               | BS 50                  | BS 57                            | BS 51                      | BS 01               |
| 50-es wall   | 142            | 304                    | 54                     | 250                   | 500            | BS 49               | BS 50                  | BS 57                            | BS 51                      | BS 01               |
| 30/1-st wall | 192            | 54                     | 54                     | 250                   | 300            | BS 01               | BS 50                  | BS 66                            | BS 60                      | BS 01               |
| 35/1-st wall | 192            | 104                    | 54                     | 250                   | 350            | BS 40               | BS 50                  | BS 66                            | BS 60                      | BS 01               |
| 45/1-st wall | 192            | 204                    | 54                     | 250                   | 450            | BS 47               | BS 50                  | BS 66                            | BS 60                      | BS 01               |
| 50/1-st wall | 192            | 254                    | 54                     | 250                   | 500            | BS 48               | BS 50                  | BS 66                            | BS 60                      | BS 01               |
| 55/1-st wall | 192            | 304                    | 54                     | 250                   | 550            | BS 49               | BS 50                  | BS 66                            | BS 60                      | BS 01               |

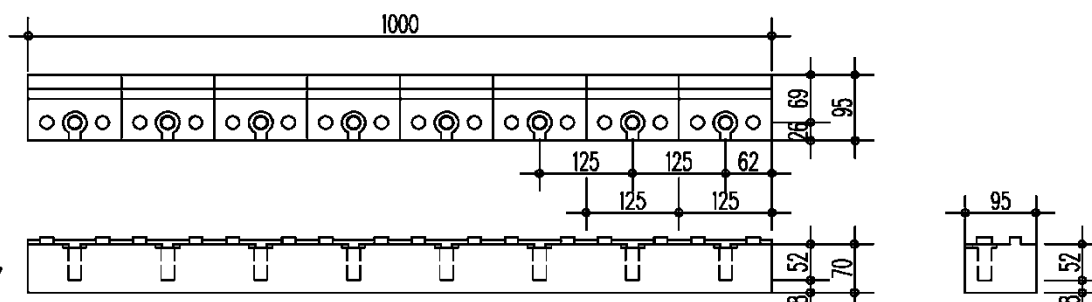
Dimensions in [mm], without scale

|                                     |          |
|-------------------------------------|----------|
| permanent shuttering kit "DuoTherm" | Annex A2 |
| Standard shuttering elements        |          |

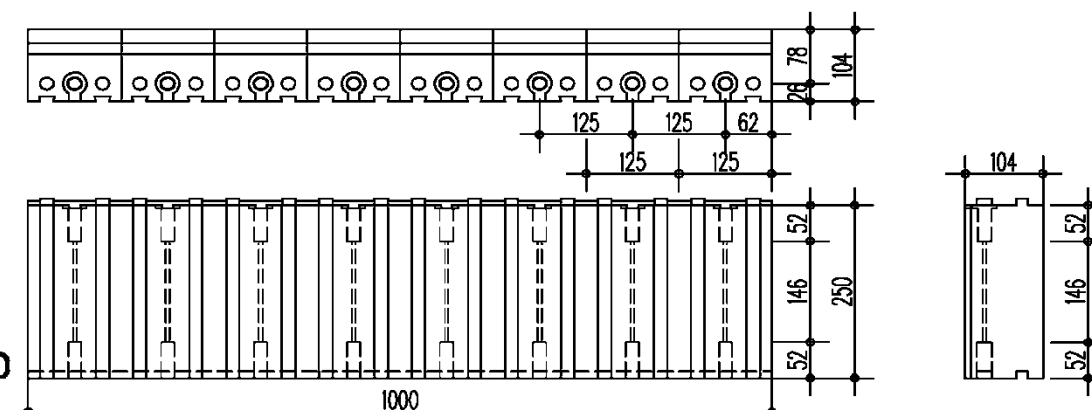


|                                                    |          |
|----------------------------------------------------|----------|
| permanent shuttering kit "DuoTherm"                | Annex A3 |
| BS-elements: BS 91 / BS 08 / BS 07 / BS 15 / BS 16 |          |

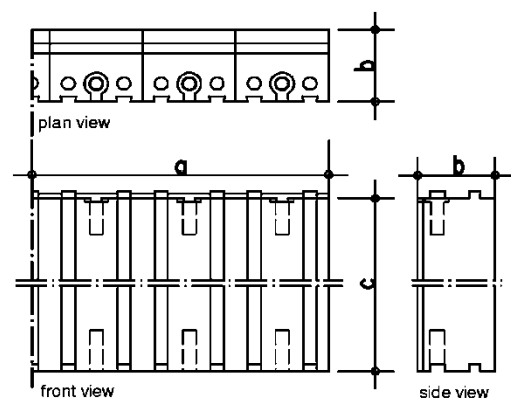
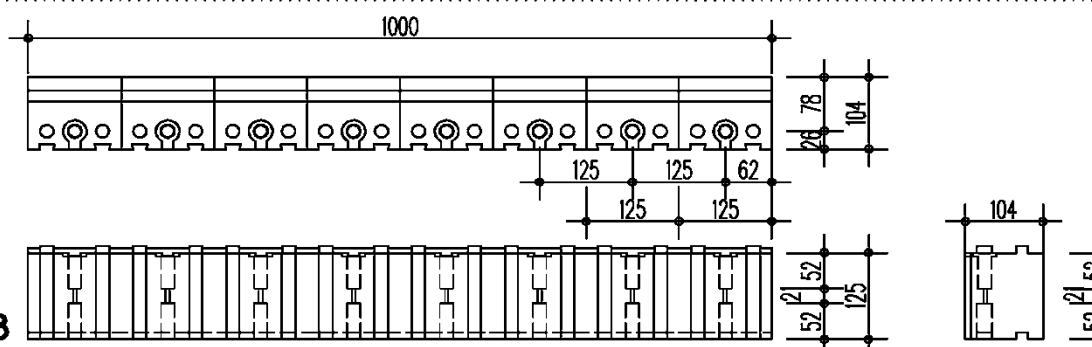
**BS 17**



**BS 40**



**BS 43**



|              | a    | b   | c   |
|--------------|------|-----|-----|
| <b>BS 17</b> | 1000 | 95  | 70  |
| <b>BS 40</b> | 1000 | 104 | 250 |
| <b>BS 43</b> | 1000 | 104 | 125 |
| <b>BS 47</b> | 1000 | 204 | 250 |
| <b>BS 48</b> | 1000 | 254 | 250 |
| <b>BS 49</b> | 1000 | 304 | 250 |

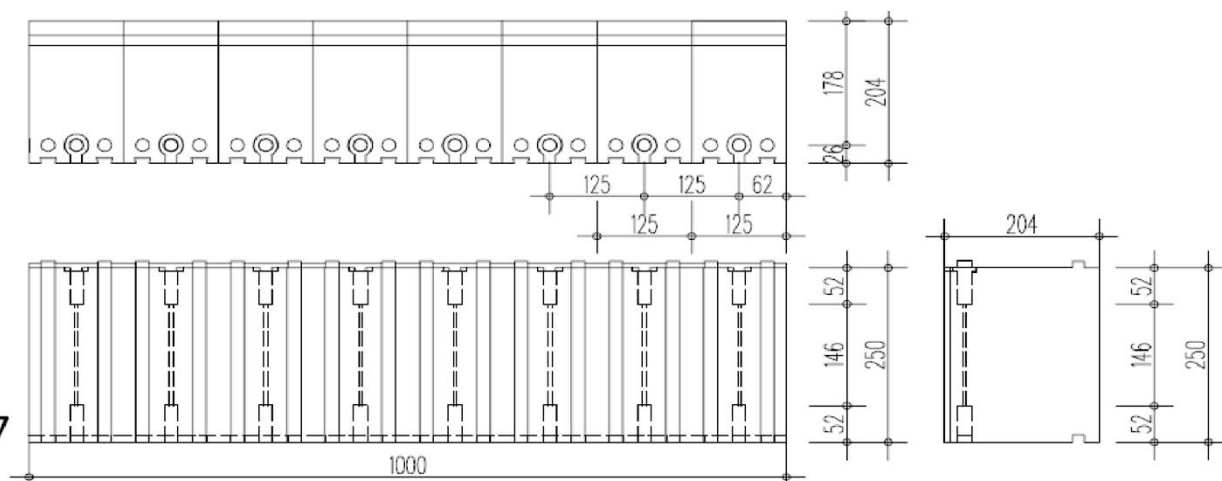
Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

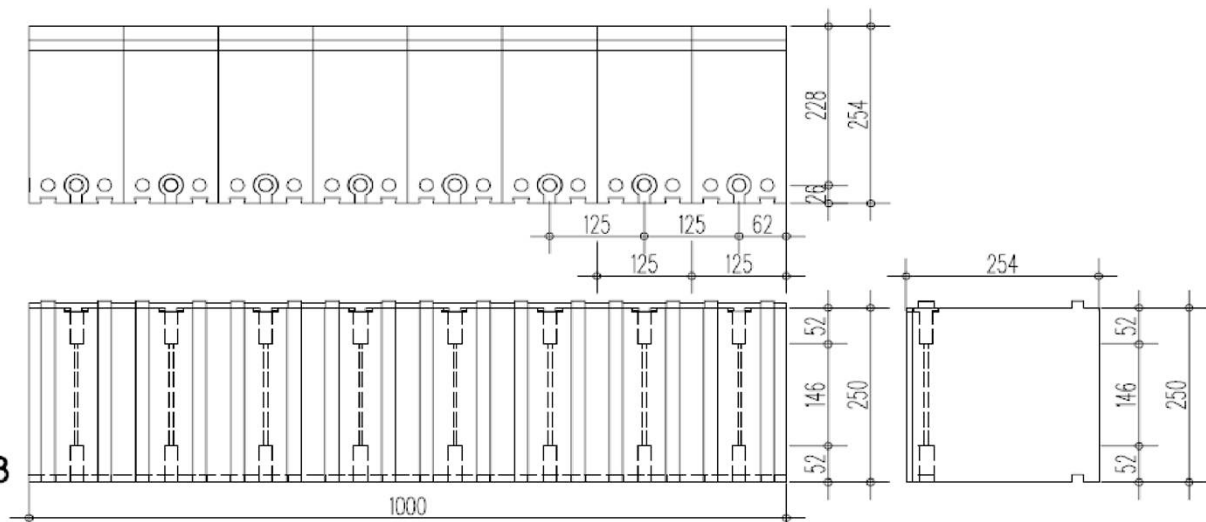
BS-elements: BS 17 / BS 40 / BS 43

Annex A4

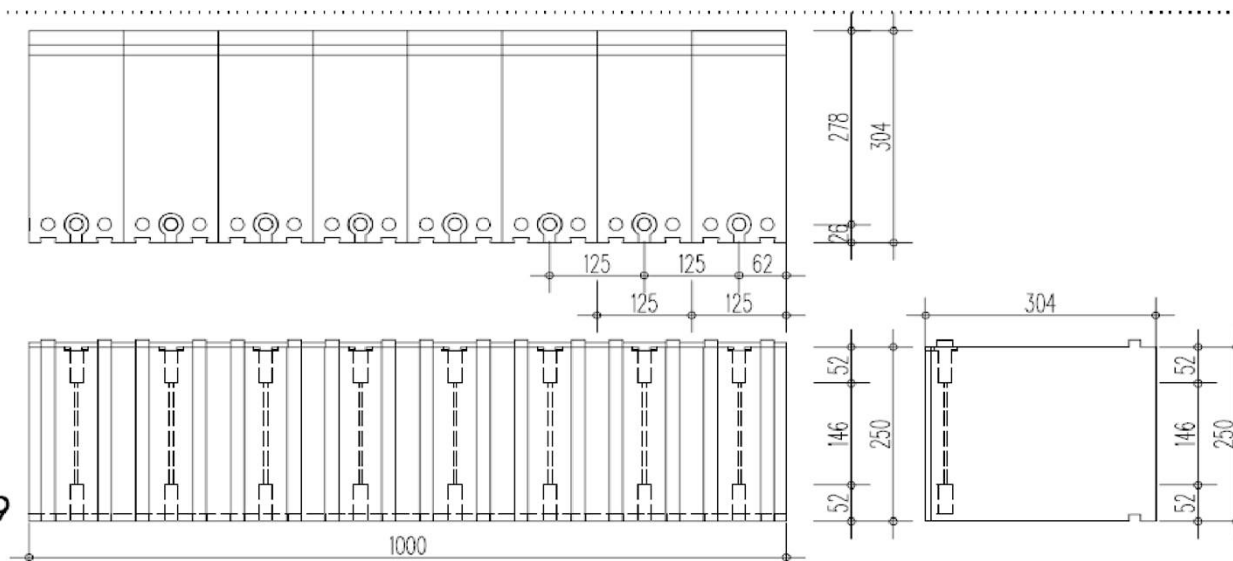
BS 47



BS 48



BS 49

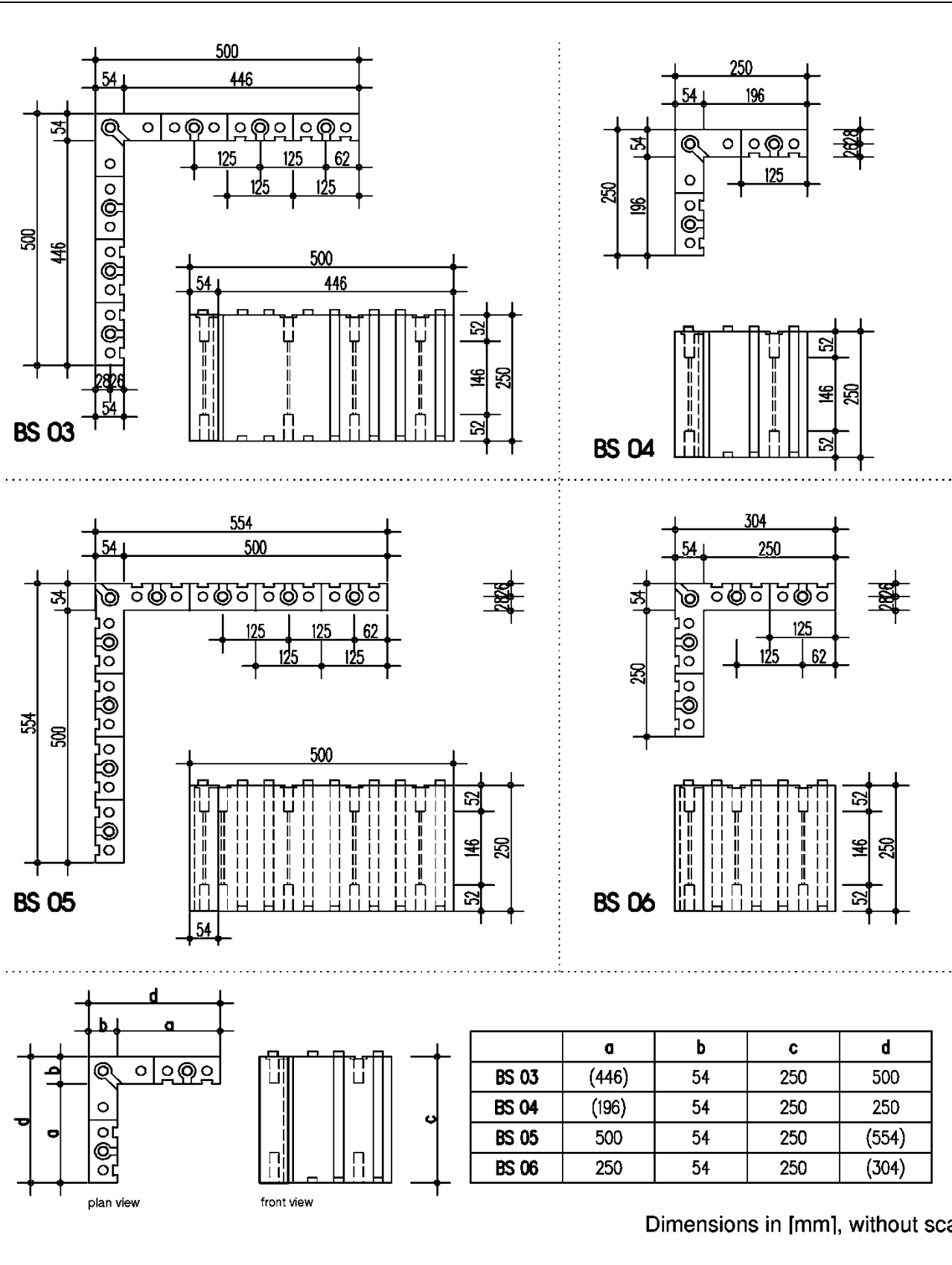


Dimensions in [mm], without scale

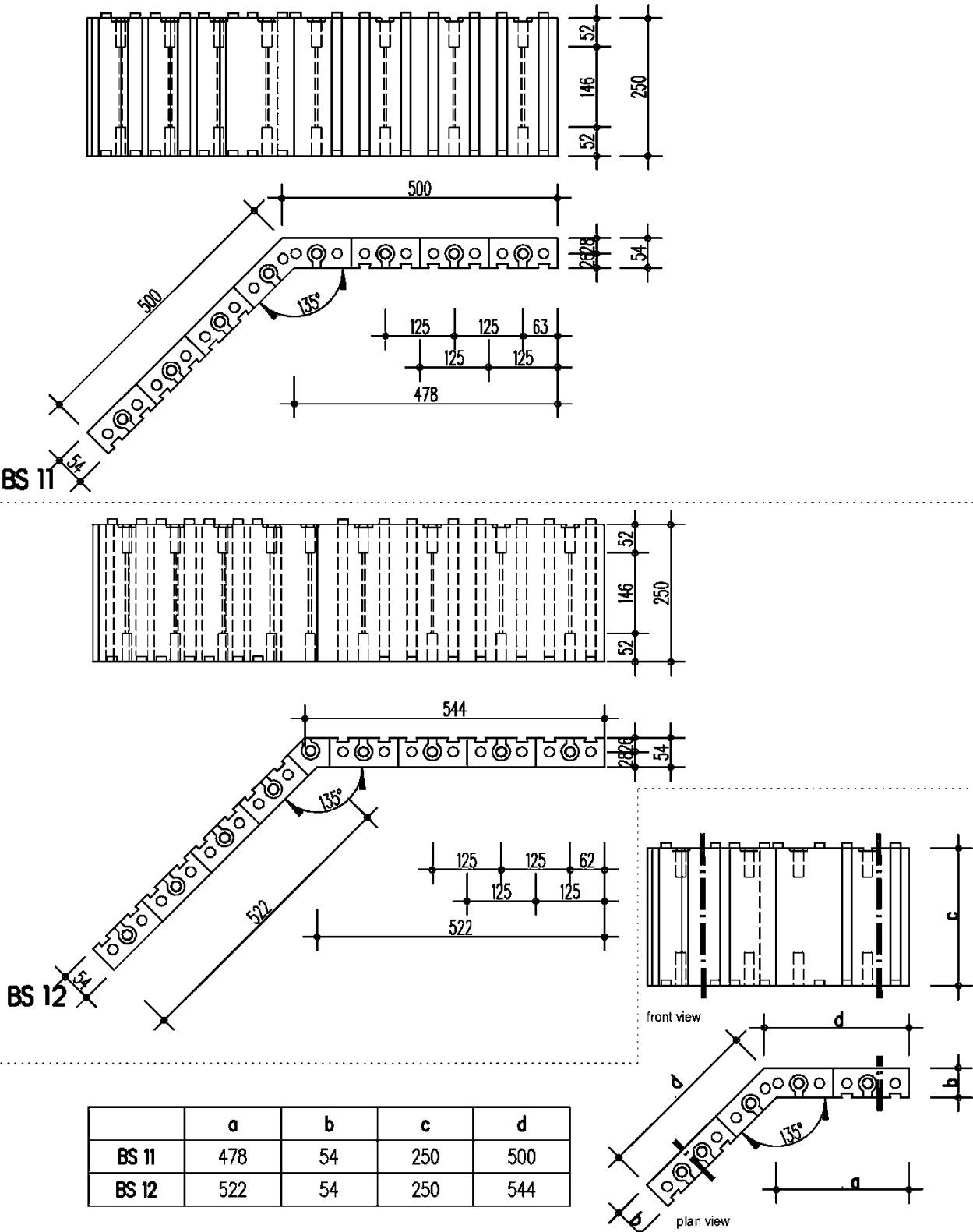
permanent shuttering kit "DuoTherm"

BS-elements: BS 47 / BS 48 / BS 49

Annex A5

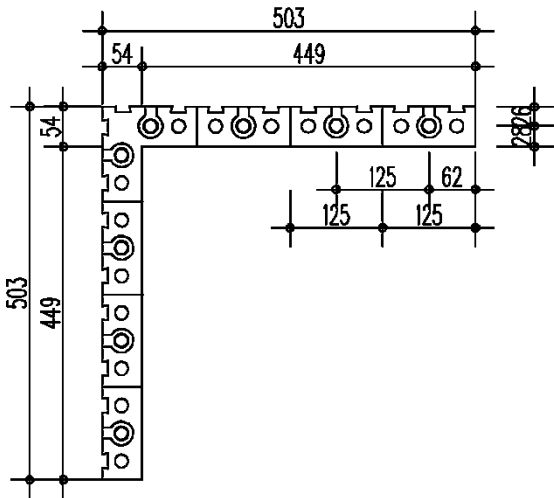


|                                            |          |
|--------------------------------------------|----------|
| permanent shuttering kit "DuoTherm"        | Annex A6 |
| BS-elements: BS 03 / BS 04 / BS 05 / BS 06 |          |

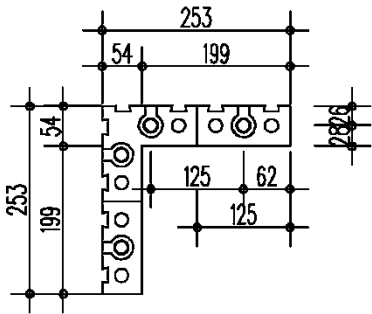
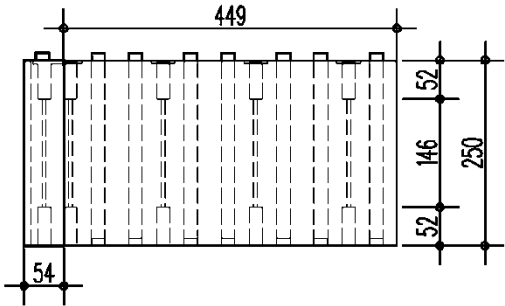


Dimensions in [mm], without scale

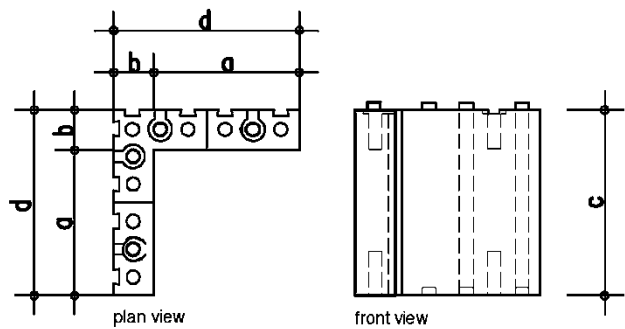
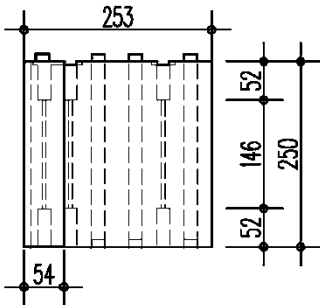
|                                     |          |
|-------------------------------------|----------|
| permanent shuttering kit "DuoTherm" | Annex A7 |
| BS-elements: BS 11 / BS 12          |          |



BS 25



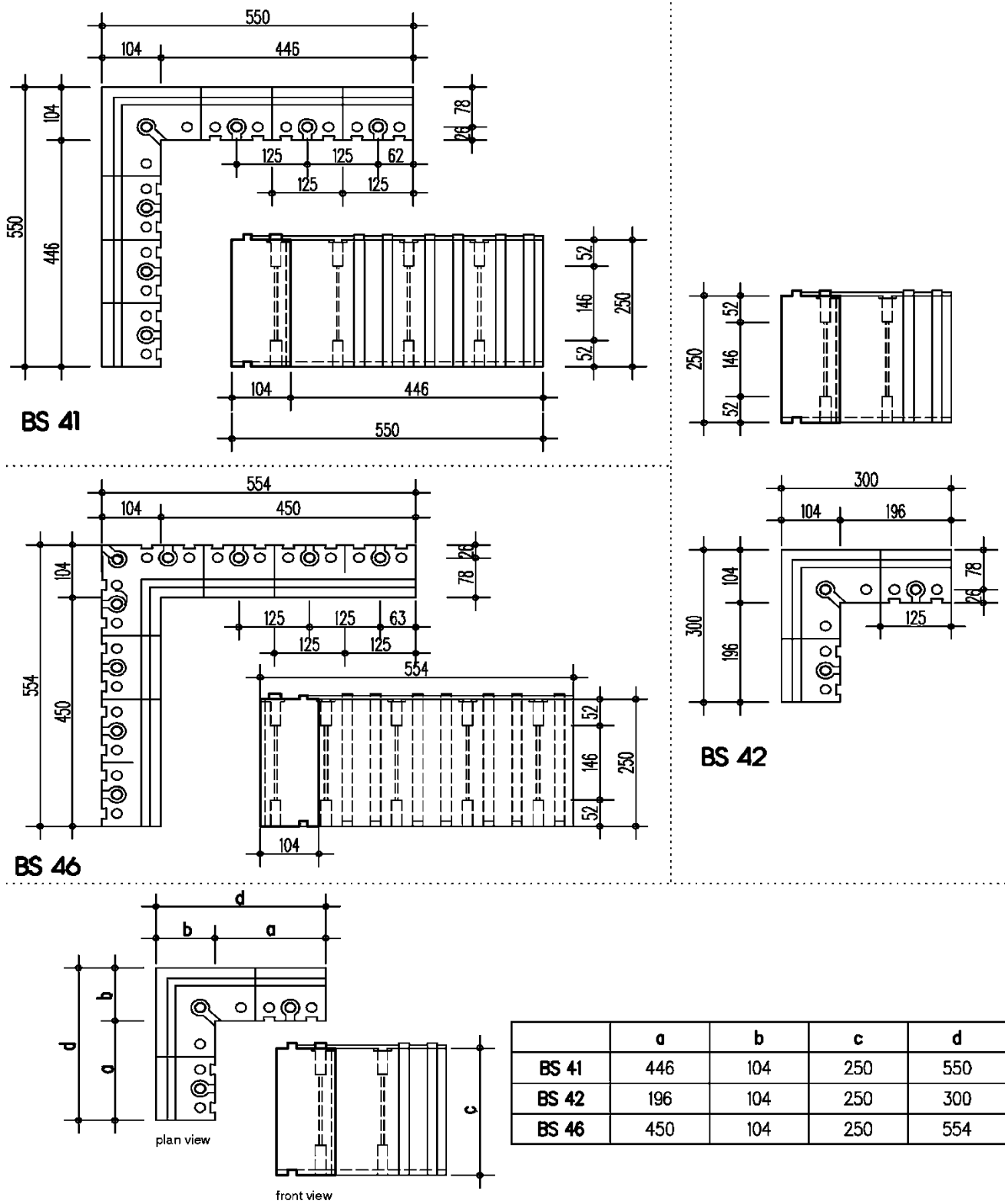
BS 26



|       | a   | b  | c   | d   |
|-------|-----|----|-----|-----|
| BS 25 | 449 | 54 | 250 | 503 |
| BS 26 | 199 | 54 | 250 | 253 |

Dimensions in [mm], without scale

|                                     |          |
|-------------------------------------|----------|
| permanent shuttering kit "DuoTherm" | Annex A8 |
| BS-elements: BS 25 / BS 26          |          |

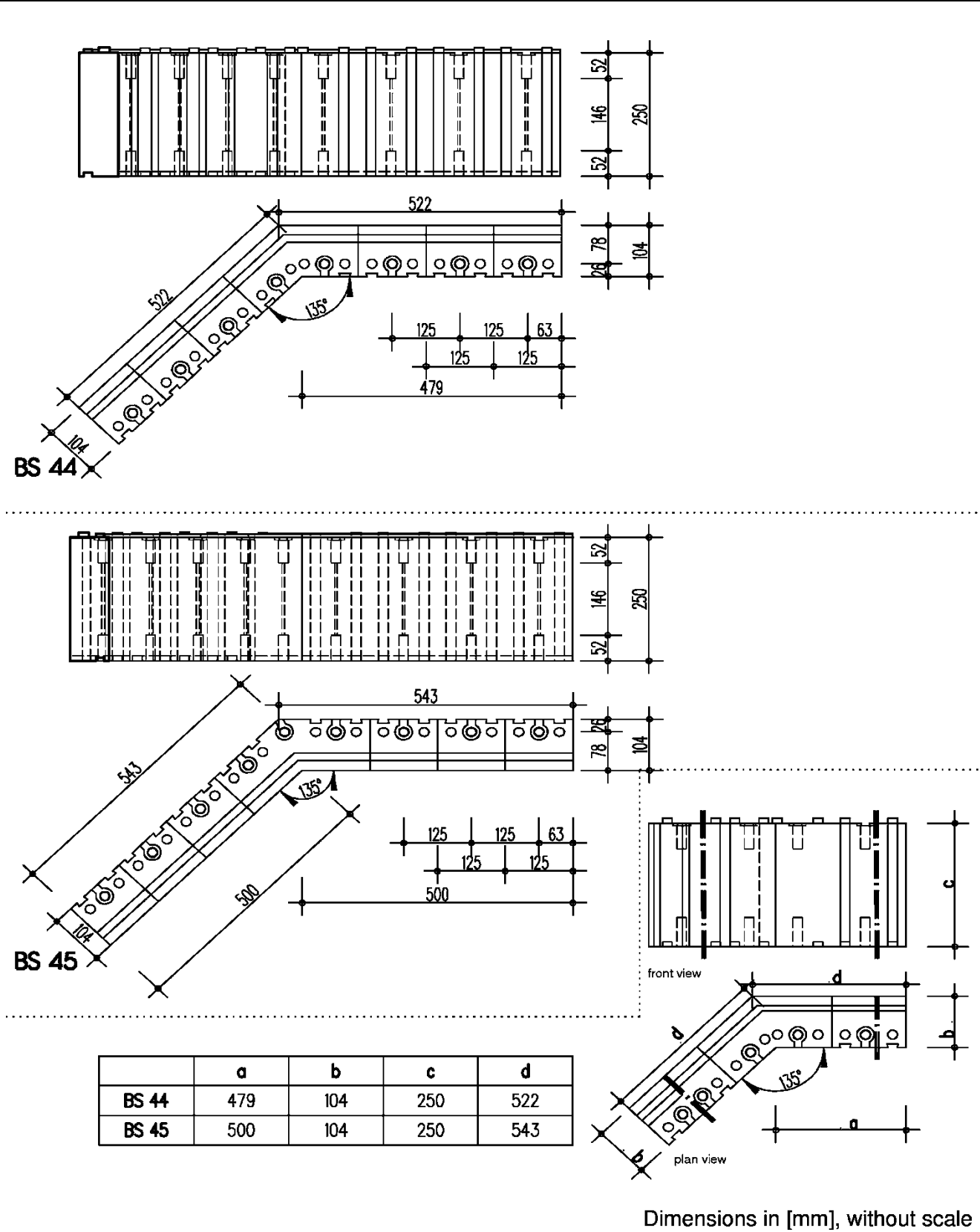


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

BS-elements: BS 41 / BS 42 / BS 46

Annex A9

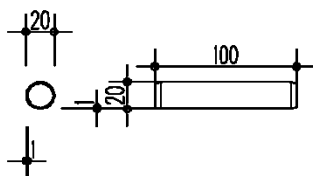


permanent shuttering kit "DuoTherm"

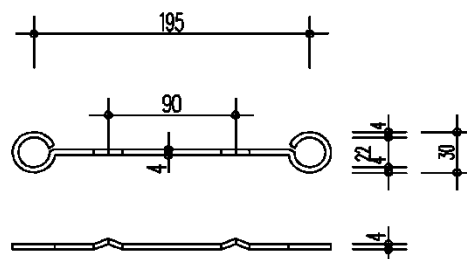
BS-elements: BS 44 / BS 45

Annex A10

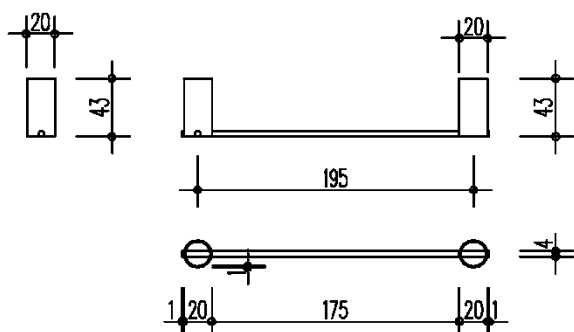
BS 50



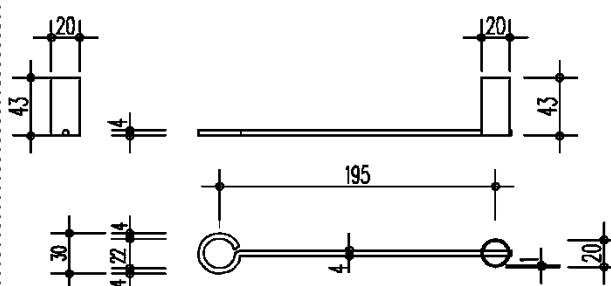
BS 51



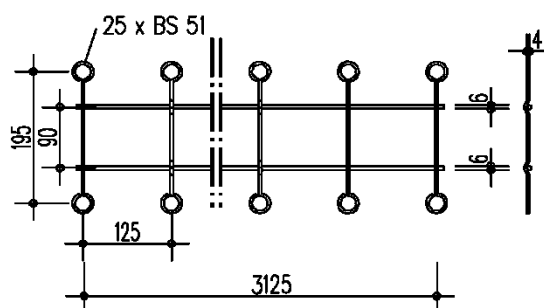
BS 58



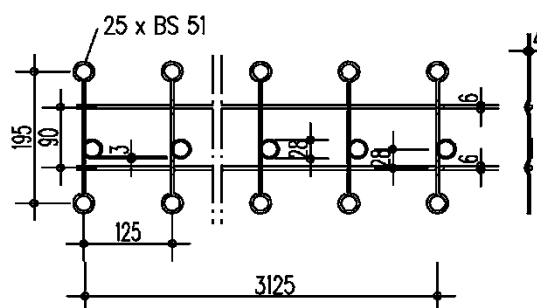
BS 59



BS 57



BS 57K

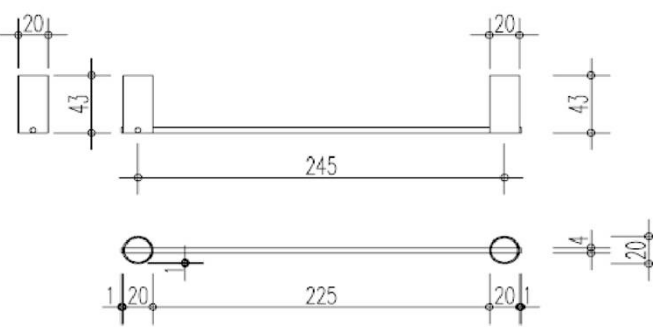
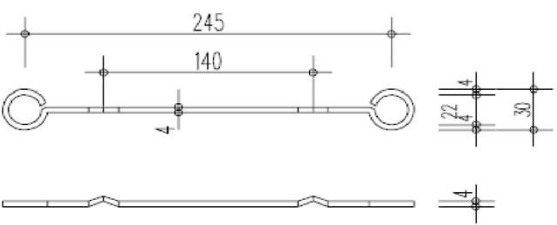
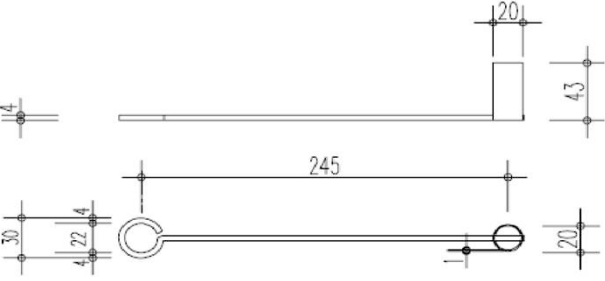
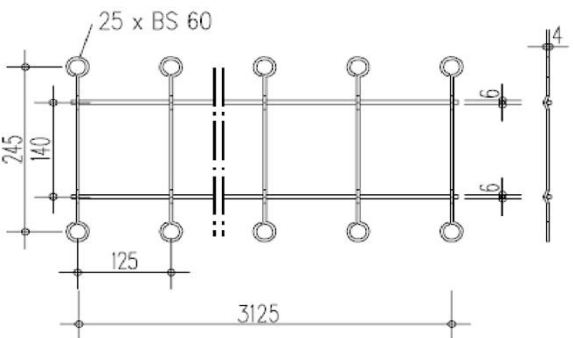
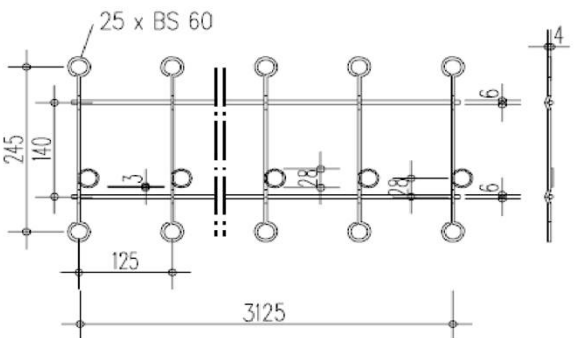


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

BS-elements: BS 50 / BS 51 / BS 58 / BS 59 / BS 57 / BS 57K

Annex A11

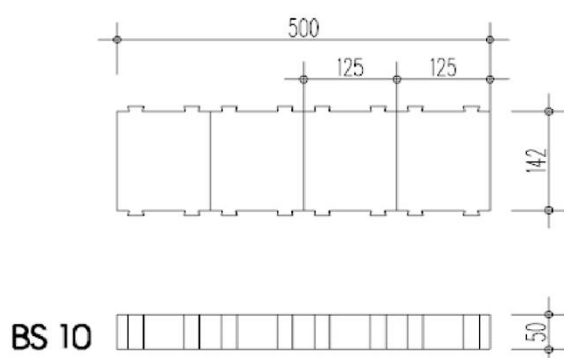
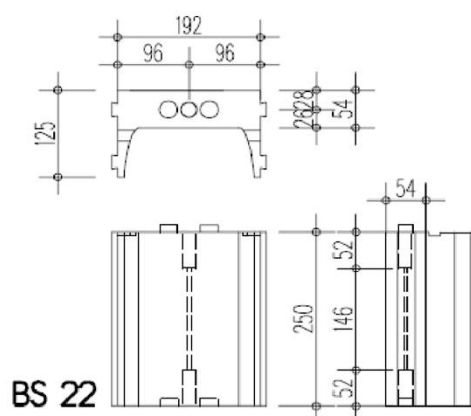
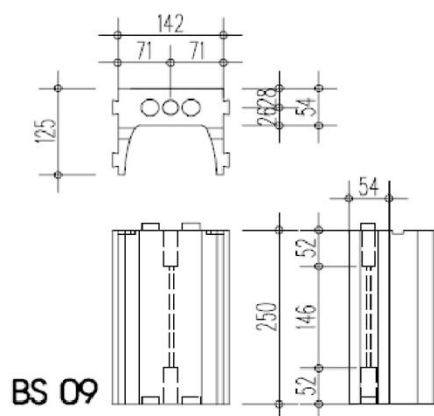
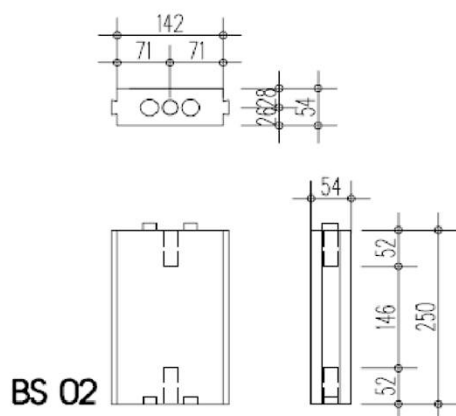
|                                                                                                         |                                                                                                           |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
|  <p><b>BS 65</b></p>   |                                                                                                           |
|  <p><b>BS 60</b></p>  |  <p><b>BS 64</b></p>   |
|  <p><b>BS 66</b></p> |  <p><b>BS 66K</b></p> |

Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

BS-elements: BS 65 / BS 60 / BS 64 / BS 66 / BS 66K

Annex A12



Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

BS-elements: BS 02 / BS 09 / BS 10 / BS 22

Annex A13

| DuoTherm-elements                   |                                          |                        |    |    |    |    |                        |    |    |    |    |           |  |
|-------------------------------------|------------------------------------------|------------------------|----|----|----|----|------------------------|----|----|----|----|-----------|--|
|                                     |                                          | 142mm core of concrete |    |    |    |    | 192mm core of concrete |    |    |    |    | annex     |  |
|                                     | total thickness of wall                  | 25                     | 30 | 40 | 45 | 50 | 30                     | 35 | 45 | 50 | 55 |           |  |
| BS01                                | standard element                         | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A3        |  |
| BS02                                | face element                             | x                      | x  | x  | x  | x  |                        |    |    |    |    | A13       |  |
| BS03                                | outer corner 50/50                       | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A6        |  |
| BS04                                | outer corner 25/25                       | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A6        |  |
| BS05                                | internal corner 50/50                    | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A6        |  |
| BS06                                | internal corner 25/25                    | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A6        |  |
| BS07                                | levelling element 3,7cm                  | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A3        |  |
| BS08                                | levelling element 12,5cm                 | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A3        |  |
| BS09                                | end element                              | x                      | x  | x  | x  | x  |                        |    |    |    |    | A13       |  |
| BS10                                | lintel element                           | x                      | x  | x  | x  | x  |                        |    |    |    |    | A13       |  |
| BS11                                | outer corner 135°                        | x                      |    |    |    |    | x                      |    |    |    |    | A7        |  |
| BS12                                | outer corner 45°                         | x                      |    |    |    |    | x                      |    |    |    |    | A7        |  |
| BS15                                | levelling element 7cm                    | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A3        |  |
| BS16                                | levelling element 5cm                    | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A3        |  |
| BS17                                | levelling element 7cm                    |                        | x  |    |    |    |                        | x  |    |    |    | A4        |  |
| BS22                                | end element                              |                        |    |    |    |    | x                      | x  | x  | x  | x  | A13       |  |
| BS25                                | internal corner 45/45                    | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A8        |  |
| BS26                                | internal corner 20/20                    | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A8        |  |
| BS40                                | standard element                         |                        | x  |    |    |    |                        | x  |    |    |    | A4        |  |
| BS41                                | outer corner 50/50                       |                        | x  |    |    |    |                        | x  |    |    |    | A9        |  |
| BS42                                | outer corner 25/25                       |                        | x  |    |    |    |                        | x  |    |    |    | A9        |  |
| BS43                                | levelling element 12,5cm                 |                        | x  |    |    |    |                        | x  |    |    |    | A4        |  |
| BS44                                | outer corner 45°                         |                        | x  |    |    |    |                        | x  |    |    |    | A10       |  |
| BS45                                | outer corner 135°                        |                        | x  |    |    |    |                        | x  |    |    |    | A10       |  |
| BS46                                | internal corner 90°/external             |                        | x  |    |    |    |                        | x  |    |    |    | A9        |  |
| BS47                                | standard element                         |                        |    | x  |    |    |                        |    | x  |    |    | A5        |  |
| BS48                                | standard element                         |                        |    |    | x  |    |                        |    |    | x  |    | A5        |  |
| BS49                                | standard element                         |                        |    |    |    | x  |                        |    |    |    | x  | A5        |  |
| BS50                                | anchor tube                              | x                      | x  | x  | x  | x  | x                      | x  | x  | x  | x  | A11       |  |
| BS51                                | standard element                         | x                      | x  | x  | x  | x  |                        |    |    |    |    | A11       |  |
| BS57                                | reinforcing wire mesh 3,125m             | x                      | x  | x  | x  | x  |                        |    |    |    |    | A11       |  |
| BS57K                               | reinforcing wire mesh 3,125m f. basement | x                      | x  | x  | x  | x  |                        |    |    |    |    | A11       |  |
| BS58                                | bottom anchor                            | x                      | x  | x  | x  | x  |                        |    |    |    |    | A11       |  |
| BS59                                | ceiling anchor                           | x                      | x  | x  | x  | x  |                        |    |    |    |    | A11       |  |
| BS60                                | standard element                         |                        |    |    |    |    | x                      | x  | x  | x  | x  | A12       |  |
| BS64                                | ceiling anchor                           |                        |    |    |    |    | x                      | x  | x  | x  | x  | A12       |  |
| BS65                                | bottom anchor                            |                        |    |    |    |    | x                      | x  | x  | x  | x  | A12       |  |
| BS66                                | reinforcing wire mesh 3,125m             |                        |    |    |    |    | x                      | x  | x  | x  | x  | A12       |  |
| BS66K                               | reinforcing wire mesh 3,125m f. basement |                        |    |    |    |    | x                      | x  | x  | x  | x  | A12       |  |
| permanent shuttering kit "DuoTherm" |                                          |                        |    |    |    |    |                        |    |    |    |    | Annex A14 |  |
| Overview:<br>BS-elements            |                                          |                        |    |    |    |    |                        |    |    |    |    |           |  |

## Installation

### 1 General

The manufacturer shall ensure that the requirements in accordance with clauses 1 and 3 of the "Special Part" of this ETA as well as the Annexes 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 Annex B1, 2) site mixed or ready mixed concrete is placed and compacted (see Annex B1, 3).

In end use conditions concrete walls of a continuous type<sup>1</sup> 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 B13.

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

The design values of thermal resistance respectively the design values of thermal conductivity (see 3.6) 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).

At first the bottom 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 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 B12).

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.

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 shall be formed according to Annex B4. Wall connections (T-walls) shall be formed according to Annex B5. Typical junctions and constructions between walls and ceilings are to be formed according to Annexes B6 to B11.

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

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

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

The maximum filling height amounts to 0,75 m at a concreting velocity of 1 m/h.

<sup>1</sup> see EAD340309-00-0305, clause 1.3.3

permanent shuttering kit "DuoTherm"

Installation

Annex B1  
Page 1 / 2

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

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

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

Before the further placing of concrete, cement laitance and detached / loose concrete shall be removed and the construction 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 construction joints are provided, concreting in layers may only be interrupted as long as the last layer has not yet been solidified and thus a good and uniform bond between the two concrete layers is possible. If internal vibrators are used, care must be taken that the vibratory bottle can still penetrate into the lower, already compacted concrete layer.

The concrete shall fall freely only up to a height of 2 m. From this height, it must be held together by means of conductor pipes or concreting hoses with a maximum diameter of 100 mm and brought up just before the filling point.

The formation of concrete hills is to be avoided by selecting small distances between the filling points.

During the planning, sufficient spaces must be provided in the reinforcement for conductor pipes or concreting hoses.

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

Prefabricated ceilings shall only be placed on walls made with 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.

#### **5 Reworking and finishes**

Walls of the type "DuoTherm" 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 EAD 040083-00-0404. 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 four months after erecting the load-bearing structure, because of the detrimental influence of weather and UV radiation on the surface of the shuttering leaves.

|                                     |                        |
|-------------------------------------|------------------------|
| permanent shuttering kit "DuoTherm" | Annex B1<br>Page 2 / 2 |
| Installation                        |                        |

| standards and guidelines            |                | issue                | title                                                                                                                                                                                                        |
|-------------------------------------|----------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN                                  | 206            | 2013+ A2:2021        | Concrete – Specification, performance, production and conformity                                                                                                                                             |
| EN                                  | 1992-1-1       | 2011-01 + A1:2015-03 | Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings;                                                                                                                 |
| EN                                  | 13163          | 2012+A2:2016         | Thermal insulation products for buildings – Factory made expanded polystyrene (EPS) products – Specification                                                                                                 |
| EN                                  | 13501-1        | 2010-01              | Fire classification of construction products and building elements – Part 1: Classification using 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                              | 6946           | 2018                 | Building components and building elements – Thermal resistance and thermal transmittance – Calculation method (ISO 6946:2007);                                                                               |
| EN ISO                              | 10456          | 2010                 | Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007 + Cor. 1:2009);                        |
| EN ISO                              | 13788          | 2013                 | Hygrothermal performance of building components and building elements . Internal surface temperature to avoid critical surface humidity and interstitial condensation. Calculation methods (ISO 13788:2012); |
| EAD                                 | 040083-00-0404 | 2019-01              | External thermal insulation composite systems (ETICS) with renderings                                                                                                                                        |
| EAD                                 | 340309-00-0305 | 2019-01              | Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete                                                                           |
| permanent shuttering kit "DuoTherm" |                |                      | Annex B2                                                                                                                                                                                                     |
| List of standards and guidelines    |                |                      |                                                                                                                                                                                                              |

## Instructions for determining the declared values of the thermal resistance under end use conditions

The declared value of the thermal resistance of the shuttering leaves off EPS  $R_{D, EPS}$  is determined in accordance with EN ISO 6946. For the declared value of the thermal conductivity of the EPS  $\lambda_{EPS}$ , the values according to section 3.6.1 should be used, depending on the material used (white or gray). The thermal conductivity of the concrete  $\lambda_{concrete}$  shall be taken from EN ISO 10456, Table 3. The density of the used concrete shall be taken into account.

Taking into account the inhomogeneity possible for the system "DuoTherm" (higher thermal conductivity of the wire spacers (see Annexes A11 and A12) than the concrete) the thermal resistance is reduced.

In following tables, these declared values of the thermal resistance of the concrete walls are given for a concrete core without reinforcement with a density of  $\rho = 2200 \text{ kg/m}^3$ . The corresponding thermal conductivity according to EN ISO 10456, Table 3 for this concrete is  $\lambda_{concrete, table} = 1,65 \text{ W/(m K)}$ . The plaster was disregarded in these calculations. Table 1 contains the values for EPS material white and Table 2 for EPS material gray.

**Table 1:** Declared value of the thermal resistance  $R_{D, element}$  for shuttering elements off **EPS material white** (see 3.6.1) under end use conditions (concrete core without reinforcement with a density of  $\rho = 2200 \text{ kg/m}^3$  and a corresponding thermal conductivity according to EN ISO 10456, Table 3 of  $\lambda_{concrete, table} = 1,65 \text{ W/(m K)}$ ), without plaster) in dependence of the thickness of the outer shuttering leaf.

| Type         | Thickness of wall | Thickness of concrete core | Thickness of EPS shuttering leaves |       | Declared value of thermal resistance $R_D$ according to EN ISO 6946 considering the spacers of steel |
|--------------|-------------------|----------------------------|------------------------------------|-------|------------------------------------------------------------------------------------------------------|
|              |                   |                            | inner                              | outer |                                                                                                      |
|              | [mm]              | [mm]                       | [mm]                               | [mm]  | $[(\text{m}^2 \times \text{K})/\text{W}]$                                                            |
| 25-es wall   | 250               | 142                        | 54                                 | 54    | 2,70                                                                                                 |
| 30-es wall   | 300               | 142                        | 54                                 | 104   | 4,13                                                                                                 |
| 40-es wall   | 400               | 142                        | 54                                 | 204   | 6,99                                                                                                 |
| 50-es wall   | 500               | 142                        | 54                                 | 304   | 9,85                                                                                                 |
| 30/1-st wall | 300               | 192                        | 54                                 | 54    | 2,73                                                                                                 |
| 35/1-st wall | 350               | 192                        | 54                                 | 104   | 4,16                                                                                                 |
| 45/1-st wall | 450               | 192                        | 54                                 | 204   | 7,02                                                                                                 |
| 55/1-st wall | 550               | 192                        | 54                                 | 304   | 9,88                                                                                                 |

permanent shuttering kit "DuoTherm"

Instructions for determining the thermal resistance under end use conditions

Annex B3  
page 1 / 2

**Table 2:** Declared value of the thermal resistance  $R_{D,element}$  for shuttering elements off **EPS material gray** (see 3.6.1) under end use conditions (concrete core without reinforcement with a density of  $\rho = 2200 \text{ kg/m}^3$  and a corresponding thermal conductivity according to EN ISO 10456, Table 3 of  $\lambda_{concrete, table} = 1,65 \text{ W/(m K)}$ ), without plaster) in dependence of the thickness of the outer shuttering leaf.

| Type         | Thickness of wall | Thickness of concrete core | Thickness of EPS shuttering leaves |       | Declared value of thermal resistance $R_D$ according to EN ISO 6946 considering the spacers of steel |
|--------------|-------------------|----------------------------|------------------------------------|-------|------------------------------------------------------------------------------------------------------|
|              |                   |                            | inner                              | outer |                                                                                                      |
|              | [mm]              | [mm]                       | [mm]                               | [mm]  | [(m <sup>2</sup> ×K)/W]                                                                              |
| 25-es wall   | 250               | 142                        | 54                                 | 54    | 3,22                                                                                                 |
| 30-es wall   | 300               | 142                        | 54                                 | 104   | 4,79                                                                                                 |
| 40-es wall   | 400               | 142                        | 54                                 | 204   | 7,92                                                                                                 |
| 50-es wall   | 500               | 142                        | 54                                 | 304   | 11,05                                                                                                |
| 30/1-st wall | 300               | 192                        | 54                                 | 54    | 3,25                                                                                                 |
| 35/1-st wall | 350               | 192                        | 54                                 | 104   | 4,81                                                                                                 |
| 45/1-st wall | 450               | 192                        | 54                                 | 204   | 7,93                                                                                                 |
| 55/1-st wall | 550               | 192                        | 54                                 | 304   | 11,06                                                                                                |

For other densities of the concrete core than  $\rho_{concrete, tabel} = 2200 \text{ kg/m}^3$ , the modified nominal value of the thermal resistance can be determined as follows:

$$R_{D,element} = R_{D,element, table} - d_k / \lambda_{concrete, table} + d_k / \lambda_{concrete}$$

If the thermal conductivity of the inner plaster  $\lambda_{plaster, inside}$  and of the outer plaster  $\lambda_{plaster, outside}$  are known, the thermal resistance of the finished wall, taking into account the plasters, can be determined as follows:

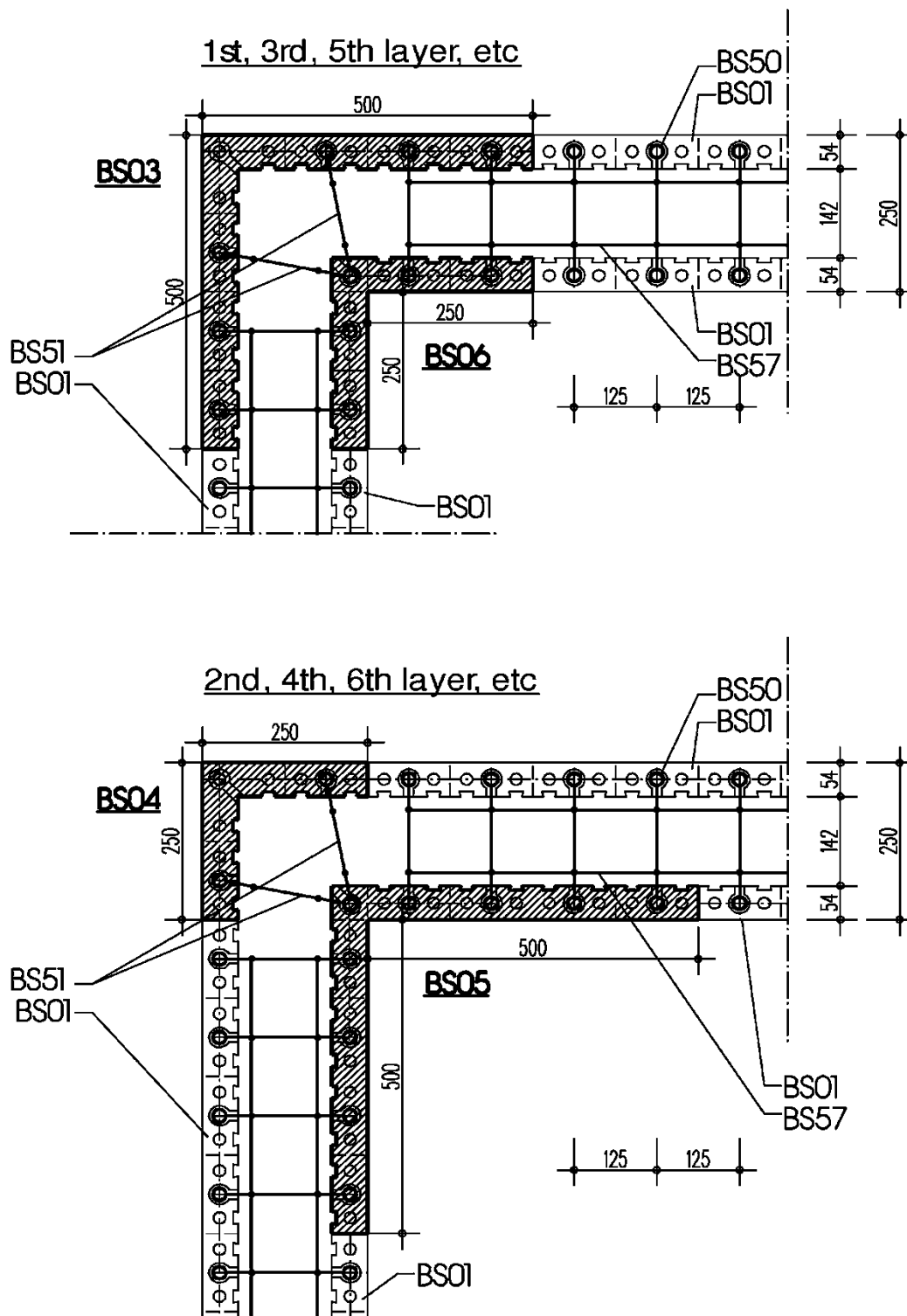
$$R_{D,element} = R_{D,element} + d_{plaster, inside} / \lambda_{plaster, inside} + d_{plaster, outside} / \lambda_{plaster, outside} + R_{si} + R_{se}$$

Wherever relevant, the designer shall consider the thermal bridges (e.g. metal accessories that pierce the insulation) to determine the thermal resistance of the wall.

permanent shuttering kit "DuoTherm"

Instructions for determining the thermal resistance under end use conditions

Annex B3  
Page 2 / 2

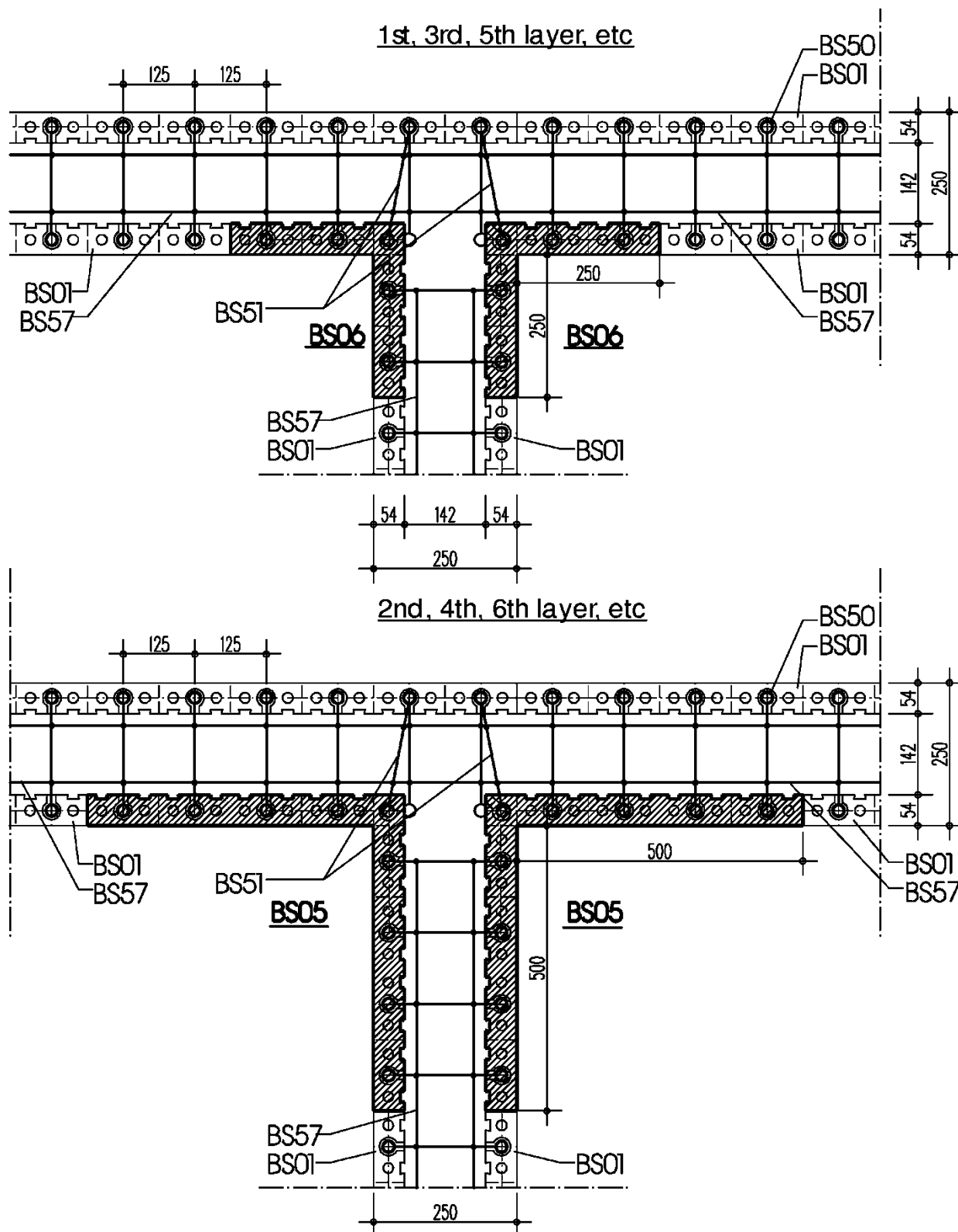


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

Outer corner of walls:  
T-wall with grid sectioning

Annex B4

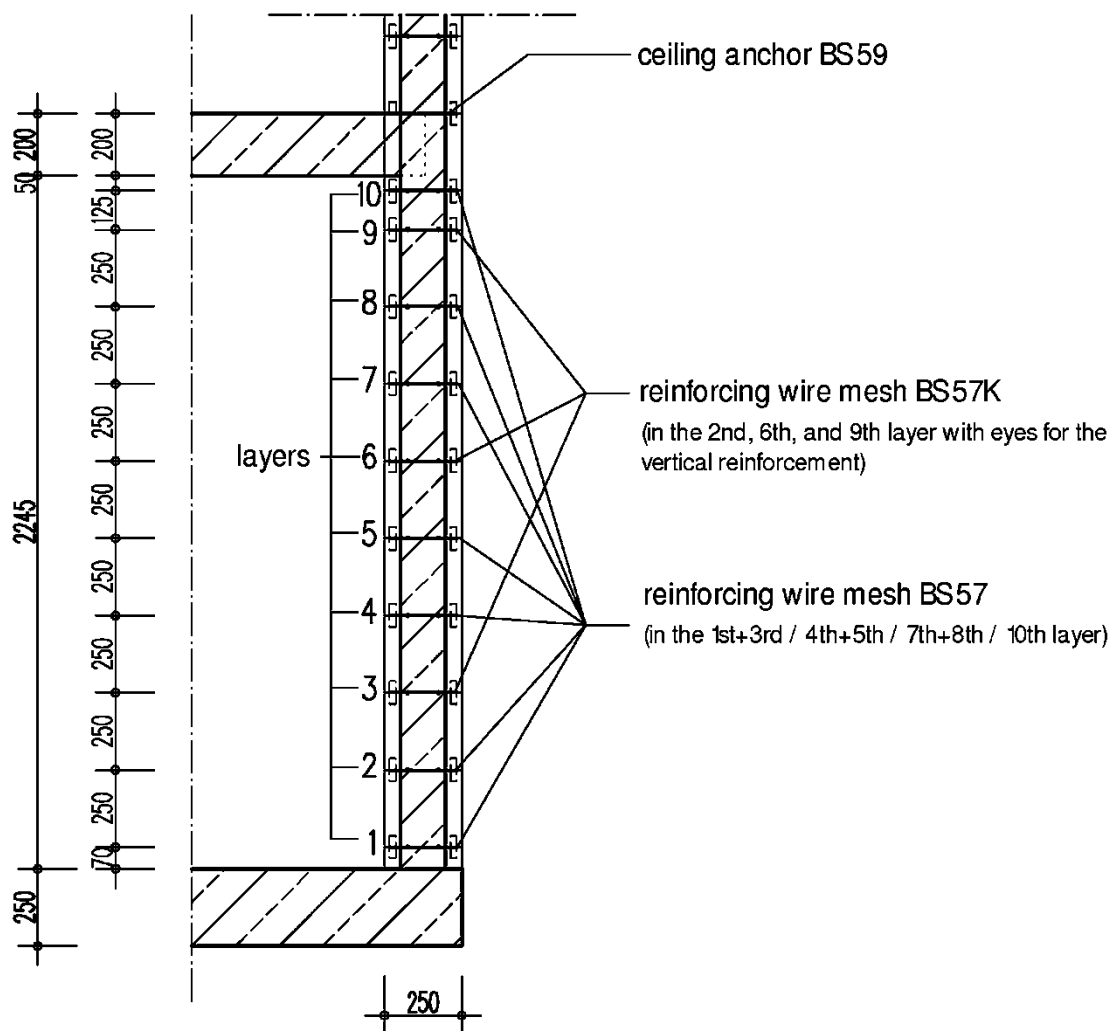


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

T-walls:  
T-wall with grid sectioning

Annex B5

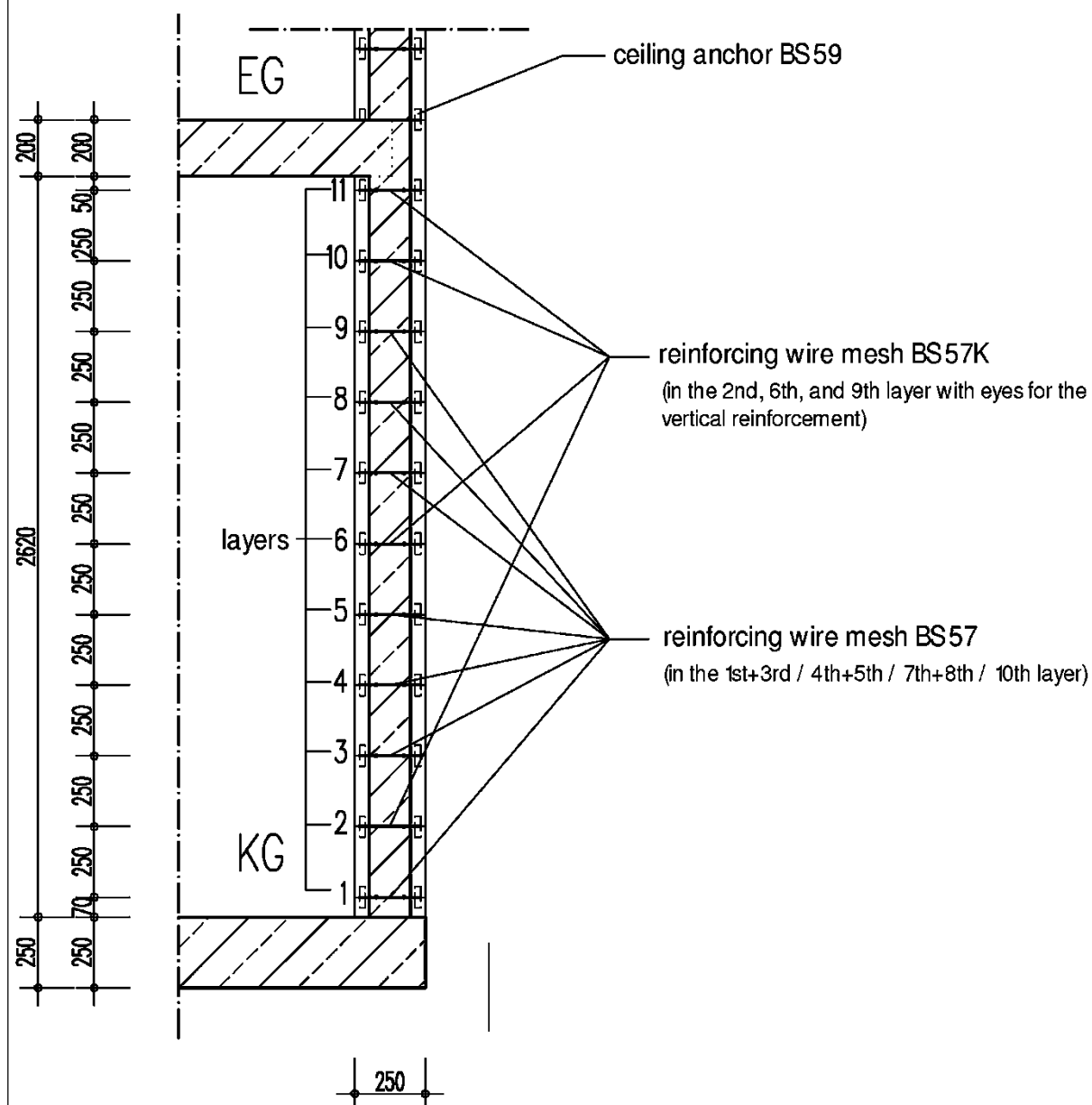


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

Typical junction:  
Cellar (basement) wall construction with arrangement of reinforcement

Annex B6

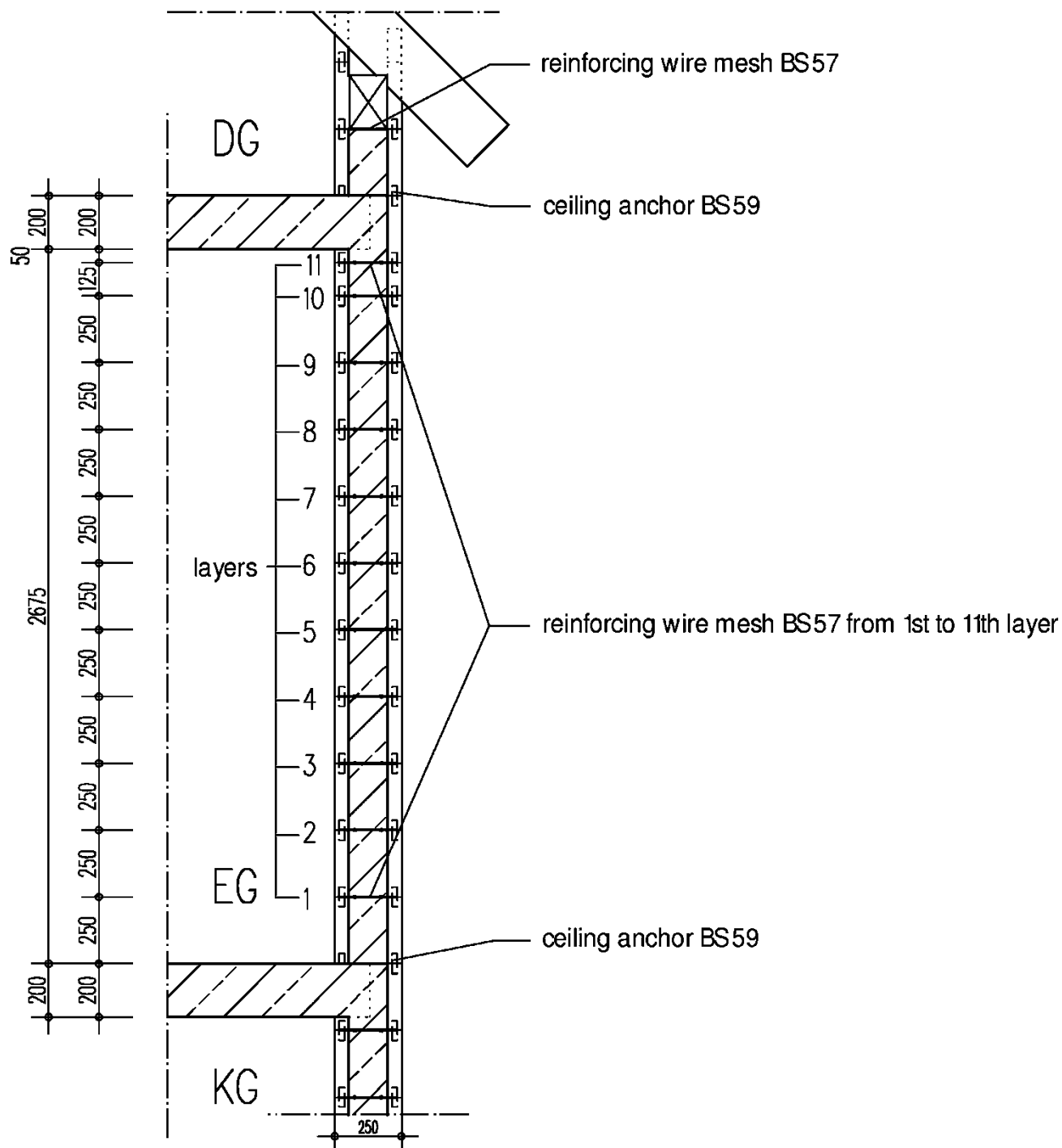


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

Typical junction:  
Cellar (basement) wall construction with arrangement of reinforcement

Annex B7

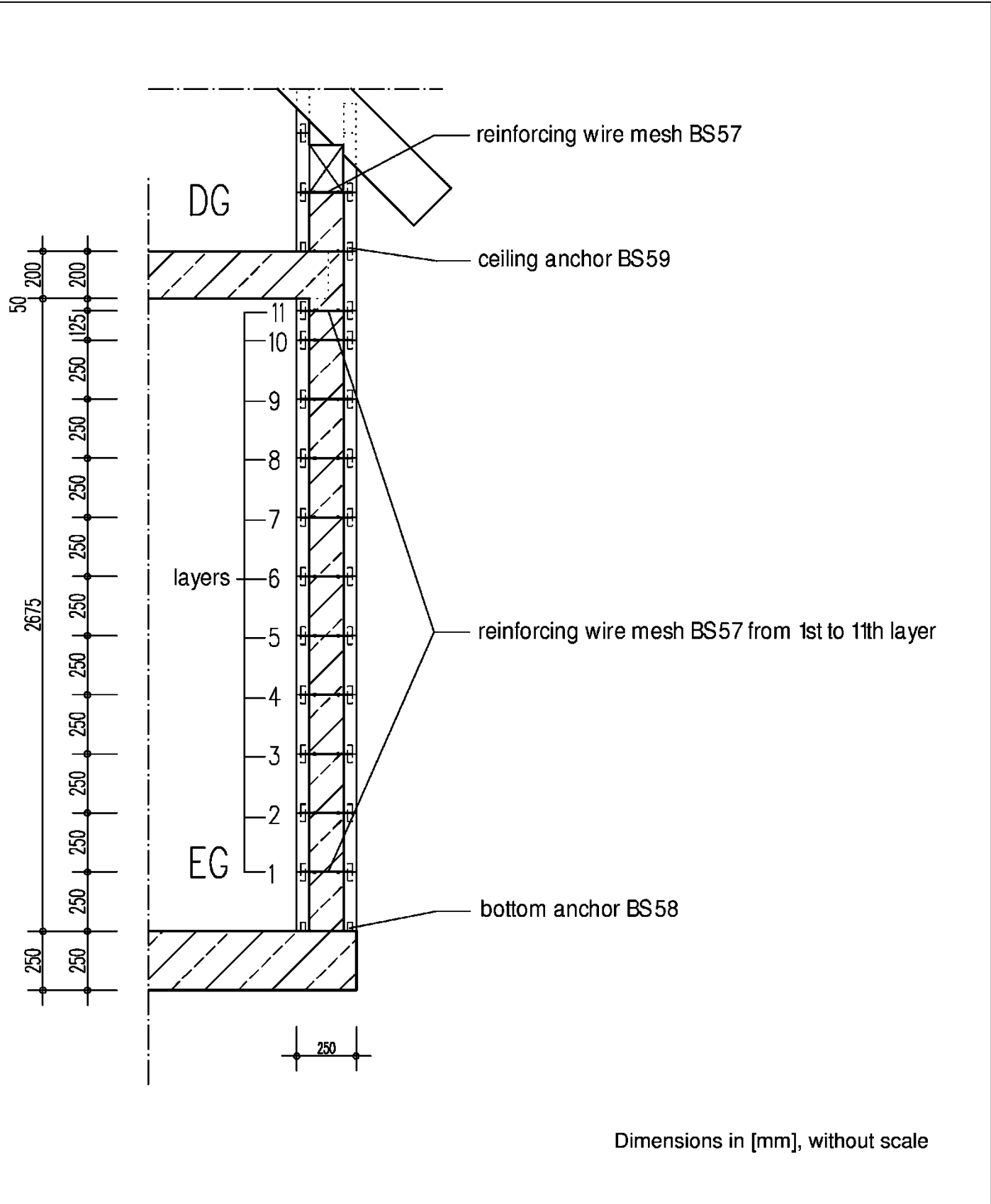


Dimensions in [mm], without scale

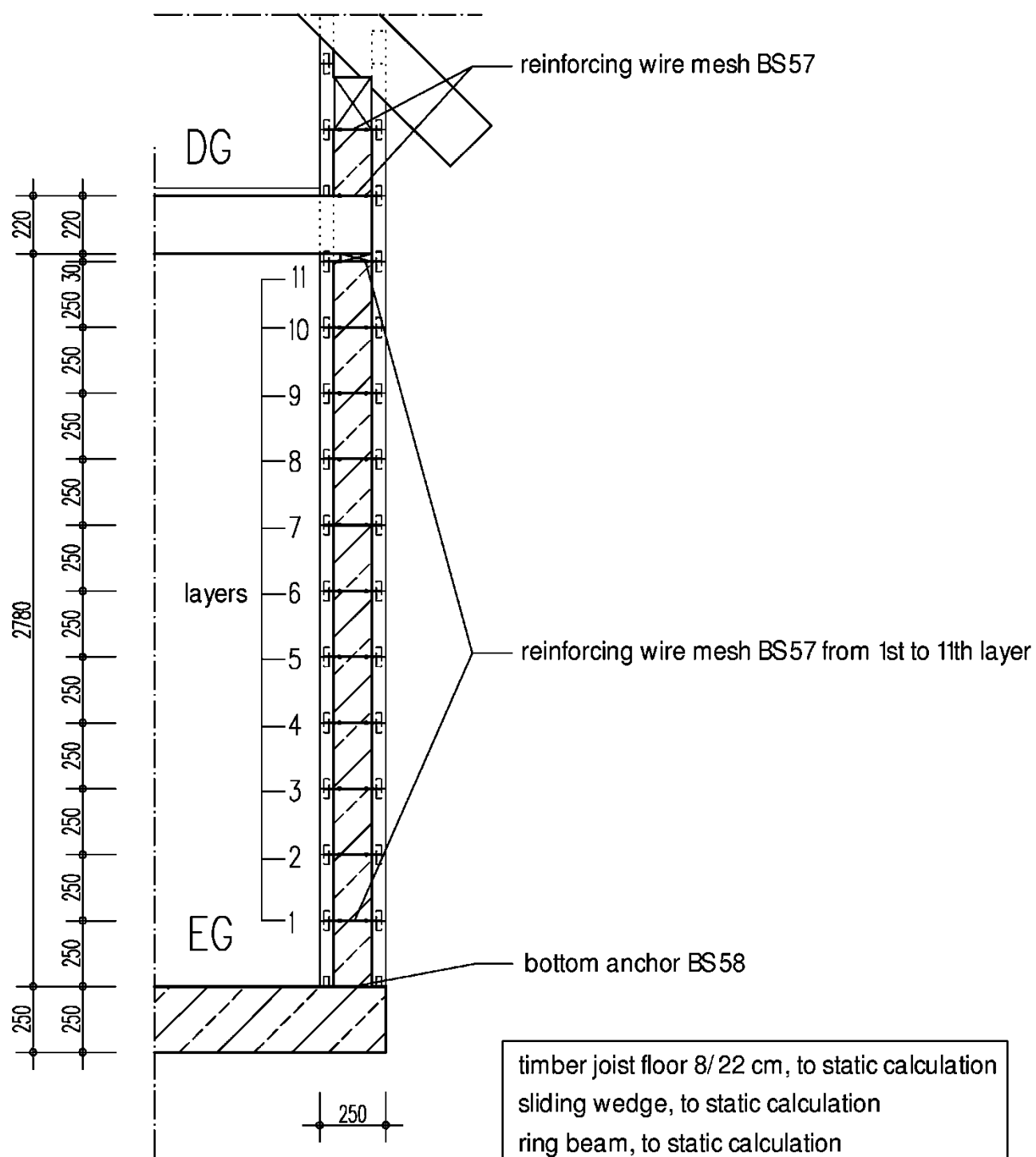
permanent shuttering kit "DuoTherm"

Typical construction:  
Cellar (basement) / ground floor) / top floor with grid sectioning

Annex B8



|                                                                        |          |
|------------------------------------------------------------------------|----------|
| permanent shuttering kit "DuoTherm"                                    | Annex B9 |
| Typical construction:<br>Ground floor / top floor with grid sectioning |          |

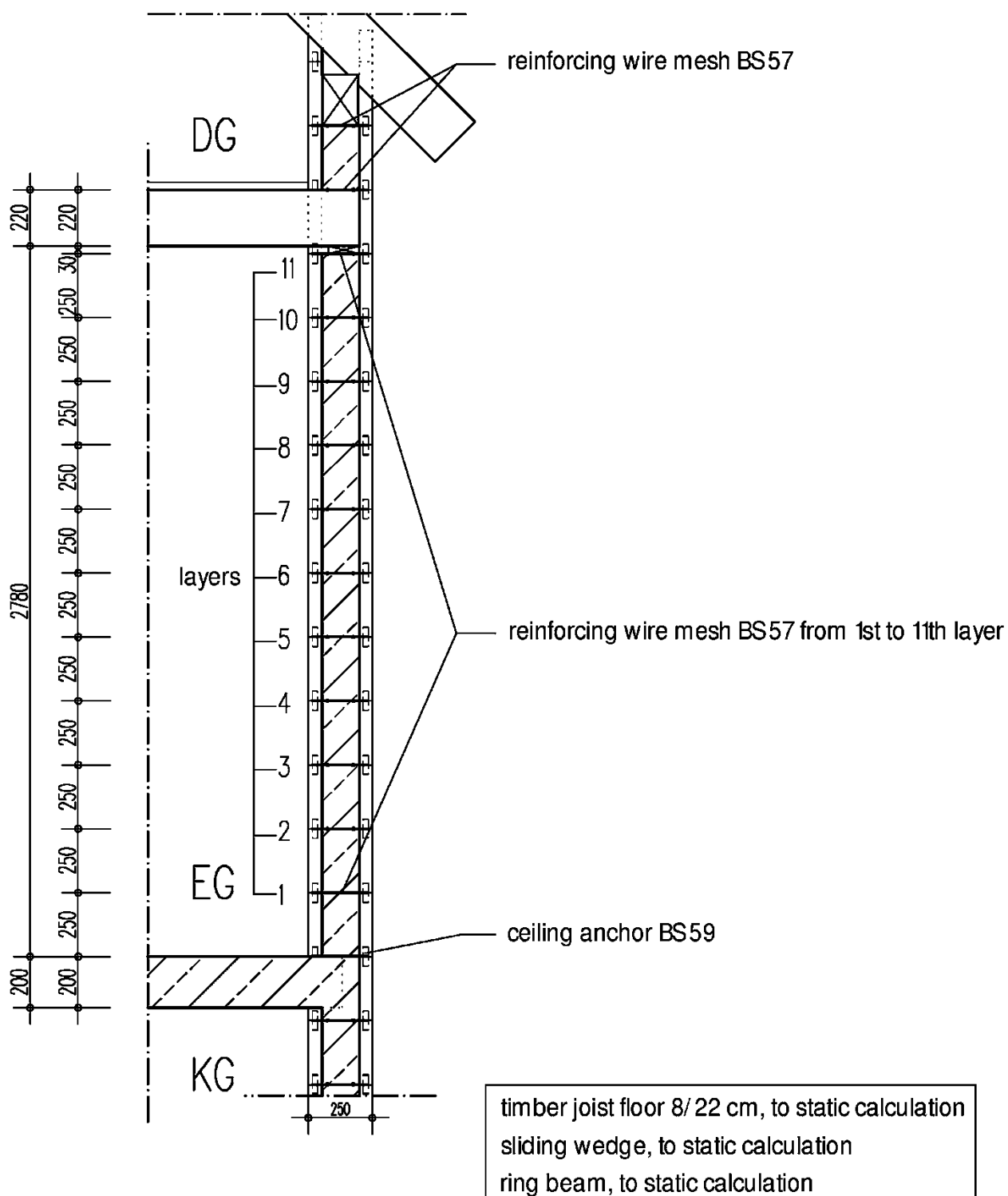


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

Typical construction:  
Timber joist floor between ground floor and top floor with grid sectioning

Annex B10

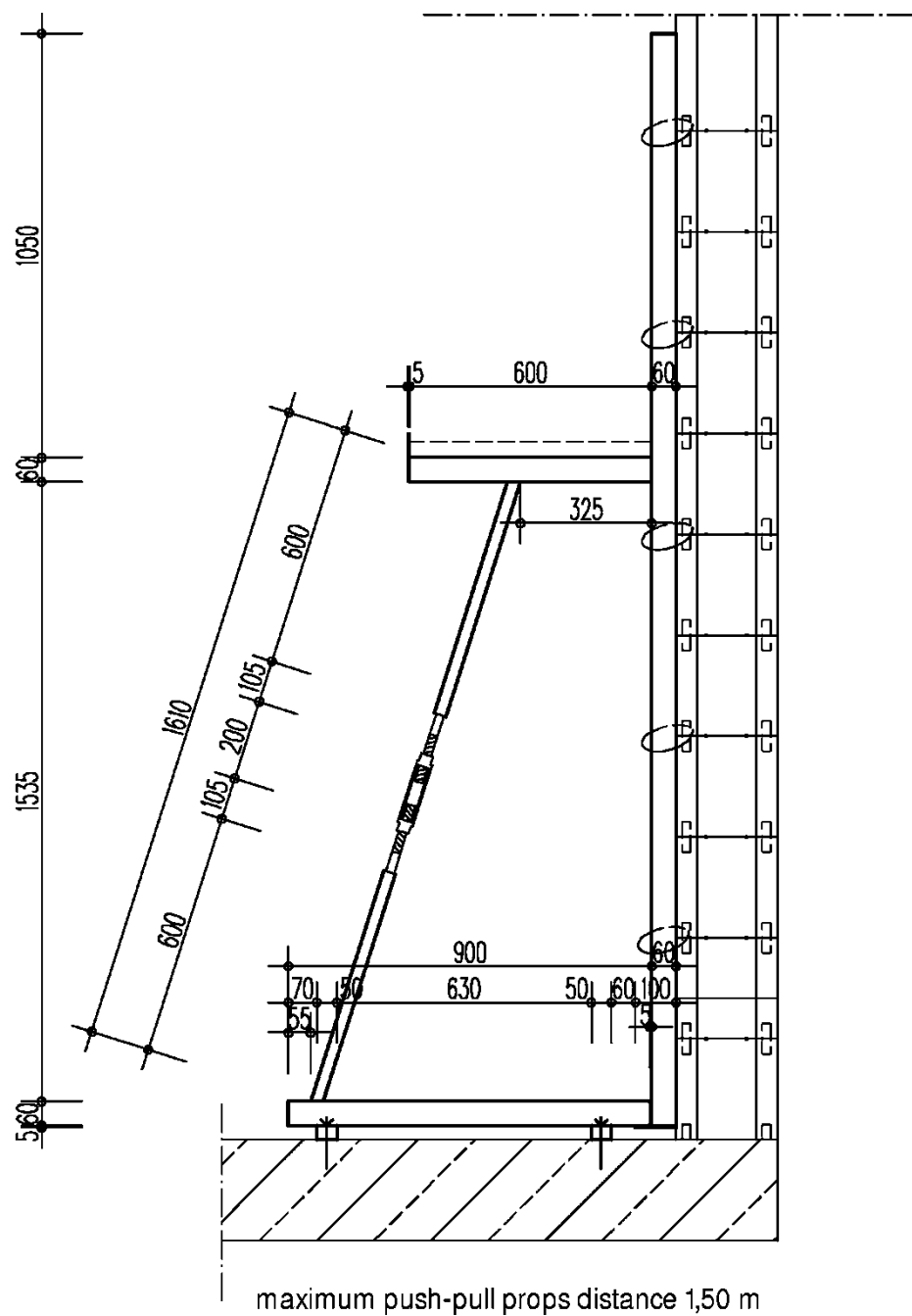


Dimensions in [mm], without scale

permanent shuttering kit "DuoTherm"

Typical construction:  
Cellar and timber joist floor between ground floor and top floor with grid sectioning

Annex B11



Dimensions in [mm], without scale

|                                     |           |
|-------------------------------------|-----------|
| permanent shuttering kit "DuoTherm" | Annex B12 |
| Mounted push-pull props             |           |

| Type           | according<br>Annex | Thickness of<br>the wall | Thickness of<br>concrete core | Area of concrete core<br>in plan view/<br>per meter wall length | Assumed weight of shuttering<br>elements without rendering<br>$\gamma_{\text{EPS}} = 0,3 \text{ KN/m}^2$ | Assumed weight of the wall with<br>concrete core without rendering<br>$\gamma_{\text{concrete}} = 25 \text{ KN/m}^2$ | Area of horizontal frame<br>$A_R$ |
|----------------|--------------------|--------------------------|-------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|                |                    | [mm]                     | [mm]                          | [m <sup>2</sup> /m]                                             | [kg/m <sup>2</sup> ]                                                                                     | [kg/m <sup>2</sup> ]                                                                                                 | [mm <sup>2</sup> ]                |
| <b>25-es</b>   | A1                 | 250                      | 142                           | 0,1445                                                          | 3,24                                                                                                     | 358                                                                                                                  | ./.                               |
| <b>30-es</b>   |                    | 300                      | 142                           | 0,1445                                                          | 4,74                                                                                                     | 360                                                                                                                  | ./.                               |
| <b>40-es</b>   |                    | 400                      | 142                           | 0,1445                                                          | 7,74                                                                                                     | 363                                                                                                                  | ./.                               |
| <b>45-es</b>   |                    | 450                      | 142                           | 0,1445                                                          | 9,24                                                                                                     | 364                                                                                                                  | ./.                               |
| <b>52-es</b>   |                    | 500                      | 142                           | 0,1445                                                          | 10,74                                                                                                    | 366                                                                                                                  | ./.                               |
| <b>30/1-st</b> |                    | 300                      | 192                           | 0,1945                                                          | 3,24                                                                                                     | 483                                                                                                                  | ./.                               |
| <b>35/1-st</b> |                    | 350                      | 192                           | 0,1945                                                          | 4,74                                                                                                     | 485                                                                                                                  | ./.                               |
| <b>45/1-st</b> |                    | 450                      | 192                           | 0,1945                                                          | 7,74                                                                                                     | 488                                                                                                                  | ./.                               |
| <b>50/1-st</b> |                    | 500                      | 192                           | 0,1945                                                          | 9,24                                                                                                     | 489                                                                                                                  | ./.                               |
| <b>55/1-st</b> |                    | 550                      | 192                           | 0,1945                                                          | 10,74                                                                                                    | 491                                                                                                                  | ./.                               |

permanent shuttering kit "DuoTherm"

Standard shuttering elements  
Dimensions and weights

Annex B13

#### Description to BWR 1 – Mechanical resistance and stability

##### Efficiency of filling

Considering the instructions of Annex B1 and the installation guide of the ETA holder the efficient filling without bursting of the shuttering and without voids or any uncovered reinforcement in the concrete core is possible.

##### Possibility of steel reinforcement

The instructions in the installation guide of the ETA holder are appropriate to install steel reinforcement for walls according to EN 1992-1-1 or corresponding national rules (see e. g. Annexes B8 to B15 and B21).

permanent shuttering kit "DuoTherm"

Description of Performance to BWR 1  
Mechanical resistance and stability

Annex C1

#### Description of performance to BWR 3 – hygiene, health and environment

##### Water vapour permeability

The tabulated design value of water vapour diffusion resistance coefficient of expanded polystyrene (EPS), according to EN 12524, is  $\mu = 60$ .

The values for the water vapour diffusion resistance of concrete in dependence of density and type are tabulated in EN 12524.

permanent shuttering kit "DuoTherm"

Description of Performance to BWR 3  
hygiene, health and environment

Annex C2

## Description to BWR 4 – Safety and accessibility in use

### Bond Strength

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

The EPS shuttering leaf is bonded to the concrete by mechanical interlocking of the T guides [figure 2.2.10.2.1 (b) in EAD 340309-00-0305, chapter 2.2.10.2].

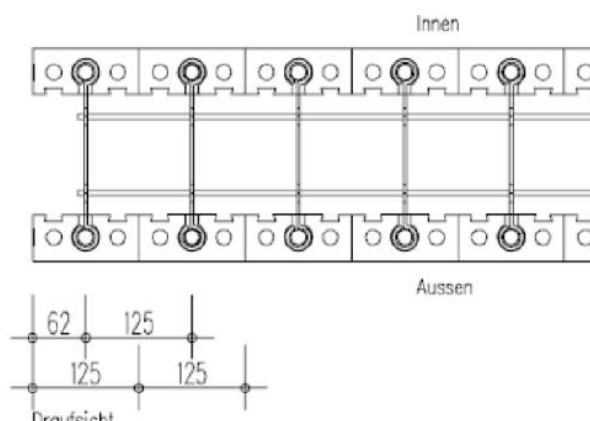


Figure 1: sketch, interlocking mechanism between concrete core and EPS leaf

Under end use conditions the EPS shuttering leaves are durable fixed by the steel spacers. The bond strength is at least equal to the resisting pressure of fresh concrete of the EPS shuttering leaves. Furthermore the vertical element-high grooves on the inside face of each EPS shuttering leaf provide a mechanical interlock between EPS shuttering leaves and concrete core.

### Resistance to impact load

#### Global resistance

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

#### Local resistance

No performance assessed

permanent shuttering kit "DuoTherm"

Description of Performance to BWR 4  
Safety and accessibility in use

Annex C3  
Page 1/2

### Resistance to fresh concrete pressure

bending tensile strength of the shuttering leaves > 250 kPa

The tensile strength shall be at least

- 680 MPa for the steel spacers (see Annexes A11 and A12) respectively
- 520 MPa for the PP tubes (Annex A11, element BS 50).

The pull-out strength between steel spacers and the shuttering leaves shall be at least

- 570 N for the steel spacer without metal tubes in the space of the wall area (see Annexes A11 and A12, e. g. elements BS 51, BS 57, BS 59, BS 60, BS 64 and BS 66) in conjunction with PP tubes (see Annex A11, element BS 50) respectively
- 290 N for the steel spacer with metal tubes at wall base (see Annexes A11 and A12, e. g. elements BS 58 and BS 65).

permanent shuttering kit "DuoTherm"

Description of Performance to BWR 4  
Safety and accessibility in use

Annex C3  
Page 2/2

## Description to BWR 6 – Energy economy and heat retention

### Thermal Resistance

The shuttering elements according to Annex A2 are produced in two materials:

- Material white: BASF Styropor F 315 R
- Material gray: BASF Neopor F2400.

The thermal conductivity of the shuttering panels made with these materials is:

- Material white:  $\lambda = 0.035 \text{ W} / (\text{m} \times \text{K})$  with a maximum density of  $33 \text{ kg} / \text{m}^3$
- Material gray:  $\lambda = 0.032 \text{ W} / (\text{m} \times \text{K})$  with a maximum density of  $32 \text{ kg} / \text{m}^3$ .

The values for the thermal resistances of the walls are tabled in Annex B3.

permanent shuttering kit "DuoTherm"

Description of Performance to BWR 6  
Energy Economy and heat retention

Annex C4

Description to: Aspects of durability

**Resistance to deterioration**

Physical agent

As given in the designation code "DS(70,-)3" of the EPS (see Annex A1, 5.1) the relative changes of the shuttering leaves in length, width and thickness under specified temperature and humidity conditions shall not exceed 3 % after exposing them for 48 h at 70 °C, according to EN 13163.

permanent shuttering kit "DuoTherm"

Description to "Aspects of durability"

Annex C5