



European Technical Approval ETA-07/0235

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

DuoTherm

Zulassungsinhaber
Holder of approval

DuoTherm Entwicklungs-Vertriebs mbH
Am Himmelfeld 2
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DEUTSCHLAND

Zulassungsgegenstand
und Verwendungszweck

*Generic type and use
of construction product*

Nicht lasttragendes verlorenes Schalungssystem "DuoTherm"
bestehend aus EPS-Schalungselementen

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

Geltungsdauer:
Validity:

vom
from

7 December 2007

bis
to

7 December 2012

verlängert
extended

vom
from

7 December 2012

bis
to

7 December 2017

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Diese Zulassung umfasst
This Approval contains

41 Seiten einschließlich 24 Anhänge
41 pages including 24 annexes

I LEGAL BASES AND GENERAL CONDITIONS

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

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

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product/ products 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, accessory parts and special shuttering elements (see e. g. Annex 1) 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),
- spacer 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".

1.1.1 Standard shuttering elements

The standard shuttering elements (see Annexes 1 to 4, 10 and 11) consist of inner and outer shuttering leaves of expanded polystyrene (EPS shuttering leaves) and spacers. These components are assembled on site.

The EPS shuttering leaves are one-layered and 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 thickness of the outer EPS shuttering leaf range 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 Annexes 1 to 4).

The spacers are made of galvanized steel. There are two different types of spacers:

- steel spacers (see Annex 10) with (e. g. element BS 58) or without metal tubes (e. g. element BS 51) and
- reinforcing wire mesh (see Annexes 10 and 11, e. g. elements BS 57 and BS 66).

Anchor tubes made of polypropylene (PP tubes, trade name: "NOVOLEN") are also part of the shuttering elements (see Annex 10, element BS 50). The task of the PP tubes is to connect the steel spacers without metal tubes with the inner and outer EPS shuttering leaves.

The following types of standard shuttering elements are available:

Table 1: Wall thicknesses of the EPS standard shuttering elements

Type	according Annex	Thickness of the wall	Thickness of concrete core	EPS shuttering leaves			Longitudinal centre distance of steel spacers
				Thickness		Height	
				inner	outer		
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25-es	1	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

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

The surfaces 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 clause 2.2.5.1).

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 to between any of the formed joints.

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

The formwork requires alignment and support during concrete placing (see Annex 21).

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 Table 1 and Annexes 1 to 4.

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 formwork is used in conjunction with concrete class C16/20 (according to EN 206-1) to built plain concrete walls or in conjunction with concrete of classes in the range from C20/25 to C50/60 (according to EN 206-1) to built reinforced concrete walls.

1.1.2 Accessory parts

Accessory parts are also part of the shuttering system. Accessory parts are designed in the same manner as the standard shuttering elements described above, see clause 1.1.1.

1.1.3 Special shuttering elements

Special shuttering elements are also part of the shuttering system. Special shuttering elements are designed in the same manner as the standard shuttering elements described above, see clause 1.1.1.

1.2 Intended use

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

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

According to EOTA TR 034 the following use categories apply:

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

The provisions made in this European technical approval are based on an assumed working life of the shuttering kit of at least 50 years provided that the conditions laid down in clauses 4.2, 5.1 and 5.2 for the packaging, transport, storage, installation, use, maintenance and repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

2 Characteristics of product and methods of verification

2.1 Characteristics of product

2.1.1 General

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

- standard shuttering elements,
 - accessory parts and
 - special shuttering elements,
- see clauses 2.1.2, 2.1.3 and 2.1.4.

2.1.2 Standard shuttering elements

The standard shuttering elements (composed of EPS shuttering leaves and steel spacers) correspond to the information and drawings given in Annexes 1 to 4, 10 and 11.

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

The density ρ of the expanded polystyrene is 29 kg/m³.

The minimal nominal value of thermal conductivity of the expanded polystyrene is 0,035 W/(m×K).

The minimum overall thickness is

- 4,15 mm for the steel spacers (see Annexes 10 and 11) respectively
- 1,0 mm for the PP tubes (see Annex 10, element BS 50).

The minimum tensile strength shall be at least

- 680 MPa for the steel spacers (see Annexes 10 and 11) respectively
- 520 MPa for the PP tubes (Annex 10, element BS 50).

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

- 570 N for the steel spacer without metal tubes in the space of the wall area (see Annexes 10 and 11, e. g. elements BS 51, BS 57, BS 59, BS 60, BS 64 and BS 66) in conjunction with PP tubes (see Annex 10, element BS 50) respectively
- 290 N for the steel spacer with metal tubes at wall base (see Annexes 10 and 11, e. g. elements BS 58 and BS 65).

The material characteristics, dimensions and tolerances of the shuttering elements not indicated in Annexes 1 to 12 are given in the technical documentation⁷ of the ETA.

2.1.3 Accessory parts

The accessory parts correspond to the information and drawings given in Annexes 2 and 12. The accessory parts are:

- adjustment leaves (see Annex 2, e. g. element BS 15),
- steel spacers to connect wall - bottom (see Annex 10, element BS 58),
- steel spacers to connect wall - ceiling (see Annex 10, element BS 59),
- front leaves for sealing the front part of shuttering elements (see Annex 12, element BS 02),
- completion leaves (see Annex 12, elements BS 09 and BS 22) and
- lintel leaves (see Annex 12, element BS 10).

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

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

2.1.4 Special shuttering elements

The special shuttering elements correspond to the information and drawings given in Annexes 5 to 9. The special shuttering elements are:

- inner and outer corner elements 90° (see Annexes 5, 7 and 8) and
- inner and outer corner elements 135° (see Annexes 6 and 9).

Special shuttering elements are designed in the same manner as the standard shuttering elements described above, see clause 1.1.1.

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

2.2 Methods of verification

2.2.1 General

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

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

2.2.2 Essential Requirement 1: Mechanical resistance and stability

2.2.2.1 Resulting structural pattern

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

2.2.2.2 Efficiency of filling

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

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

2.2.2.3 Possibility of steel reinforcement

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

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

2.2.3 Essential Requirement 2: Safety in case of fire

2.2.3.1 Reaction to fire

Shuttering elements "DuoTherm" made of expanded polystyrene (EPS) fulfil the requirement of Class E according to EN 13501-1⁸.

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

2.2.3.2 Resistance to fire

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

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

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

Thickness of concrete core [mm]	"REI"	"EI"
142	90	120
192	120	120

The preconditions for this classification are:

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

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

2.2.4 Essential Requirement 3: Hygiene, health and environment

2.2.4.1 Content and/or release of dangerous substances

The chemical composition of the shuttering system/kit must comply with the data deposited with DIBt.⁹

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

The content of HBCDD is < 1 % by weight.

⁹ In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e. g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

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

- no assessment and verification methods are given in this ETA,
- or
- the "No performance determined" option is declared,
- or
- the chosen verification and assessment method does not comply with the regulatory requirement of a particular Member State,

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

2.2.4.2 Water vapour permeability

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

Using this value to verify the annual moisture balance or the maximum amount of interstitial condensation according to EN ISO 13788 will be on the safe side.

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

2.2.4.3 Water absorption

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

2.2.4.4 Watertightness

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

2.2.5 Essential Requirement 4: Safety in use

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

Under end use conditions the EPS shuttering leaves are durable fixed by the steel spacers. The bond strength is at least equal to the resisting pressure of fresh concrete of the EPS shuttering leaves, see clause 2.2.5.2, furthermore the vertical element-high grooves on the inside face of each EPS shuttering leaf with a horizontal distance of minimum 35 mm and maximum 55 mm provide a mechanical interlock between EPS shuttering leaves and concrete core.

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 under normal used impact loads.

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

2.2.5.2 Resistance to pressure of fresh concrete

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

The minimum tensile strength shall be at least

- 680 MPa for the steel spacers (see Annexes 10 and 11) respectively
- 520 MPa for the PP tubes (Annex 10, element BS 50).

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

- 570 N for the steel spacer without metal tubes in the space of the wall area (see Annexes 10 and 11, e. g. elements BS 51, BS 57, BS 59, BS 60, BS 64 and BS 66) in conjunction with PP tubes (see Annex 10, element BS 50) respectively
- 290 N for the steel spacer with metal tubes at wall base (see Annexes 10 and 11, e. g. elements BS 58 and BS 65).

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

2.2.5.3 Safety against personal injury by contact

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

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

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

2.2.6 Essential Requirement 5: Protection against noise

2.2.6.1 Airborne sound insulation

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

2.2.6.2 Sound absorption

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

2.2.7 Essential Requirement 6: Energy economy and heat retention

2.2.7.1 Thermal resistance

The nominal value of thermal resistance R_D of the shuttering elements in end use conditions (see Table 3, with concrete core without rendering) is the sum of the nominal value of thermal resistance of the EPS shuttering leaves $R_{D, \text{EPS}}$ and the concrete core $R_{D, \text{concrete}}$. The nominal value of thermal resistance of the EPS shuttering leaves $R_{D, \text{EPS}}$ shall be calculated in accordance with EN ISO 6946 with a nominal value of thermal conductivity of the EPS shuttering leaves of $\lambda = 0,035 \text{ W/(m}\times\text{K)}$ according to EN 13163, clause 4.2.1 and the nominal value of thermal resistance of the concrete core $R_{D, \text{concrete}}$ shall be calculated in accordance with EN ISO 6946 with a nominal value of thermal conductivity of the concrete core of $\lambda = 1,65 \text{ W/(m}\times\text{K)}$ and considering the influence of the steel spacers by an reduction factor, see Table 3, according to the influence of the thickness of the shuttering elements.

Table 3: Nominal values of thermal resistance R_D (calculated with concrete core without rendering but with influence of steel spacers) depending on the thickness of the outer EPS shuttering leaves, the thickness of concrete core and the reduction factor

Type	Thickness of the wall	Thickness of concrete core	Thickness of EPS shuttering leaves		Nominal value of thermal resistance R_D according to EN ISO 6946	Reduction factor
			inner	outer		
	[mm]	[mm]	[mm]	[mm]	[(m ² ×K)/W]	
25-es Wall	250	142	54	54	2,70	0,930
30-es Wall	300	142	54	104	4,13	0,955
40-es Wall	400	142	54	204	6,99	0,970
50-es Wall	500	142	54	304	9,85	0,970
30/1-st Wall	300	192	54	54	2,73	0,930
35/1-st Wall	400	192	54	104	4,16	0,955
45/1-st Wall	450	192	54	204	7,02	0,970
55/1-st Wall	550	192	54	304	9,88	0,970

The planner shall consider the metal parts of the system (see Annexes 10 und 11) as thermal bridges, where relevant, for determination of the nominal value of thermal resistance R_D .

2.2.7.2 Heat capacity

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

2.2.8 Aspects of durability and serviceability

2.2.8.1 Resistance to deterioration

Physical agent

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

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

Chemical agent

The steel spacers are only necessary for the resistance to pressure of fresh concrete. When the concrete core has sufficiently hardened the bond between concrete core and EPS shuttering leaves is given by the vertical grooves on the inside face of each EPS shuttering leaf (see clause 2.2.5.1).

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

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

Biological agent

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

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

The shuttering system "DuoTherm" does not contain any biocides.

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

2.2.8.2 Resistance to normal use damage

Normal use impacts

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 under normal used impact loads.

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

Incorporation of ducts

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

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

Fixing of objects

Fixing of heavy objects (≥ 30 kg/anchor) in the EPS shuttering leaves is not possible. The part of fixings which is significant for the mechanical resistance shall be in the concrete core.

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

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 98/279/EC¹⁰ of 5 December 1997 amended by the Decision 2001/596/EC¹¹ of the European Commission system 2+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

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

(a) Tasks for the manufacturer:

- (1) initial type-testing of the product;
- (2) factory production control;
- (3) testing of samples taken at the factory in accordance with a prescribed test plan.

(b) Tasks for the approved body:

- (4) certification of factory production control on the basis of:
 - initial inspection of factory and of factory production control;
 - continuous surveillance, assessment and approval of factory production control.

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

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

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

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Initial type-testing of the product

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

3.2.1.2 Factory production control

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

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

The factory production control shall be in accordance with the control plan of 07 December 2007 which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.¹²

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

3.2.1.3 Other tasks of the manufacturer

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

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

3.2.2 Tasks for the approved body

The approved body shall perform the

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

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

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

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

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

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

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

3.3 CE marking

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

- the name and the address of the manufacturer (legal entity responsible for the manufacture)
- the last two digits of the year in which the CE marking was affixed
- the number of the EC certificate for the factory production control
- the number of the European technical approval ETA-07/0235
- the number of the guideline ETAG 009 of the European technical approval
- Reaction to fire: Class according to EN 13501-1 (see clause 2.2.3.1)
- Resistance to fire: Class according to EN 13501-2 in dependence of minimum thickness of the concrete core (see clause 2.2.3.2)
- Protection against noise (see clause 2.2.6)
- the designation code of the expanded polystyrene according to EN 13163 (see clause 2.1.2)
- the nominal value of thermal resistance R_D of the shuttering elements with concrete core and without rendering (see clause 2.2.7.1)

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

4.1 Manufacturing

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

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

4.2 Installation

4.2.1 General

The manufacturer shall ensure that the requirements in accordance with clauses 1, 2, and 4 are made known to those involved in planning and execution. The installation guide is deposited with Deutsches Institut für Bautechnik and shall be present at every construction site. If the manufacturer's instructions contain provisions which differ from those stated here, the specifications of the ETA shall apply.

After installation of the shuttering elements (see clause 4.2.2) site mixed or ready mixed concrete is placed and compacted (see clause 4.2.3).

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

¹³ see ETAG 009 clause 2.2

For structural design purposes the thickness of the wall and the weight per unit area without rendering is shown in Annex 23.

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

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

4.2.2 Installation of the shuttering elements

The shuttering elements are put together on site in layers without mortar or adhesive. To receive stable floor high formworks the vertical joints between two elements of one layer have to be shifted of at least a quarter of the element length, better a half of the element length, to the vertical joints of the previous and next layer (see Annexes 13 and 14).

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

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

Subsequently, according to the installation guide of the manufacturer, the shuttering elements are to be interlocked to floor height, levelled and fastened to the push pull props (see Annex 21).

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 13. T walls shall be formed according to Annex 14. Typical junctions and constructions between walls and ceilings are to be formed according to Annexes 15 to 20.

Further information is given in the installation guide.

4.2.3 Concreting

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

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

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

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

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

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

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

- Two adjacent starter bars shall not be situated in the same plane parallel to the surface of the wall.
- The distance between two starter bars in wall direction shall be at least 10 cm and not larger than 50 cm.

- The total section area of the starter bars shall not be less than 1/2000 of the section area of the concrete.
- Anchorage length of the starter bars on both sides of the cold joint shall be at least 20 cm.

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

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

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

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

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

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

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

4.2.4 Ducts crossing and situated inside the wall

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

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

Also vertical ducts in the concrete core shall be considered, if their diameter exceeds 1/6 of the thickness of the concrete core and the distance of the ducts is less than 2 m.

4.2.5 Reworking and finishes

Walls of the type "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 requirement of ETAG 004. The cladding respectively panelling or their substructures shall be anchored in the concrete core. The execution of the rendering shall be performed according to applicable national rules.

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

4.2.6 Fixing of objects

Fixing of heavy objects (≥ 30 kg/anchor) in the EPS shuttering leaves is not possible. The part of fixings which is relevant for the mechanical resistance shall be inside the concrete core. The influence of the fixing to the reduction of the nominal value of thermal resistance R_D shall be considered according to EN ISO 6946.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

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

5.2 Use, maintenance, repair

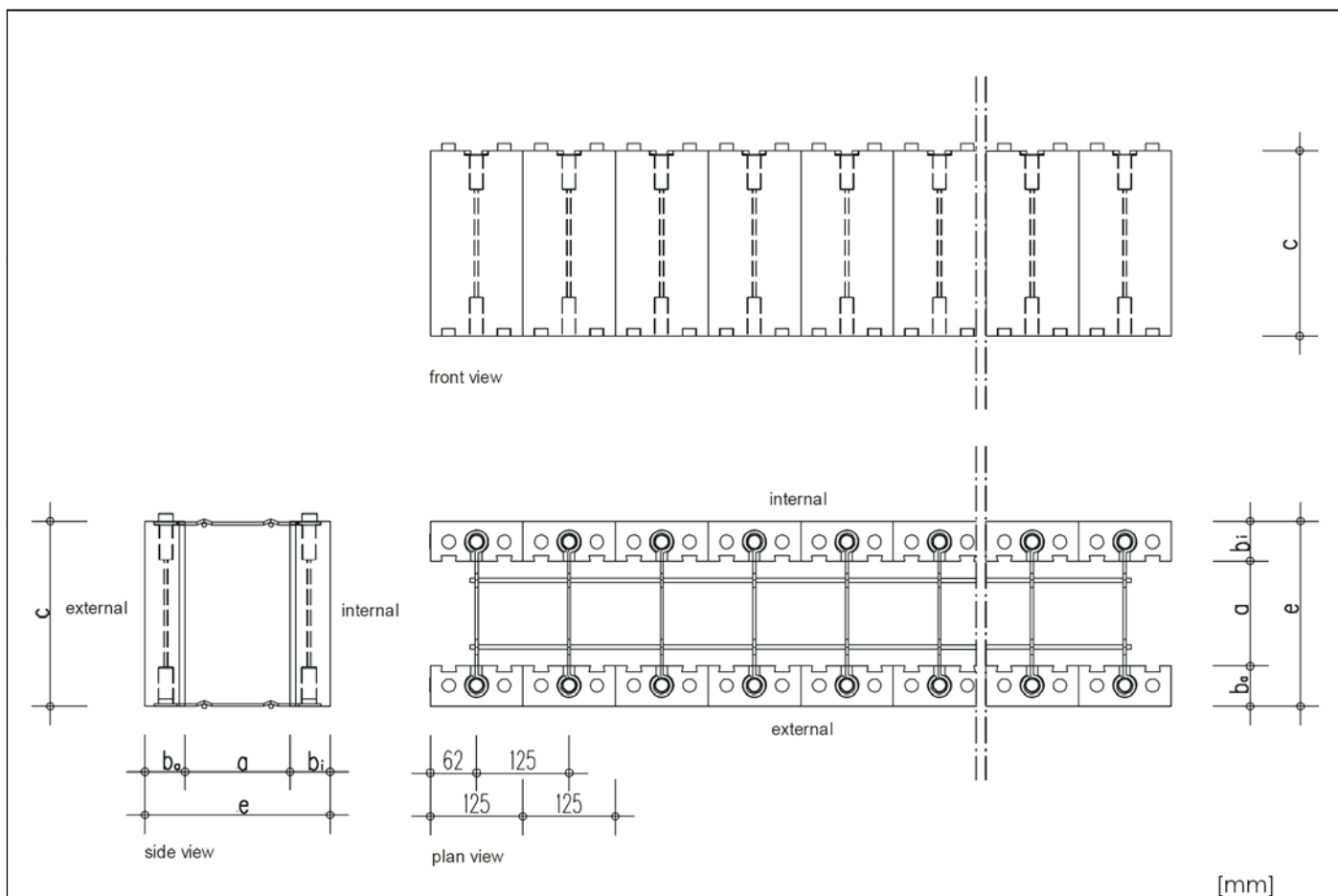
Regular checks should be carried out on renderings and finishes to ensure that any damage is detected and repaired as soon as possible.

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

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

Georg Feistel
Head of Department

beglaubigt:
Schwab



[mm]

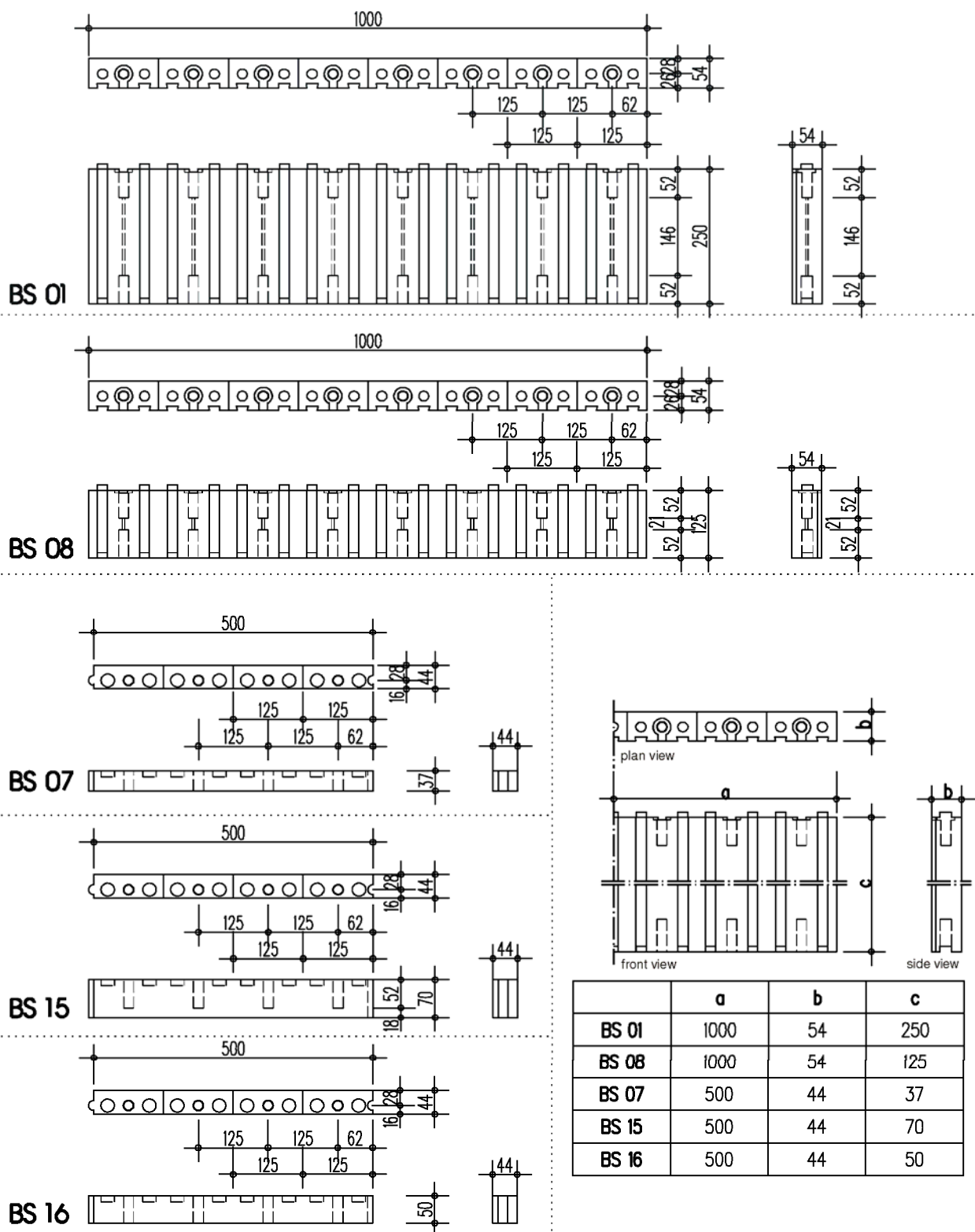
type	core thickness	EPS thickness external	EPS thickness internal	height of the element	wall thickness	BS-element external	BS-element anchor tube	BS-element reinforcing wire mesh	BS-element standard anchor	BS-element internal
	a	b_a	b_i	c	e					
	[mm]	[mm]	[mm]	[mm]	[mm]					
25-es wall	142	54	54	250	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

DuoTherm

Standard shuttering elements

Annex 1

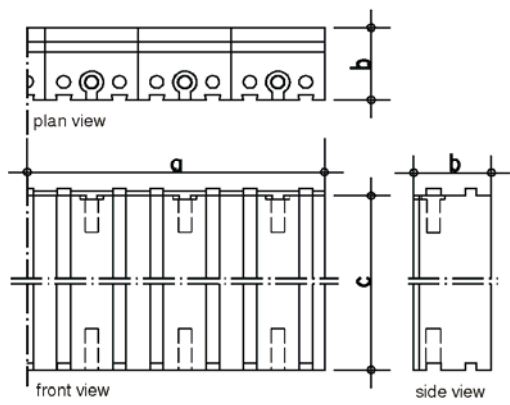
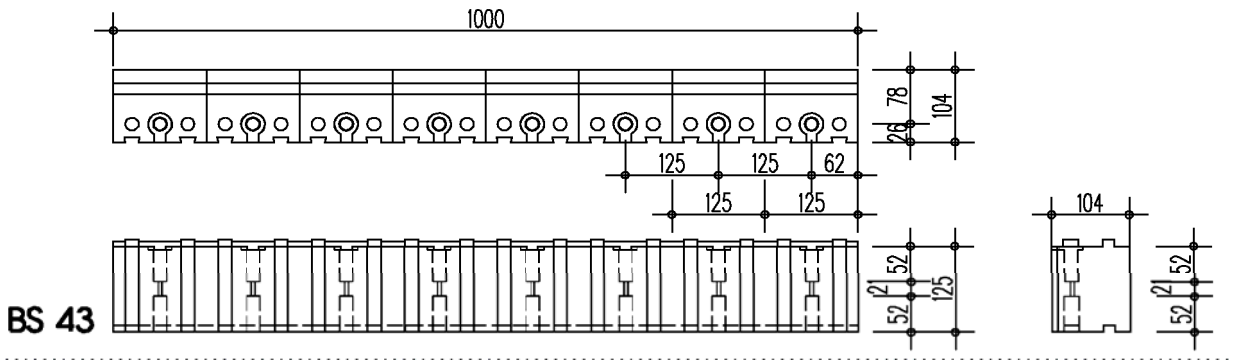
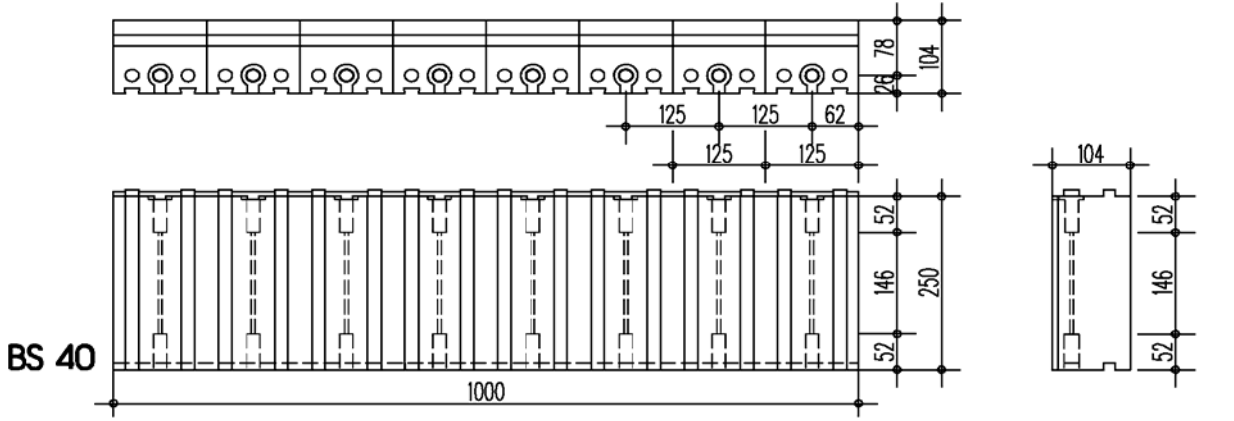
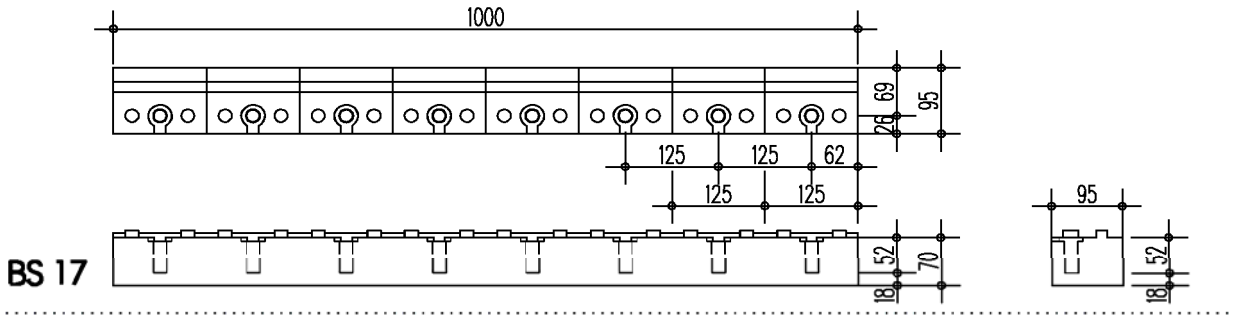


Dimensions in [mm], without scale

DuoTherm

BS-elements: BS 01 / BS 08 / BS 07 / BS 15 / BS 16

Annex 2

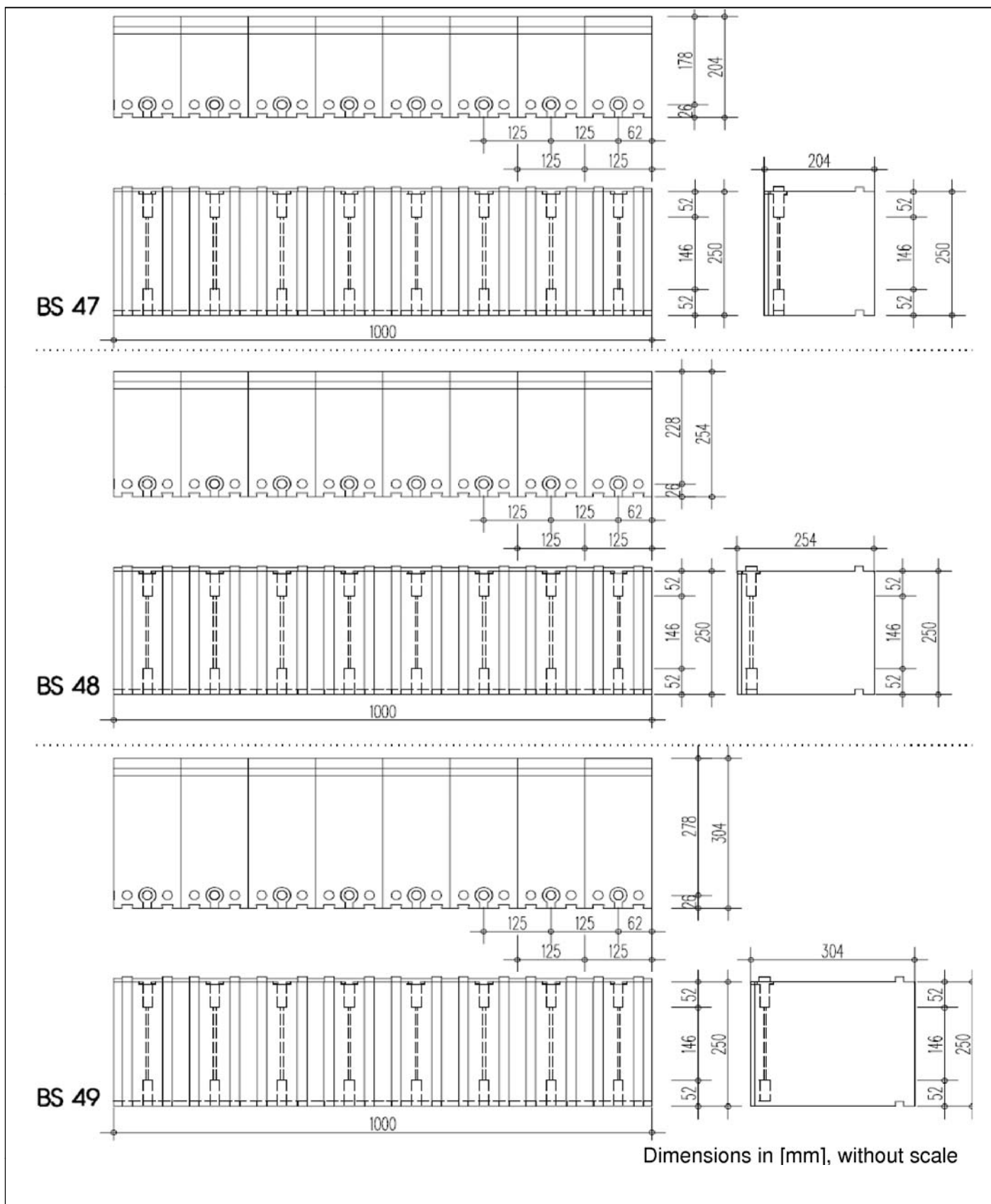


	a	b	c
BS 17	1000	95	70
BS 40	1000	104	250
BS 43	1000	104	125
BS 47	1000	204	250
BS 48	1000	254	250
BS 49	1000	304	250

Dimensions in [mm], without scale

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DuoTherm	Annex 3
BS-elements: BS 17 / BS 40 / BS 43	

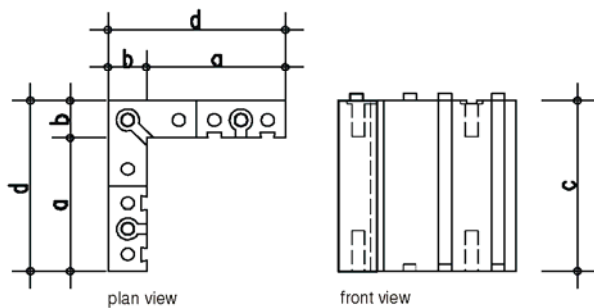
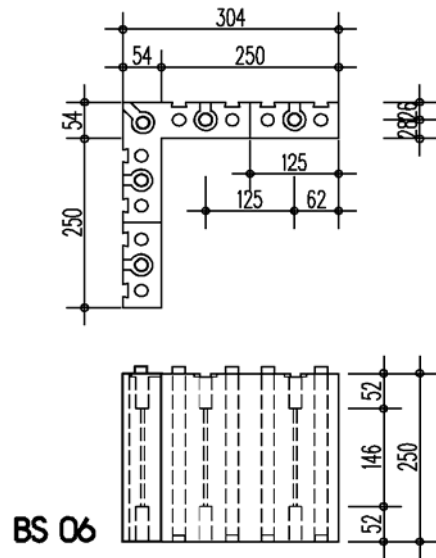
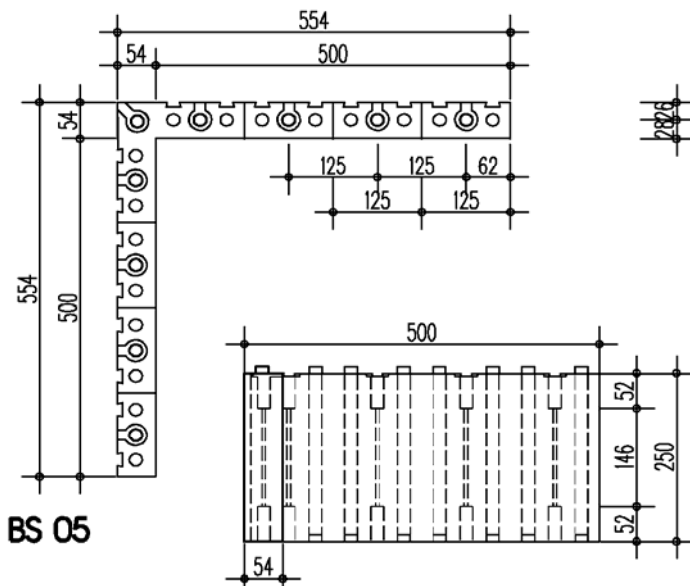
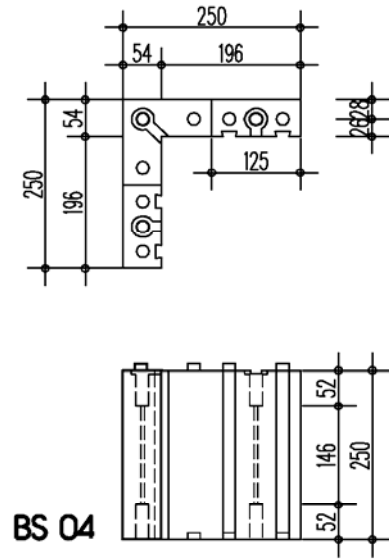
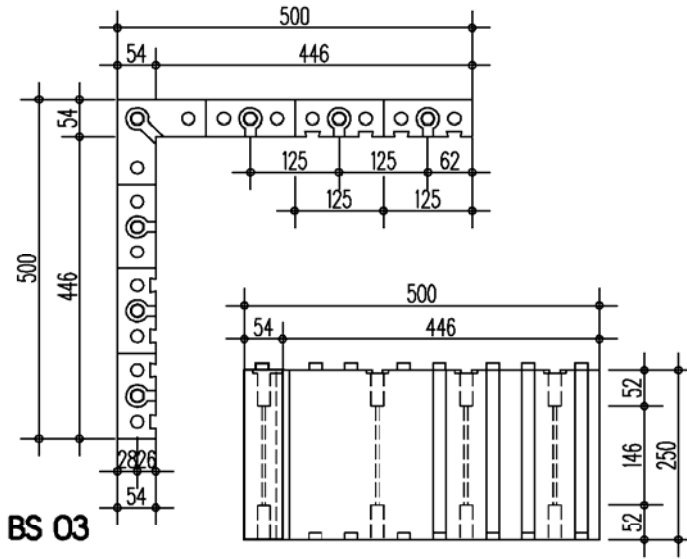


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DuoTherm

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

Annex 4



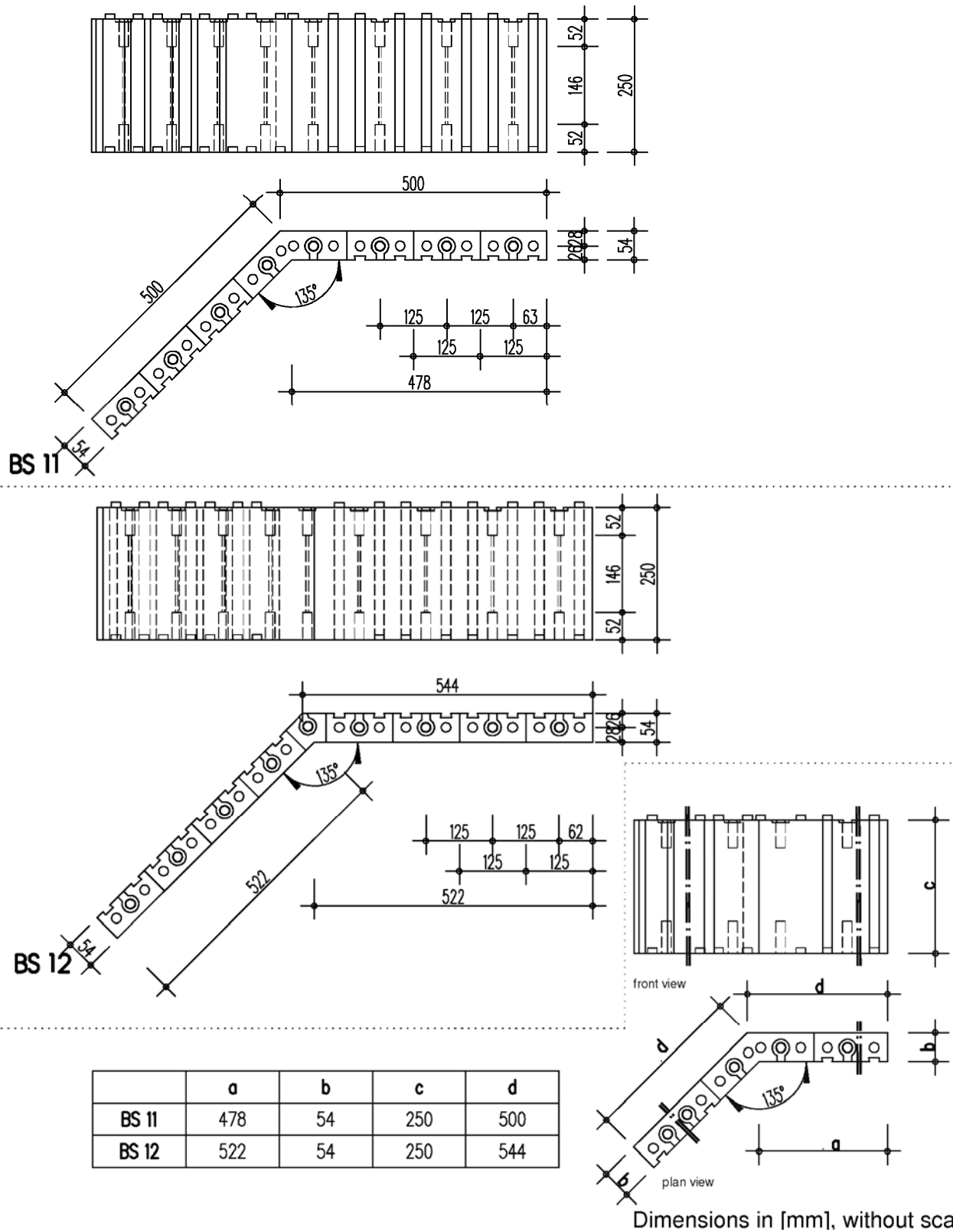
	a	b	c	d
BS 03	(446)	54	250	500
BS 04	(196)	54	250	250
BS 05	500	54	250	(554)
BS 06	250	54	250	(304)

Dimensions in [mm], without scale

DuoTherm

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

Annex 5

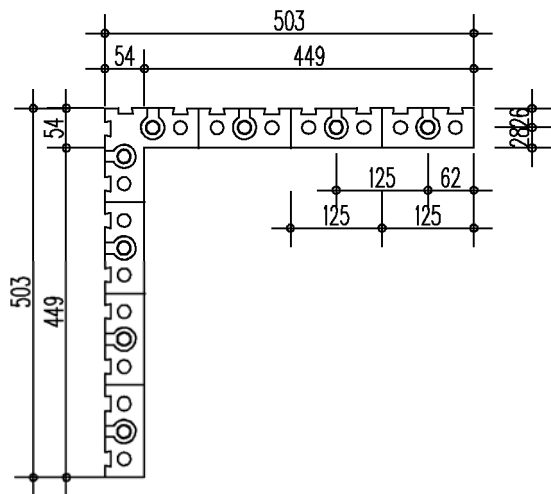


electronic copy of the eta by dibt: eta-07/0235

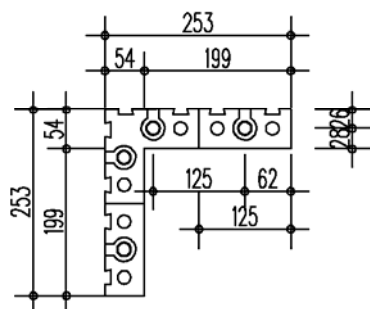
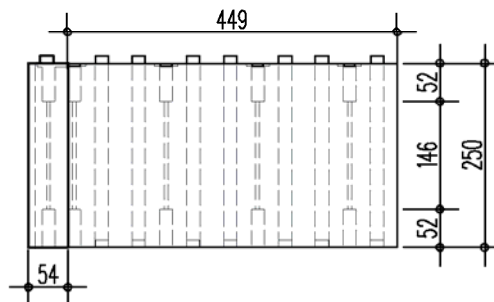
DuoTherm

BS-elements: BS 11 / BS 12

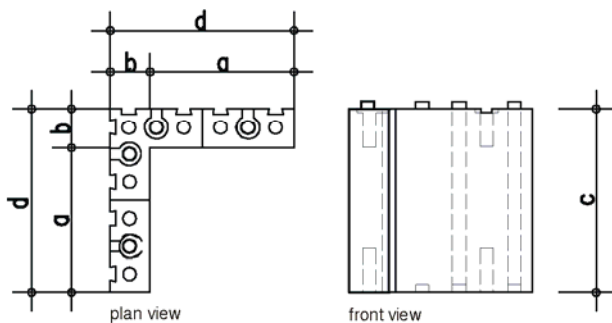
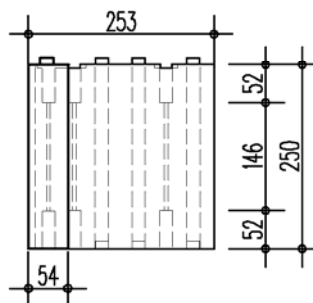
Annex 6



BS 25



BS 26



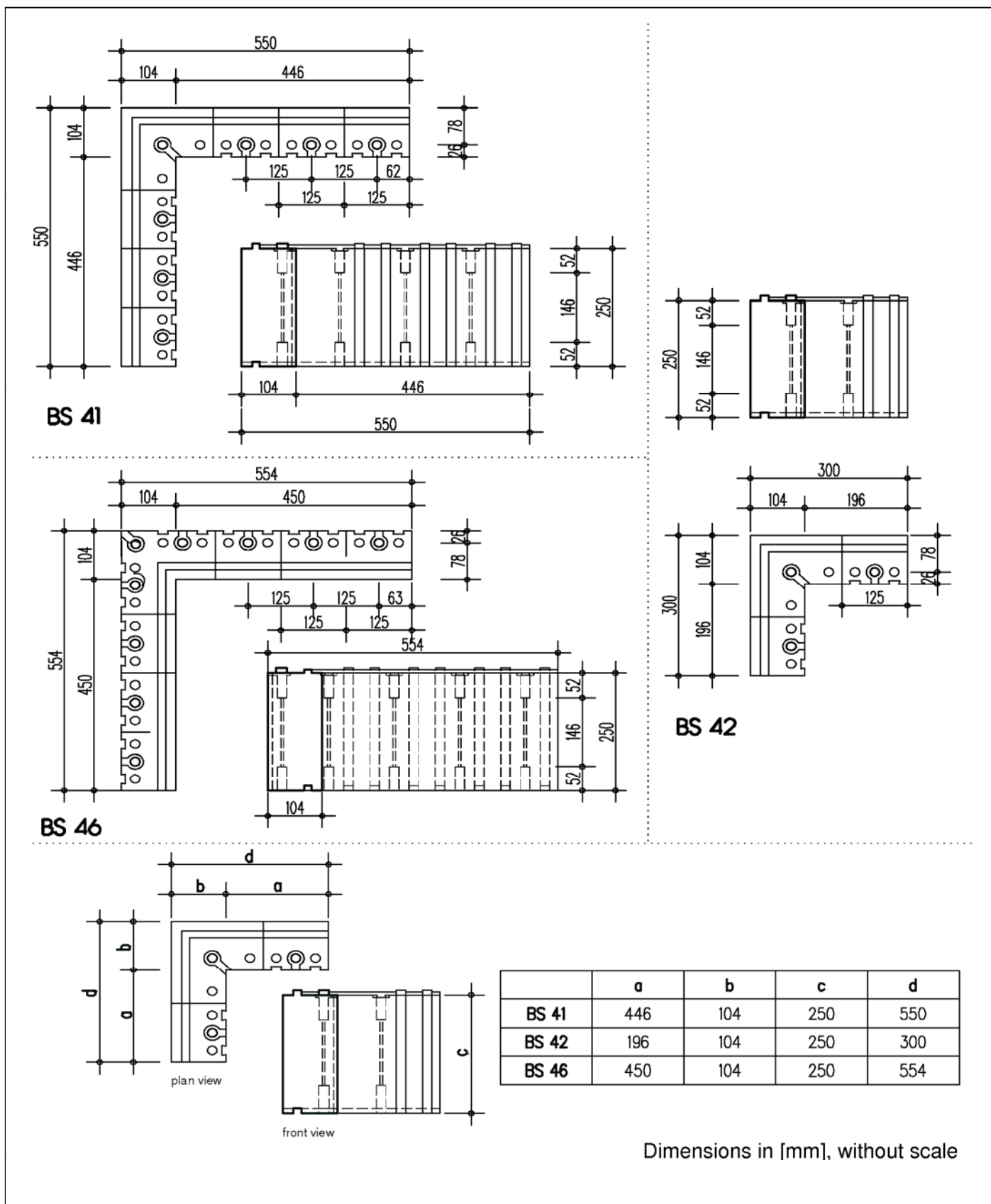
	a	b	c	d
BS 25	449	54	250	503
BS 26	199	54	250	253

Dimensions in [mm], without scale

DuoTherm

BS-elements: BS 25 / BS 26

Annex 7

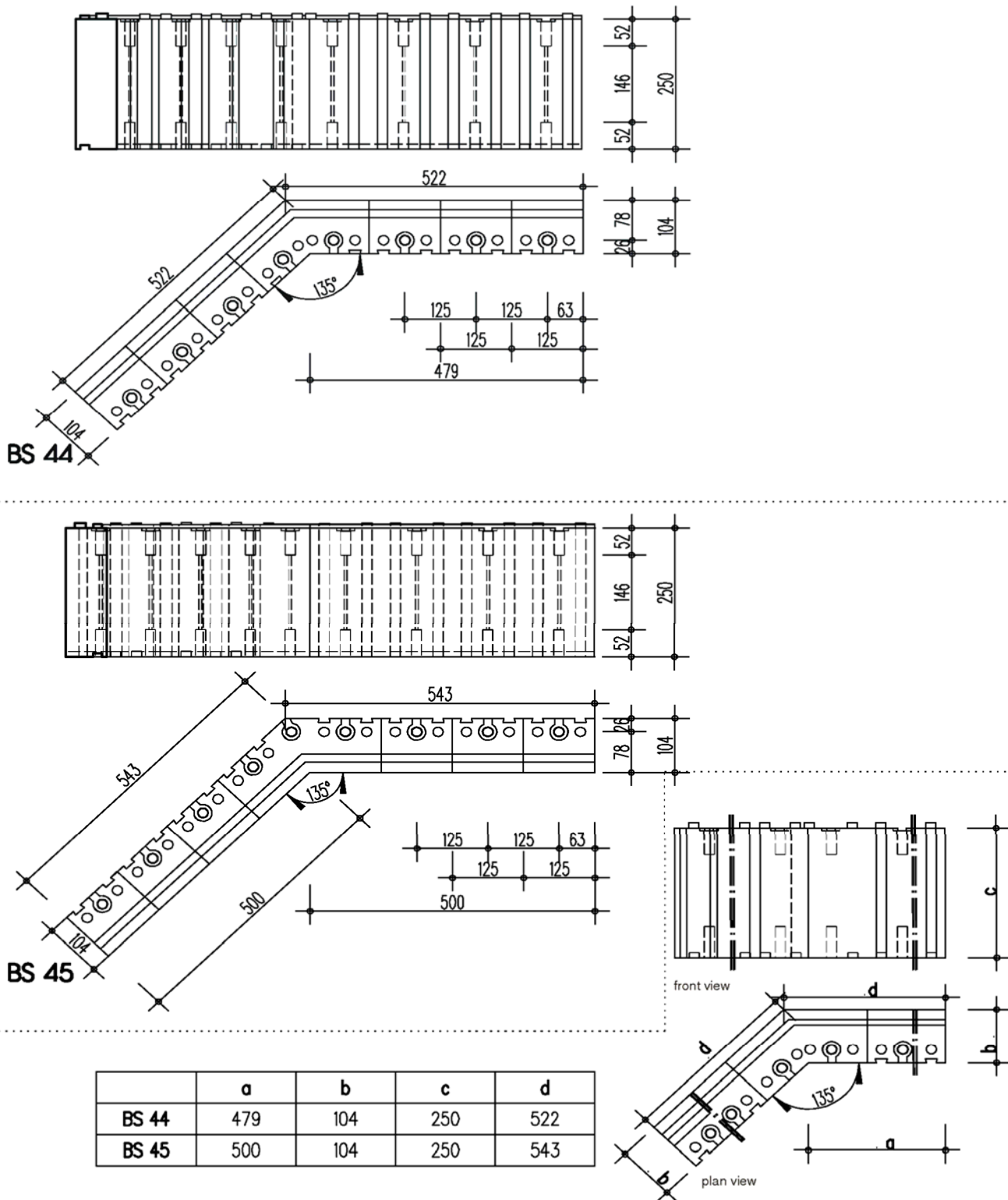


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DuoTherm

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

Annex 8



Dimensions in [mm], without scale

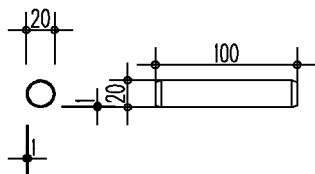
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DuoTherm

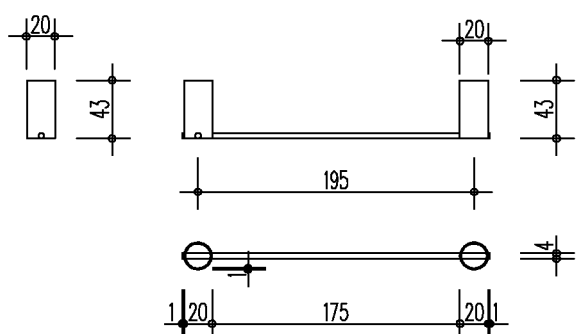
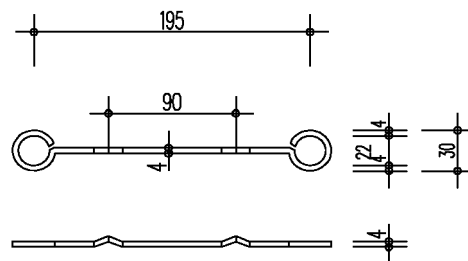
BS-elements: BS 44 / BS 45

Annex 9

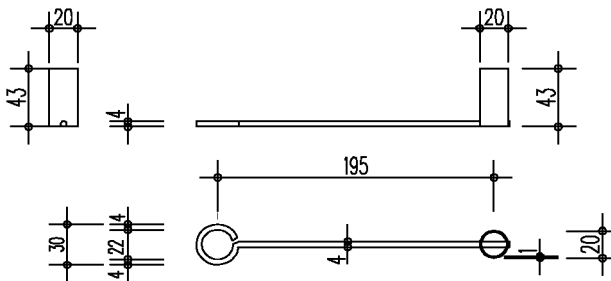
BS 50



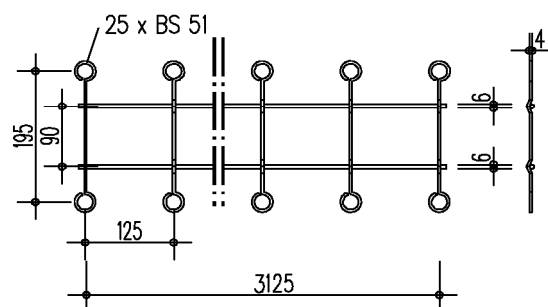
BS 51



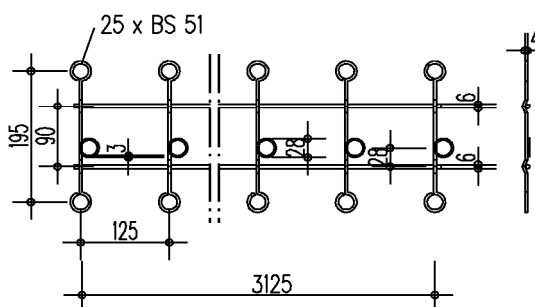
BS 58



BS 59



BS 57



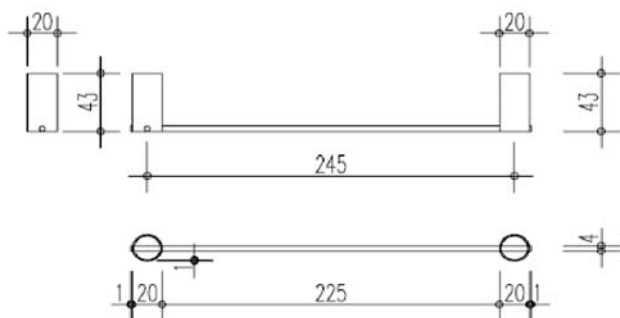
BS 57K

Dimensions in [mm], without scale

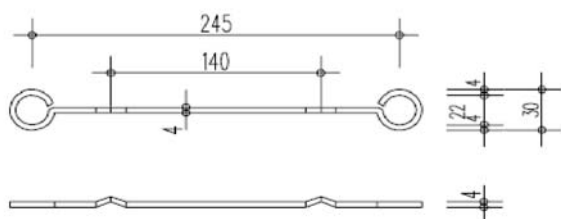
DuoTherm

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

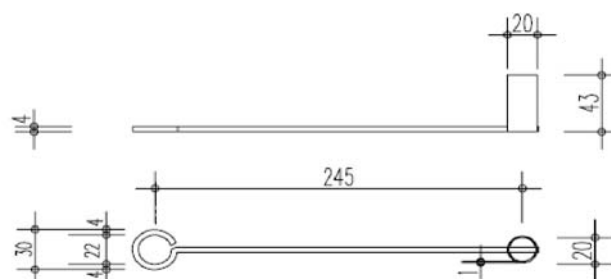
Annex 10



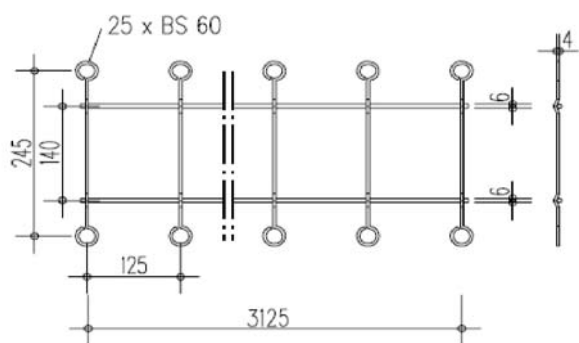
BS 65



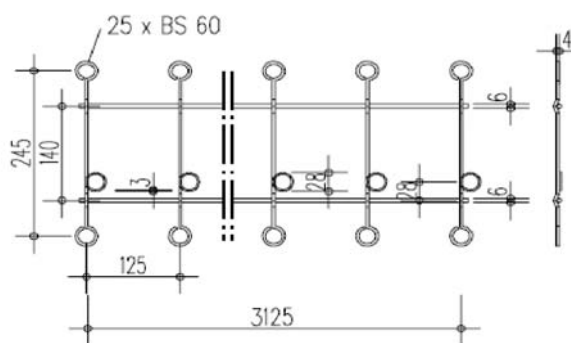
BS 60



BS 64



BS 66



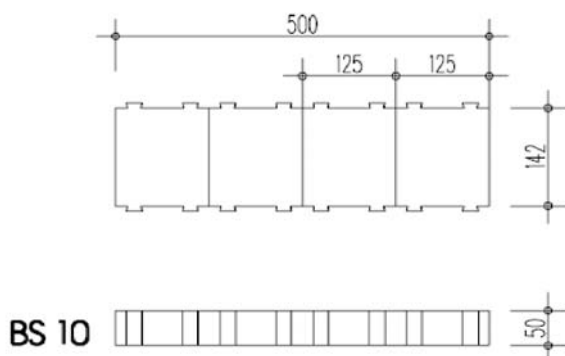
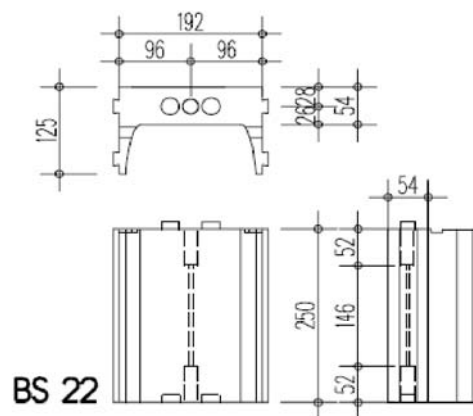
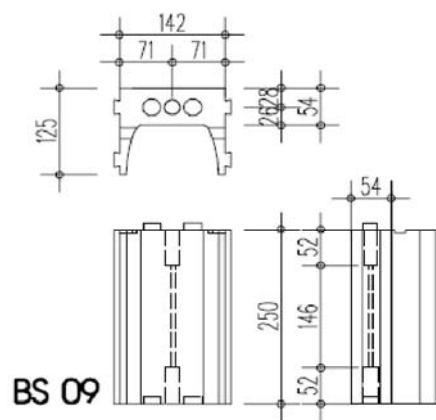
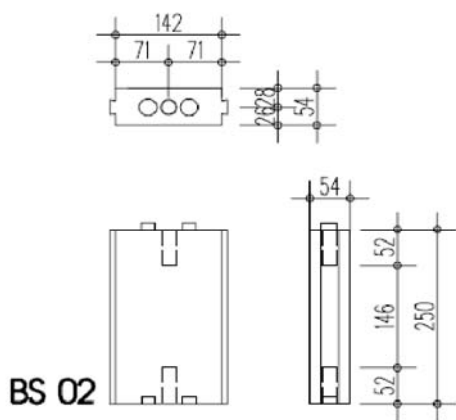
BS 66K

Dimensions in [mm], without scale

DuoTherm

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

Annex 11

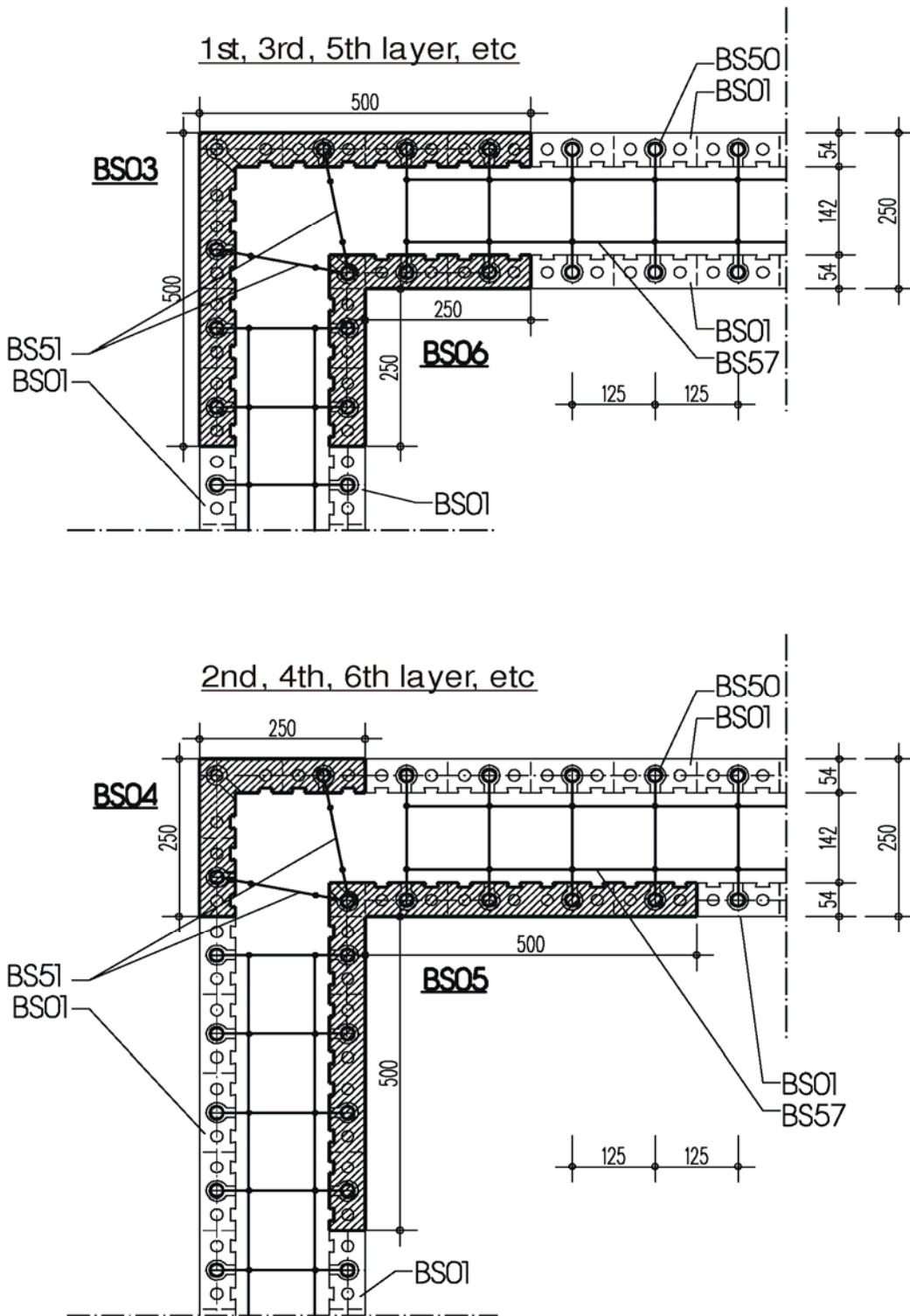


Dimensions in [mm], without scale

DuoTherm

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

Annex 12

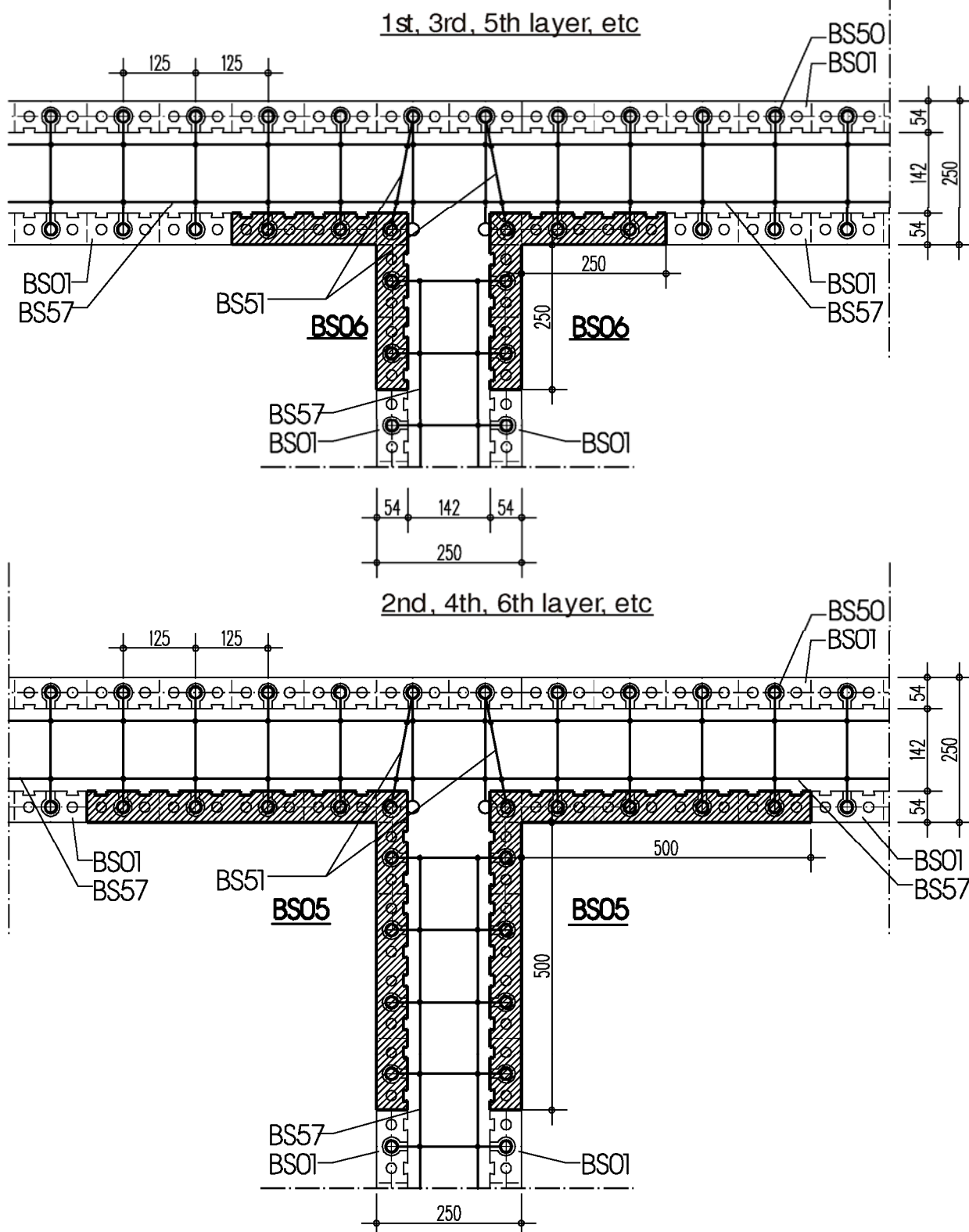


Dimensions in [mm], without scale

DuoTherm

Rectangular corners:
Outer corner with grid sectioning

Annex 13

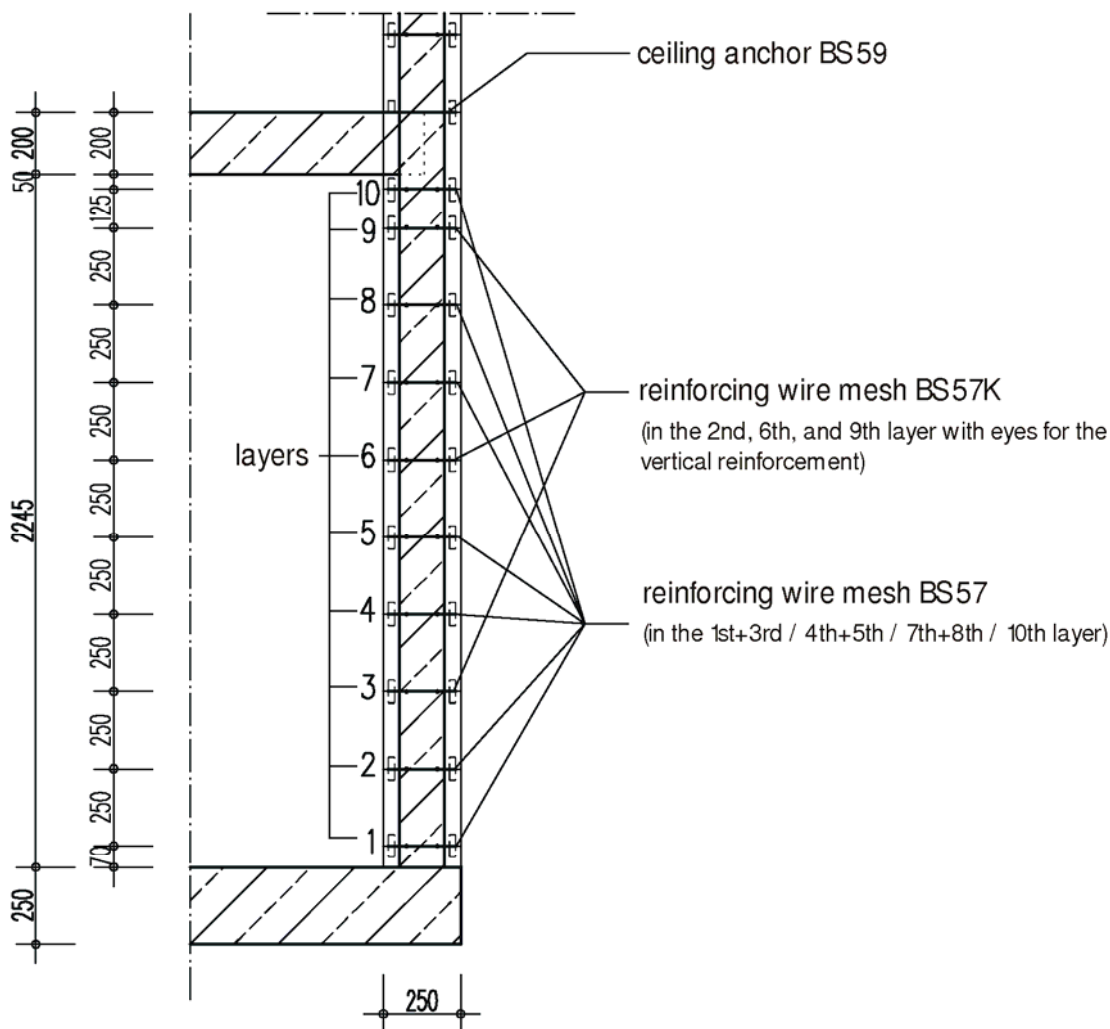


Dimensions in [mm], without scale

DuoTherm

T-walls:
T-wall with grid sectioning

Annex 14

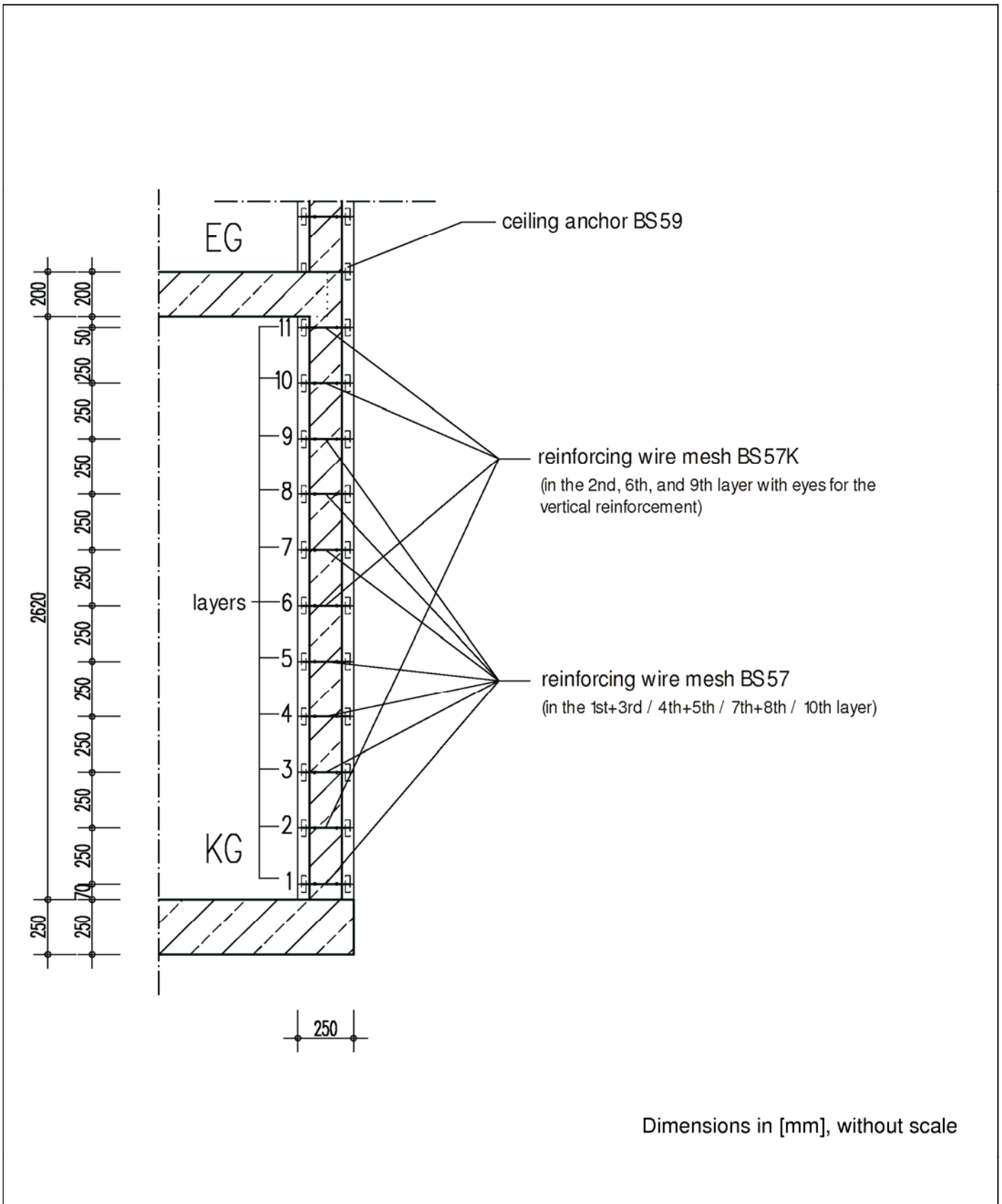


Dimensions in [mm], without scale

DuoTherm

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

Annex 15



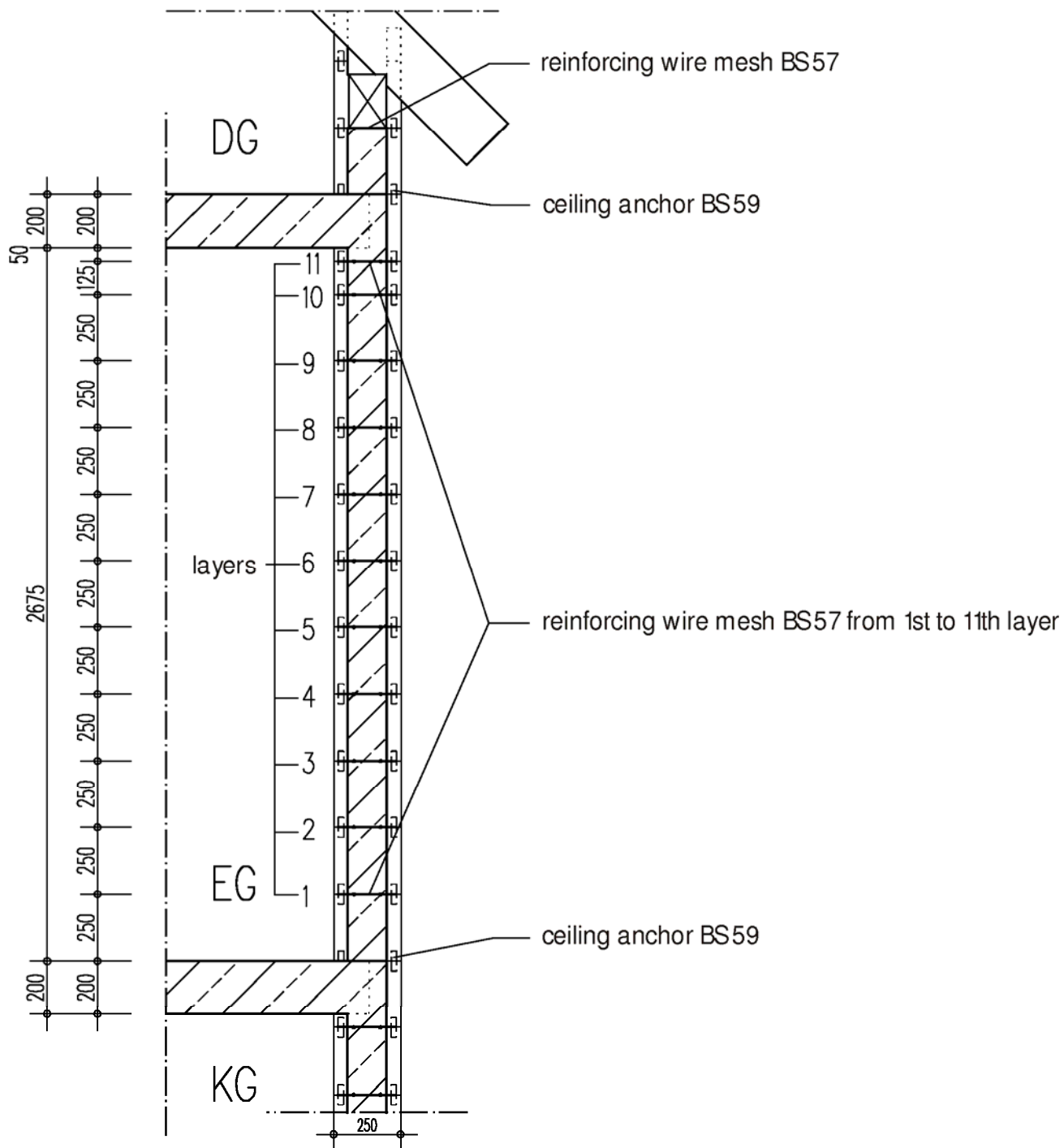
Dimensions in [mm], without scale

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DuoTherm

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

Annex 16



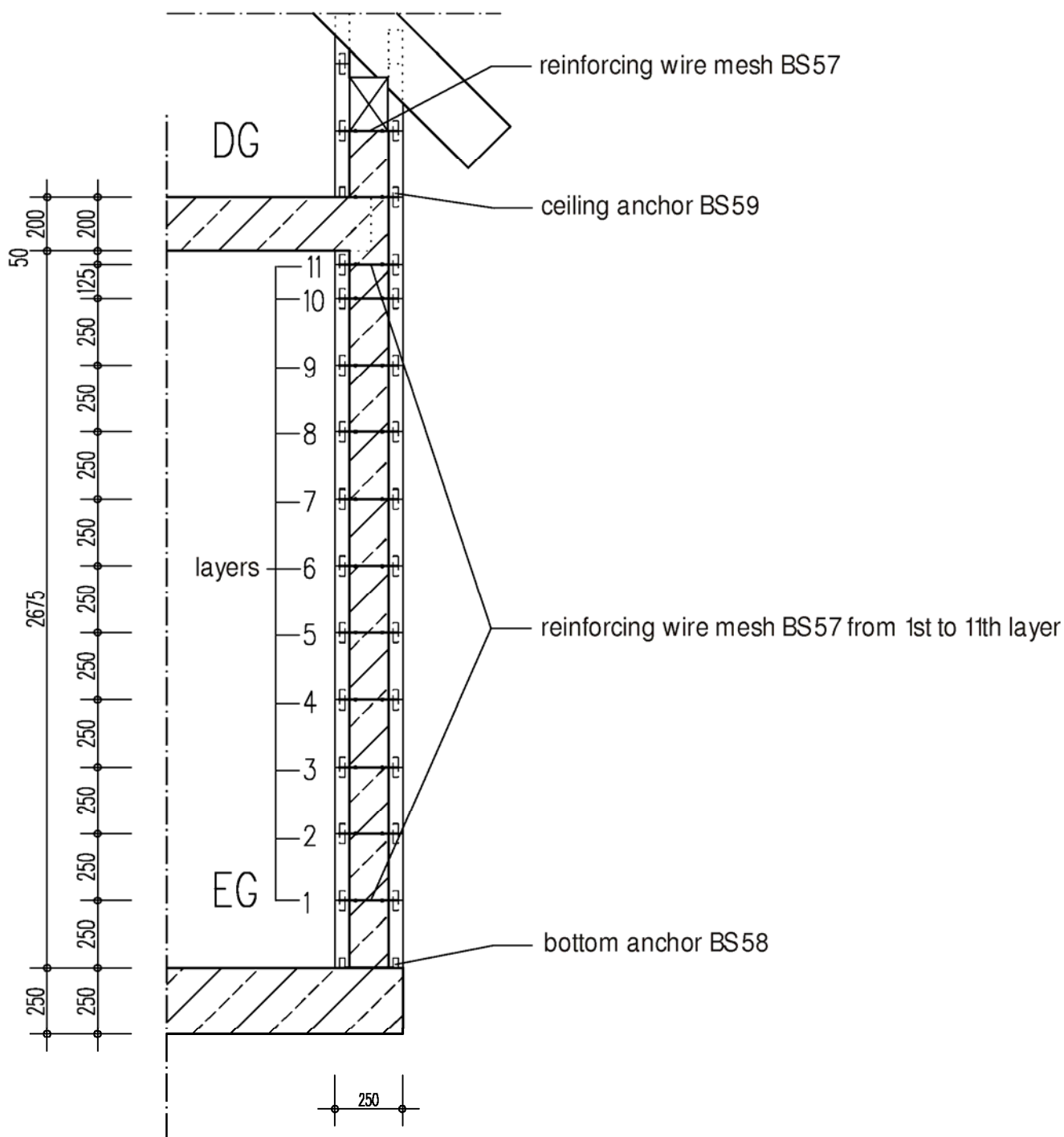
Dimensions in [mm], without scale

electronic copy of the eta by dibt: eta-07/0235

DuoTherm

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

Annex 17



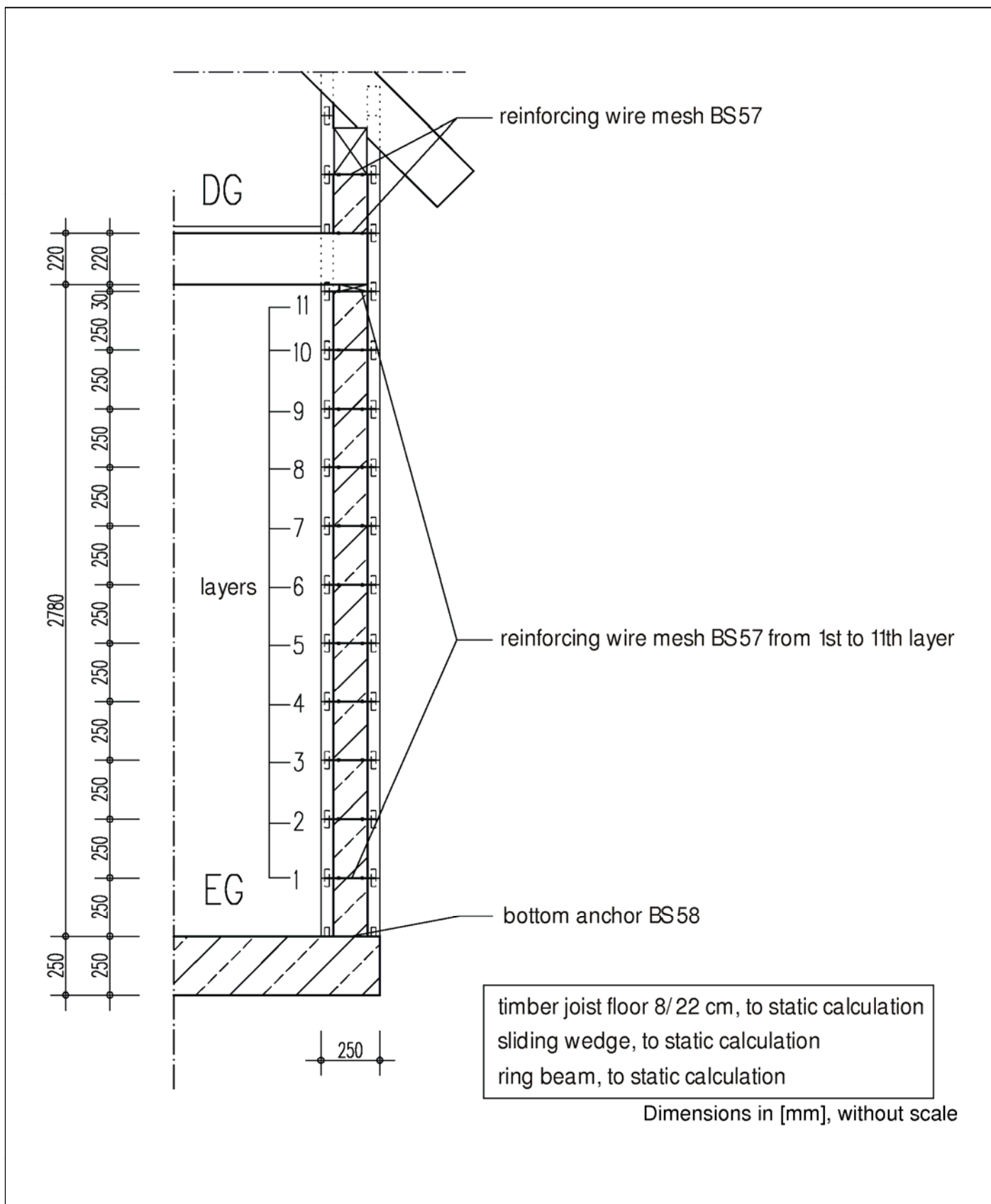
Dimensions in [mm], without scale

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DuoTherm

Typical construction:
Ground floor / top floor with grid sectioning

Annex 18

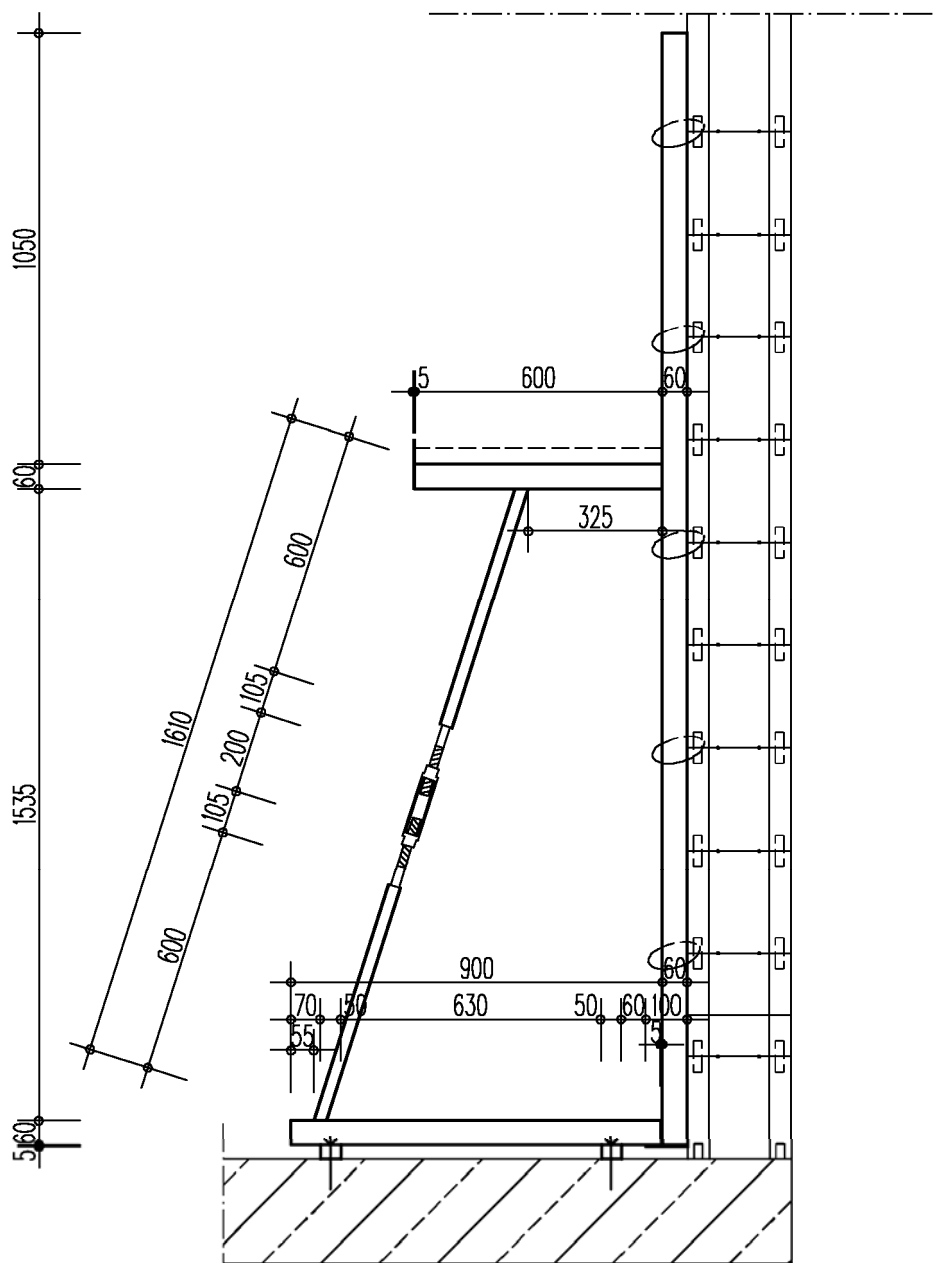


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DuoTherm

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

Annex 19



maximum push-pull props distance 1,50 m

Dimensions in [mm], without scale

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DuoTherm

Mounted push-pull props

Annex 21

Kern-Haus BS-elements

total thickness of wall		142mm core of concrete					192mm core of concrete					
		25	30	40	45	50	30	35	45	50	55	
BS01	standard element	x	x	x	x	x	x	x	x	x	x	annex 2
BS02	face element	x	x	x	x	x						annex 12
BS03	outer corner 50/50	x	x	x	x	x	x	x	x	x	x	annex 5
BS04	outer corner 25/25	x	x	x	x	x	x	x	x	x	x	annex 5
BS05	internal corner 50/50	x	x	x	x	x	x	x	x	x	x	annex 5
BS06	internal corner 25/25	x	x	x	x	x	x	x	x	x	x	annex 5
BS07	levelling element 3,7cm	x	x	x	x	x	x	x	x	x	x	annex 2
BS08	levelling element 12,5cm	x	x	x	x	x	x	x	x	x	x	annex 2
BS09	end element	x	x	x	x	x						annex 12
BS10	lintel element	x	x	x	x	x						annex 12
BS11	outer corner 135°	x					x					annex 6
BS12	outer corner 45°	x					x					annex 6
BS15	levelling element 7cm	x	x	x	x	x	x	x	x	x	x	annex 2
BS16	levelling element 5cm	x	x	x	x	x	x	x	x	x	x	annex 2
BS17	levelling element 7cm		x					x				annex 3
BS22	end element						x	x	x	x	x	annex 12
BS25	internal corner 45/45	x	x	x	x	x	x	x	x	x	x	annex 7
BS26	internal corner 20/20	x	x	x	x	x	x	x	x	x	x	annex 7
BS40	standard element		x					x				annex 3
BS41	outer corner 50/50		x					x				annex 8
BS42	outer corner 25/25		x					x				annex 8
BS43	levelling element 12,5cm		x					x				annex 3
BS44	outer corner 45°		x					x				annex 9
BS45	outer corner 135°		x					x				annex 9
BS46	internal corner 90°external		x					x				annex 8
BS47	standard element			x					x			annex 4
BS48	standard element				x					x		annex 4
BS49	standard element					x					x	annex 4
BS50	anchor tube	x	x	x	x	x	x	x	x	x	x	annex 10
BS51	standard element	x	x	x	x	x						annex 10
BS57	reinforcing wire mesh 3,125m	x	x	x	x	x						annex 10
BS57K	reinforcing wire mesh 3,125m f. basement	x	x	x	x	x						annex 10
BS58	bottom anchor	x	x	x	x	x						annex 10
BS59	ceiling anchor	x	x	x	x	x						annex 10
BS60	standard element						x	x	x	x	x	annex 11
BS64	ceiling anchor						x	x	x	x	x	annex 11
BS65	bottom anchor						x	x	x	x	x	annex 11
BS66	reinforcing wire mesh 3,125m						x	x	x	x	x	annex 11
BS66K	reinforcing wire mesh 3,125m f. basement						x	x	x	x	x	annex 11

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Overview:
BS-elements

Annex 22

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 $\gamma_{\text{EPS}} = 0,3 \text{ KN/m}^2$	Assumed weight of the wall with concrete core without rendering $\gamma_{\text{concrete}} = 25 \text{ KN/m}^2$	Area of horizontal frame A_R
		[mm]	[mm]	[m ² /m]	[kg/m ²]	[kg/m ²]	[mm ²]
25-es	1	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	./.

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Standard shuttering elements
Dimensions and weights

Annex 23

standards and guidelines	issue	title
EN 206-1	2000	Concrete - Part 1: Specification, performance, production and conformity
EN 1992-1-1	2004 + AC:2010	Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
EN 13163	2008	Thermal insulation products for buildings - Factory made products of expanded polystyrene (EPS) - Specification
EN 13501-1	2007 + A1:2009	Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests
EN 13501-2	2007 + A1:2009	Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services
EN ISO 6946	2007	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method
EN ISO 10456	2007 + AC:2009	Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values
EN ISO 13788	2001	Hygrothermal performance of building components and building elements - Internal surface temperature to avoid critical surface humidity and interstitial condensation - Calculation methods
ETAG 004	2011	Guideline for European technical approval of "External thermal insulation composite systems with rendering"
ETAG 009	2002-06	Guideline for European technical approval of "Non load bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete"
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List of standards and guidelines		