Deutsches Institut für Bautechnik

Public-law institution jointly founded by the federal states and the Federation

European Technical Assessment Body for construction products

Member of EOTA
www.eota.eu

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment ETA-07/0235 of 26 February 2026

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	permanent shuttering kit "DuoTherm"
Product family to which the construction product belongs	Non-load bearing permanent shuttering kit "DuoTherm" based on shuttering elements of EPS
Manufacturer	DuoTherm Entwicklungs-Vertriebs mbH Am Himmelfeld 2 56410 Montabaur DEUTSCHLAND
Manufacturing plant	Schaumaplast Sachsen GmbH Gewerbestraße 12 01681 Nossen DEUTSCHLAND Beck & Heun GmbH Steinstraße 4 35794 Mengerskirchen-Waldernbach
This European Technical Assessment contains	44 pages including 37 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Article 95(4) of Regulation (EU) No 2024/3110, on the basis of	EAD 340309-00-0305
This version replaces	ETA-07/0235 issued on 6 September 2018

The European Technical Assessment is issued by the Technical Assessment Body in its official language. Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and shall be identified as such.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full. However, partial reproduction may only be made with the written consent of the issuing Technical Assessment Body. Any partial reproduction shall be identified as such.

This European Technical Assessment may be withdrawn by the issuing Technical Assessment Body, in particular pursuant to information by the Commission in accordance with Article 36(3) of Regulation (EU) No 2024/3110.

Specific part

1 Technical description of the product

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 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 built 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 3.4.1).

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 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 Spacer

Spacer 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 [a)]	None of these raw materials are actively used in the manufacture of the construction product.[b) c)]
Substances classified as Muta. 1A/1B [a)]	
Substances classified as Acute Tox. 1, 2, 3; Repr. 1A/1B; STOT SE 1 and STOT RE 1 [a)]	
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
Water absorption	No performance assessed (finishes are not part of this ETA)
Water tightness	

[a)] In accordance with Regulation (EC) No 1272/2008
[b)] Assessment based on the detailed manufacturers' statements on dangerous substances
[c)] 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 ≥ 250 kPa (see also designation code of EPS in Annex A1, chapter 5.1) pull-out forces see Annex C3
Safety to personal injuries	When delivered on site the shuttering elements do not have sharp or cutting edges. Due to the soft surfaces of the shuttering leaves, there is no risk of abrasion or of cutting to people.

3.5 Protection against noise (BWR 5)

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

3.6 Energy economy and heat retention (BWR 6)

Essential characteristic	Performance
Thermal resistance	
White EPS	See Annex C4 and table 1 in Annex B2
Gray 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 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 26 February 2026 by Deutsches Institut für Bautechnik

LBD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Groth

Deutsches Institut für Bautechnik DIBt

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

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).

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 395-N (material white) or BASF Neopor F2400 (material gray).

The density ρ of the expanded polystyreneis , depending on the material:

material white:	27 - 29 kg / m^3
material gray:	30 - 32 kg / m^3

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).

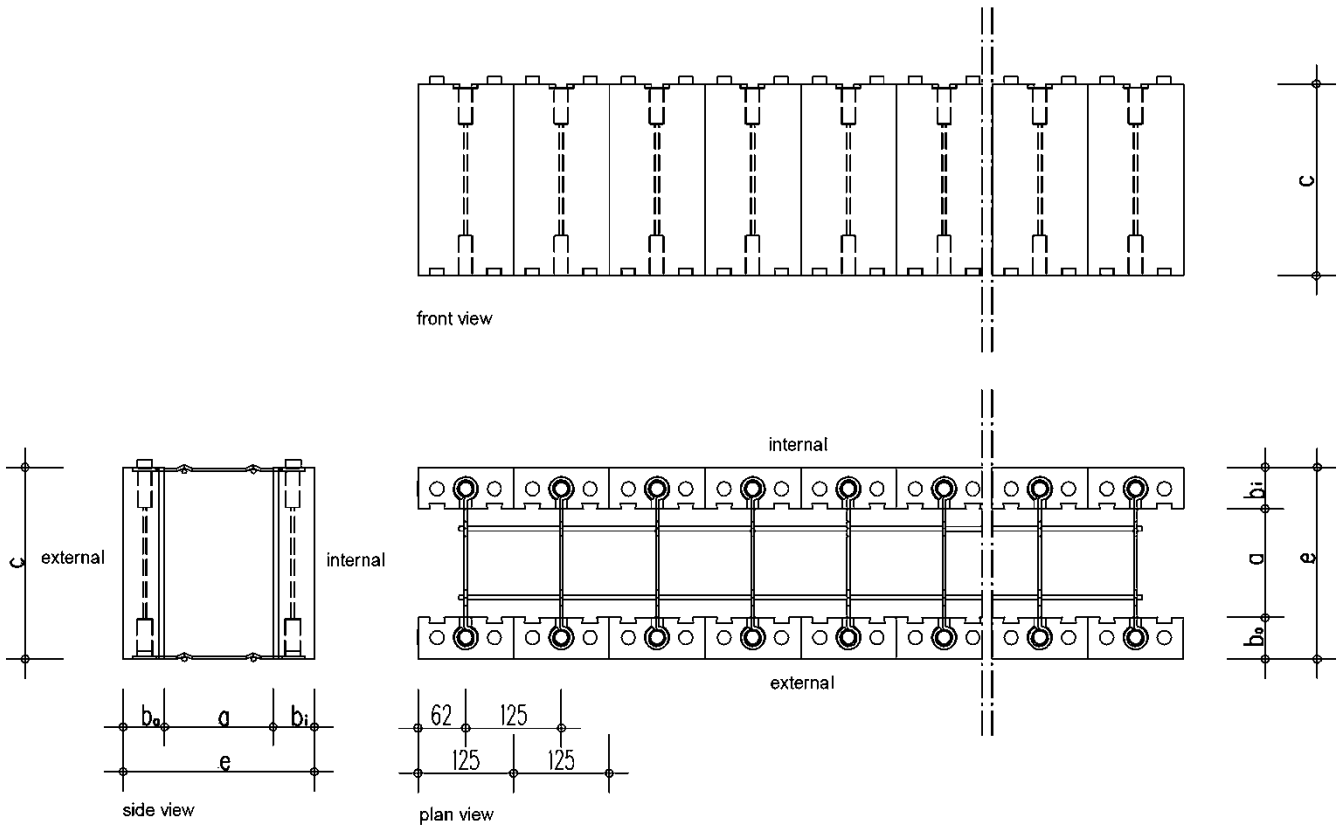
5.2 Accessory parts

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).



[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
	a	**b_a**	**b_i**	**c**	**e**					
	[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

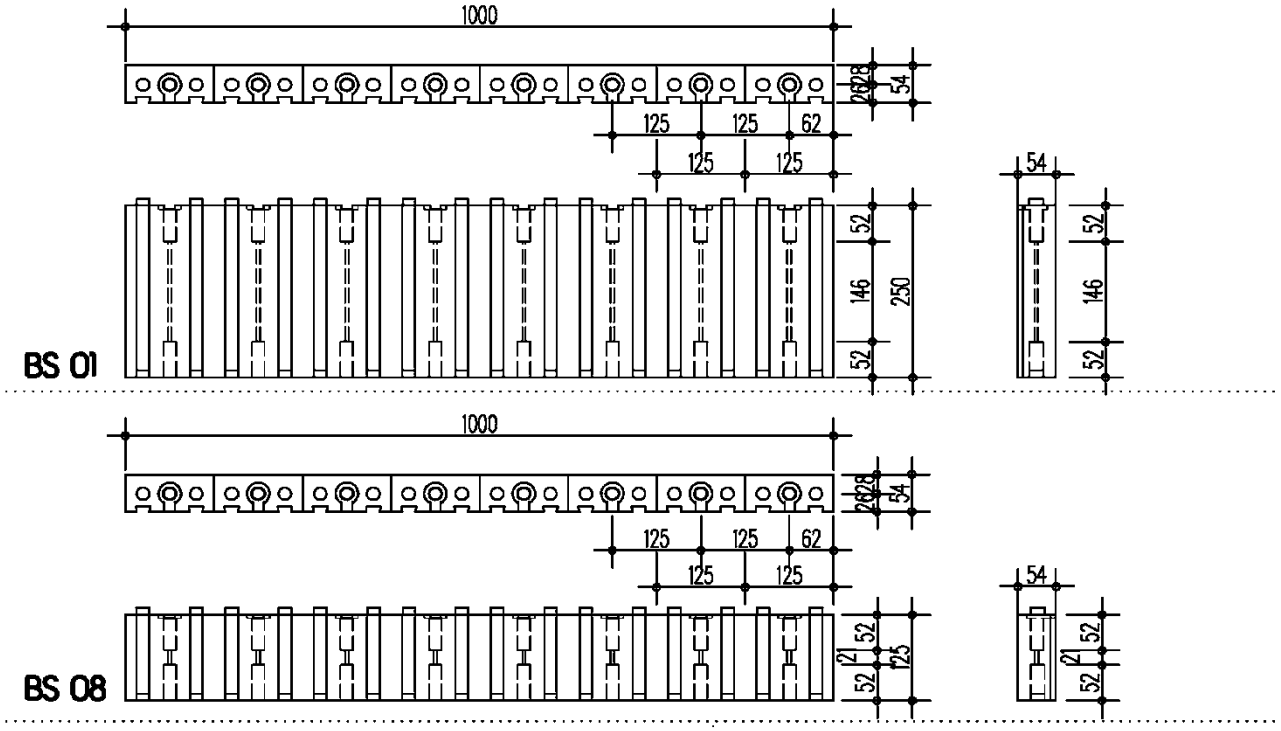
Dimensions in [mm], without scale

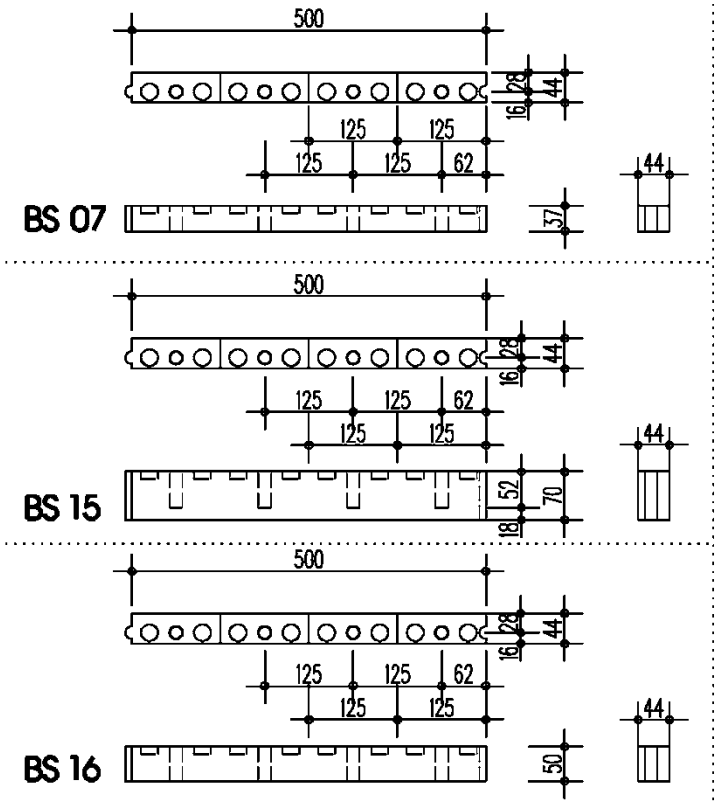
Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""

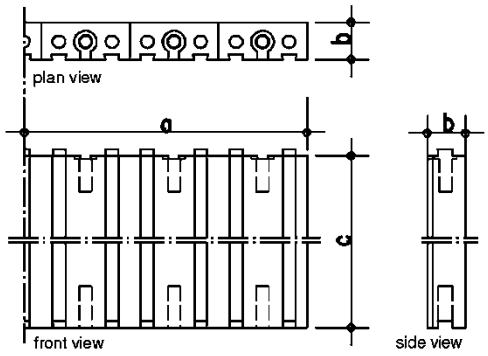
Standard shuttering elements

Annex A2

Deutsches Institut für Bautechnik DIBt







	a	b	c
BS 01	1000	54	250
BS 08	1000	54	125
BS 07	500	44	37
BS 15	500	44	70
BS 16	500	44	50

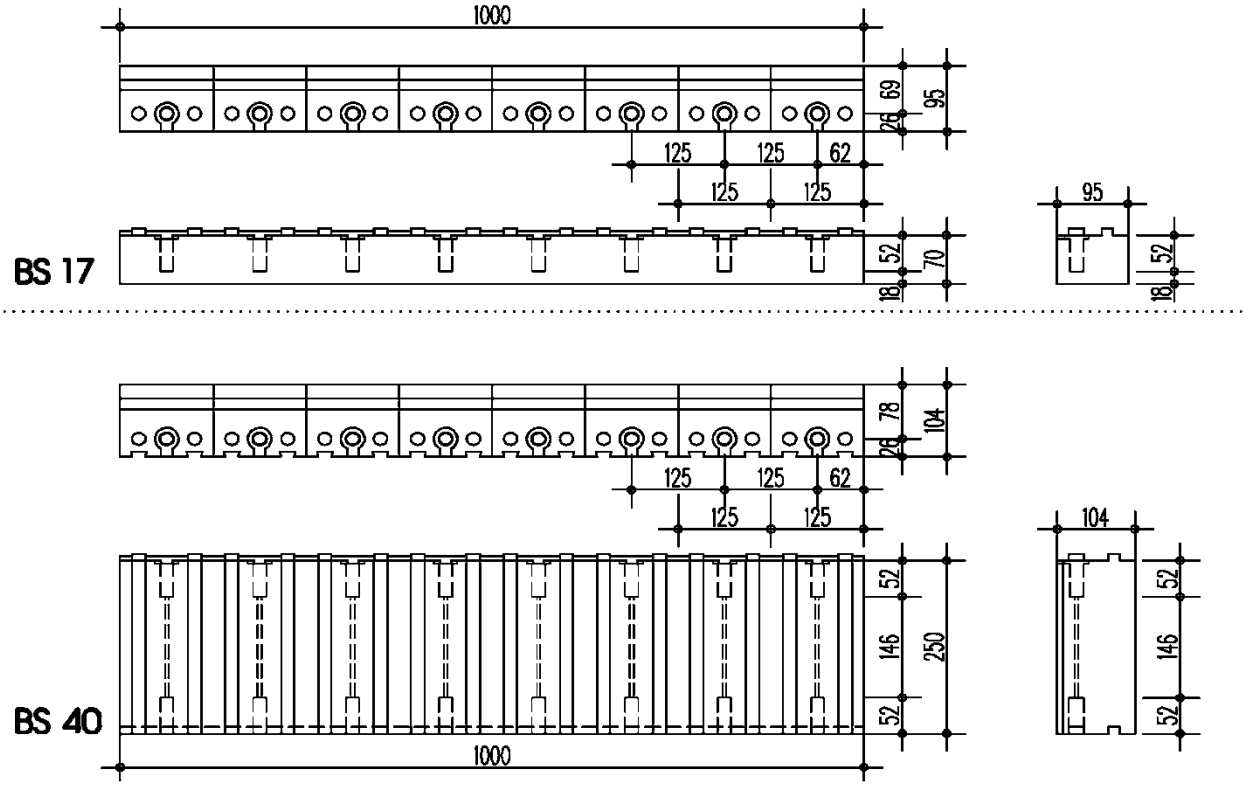
Dimensions in [mm], without scale

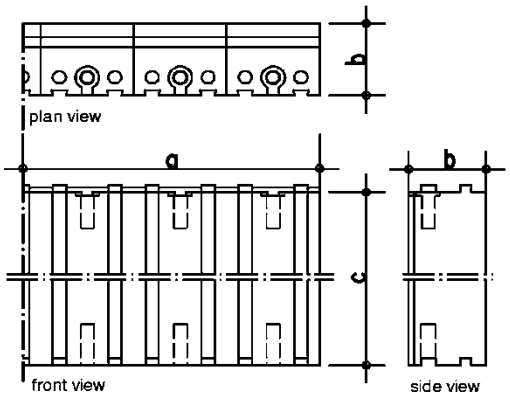
Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""

BS-elements: BS 91 / BS 08 / BS 07 / BS 15 / BS 16

Annex A3

Deutsches Institut für Bautechnik DIBt





	a	b	c
BS 17	1000	95	70
BS 40	1000	104	250
BS 43	1000	104	125
BS 47	1000	204	250
BS 48	1000	254	250
BS 49	1000	304	250

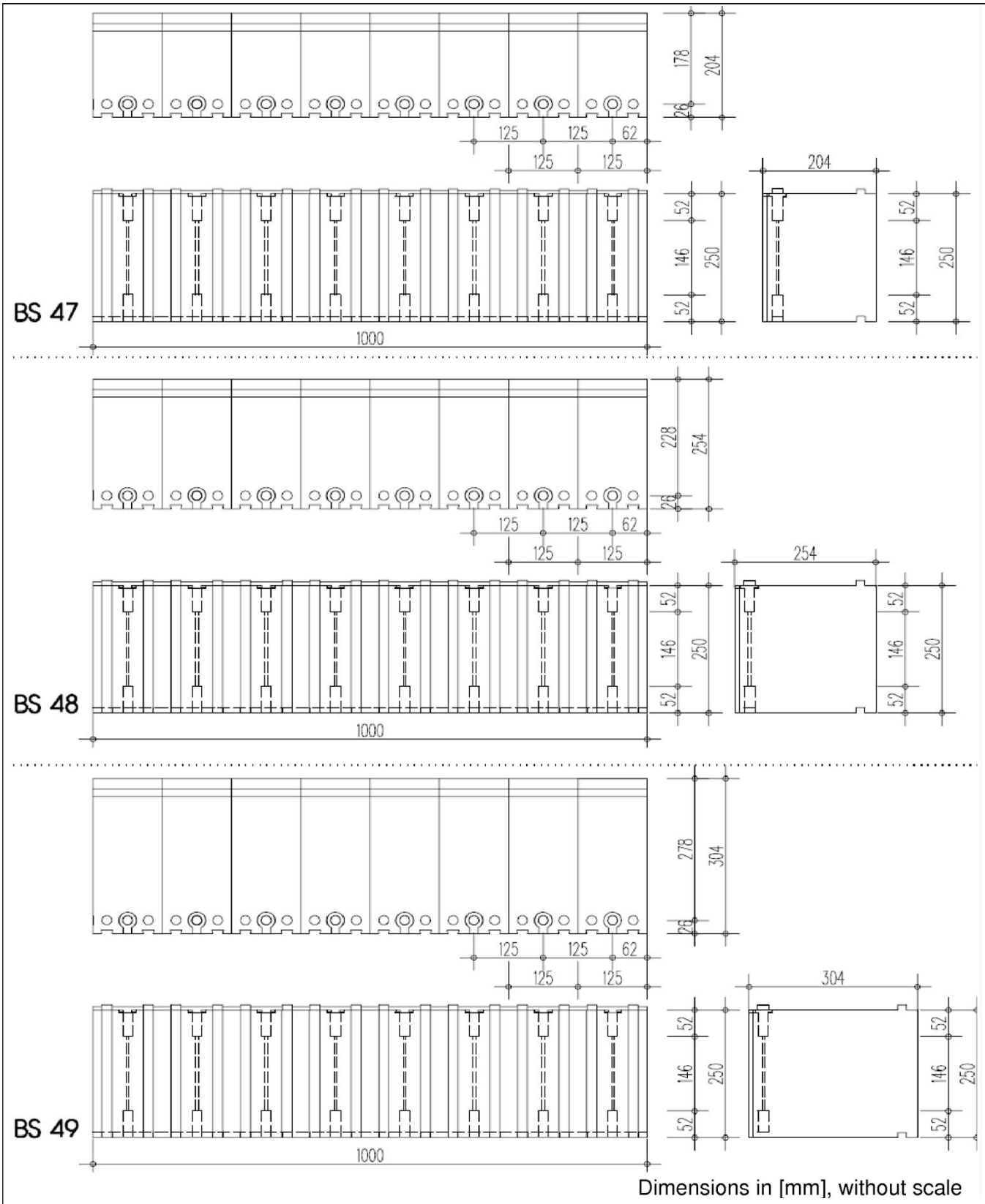
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""

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

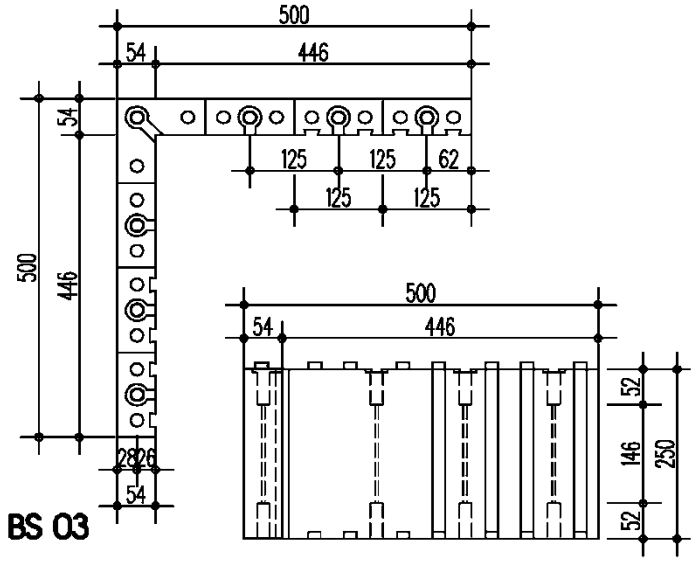
Annex A4

Deutsches Institut für Bautechnik DIBt

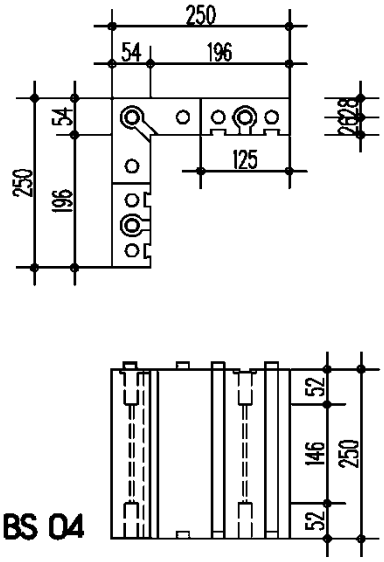


Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex A5
BS-elements: BS 47 / BS 48 / BS 49	

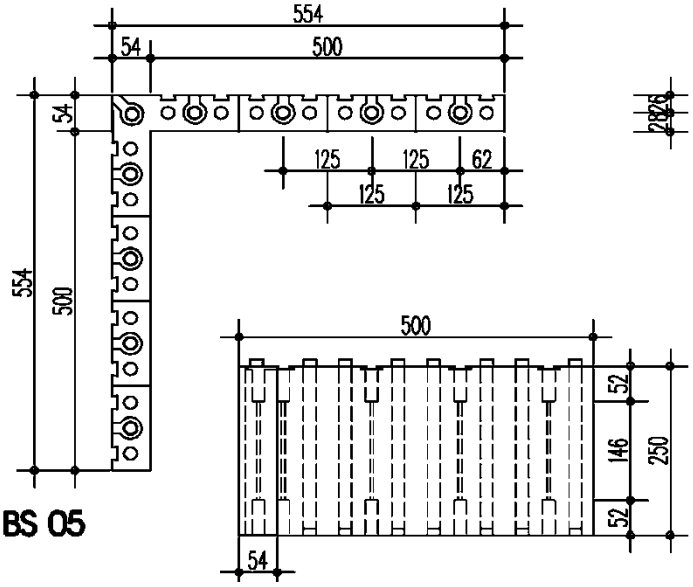
Deutsches Institut für Bautechnik DIBt



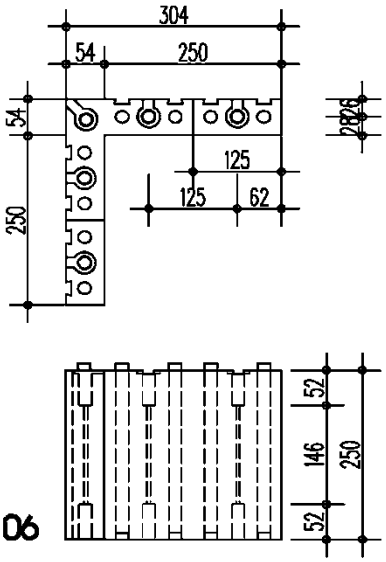
BS 03



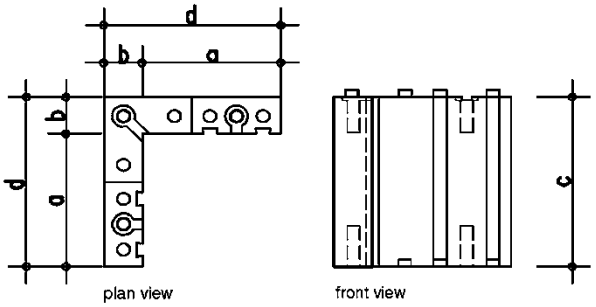
BS 04



BS 05



BS 06



	a	b	c	d
BS 03	(446)	54	250	500
BS 04	(196)	54	250	250
BS 05	500	54	250	(554)
BS 06	250	54	250	(304)

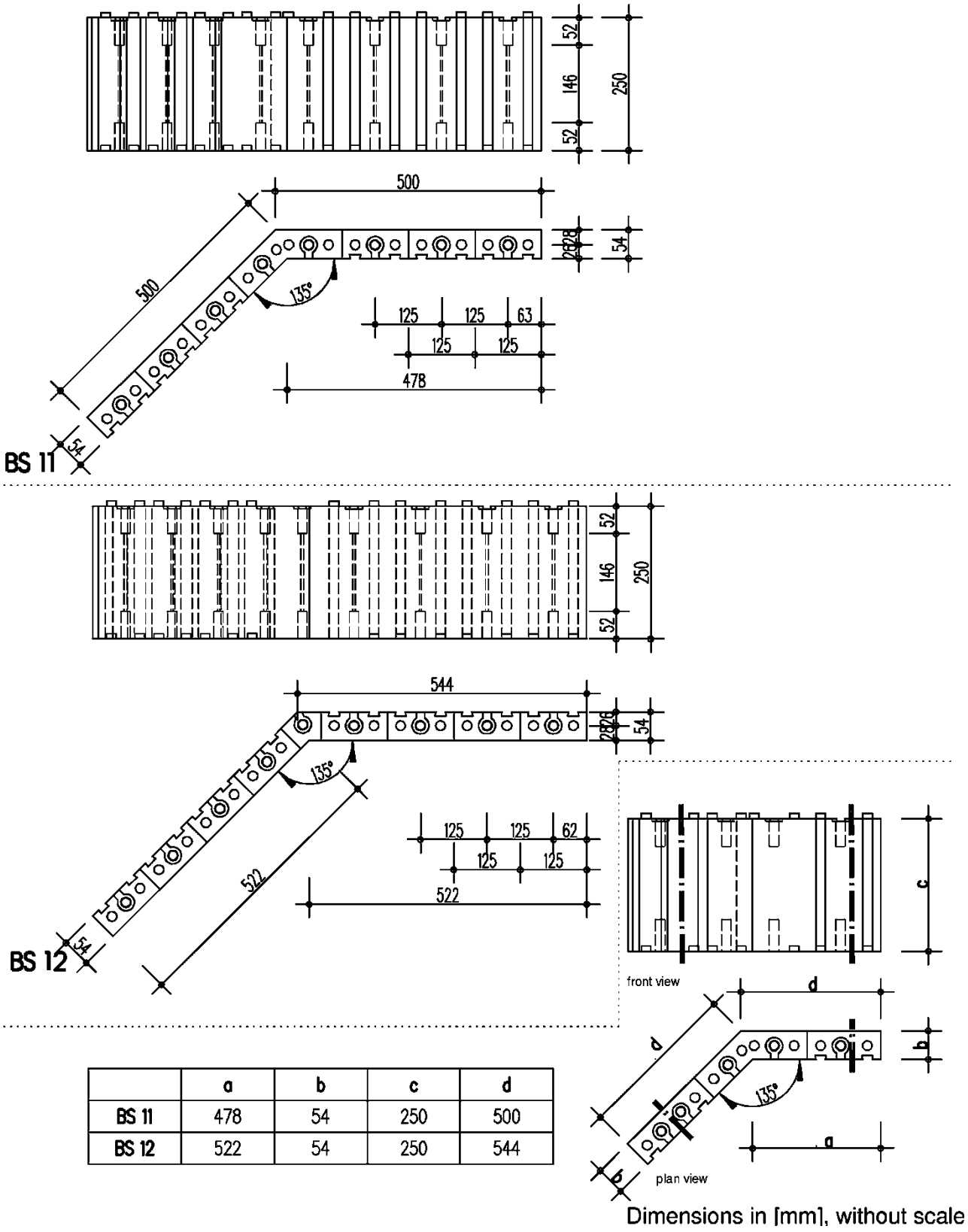
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""

BS-elements: BS 03 / BS 04 / BS 05 / BS 06

Annex A6

Deutsches Institut für Bautechnik DIBt

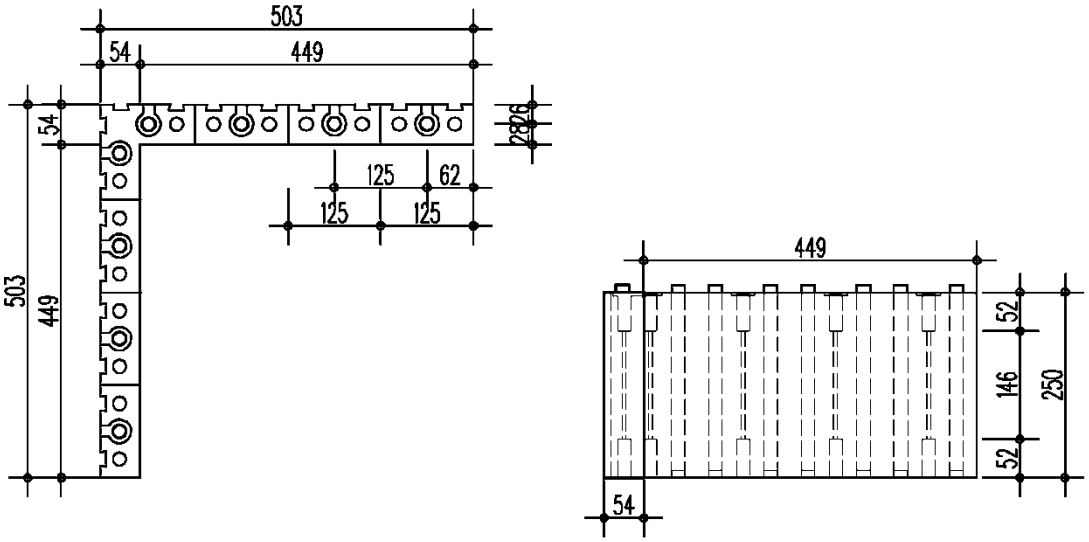


	a	b	c	d
BS 11	478	54	250	500
BS 12	522	54	250	544

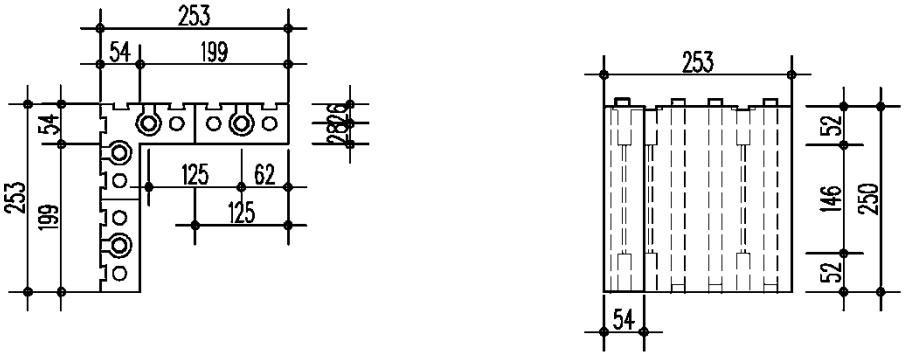
Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""

BS-elements: BS 11 / BS 12

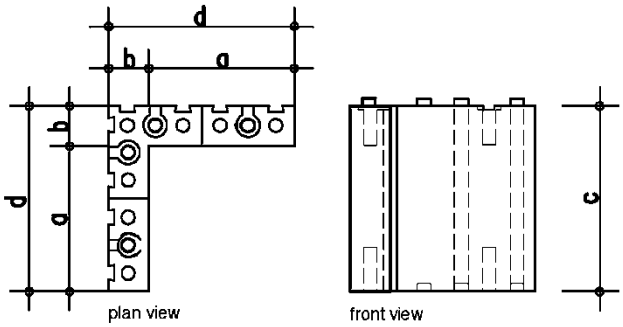
Annex A7



BS 25



BS 26

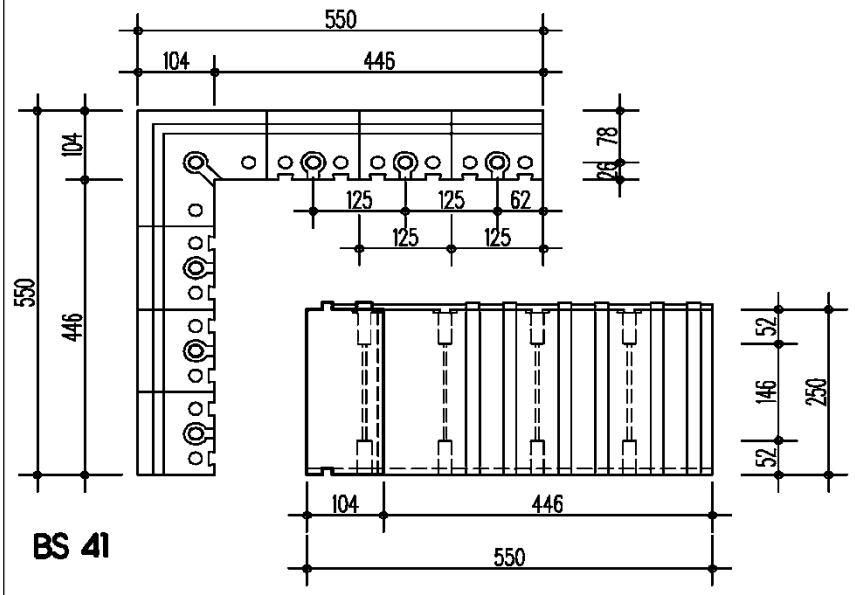


	a	b	c	d
BS 25	449	54	250	503
BS 26	199	54	250	253

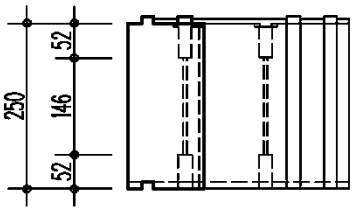
Dimensions in [mm], without scale

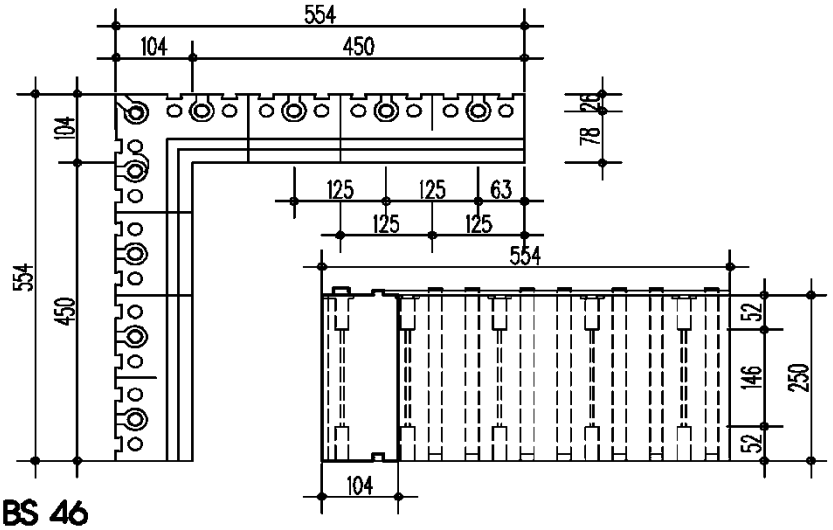
Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex A8
BS-elements: BS 25 / BS 26	

Deutsches Institut für Bautechnik DIBt

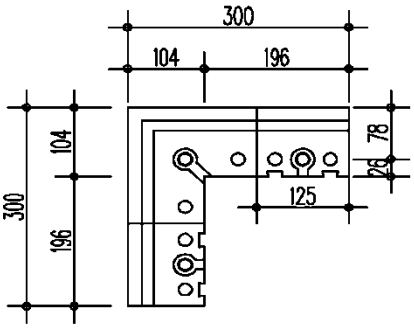


BS 41

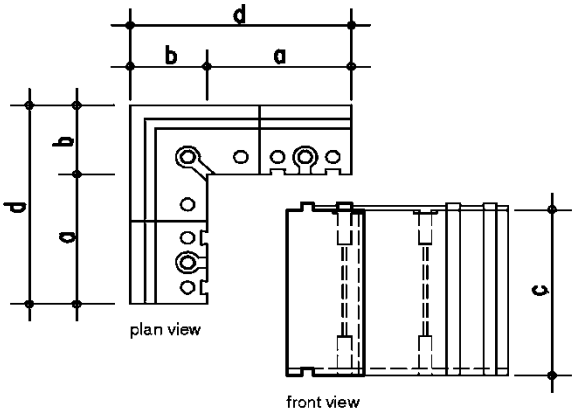




BS 46



BS 42

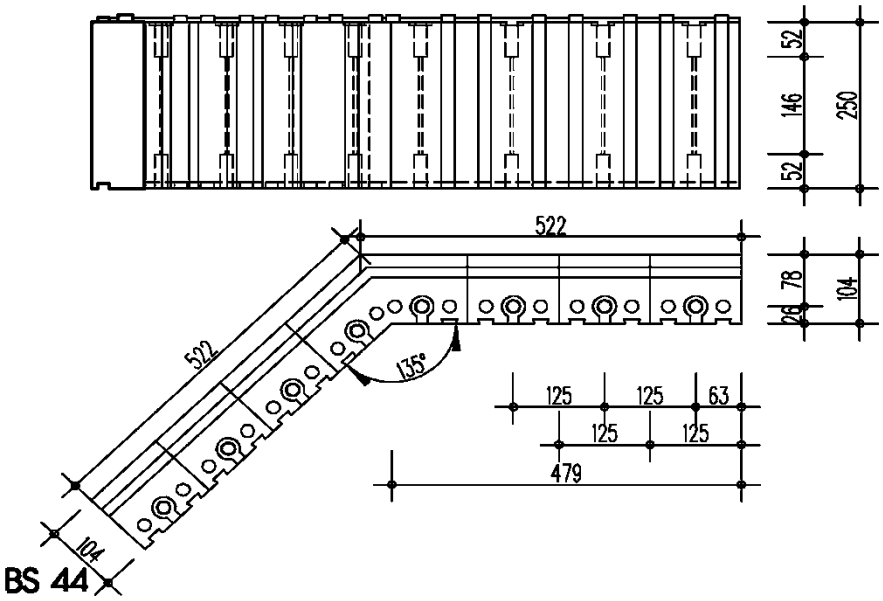


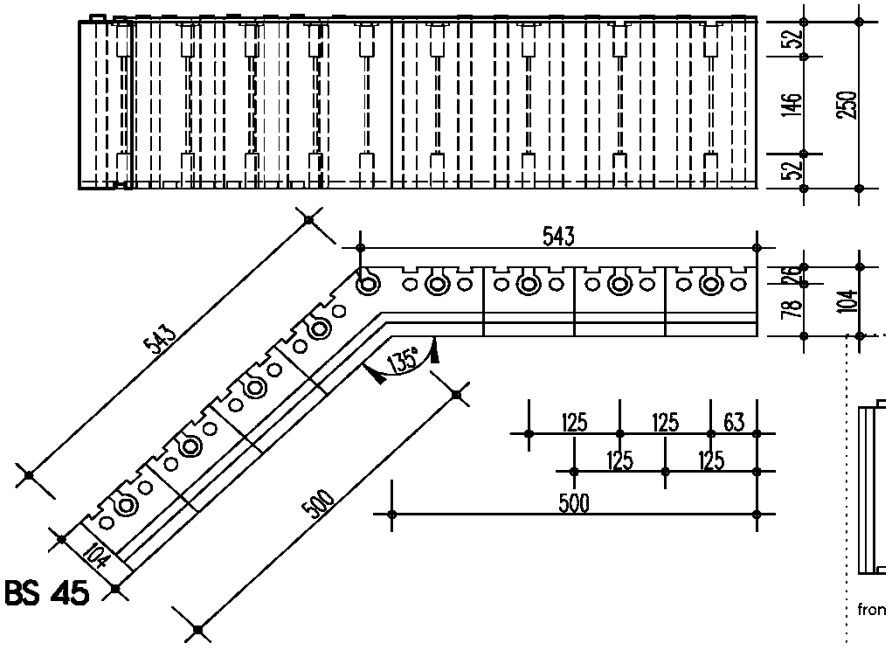
	a	b	c	d
BS 41	446	104	250	550
BS 42	196	104	250	300
BS 46	450	104	250	554

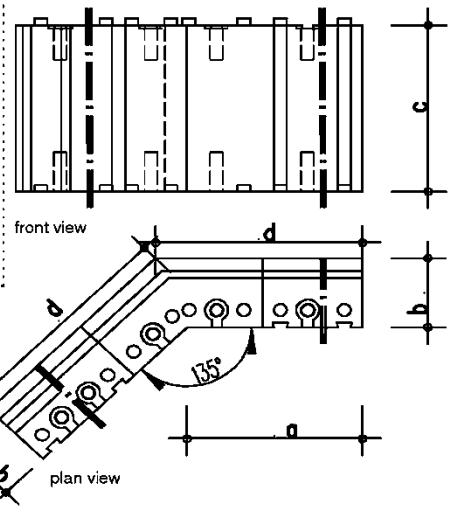
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex A9
BS-elements: BS 41 / BS 42 / BS 46	

Deutsches Institut für Bautechnik DIBt





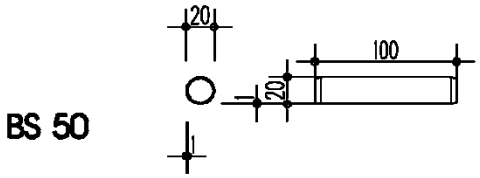


	a	b	c	d
BS 44	479	104	250	522
BS 45	500	104	250	543

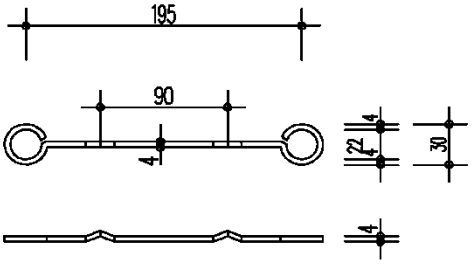
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex A10
BS-elements: BS 44 / BS 45	

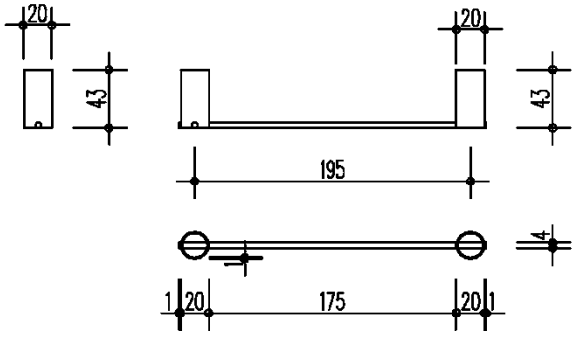
Deutsches Institut für Bautechnik DIBt



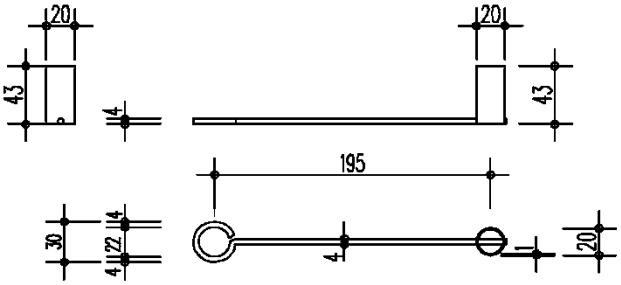
BS 50



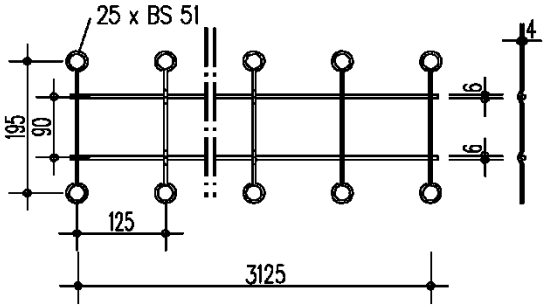
BS 51



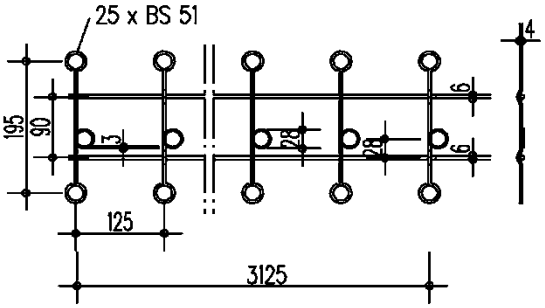
BS 58



BS 59



BS 57

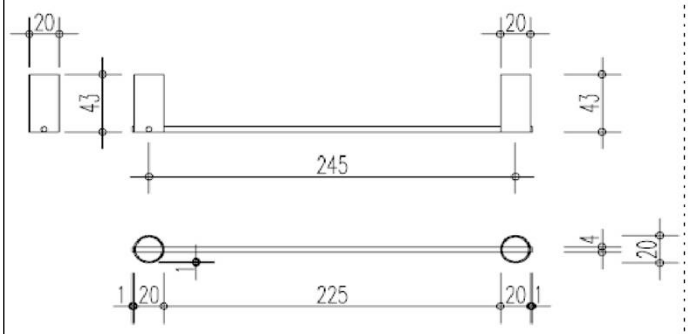


BS 57K

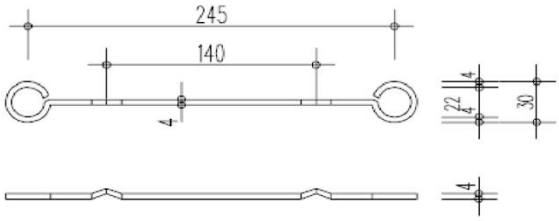
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex A11
BS-elements: BS 50 / BS 51 / BS 58 / BS 59 / BS 57 / BS 57K	

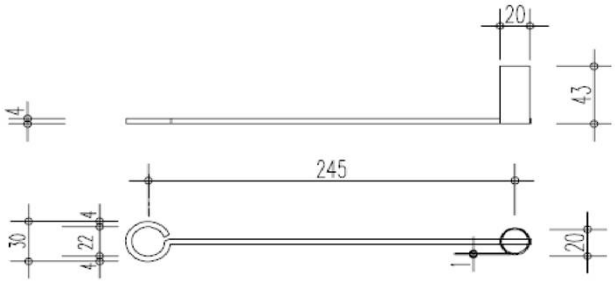
Deutsches Institut für Bautechnik DIBt



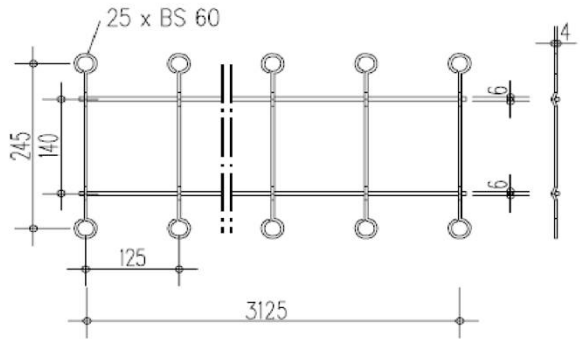
BS 65



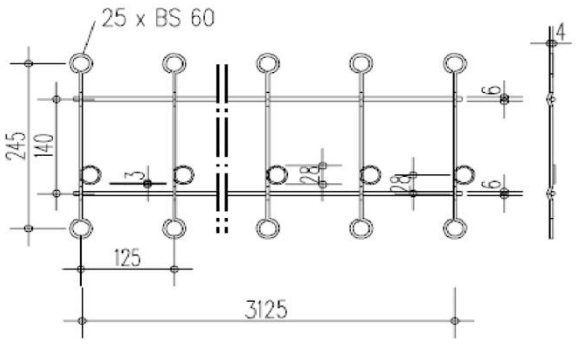
BS 60



BS 64



BS 66

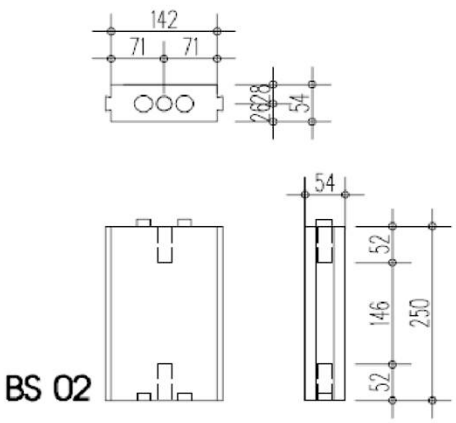


BS 66K

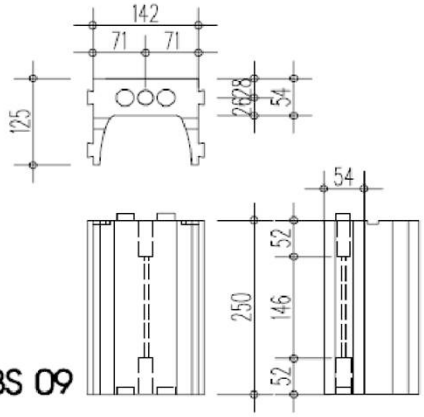
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex A12
BS-elements: BS 65 / BS 60 / BS 64 / BS 66 / BS 66K	

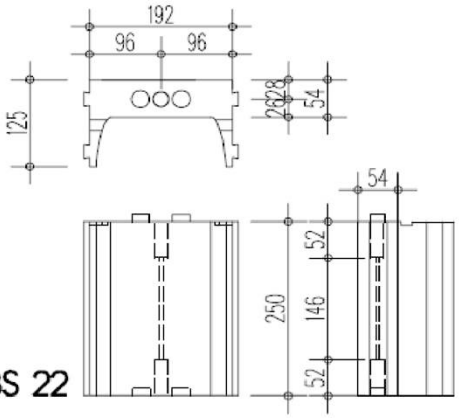
Deutsches Institut für Bautechnik DIBt



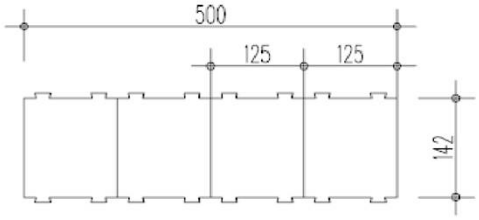
BS 02

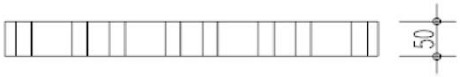


BS 09



BS 22





BS 10

Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex A13
BS-elements: BS 02 / BS 09 / BS 10 / BS 22	

Deutsches Institut für Bautechnik DIBt

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 "Verlorener Schalungsbausatz "DuoTherm""

Overview:
BS-elements

Annex A14

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[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 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 layer 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.

[1] see EAD340309-00-0305, clause 1.3.3

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.

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

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 λ_{EPS}, the values according to section 3.6 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 ρ = 2200 kg/m³. The corresponding thermal conductivity according to EN ISO 10456, Table 3 for this concrete is $\lambda_{concrete, table}$ = 1,65 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) under end use conditions (concrete core without reinforcement with a density of ρ = 2200 kg/m³ and a corresponding thermal conductivity according to EN ISO 10456, Table 3 of $\lambda_{concrete, table}$ = 1,65 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]	[(m²×K)/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

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 ρ = 2200 kg/m³ and a corresponding thermal conductivity according to EN ISO 10456, Table 3 of $\lambda_{concrete, table}$ = 1,65 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]	[(m²×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

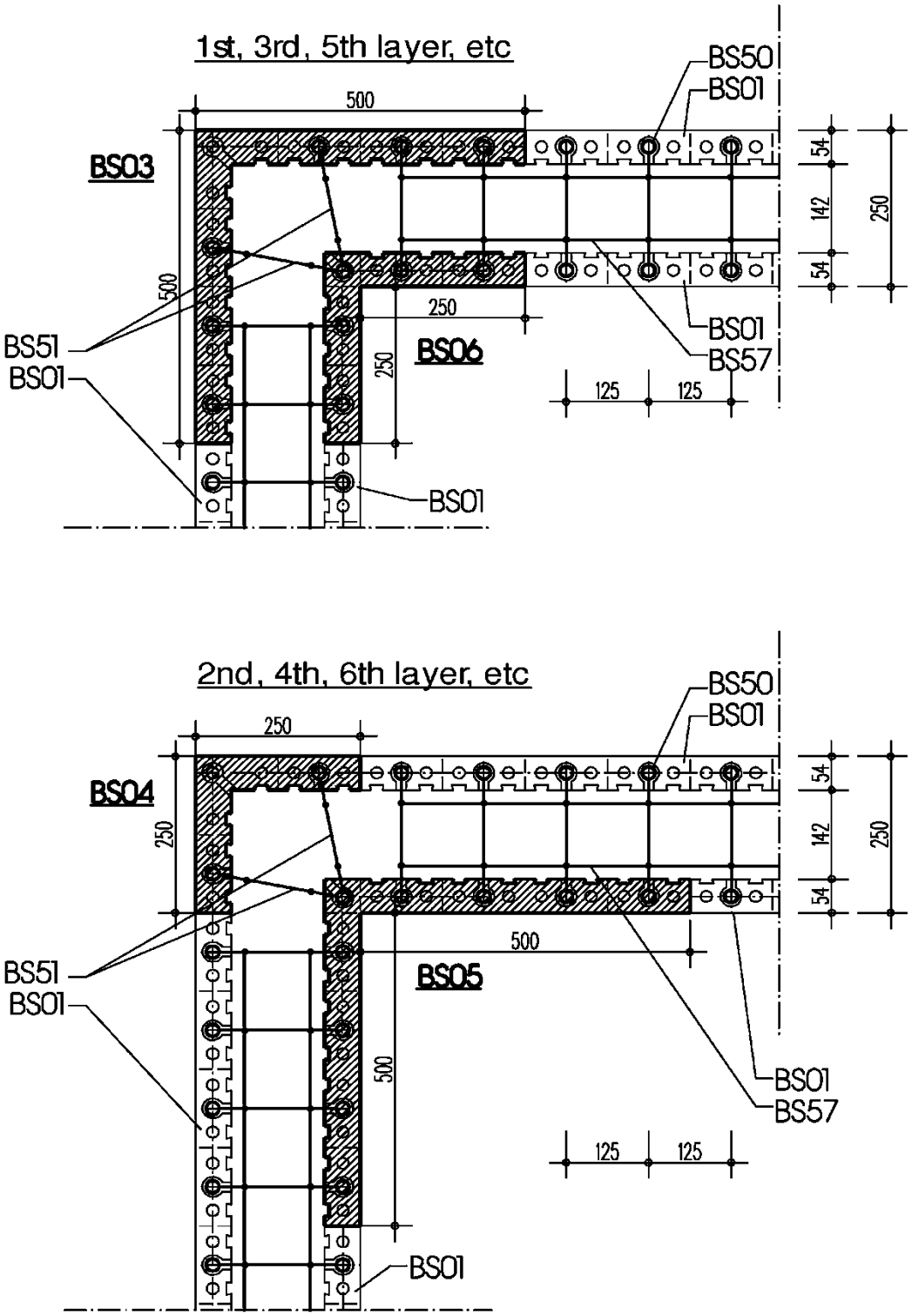
For other densities of the concrete core than $\rho_{concrete, tabel}$ = 2200 kg/m³, the modified nominal value of the thermal resistance can be determined as follows:

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

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:

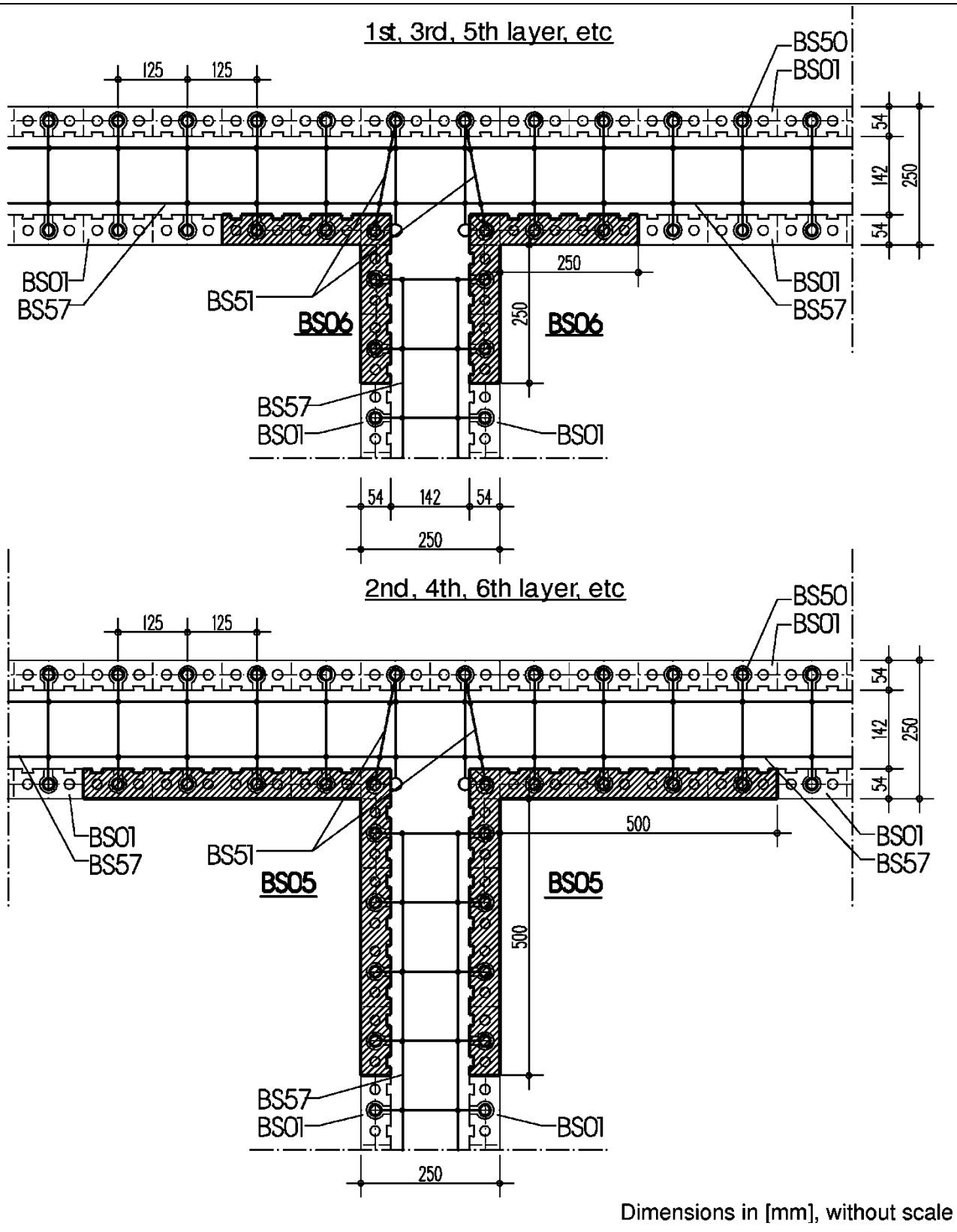
$$R_{D,element} = R_{D,element} + d_{plaster, inside} / \lambda_{plaster, inside} + d_{plaster, outside} / \lambda_{plaster, outside} + R_{si} + R_{se}$$

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.



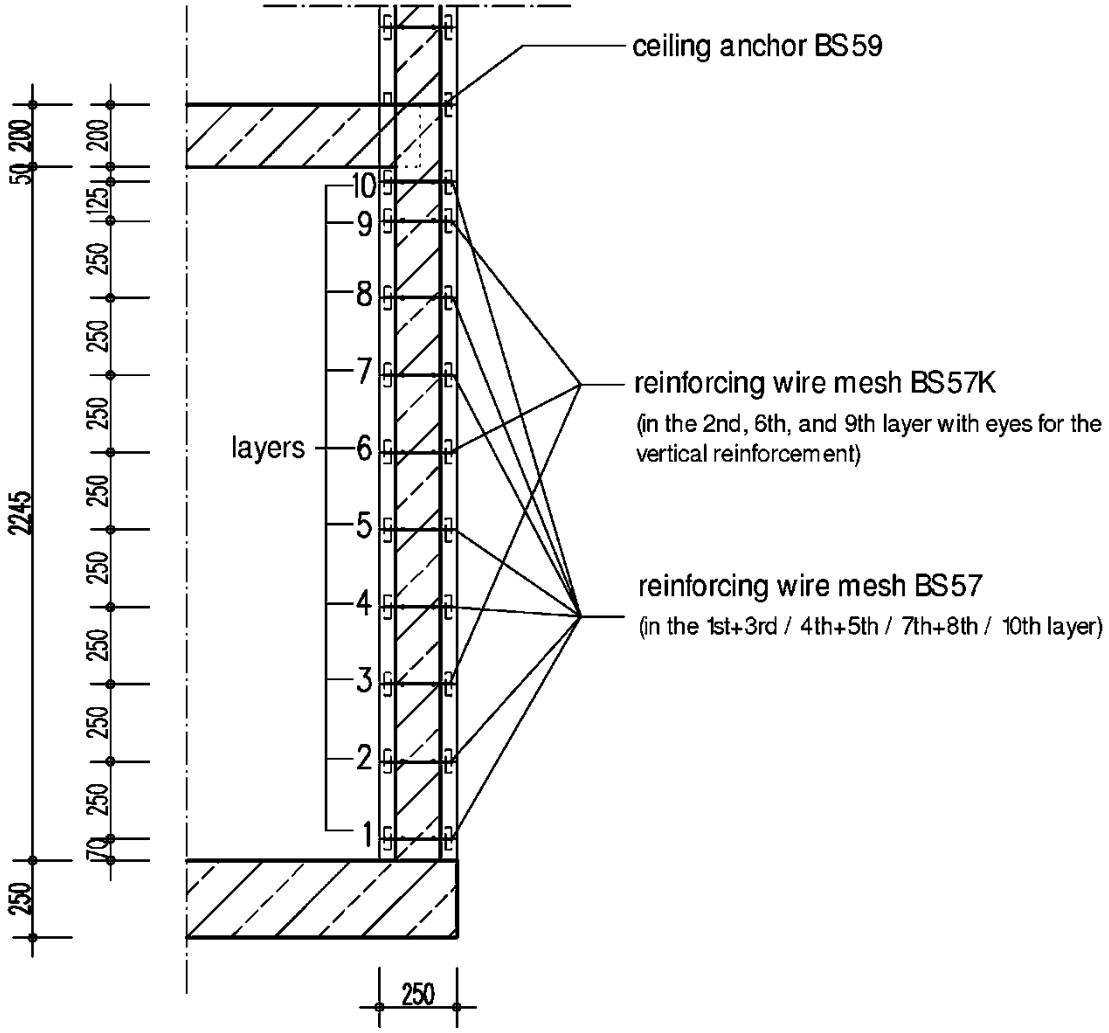
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B4
Outer corner of walls: T-wall with grid sectioning	



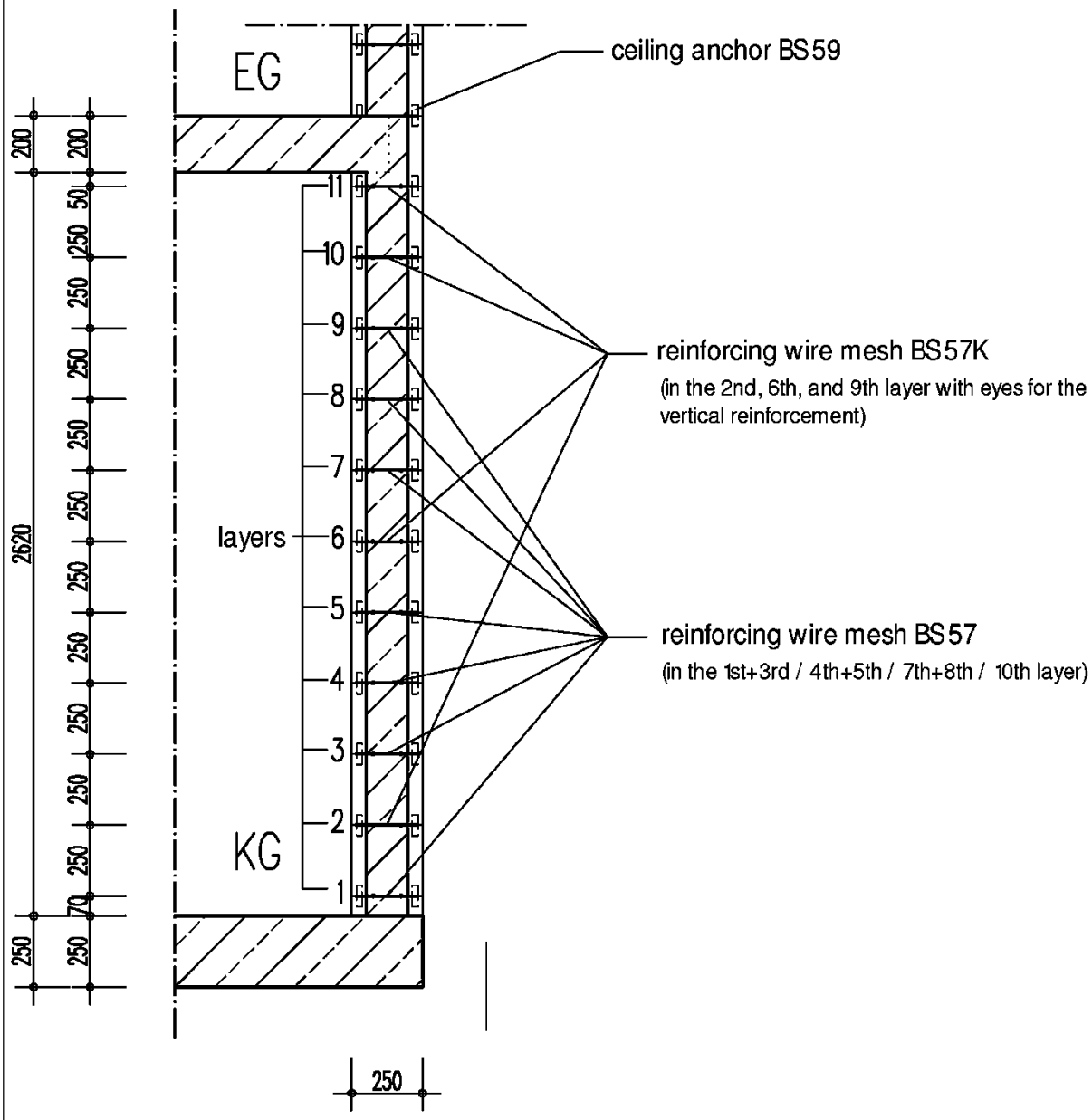
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B5
T-walls: T-wall with grid sectioning	



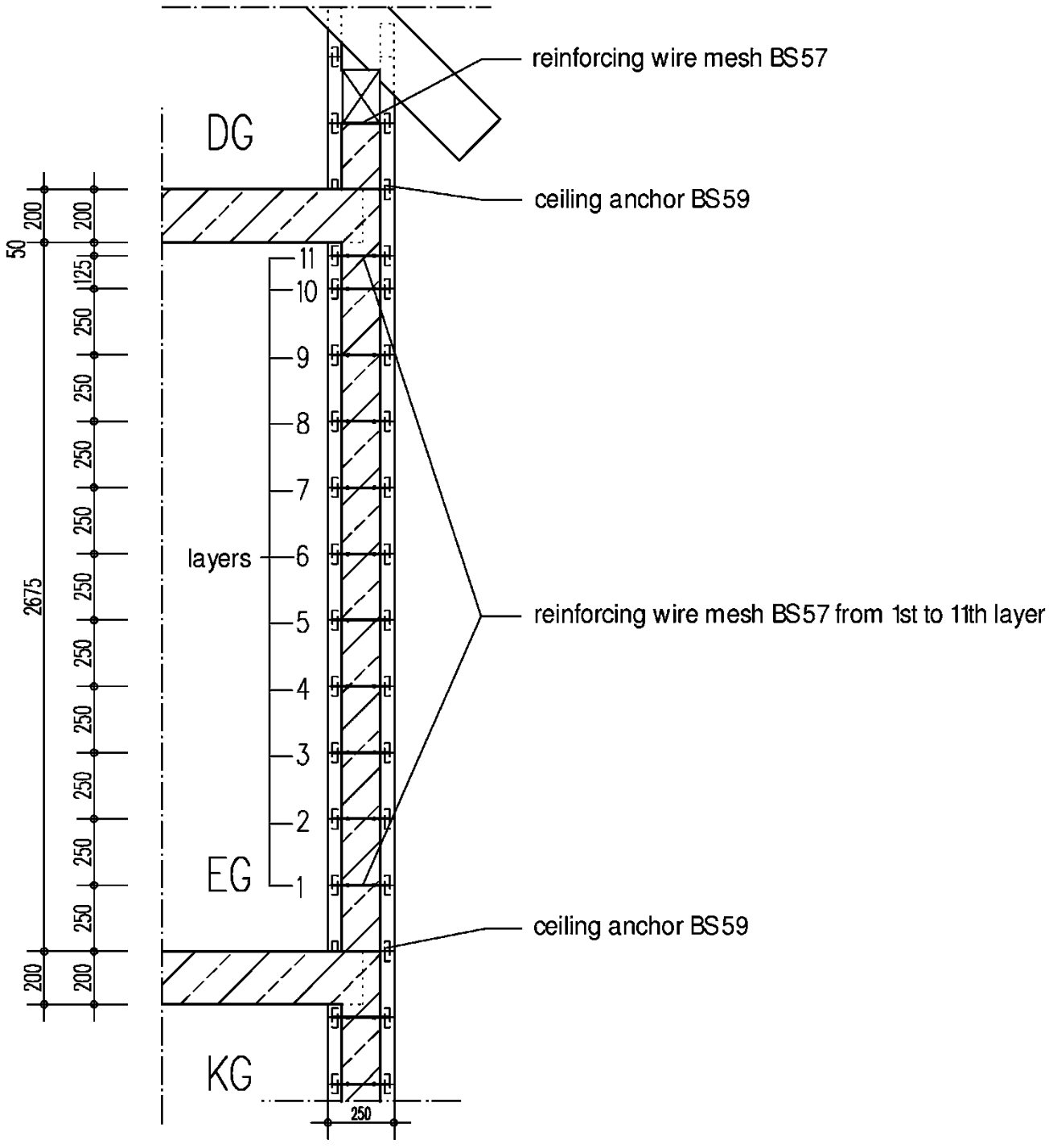
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B6
Typical junction: Cellar (basement) wall construction with arrangement of reinforcement	



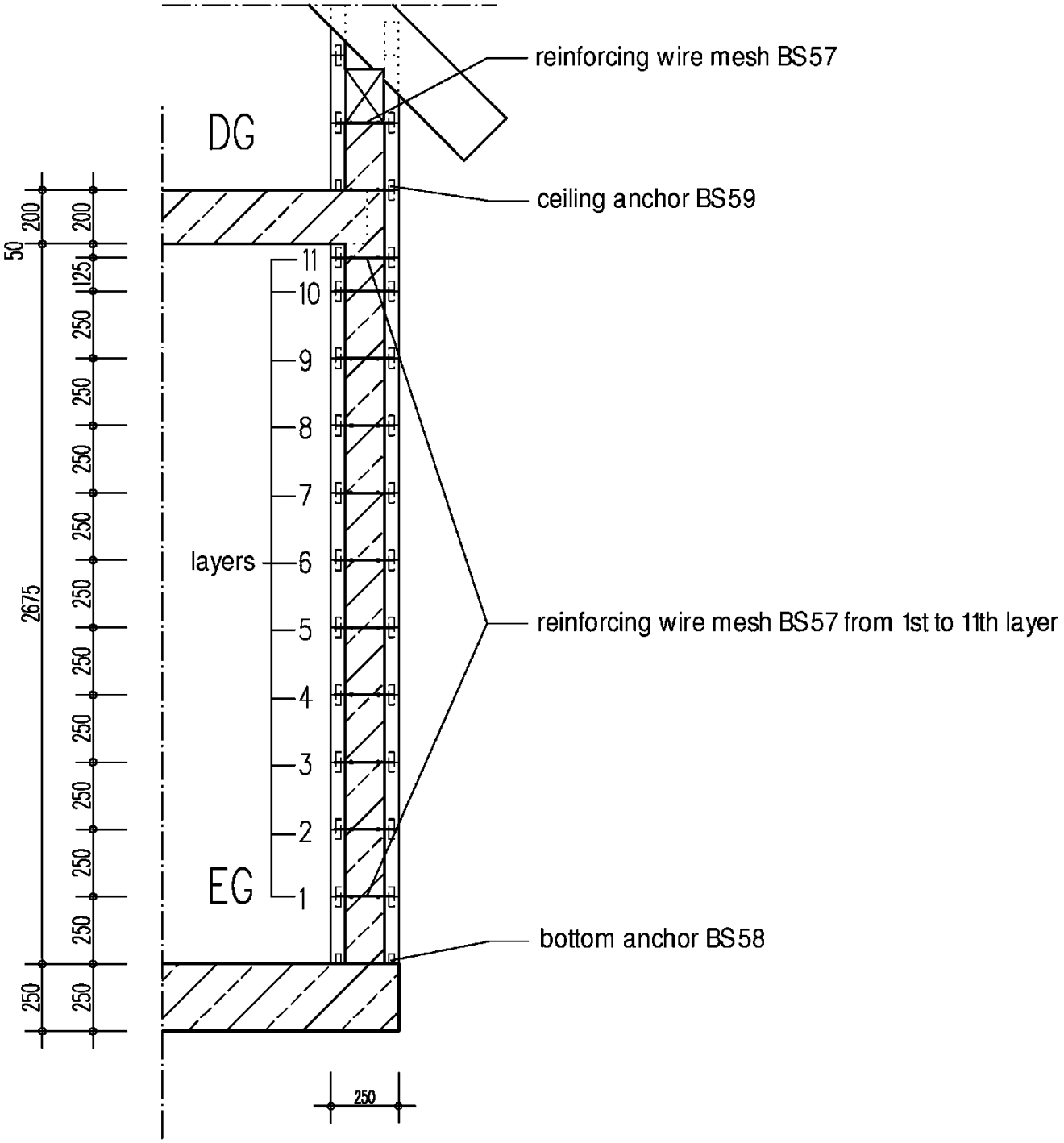
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B7
Typical junction: Cellar (basement) wall construction with arrangement of reinforcement	



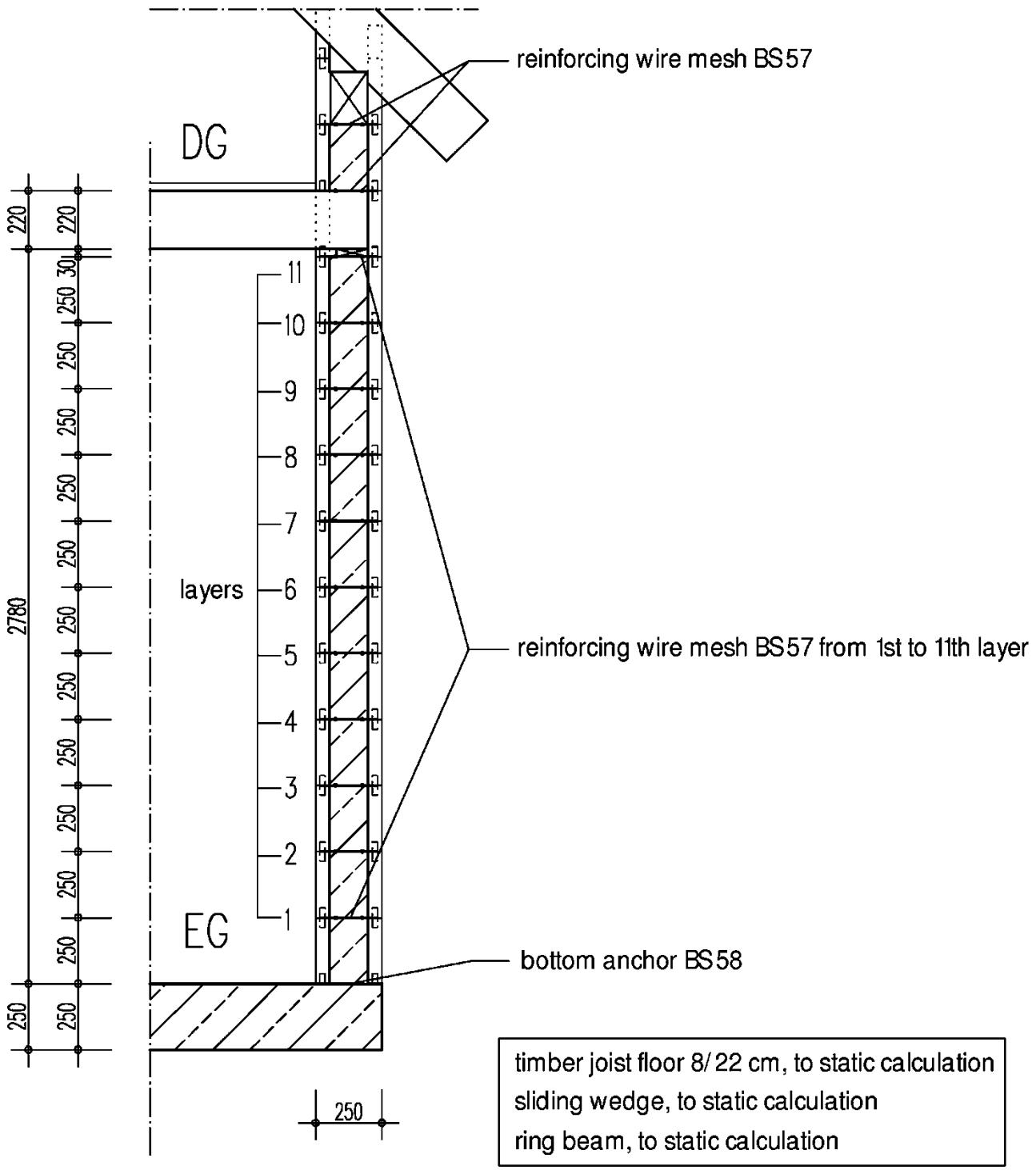
Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B8
Typical construction: Cellar (basement) / ground floor) / top floor with grid sectioning	

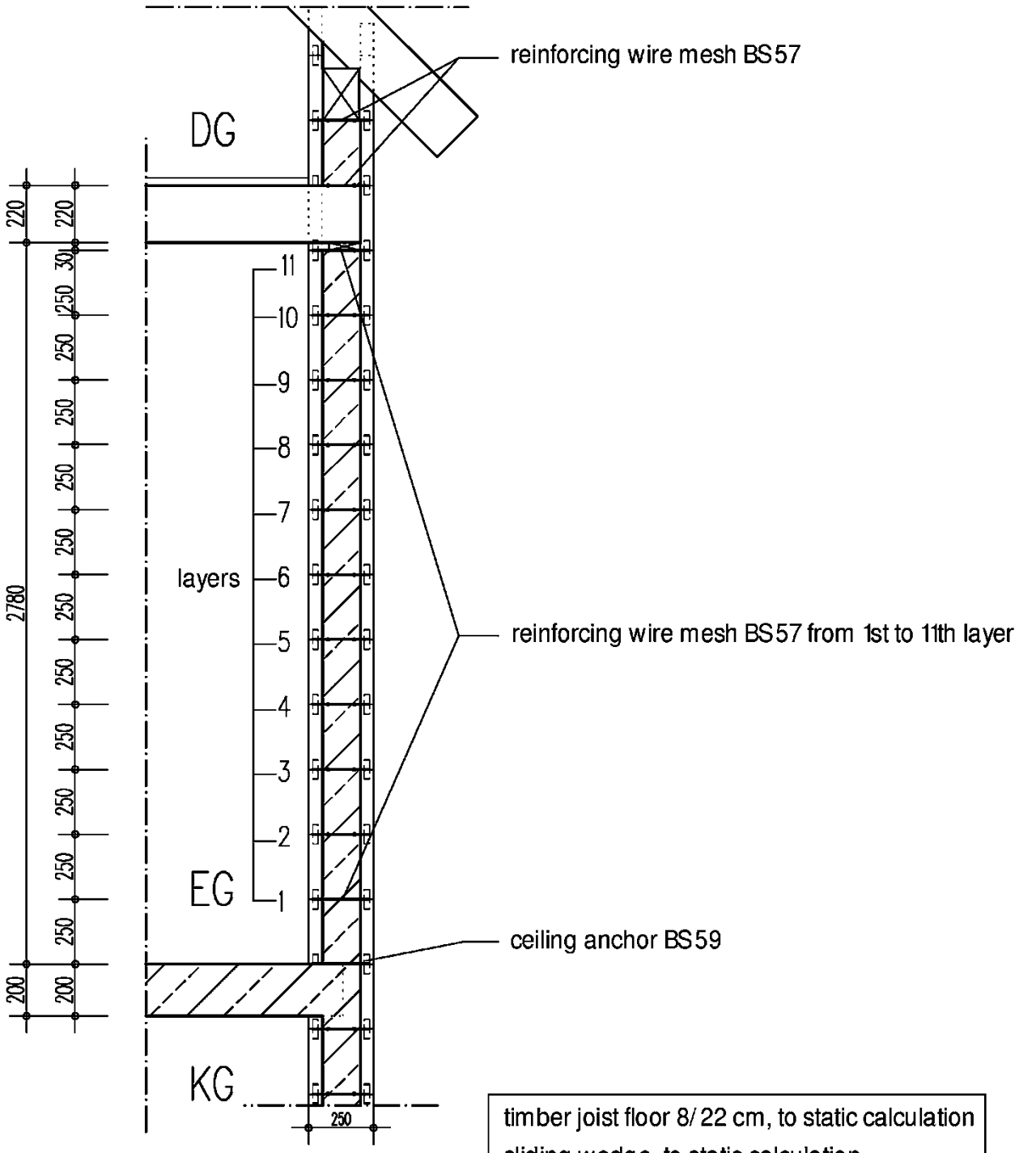


Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B9
Typical construction: Ground floor / top floor with grid sectioning	



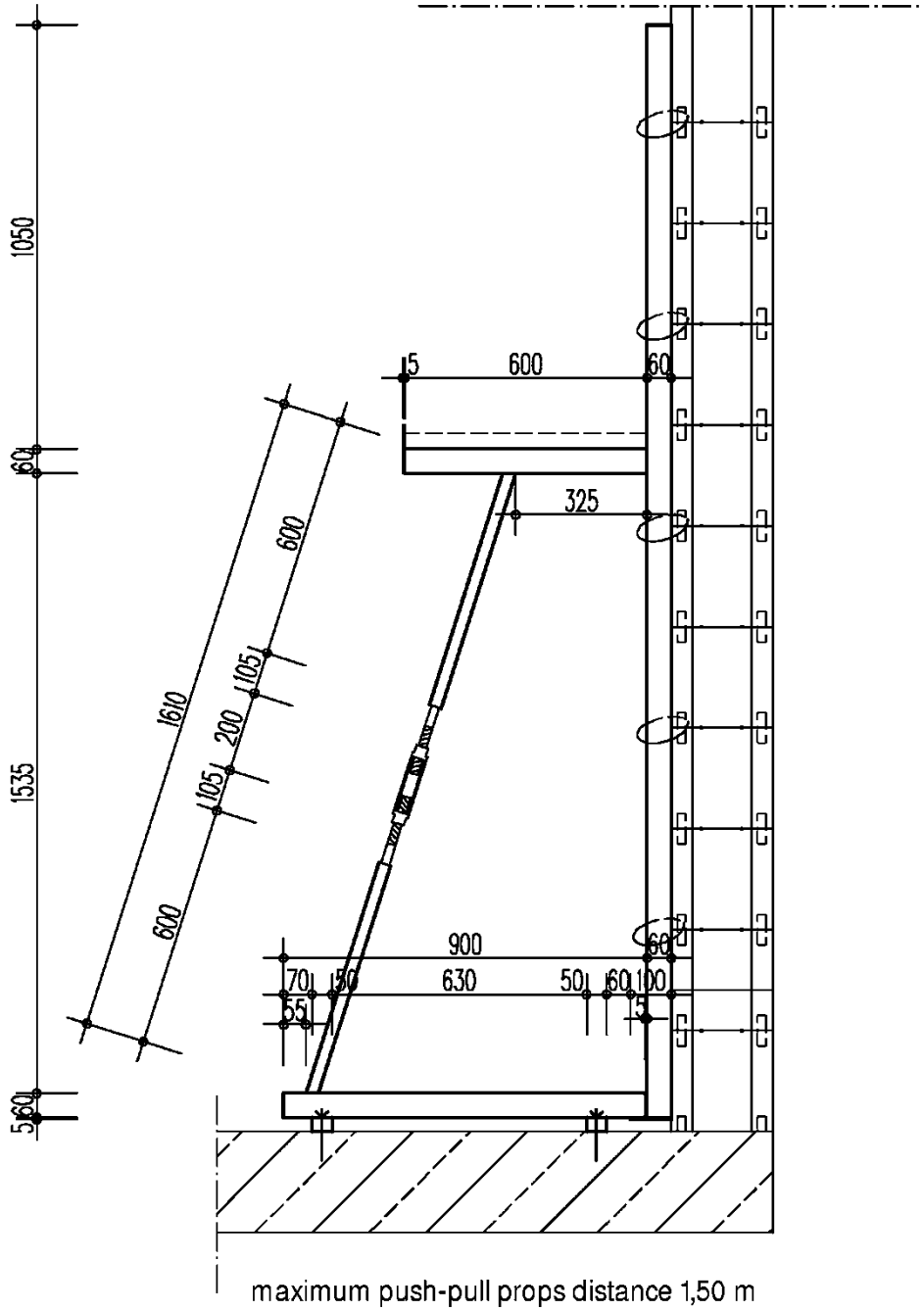
Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B10
Typical construction: Timber joist floor between ground floor and top floor with grid sectioning	



timber joist floor 8/ 22 cm, to static calculation
sliding wedge, to static calculation
ring beam, to static calculation

Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B11
Typical construction: Cellar and timber joist floor between ground floor and top floor with grid sectioning	



maximum push-pull props distance 1,50 m

Dimensions in [mm], without scale

Permanent shuttering kit "Verlorener Schalungsbausatz "DuoTherm""	Annex B12
Mounted push-pull props	

Type	according Annex	Thickness of the wall	Thickness of concrete core	Area of concrete core in plan view/ per meter wall length	Assumed weight of shuttering elements without rendering γ_{EPS} = 0,3 KN/m²	Assumed weight of the wall with concrete core without rendering $\gamma_{concrete}$ = 25 KN/m²	Area of horizontal frame A_R
		[mm]	[mm]	[m²/m]	[kg/m²]	[kg/m²]	[mm²]
25-es	A1	250	142	0,1445	3,24	358	./.
30-es		300	142	0,1445	4,74	360	./.
40-es		400	142	0,1445	7,74	363	./.
45-es		450	142	0,1445	9,24	364	./.
52-es		500	142	0,1445	10,74	366	./.
30/1-st		300	192	0,1945	3,24	483	./.
35/1-st		350	192	0,1945	4,74	485	./.
45/1-st		450	192	0,1945	7,74	488	./.
50/1-st		500	192	0,1945	9,24	489	./.
55/1-st		550	192	0,1945	10,74	491	./.

Permanent shuttering kit "Verlorener Schalungsbausatz "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).

Deutsches Institut für Bautechnik DIBt

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.

Deutsches Institut für Bautechnik DIBt

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].

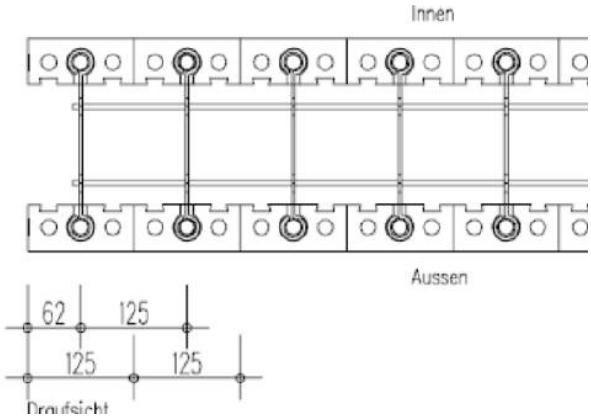


Figure 1: sketch, interlocking mechanism between concrete core and EPS leaf

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 "DuoTherm" 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

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).

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 395 R
- Material gray: BASF Neopor F2400.

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

- Material white: λ = 0.035 W / (m × K) with a maximum density of 29 kg / m³
- Material gray: λ = 0.032 W / (m × K) with a maximum density of 32 kg / m³.

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

Heat capacity

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

permanent shuttering kit "DuoTherm"	Annex C4
Description of Performance to BWR 6 Energy Economy and heat retention	

Description to: Aspects of durability

Resistance to detoriation

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"	Annex C5
Description to "Aspects of durability"	