

European Technical Approval ETA-13/0256

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

DUROFIX II - Schalungssteine aus Holzspanbeton
DUROFIX II - shuttering blocks made of wood-chip concrete

Zulassungsinhaber
Holder of approval

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Zulassungsgegenstand
und Verwendungszweck
*Generic type and use
of construction product*

Nicht lasttragendes verlorenes Schalungssystem "DUROFIX II"
bestehend aus Schalungssteinen aus Holzspanbeton
*Non-load bearing permanent shuttering kit "DUROFIX II" based on
shuttering blocks of wood-chip concrete*

Geltungsdauer:
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to

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This Approval contains

39 Seiten einschließlich 17 Anhänge
39 pages including 17 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.
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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 the product and intended use

1.1 Definition of the construction product

1.1.1 General

The shuttering system "DUROFIX II" is a non load-bearing permanent shuttering kit based on standard shuttering blocks and special shuttering blocks (see e. g. Annex 1) applicable as formwork for plain and reinforced concrete walls cast in-situ.

The shuttering blocks consist of shuttering leaves and webs of wood-chip concrete.

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

Finishes are not part of the shuttering system "DUROFIX II".

1.1.2 Standard shuttering blocks

The standard shuttering blocks (see Annexes 1 to 2 and 4 to 8) consist of inner and outer shuttering leaves and webs of mineral bonded wood-chips (wood-chip concrete) according to EN 14474. The wood-chip concrete standard shuttering blocks are precast concrete products and may include factory installed thermal insulation (see clause 2.1.2, Table 1) according to the relevant standard of the series EN 13162 to EN 13171 to improve the thermal resistance. The following types of standard shuttering blocks are available:

- standard shuttering blocks D with or without thermal insulation inserts (Annex 1)
- standard shuttering blocks G with or without thermal insulation inserts (Annex 2)
- standard shuttering blocks HLS without thermal insulation inserts (Annex 4)
- standard shuttering blocks DII and DIII with or without thermal insulation inserts (Annex 5)
- H shuttering blocks D with or without thermal insulation inserts (Annex 6)
- HI shuttering blocks D and B with thermal insulation inserts (Annex 7)
- RF shuttering blocks RF without thermal insulation inserts (Annex 8)

The shuttering leaves of wood-chip concrete are one-layered and the webs of wood-chip concrete provide thicknesses of the concrete columns in the range of 80 mm to 420 mm and thicknesses of the wall in the range of 150 mm to 500 mm, as indicated in Annexes 1 to 2 and 4 to 8. The thickness of the inner shuttering leaves as well as the thickness of the outer shuttering leaves is in the range of 25 mm to 80 mm. Standard shuttering blocks with the same thickness of the inner and outer shuttering leaf are also used for internal walls. Standard shuttering blocks with a thicker outer shuttering leaf or with thermal insulation inserts are generally used for external load-bearing walls. The thickness of the thermal insulation inserts is in the range of 20 mm to 280 mm (see Annexes 1 to 2 and 5 to 7). The length of the standard shuttering blocks is in the range of 497 mm to 997 mm and the height is 248 mm (see Annexes 1 to 2 and 4 to 8).

The vertical ends of the standard shuttering blocks are either smooth or tongue and groove joints depending on the type of standard shuttering blocks and form a tight joint. The top and the bottom of each shuttering leaf do not provide an interlocking arrangement to form a tight joint but the static friction between the top and the bottom surfaces ensure an adequate positional stability when building up the standard shuttering blocks and while placing the concrete.

The standard shuttering blocks are dry laid in staggered vertical joints (masonry bond).

The standard shuttering blocks are interlocked and built up horizontally and vertically into a tight and rigid formwork. The wall is formed by filling of the standard shuttering blocks with concrete. The formwork is used in conjunction with concrete class C16/20 (according to EN 206-1) to build plain concrete walls or in conjunction with concrete of classes in the range from C20/25 to C50/60 (according to EN 206-1) to build reinforced concrete walls.

1.1.3 Special shuttering blocks

The special shuttering blocks are specially shaped ancillary blocks for the execution of constructional details, such as corners, reveals, lintels, etc.

1.1.3.1 Stopper blocks / Universal blocks (Annex 3)

Stopper blocks respectively universal blocks are designed in the same manner as the standard shuttering blocks described above, see clause 1.1.2.

1.1.3.2 Lintel blocks

Lintel blocks are made of standard shuttering blocks DII and DIII (see clause 1.1.2 and Annex 5) by cutting out one of the end webs of these shuttering blocks. The maximum height of the shuttering leaf of the lintel blocks shall not exceed 0,50 m.

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 "DUROFIX II" consists of the following shuttering blocks:

- standard shuttering blocks and
 - special shuttering blocks,
- see clauses 2.1.2 and 2.1.3.

2.1.2 Standard shuttering blocks

The standard shuttering blocks (composed of shuttering leaves and webs of wood-chip concrete) correspond to the information and drawings given in Annexes 1 to 2 and 4 to 8.

The geometric characteristics of the standard shuttering blocks are given in Annexes 1 to 2 and 4 to 8. The requirements of the standard shuttering blocks regarding to geometric characteristics are given in EN 15498, clauses 4.2.1 and 5.2.1.

Only wood-chip concrete according to EN 14474 shall be used for the manufacture of shuttering blocks of wood-chip concrete.

The material oven dry density ρ_{dry} of wood-chip concrete of the standard shuttering blocks is

- 510 kg/m³ (see Annexes 1 and 2) and
- 800 kg/m³ (see Annexes 4 to 8).

The mean material oven dry density shall deviate by not more than $\pm 10\%$ from the declared value according to EN 15498, clauses 4.2.2 and 5.2.2.

The minimum value of tensile strength of the webs $f_{t,m}$ of wood-chip concrete according to EN 15498, clauses 4.2.6 and 5.2.6 shall be at least the value determined according to EN 15498, Annex B, clause B.4.2.

When thermal insulation inserts are used (see Annexes 1 to 2 and 5 to 7), they shall comply with the relevant standard of the series EN 13162 to EN 13171. The materials of the thermal insulation inserts are:

- mineral wool and
- expanded polystyrene.

The parameters and characteristics of the thermal insulation inserts are indicated in Table 1.

Table 1: Parameters and characteristics of the thermal insulation inserts

Thermal insulation inserts	Standard	Designation code of the thermal insulation inserts (see Annexes 1 to 2 and 5 to 7)	Mean value of density	Declared value of thermal conductivity	Reaction to fire: Class according to EN 13501-1 see clause 2.2.3.1	
			ρ	λ_D	thermal insulation inserts	shuttering blocks with thermal insulation inserts
			[kg/m ³]	[W/(m·K)]		
Mineral wool (MW)	EN 13162	MW-EN 13162-T5-DS(T+)-DS(TH)-CS(10)40-TR15-WS-WL(P)	70,0	0,039	A1	B-s1, d0
Expanded polystyrene (EPS)	EN 13163	EPS-EN 13163-T1-L1-W1-S1-P3-DS(70, -)3-BS100-CS(10)60-DS(N)5	17,0	0,038	E	E

The material characteristics, dimensions and tolerances of the standard shuttering blocks not indicated in Annexes 1 to 2 and 4 to 8 are given in the technical documentation⁷ of the ETA.

2.1.3 Special shuttering blocks

The special shuttering blocks correspond to the information and drawings given in Annex 3. The special shuttering blocks are:

- stopper blocks / universal blocks and
- lintel blocks.

Special shuttering blocks are designed in the same manner as the standard shuttering blocks described above, see clause 1.1.2.

The special shuttering blocks consist of shuttering leaves and webs of mineral bonded wood-chips (wood-chip concrete) and may include factory installed thermal insulation, it is the same material used for standard shuttering blocks 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 "DUROFIX II" 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.

⁷

The technical documentation of the ETA is deposited at 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.

2.2.2 Essential Requirement 1: Mechanical resistance and stability

2.2.2.1 Resulting structural pattern

In end use conditions walls made with shuttering blocks "DUROFIX II" are walls of a grid 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 an efficient filling without bursting of the shuttering and without voids or any uncovered reinforcement in the concrete columns 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 according to clause 4.2.2 and 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 fire⁸

Shuttering blocks "DUROFIX II" made of wood-chip concrete with thicknesses of the inner shuttering leaf of $t_{s1} \leq 30$ mm respectively of the outer shuttering leaf of $t_{s2} \leq 30$ mm and

- without thermal insulation inserts (see Annexes 1 to 2 and 4 to 6 and 8) fulfil the requirement of Class B-s1, d0 according to EN 13501-1 respectively
- with thermal insulation inserts (see Annexes 1 to 2 and 5 to 7) fulfil the requirements of classification criteria of Table 1 according to EN 13501-1.

All other shuttering blocks "DUROFIX II" made of wood-chip concrete with or without thermal insulation inserts (see Annexes 1 to 2 and 4 to 8) fulfil the requirement of Class F according to EN 13501-1.

2.2.3.2 Resistance to fire

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

For grid type walls according to ETAG 009, Annex C, Table 1, the assumption of the wall being fire exposed on one side is only applicable for shuttering blocks "DUROFIX II" made of wood-chip concrete with thicknesses of the inner shuttering leaf of $t_{s1} \leq 30$ mm respectively of the outer shuttering leaf of $t_{s2} \leq 30$ mm and

- without thermal insulation inserts respectively
- with thermal insulation inserts of mineral wool as rock wool.

These shuttering blocks "DUROFIX II" fulfils the requirement of Class B-s1, d0 according to EN 13501-1 (see clause 2.2.3.1). In this case load-bearing walls ("REI") with a minimum concrete strength of C16/20 meet the criteria "REI" according to Table 2.

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.

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

Minimum dimension of concrete columns [mm]	"REI"
100	30
120	60
150	90
170	120

For all other shuttering blocks "DUROFIX II" made of wood-chip concrete with or without thermal insulation inserts which fulfil the requirement of Class F, according to EN 13501-1 (see clause 2.2.3.1) and where therefore the specifications for applying ETAG 009, Annex C, Table 1 are not fulfilled (melting or easy burning materials of the shuttering leaves and/or thermal insulation inserts) the concrete columns are considered to be exposed on more than one side and the minimum dimension of such concrete column is given in ETAG 009, Annex C, Table 2. In this case load-bearing walls ("R") with a minimum concrete strength of C16/20 meet the criteria "R" according to Table 3.

Table 3: Determination of "R" of load-bearing walls

Minimum dimension of concrete columns [mm]	"R"
150	30
200	60
240	90
280	120

The preconditions for the classifications according Table 2 and Table 3 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 class of concrete shall be between C16/20 and C50/60 according to EN 206-1. In lack of availability of European standard EN 206-1, alternatively a concrete according to national rules, valid in the place of use, with a compressive strength which fits in the interval given above, is also considered as appropriate.
- The shuttering blocks shall on both sides either be plastered/rendered or at least the joints on both sides shall be sealed with plastering/rendering mortar. The mortar for plastering/rendering or for sealing shall be based on inorganic aggregates, gypsum, cement or lime or on suitable combinations of these three binders.

Note: The classification of walls constructed with the shuttering system "DUROFIX II" 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 "DUROFIX II", 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.

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 value of the water vapour resistance factor of wood-chip concrete is $\mu = 7$ (wet conditions as well as dry conditions).

The values of the water vapour resistance factor of concrete columns depending on type and density and of the materials of thermal insulation inserts (see clause 2.1.2, Table 1) are tabulated values in EN ISO 10456.

Using these values the verification of the annual moisture balance or the maximum amount of interstitial condensation according to EN ISO 13788 will be on the safe side.

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 "DUROFIX II" 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 shuttering leaves of wood-chip concrete and concrete columns and resistance to impact load

The bond strength is at least equal to the resistance of the shuttering blocks against the pressure of fresh concrete, see clause 2.2.5.2.

Concrete walls (without consideration of the finishes), constructed with shuttering system "DUROFIX II" 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 columns 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.

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.

2.2.5.2 Resistance to pressure of fresh concrete

To resist the pressure of fresh concrete according to EN 15498, Annex A the minimum value of tensile strength of the webs $f_{t,m}$ of wood-chip concrete and the minimum value of bending tensile strength of the shuttering leaves $f_{f,m}$ of wood-chip concrete according to EN 15498, clauses 4.2.6 and 5.2.6 shall be at least the values determined according to EN 15498, Annex B, clause B.4.2 and Annex C, clause C.4.2. The minimum value of tensile strength of the shuttering leaves of wood-chip concrete perpendicular to faces f_{tp} shall be at least 0,15 MPa.

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 blocks do not have sharp or cutting edges.

Because of a certain risk of abrasion or of cutting people on rough surfaces of the shuttering blocks handling on site shall be done with gloves.

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 declared value of thermal resistance $R_{D,wall}$ of walls made of shuttering blocks of wood-chip concrete in end use conditions (shuttering blocks with concrete columns and maybe thermal insulation inserts but without rendering) is the sum of the declared value of thermal resistance of the shuttering blocks of wood-chip concrete $R_{D,block}$, the concrete columns $R_{D,concrete}$ and maybe the thermal insulation inserts $R_{D,insulation}$. The declared value of thermal resistance of the shuttering blocks of wood-chip concrete $R_{D,block}$ shall be calculated in accordance with EN ISO 6946 with a declared value of thermal conductivity λ_D of the shuttering blocks of wood-chip concrete depending on the material oven dry density ρ_{dry} tabulated in Table 4. The declared value of thermal resistance of the concrete columns $R_{D,concrete}$ shall be calculated in accordance with EN ISO 6946 with a value of thermal conductivity λ of the concrete columns depending on the density ρ tabulated in EN ISO 10456. The declared value of thermal resistance of thermal insulation inserts $R_{D,insulation}$ shall be calculated in accordance with EN ISO 6946 with a declared value of thermal conductivity λ_D of the materials of thermal insulation inserts tabulated in Table 1.

Table 4: Declared value of thermal conductivity of wood-chip concrete

Material oven dry density ρ_{dry} [kg/m ³]	Declared value of thermal conductivity λ_D^* [W/(m × K)]
510	0,120
800	0,170

* the declared value of thermal conductivity λ_D corresponds to a temperature of 23 °C and 50 % relative humidity
moisture conversion factor at a temperature of 23 °C and 50 % relative humidity: $F_m = 1,130$

Walls made of shuttering blocks consisting of thermally homogenous and thermally inhomogeneous layers according to EN ISO 6946. The declared value of thermal resistance $R_{D,wall}$ of walls made of shuttering blocks of wood-chip concrete in end use conditions (shuttering blocks with concrete columns and maybe thermal insulation inserts but without rendering) shall be calculated according to the three following methods:

1. Determination of the wall as three thermally homogeneous layers according to EN ISO 6946, clause 6.1 without considering the webs:
 - inner shuttering leaf of wood-chip concrete,
 - concrete column and
 - outer shuttering leaf of wood-chip concrete.

This calculation leads to the minimum declared value of thermal resistance $R_{D,wall}$ of walls made of shuttering blocks of wood-chip concrete.

2. Determination of the wall as thermally homogenous and thermally inhomogeneous layers parallel to the surface of the wall according to EN ISO 6946, clause 6.2. For a simplified calculation it is possible to replace the real semicircular horizontal concrete ribs A_R (web recess areas) between the chambers of the concrete columns by modelled rectangular areas A_R , see the following Figure 1.

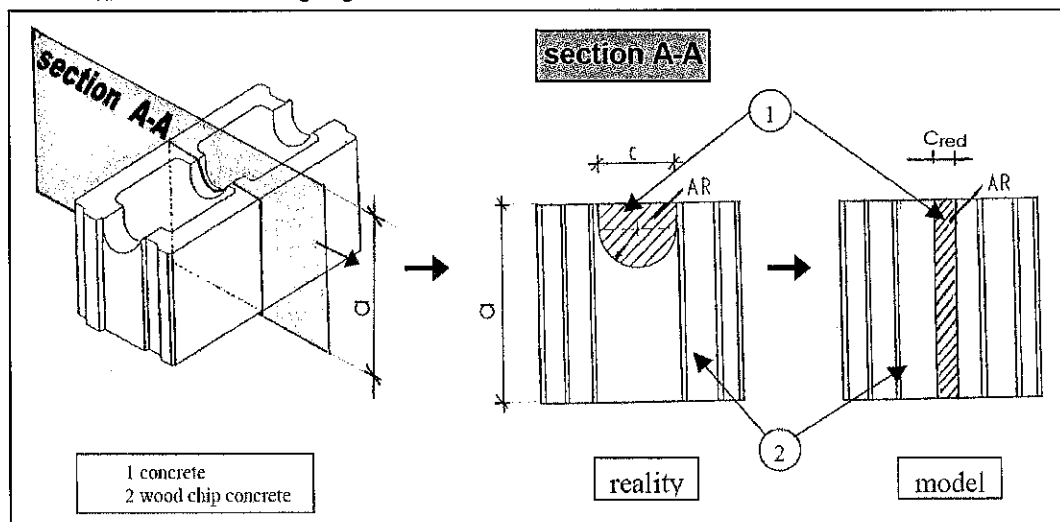


Figure 1: Replacing of the real semicircular horizontal concrete ribs A_R (web recess areas) between the chambers of the concrete columns by modelled rectangular areas A_R

3. Determination by calculation methods according to EN ISO 10211.

In case of shuttering blocks with thermal insulation inserts (see Annexes 1 to 2 und 5 to 7), the second or the third method has to be used.

2.2.7.2 Influence of moisture transfer on insulating capacity of the wall

Using the values of clause 2.2.4.2 the verification of the annual moisture balance or the maximum amount of interstitial condensation according to EN ISO 13788 will be on the safe side.

2.2.7.3 Heat capacity

The value of the heat capacity c of the shuttering blocks of wood-chip concrete is $c = 1,50 \text{ kJ}/(\text{kg} \times \text{K})$ according to EN 15498, clause 5.2.8.2.

The values of the heat capacity c of the concrete columns and of the materials of thermal insulation inserts (see clause 2.1.2, Table 1) are tabulated values in EN ISO 10456.

2.2.8 Aspects of durability and serviceability

2.2.8.1 Resistance to deterioration

Physical agent

The relative changes by moisture movement of the shuttering blocks in length involves

- the expansion between the initial condition and after soaking in water for 4 days and
- the shrinkage between the initial condition and after oven-drying for 21 days at 33 °C

and shall be at least the values indicated in Table 5 depending on the type of the shuttering blocks.

Table 5: Moisture movement

Type	according to Annex	Thickness of concrete column t_c [mm]	Total movement coefficient $\Delta l_c/l$ [mm/m]
D 15/8	1	80	0,355
D 25/18	1	180	0,482
D 30/22	1	220	0,596
HLS 37,5/28	4	280	0,509

To ensure an adequate frost resistance without direct contact with de-icing salt the loss of mass shall be less than 10 %.

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

Chemical agent

The shuttering blocks are made of wood-chip concrete. There is no corrosion of the wood-chip concrete webs in concrete.

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 wood-chip concrete as thermal insulation material for decades has shown that it is sufficiently protected against fungi, bacteria, algae and insects.

Wood-chip concrete and the thermal insulation inserts do not provide a food value and in general it does not contain voids suitable for habitation by vermin.

The shuttering system "DUROFIX II" 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 "DUROFIX II" 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 columns 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 objects in the shuttering leaves of wood-chip concrete is not possible. The part of fixings which is significant for the mechanical resistance shall be inside the concrete columns.

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/EC of 5 December 1997¹⁰ 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 control 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.

In addition, according to the Decision 2001/596/EC¹² of the European Commission system 1 of the attestation of conformity applies with regard to reaction to fire.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

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

¹² Official Journal of the European Communities L 209/33 of 2 August 2001

- (a) Tasks for the manufacturer:
 - (1) factory production control;
 - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed control plan;
- (b) Tasks for the approved body:
 - (3) initial type-testing of the product;
 - (4) initial inspection of factory and of factory production control;
 - (5) continuous surveillance, assessment and approval of factory production control.

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

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Initial type-testing of the product

For initial type-testing the results of the tests performed as part of the assessment for the European technical approval may be used unless there are changes to the product, in the production line or plant. In such cases the necessary initial type-testing shall be agreed between 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 29 April 2013 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.¹³

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 type-testing of the product (only for reaction to fire),
- initial inspection of factory and of factory production control and

¹³

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.

- continuous surveillance, assessment and approval of factory production control in accordance with the provisions laid down in the control plan.

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

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

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval (only for reaction to fire).

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

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

3.3 CE marking

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

- the name and the address of the manufacturer (legal entity responsible for the manufacturer)
- the last two digits of the year in which the CE marking was affixed
- the number of the EC certificate of conformity for the product (only for reaction to fire)
- the number of the EC certificate for the factory production control
- the number of the European technical approval ETA-13/0256
- the number of the guideline ETAG 009 of the European technical approval
- description of the product: generic name, material, dimensions, ... and intended use
- information on those relevant essential characteristics which are to be declared presented as declared values and, where relevant, level or class according to Essential Requirements or "No performance determined" for characteristics where this is relevant according to Essential Requirements
 - Geometric characteristics of the standard shuttering blocks (see clause 2.1.2 and Annexes 1 to 2 and 4 to 8)
 - Designation code of the thermal insulation inserts (see clause 2.1.2, Table 1)
 - 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 dimension of the concrete columns (see clause 2.2.3.2)
 - Water vapour permeability (see clause 2.2.4.2)
 - Minimum value of tensile strength of the webs $f_{t,m}$ of wood-chip concrete (see clause 2.2.5.2)
 - Minimum value of bending tensile strength of the shuttering leaves $f_{r,m}$ of wood-chip concrete (see clause 2.2.5.2)
 - Minimum value of tensile strength of the shuttering leaves of wood-chip concrete perpendicular to faces f_{tp} (see clause 2.2.5.2)
 - Protection against noise (see clause 2.2.6)

- Declared value of thermal conductivity λ_D of the shuttering blocks of wood-chip concrete depending on the material oven dry density ρ_{dry} (see clause 2.2.7.1, Table 4) and maybe the declared value of thermal conductivity λ_D of the materials of thermal insulation inserts (see clause 2.1.2, Table 1)
- Drying shrinkage and durability (see clause 2.2.8.1)

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

4.1 Manufacturing

The shuttering blocks 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 blocks (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 grid type¹⁴ 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 dimensions of the wall depending on type of shuttering blocks and on material oven dry density ρ_{dry} of the wood-chip concrete are shown in Annexes 1 to 8.

In end use conditions the shuttering leaves of wood-chip concrete and the thermal insulation inserts 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 blocks

The shuttering blocks are put together on site in layers without mortar or adhesive. To receive stable floor high formworks the vertical joints between two shuttering blocks ($l = 497$ mm, see Annexes 1 and 3 to 8) of one layer have to be shifted of at least a quarter of the block length, better a half of the block length, to the vertical joints of the previous and next layer (see Annex 16). Furthermore the shuttering blocks ($l = 997$ mm, see Annex 2) have to be shifted in

¹⁴ see ETAG 009, clause 2.2

layers in such a way that the webs of the shuttering blocks superimposed on the other are in a vertical alignment to obtain continuous concrete columns.

First of all one layer of the entire floor plan shall be laid exactly according to the planned elevation and alignment 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 blocks are to be laid in a bond formation (see Annex 16) to floor height and levelled.

The formwork is used in conjunction with concrete class C16/20 (according to EN 206-1) to build plain concrete walls or in conjunction with concrete of classes in the range from C20/25 to C50/60 (according to EN 206-1) to build reinforced concrete walls. The following instructions are appropriate to install steel reinforcement for walls according to EN 1992-1-1 or corresponding national rules:

- Horizontal reinforcement: In every horizontal concrete rib (web recess area).
- Vertical reinforcement: A single reinforcing bar or a reinforcing wire-mesh or a reinforcement cage in every column.

The preconditions to install steel reinforcement are:

- Vertical reinforcement: The dimensions of reinforcing wire-meshes or reinforcement cages including bar spacers shall be appropriate to the corresponding minimum dimensions of the concrete columns. If more than one reinforcing bar is installed all reinforcing bars shall be connected with each other by welded on or wired cross bars to a mesh.
- Planning shall allow for sufficient spaces in the reinforcement for discharge pipes or concreting tubes.
- The resistance of the wood-chip concrete to carbonation and chloride penetration is not determined, i. e. the concrete cover according to EN 1992-1-1 or corresponding national rules shall apply.
- The minimum and maximum distance between reinforcing bars according to EN 1992-1-1 or corresponding national rules shall apply.

In addition the necessary reinforcement according to static calculation shall be installed according to the instructions in the installation guide provided by the manufacturer.

The lintel blocks (see clause 1.1.3.2) have to be reinforced like beams according to EN 1992-1-1 or corresponding national rules.

Rectangular corners and T-walls are to be formed according to Annexes 10 and 16. Typical junctions between walls and ceilings are to be formed according to Annexes 11 and 13 to 15. Window connections are to be formed according to Annex 12.

The lintel blocks shall be supported.

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

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.

Placing the concrete shall be performed in layers of maximum 1 m at a maximum concreting rate of 3 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 blocks when the concrete columns have 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 wall columns 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 columns shall be considered, if their diameter exceeds 1/6 of the thickness of the concrete columns and the distance of the ducts is less than 2 m.

4.2.5 Reworking and finishes

Walls of the type "DUROFIX II" are to be protected by finishes (e.g. rendering, plasters, cladding, panelling, coatings). Finishes are not part of the kit and therefore not considered in this ETA. Preferably for external surfaces the rendering systems used should meet the requirements of ETAG 004. The cladding respectively panelling or their substructures shall be anchored in the concrete columns. The execution of the rendering shall be performed according to applicable national rules.

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

4.2.6 Fixing of objects

Fixing of objects in the shuttering leaves of wood-chip concrete is not possible. The part of fixings which is significant for the mechanical resistance shall be inside the concrete columns. The influence of the fixing to the reduction of the declared value of thermal resistance $R_{D,wall}$ of walls made of shuttering blocks of wood-chip concrete in end use conditions (shuttering blocks with concrete columns and maybe thermal insulation inserts but without rendering) shall be considered according to EN ISO 6946.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

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

5.2 Use, maintenance, repair

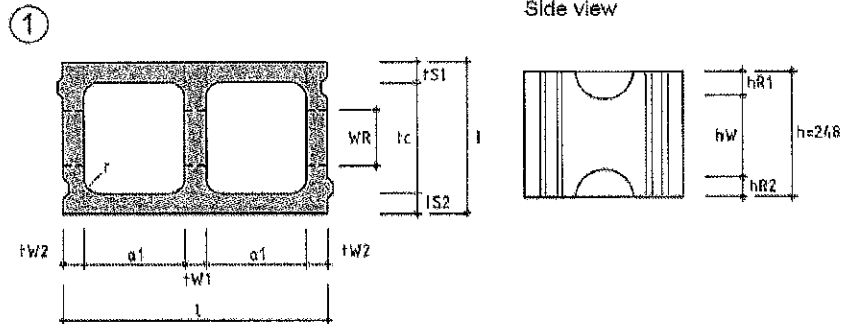
Regular checks should be carried out on renderings and finishes to ensure that any damage is detected and repaired as soon as possible.

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

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

Georg Feistel
Head of Department

beglaubigt:
Schwab



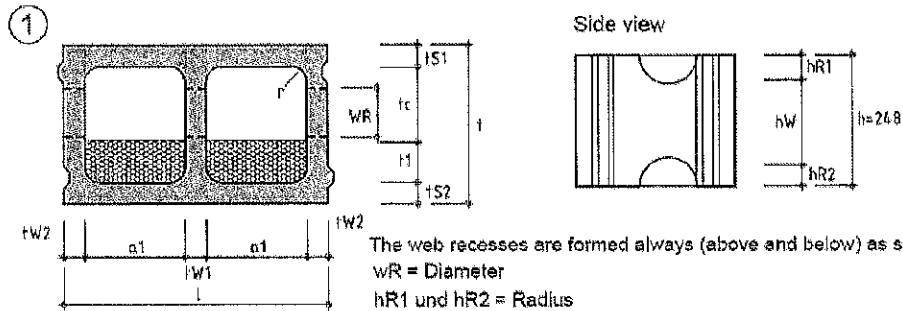
The web recesses are formed always (above and below) as semi circle
wR = Diameter
hR1 und hR2 = Radius

Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
D 15/8	248	150	497	80	35	35	30	0	47	45	180	180	75	37,5	37,5	173	44,2
D 17,5/12	248	175	497	120	27,5	27,5	30	0	47	45	180	180	100	50	50	148	78,5
D 20/12	248	200	497	120	40	40	30	0	47	45	180	180	100	50	50	148	78,5
D 20/14	248	200	497	140	30	30	30	0	47	45	180	180	120	60	60	128	113
D 25/16	248	250	497	160	45	45	0	0	47	45	180	180	120	60	60	128	113
D 25/18	248	250	497	180	35	35	0	0	47	45	180	180	120	60	60	128	113
D 30/22	248	300	497	220	40	40	0	0	47	45	180	180	130	65	65	118	133
D 32,5/25	248	325	497	250	37,5	37,5	0	0	47	45	180	180	140	70	70	108	154
D 36,5/28	248	365	497	280	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
D 36,5/29	248	365	497	280	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
D 37,5/29	248	375	497	290	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
D 40/30,5	248	400	497	305	47,5	47,5	0	0	47	45	180	180	140	70	70	108	154
D 40/31,5	248	400	497	315	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
D 42,5/33	248	425	497	330	47,5	47,5	0	0	47	45	180	180	140	70	70	108	154
D 42,5/34	248	425	497	340	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
D 45/35,5	248	450	497	355	47,5	47,5	0	0	47	45	180	180	140	70	70	108	154
D 45/36,5	248	450	497	365	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
D 47,5/38	248	475	497	380	47,5	47,5	0	0	47	45	180	180	140	70	70	108	154
D 47,5/39	248	475	497	390	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
D 50/40,5	248	500	497	405	47,5	47,5	0	0	47	45	180	180	140	70	70	108	154
D 50/41,5	248	500	497	415	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154

DUROFIX II - shuttering blocks made of wood-chip concrete

Standard shuttering blocks D **without** thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 510 kg/m³

Annex 1.1

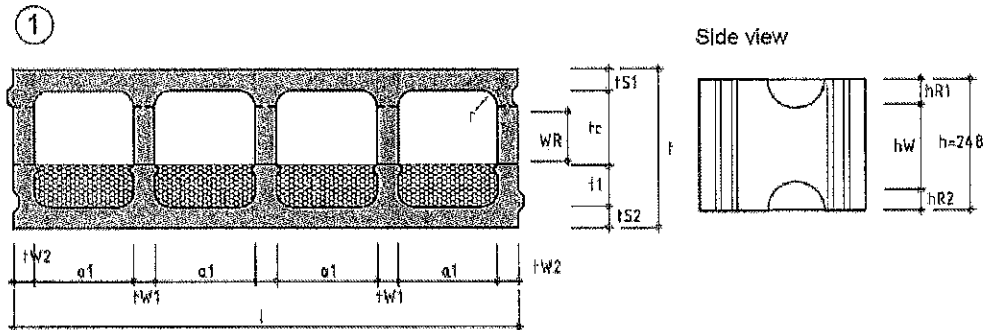


Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hr1	hr2	hw	AR
D 25/12/4	248	250	497	120	45	45	30	40	47	45	180	180	100	50	50	148	78,5
D 25/12/6	248	250	497	120	35	35	30	60	47	45	180	180	100	50	50	148	78,5
D 25/14/4	248	250	497	140	35	35	30	40	47	45	180	180	120	60	60	128	113
D 30/12/10	248	300	497	120	40	40	30	100	47	45	180	180	100	50	50	148	78,5
D 30/14/8	248	300	497	140	40	40	30	80	47	45	180	180	120	60	60	128	113
D 30/16/6	248	300	497	160	40	40	30	60	47	45	180	180	120	60	60	128	113
D 32,5/12/13	248	325	497	120	37,5	37,5	30	130	47	45	180	180	120	60	60	128	113
D 32,5/14/11	248	325	497	140	37,5	37,5	30	110	47	45	180	180	120	60	60	128	113
D 32,5/16/9	248	325	497	160	37,5	37,5	30	90	47	45	180	180	120	60	60	128	113
D 36,5/12/17	248	365	497	120	37,5	37,5	30	170	47	45	180	180	100	50	50	148	78,5
D 36,5/14/15	248	365	497	140	37,5	37,5	30	150	47	45	180	180	120	60	60	128	113
D 36,5/16/13	248	365	497	160	37,5	37,5	30	130	47	45	180	180	120	60	60	128	113
D 36,5/18/11	248	365	497	180	37,5	37,5	30	110	47	45	180	180	120	60	60	128	113
D 37,5/12/17	248	375	497	120	42,5	42,5	30	170	47	45	180	180	120	60	60	128	113
D 37,5/14/15	248	375	497	140	42,5	42,5	30	150	47	45	180	180	120	60	60	128	113
D 37,5/16/13	248	375	497	160	42,5	42,5	30	130	47	45	180	180	120	60	60	128	113
D 37,5/18/11	248	375	497	180	42,5	42,5	30	110	47	45	180	180	120	60	60	128	113
D 40/14/17,5	248	400	497	140	42,5	42,5	30	175	47	45	180	180	120	60	60	128	113
D 40/16/15,5	248	400	497	160	42,5	42,5	30	155	47	45	180	180	120	60	60	128	113
D 42,5/14/19	248	425	497	140	42,5	42,5	30	200	47	45	180	180	120	60	60	128	113
D 42,5/16/18	248	425	497	160	42,5	42,5	30	180	47	45	180	180	120	60	60	128	113
D 45/14/22,5	248	450	497	140	42,5	42,5	30	225	47	45	180	180	120	60	60	128	113
D 45/16/20,5	248	450	497	160	42,5	42,5	30	205	47	45	180	180	120	60	60	128	113
D 47,5/14/25	248	475	497	140	42,5	42,5	30	250	47	45	180	180	120	60	60	128	113
D 47,5/16/22	248	475	497	160	42,5	42,5	30	230	47	45	180	180	120	60	60	128	113
D 50/14/26,5	248	500	497	140	42,5	42,5	30	275	47	45	180	180	120	60	60	128	113
D 50/16/24,5	248	500	497	160	42,5	42,5	30	255	47	45	180	180	120	60	60	128	113

DUROFIX II - shuttering blocks made of wood-chip concrete

Standard shuttering blocks **D** with thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 510 kg/m³

Annex 1.2



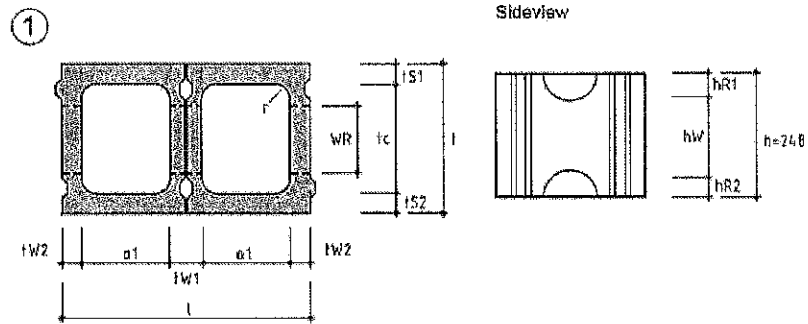
The web recesses are formed always (above and below) as semi circle
wR = Diameter
hR1 und hR2 = Radius

Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
G 25/12/4	248	250	997	120	45	45	0	40	44	48,5	192	0	100	50	50	148	78,5
G 25/12/5	248	250	997	120	40	40	0	50	44	48,5	192	0	100	50	50	148	78,5
G 25/12/6	248	250	997	120	35	35	0	60	44	48,5	192	0	100	50	50	148	78,5
G 25/14/3	248	250	997	140	40	40	0	30	44	48,5	192	0	120	60	60	128	113
G 25/14/4	248	250	997	140	35	35	0	40	44	48,5	192	0	120	60	60	128	113
G 25/16	248	250	997	160	45	45	0	0	44	48,5	192	0	120	60	60	128	113
G 25/17	248	250	997	170	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 25/18	248	250	997	180	35	35	0	0	44	48,5	192	0	120	60	60	128	113
G 30/12/9	248	300	997	120	45	45	0	90	44	48,5	192	0	120	60	60	128	113
G 30/12/10	248	300	997	120	40	40	0	100	44	48,5	192	0	120	60	60	128	113
G 30/14/7	248	300	997	140	45	45	0	70	44	48,5	192	0	120	60	60	128	113
G 30/14/8	248	300	997	140	40	40	0	80	44	48,5	192	0	120	60	60	128	113
G 30/16/5	248	300	997	160	45	45	0	50	44	48,5	192	0	120	60	60	128	113
G 30/16/6	248	300	997	160	40	40	0	60	44	48,5	192	0	120	60	60	128	113
G 30/21	248	300	997	210	45	45	0	0	44	48,5	192	0	120	60	60	128	113
G 30/22	248	300	997	220	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 37,5/29,5	248	375	997	295	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 37,5/16/13,5	248	375	997	160	40	40	0	135	44	48,5	192	0	120	60	60	128	113
G 37,5/14/15,5	248	375	997	140	40	40	0	155	44	48,5	192	0	120	60	60	128	113
G 40/32	248	400	997	320	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 40/16/16	248	400	997	160	40	40	0	160	44	48,5	192	0	120	60	60	128	113
G 40/14/18	248	400	997	140	40	40	0	180	44	48,5	192	0	120	60	60	128	113
G 42,5/34,5	248	425	997	345	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 42,5/16/18,5	248	425	997	160	40	40	0	185	44	48,5	192	0	120	60	60	128	113
G 42,5/14/20,5	248	425	997	140	40	40	0	205	44	48,5	192	0	120	60	60	128	113
G 45/37	248	450	997	370	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 45/16/21	248	450	997	160	40	40	0	210	44	48,5	192	0	120	60	60	128	113
G 45/14/23	248	450	997	140	40	40	0	230	44	48,5	192	0	120	60	60	128	113
G 47,5/39,5	248	475	997	395	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 47,5/16/23,5	248	475	997	160	40	40	0	235	44	48,5	192	0	120	60	60	128	113
G 47,5/14/25,5	248	475	997	140	40	40	0	255	44	48,5	192	0	120	60	60	128	113
G 50/42	248	500	997	420	40	40	0	0	44	48,5	192	0	120	60	60	128	113
G 50/16/26	248	500	997	160	40	40	0	260	44	48,5	192	0	120	60	60	128	113
G 50/14/28	248	500	997	140	40	40	0	280	44	48,5	192	0	120	60	60	128	113

DUROFIX II - shuttering blocks made of wood-chip concrete

Standard shuttering blocks G with or without thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 510 kg/m³

Annex 2



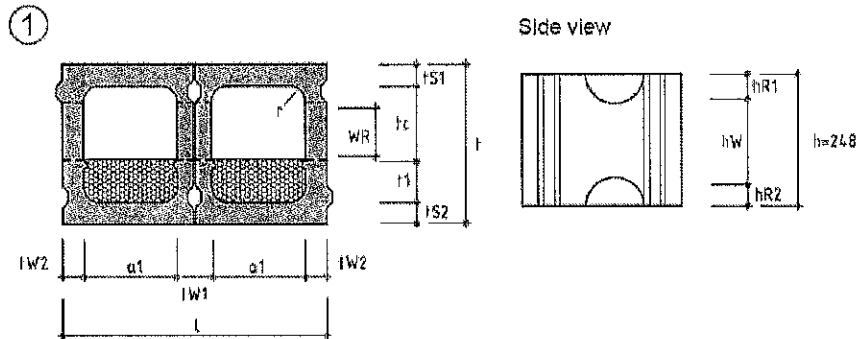
The web recesses are formed respectively above and below a semi-circle
 wR = Diameter
 $hR1$ und $hR2$ = Radius

Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
D 17,5/12	248	175	497	120	35	35	30	0	85	40	166	166	100	50	50	148	78,5
D 20/12	248	200	497	120	40	40	30	0	85	40	166	166	100	50	50	148	78,5
D 20/14	248	200	497	140	30	30	30	0	85	40	166	166	120	60	60	128	113
D 25/16	248	250	497	160	45	45	0	0	85	40	166	166	120	60	60	128	113
D 25/18	248	250	497	180	35	35	0	0	85	40	166	166	120	60	60	128	113
D 30/22	248	300	497	220	40	40	0	0	85	40	166	166	130	65	65	118	133
D 36,5/28	248	365	497	280	42,5	42,5	0	0	85	40	166	166	140	70	70	108	154
D 36,5/29	248	365	497	290	37,5	37,5	0	0	85	40	166	166	140	70	70	108	154
D 37,5/29	248	375	497	290	42,5	42,5	0	0	85	40	166	166	140	70	70	108	154
D 40/32	248	400	497	320	40	40	0	0	85	40	166	166	140	70	70	108	154
D 42,5/34,5	248	425	497	345	40	40	0	0	85	40	166	166	140	70	70	108	154
D 45/37	248	450	497	370	40	40	0	0	85	40	166	166	140	70	70	108	154
D 47,5/39,5	248	475	497	395	40	40	0	0	85	40	166	166	140	70	70	108	154
D 50/42	248	500	497	420	40	40	0	0	85	40	166	166	140	70	70	108	154

DUROFIX II - shuttering blocks made of wood-chip concrete

Stopper blocks / Universal blocks **without** thermal insulation inserts
 Material oven dry density ρ_{dry} of wood-chip concrete of 510 kg/m³

Annex 3.1



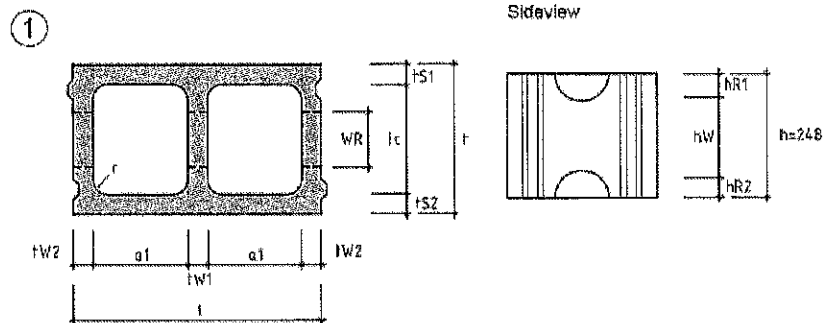
The web recesses are formed always (above and below) as semi circle
wR = Diameter
hR1 und hR2 = Radius

Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
D 25/12/4	248	250	497	120	35	35	0	40	77	40	170	170	100	50	50	148	78,5
D 25/14/4	248	250	497	140	35	35	0	40	77	40	170	170	120	60	60	128	113
D 30/12/10	248	300	497	120	40	40	0	100	77	40	170	170	100	50	50	148	78,5
D 30/14/8	248	300	497	140	40	40	0	80	77	40	170	170	120	60	60	128	113
D 30/16/6	248	300	497	160	40	40	0	60	77	40	170	170	120	60	60	128	113
D 36,5/12/17	248	365	497	120	37,5	37,5	0	170	77	40	170	170	120	60	60	128	113
D 36,5/14/15	248	365	497	140	37,5	37,5	0	150	77	40	170	170	120	60	60	128	113
D 36,5/16/13	248	365	497	160	37,5	37,5	0	130	77	40	170	170	120	60	60	128	113
D 37,5/12/17	248	375	497	120	42,5	42,5	0	170	77	40	170	170	120	60	60	128	113
D 37,5/14/15	248	375	497	140	42,5	42,5	0	150	77	40	170	170	120	60	60	128	113
D 37,5/16/13	248	375	497	160	42,5	42,5	0	130	77	40	170	170	120	60	60	128	113
D 37,5/18/11	248	375	497	180	42,5	42,5	0	110	77	40	170	170	120	60	60	128	113
D 40/14/18	248	400	497	140	40	40	0	180	77	40	170	170	120	60	60	128	113
D 40/16/16	248	400	497	160	40	40	0	160	77	40	170	170	120	60	60	128	113
D 42,5/14/20,5	248	425	497	140	40	40	0	205	77	40	170	170	120	60	60	128	113
D 42,5/16/18,5	248	425	497	160	40	40	0	185	77	40	170	170	120	60	60	128	113
D 45/14/23	248	450	497	140	40	40	0	230	77	40	170	170	120	60	60	128	113
D 45/16/21	248	450	497	160	40	40	0	210	77	40	170	170	120	60	60	128	113
D 47,5/14/25,5	248	475	497	140	40	40	0	255	77	40	170	170	120	60	60	128	113
D 47,5/16/23,5	248	475	497	160	40	40	0	235	77	40	170	170	120	60	60	128	113
D 50/14/28	248	500	497	140	40	40	0	280	77	40	170	170	120	60	60	128	113
D 50/16/26	248	500	497	160	40	40	0	260	77	40	170	170	120	60	60	128	113

DUROFIX II - shuttering blocks made of wood-chip concrete

Stopper blocks / Universal blocks **with** thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 510 kg/m³

Annex 3.2



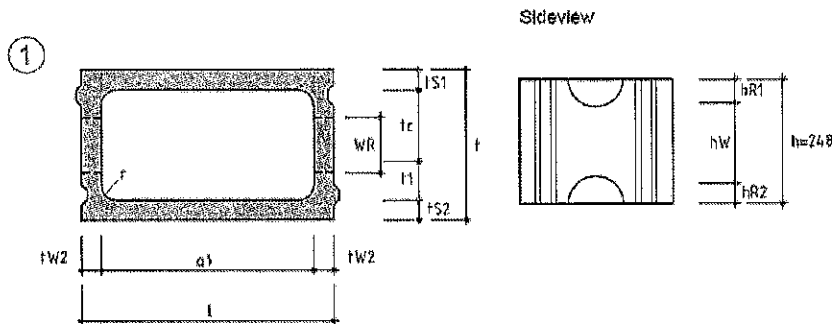
The web recesses are formed respectively above and below a semi-circle
wR = Diameter
hR1 und hR2 = Radius

Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
HLS 17,5/12	248	175	497	120	27,5	27,5	30	0	47	45	180	180	100	50	50	148	78,5
HLS 20/14	248	200	497	120	40	40	30	0	47	45	180	180	100	50	50	148	78,5
HLS 20/15	248	200	497	150	25	25	0	0	47	45	180	180	100	50	50	148	78,5
HLS 25/16	248	250	497	160	45	45	0	0	47	45	180	180	120	60	60	128	113
HLS 25/18	248	250	497	180	35	35	0	0	47	45	180	180	120	60	60	128	113
HLS 25/19	248	250	497	190	30	30	0	0	47	45	180	180	120	60	60	128	113
HLS 30/22	248	300	497	220	40	40	0	0	47	45	180	180	130	65	65	118	133
HLS 30/23	248	300	497	230	35	35	0	0	47	45	180	180	130	65	65	118	133
HLS 30/24	248	300	497	240	30	30	0	0	47	45	180	180	130	65	65	118	133
HLS 32,5/25	248	325	497	250	37,5	37,5	0	0	47	45	180	180	130	65	65	118	133
HLS 36,5/28	248	365	497	280	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
HLS 36,5/29	248	365	497	290	37,5	37,5	0	0	47	45	180	180	140	70	70	108	154
HLS 37,5/28	248	375	497	280	47,5	47,5	0	0	47	45	180	180	140	70	70	108	154
HLS 37,5/29	248	375	497	290	42,5	42,5	0	0	47	45	180	180	140	70	70	108	154
HLS 40/32	248	400	497	320	40	40	0	0	47	45	180	180	140	70	70	108	154
HLS 42,5/34,5	248	425	497	345	40	40	0	0	47	45	180	180	140	70	70	108	154
HLS 45/35,5	248	450	497	355	47,5	47,5	0	0	47	45	180	180	140	70	70	108	154
HLS 45/37	248	450	497	370	40	40	0	0	47	45	180	180	140	70	70	108	154
HLS 47,5/39,5	248	475	497	395	40	40	0	0	47	45	180	180	140	70	70	108	154
HLS 50/42	248	500	497	420	40	40	0	0	47	45	180	180	140	70	70	108	154

DUROFIX II - shuttering blocks made of wood-chip concrete

Standard shuttering blocks HLS **without** thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 800 kg/m³

Annex 4



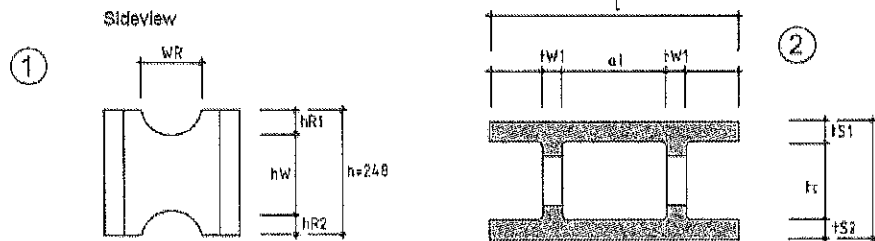
The web recesses are formed respectively above and below a semi-circle
wR = Diameter
hR1 und hR2 = Radius

Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
DII 20/9	248	200	497	90	55	55	30	0	0	52	197	197	80	40	40	168	50,2
DIII 25/12/2	248	250	497	120	55	55	30	20	0	52	197	197	100	50	50	148	78,5
DIII 25/12/4	248	250	497	120	45	45	30	40	0	52	197	197	100	50	50	148	78,5
DIII 25/14/2	248	250	497	140	45	45	30	20	0	52	197	197	120	60	60	128	113
DII 25/14	248	250	497	140	55	55	30	0	0	52	197	197	120	60	60	128	113
DII 25/16	248	250	497	160	45	45	30	0	0	52	197	197	120	60	60	128	113
DIII 30/12/7	248	300	497	160	35	35	30	70	0	52	197	197	120	60	60	128	113
DIII 30/14/5	248	300	497	140	55	55	30	50	0	52	197	197	120	60	60	128	113
DIII 30/14/8	248	300	497	140	40	40	30	80	0	52	197	197	120	60	60	128	113
DIII 30/16/3	248	300	497	160	55	55	30	30	0	52	197	197	120	60	60	128	113
DII 30/14	248	300	497	140	80	80	30	0	0	52	197	197	120	60	60	128	113
DII 30/16	248	300	497	160	70	70	30	0	0	52	197	197	120	60	60	128	113
DII 30/19	248	250	497	190	30	30	30	0	0	52	197	197	120	60	60	128	113
DIII 33/16/8	248	330	497	160	45	45	30	80	0	52	197	197	120	60	60	128	113
DII 33/22	248	330	497	220	55	55	30	0	0	52	197	197	120	60	60	128	113

DUROFIX II - shuttering blocks made of wood-chip concrete

Standard shuttering blocks DII and DIII **with or without** thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 800 kg/m³

Annex 5



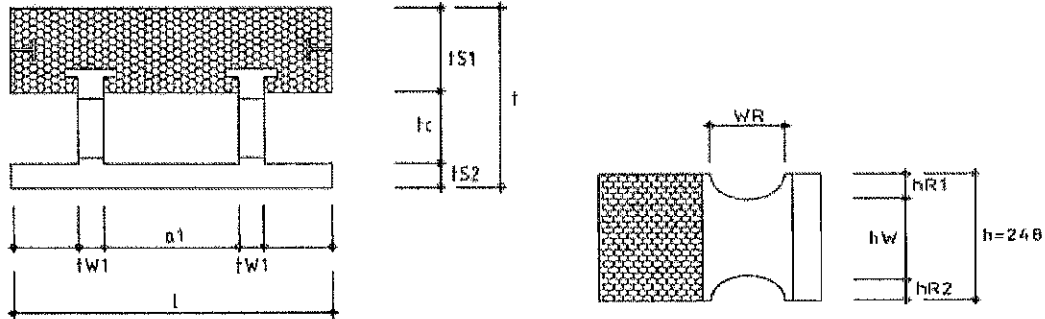
The web recesses are formed respectively above and below a semi-circle
 wR = Diameter
 $hR1$ und $hR2$ = Radius

Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
D 30/19	248	300	497	190	55	55	30	0	50	0	220	88,5	120	60	60	128	113
D 30/20/2	248	250	497	160	45	45	30	0	50	0	220	88,5	120	60	60	128	113

DUROFIX II - shuttering blocks made of wood-chip concrete

H shuttering blocks D **without** thermal insulation inserts
 Material oven dry density ρ_{dry} of wood-chip concrete of 800 kg/m³

Annex 6.1

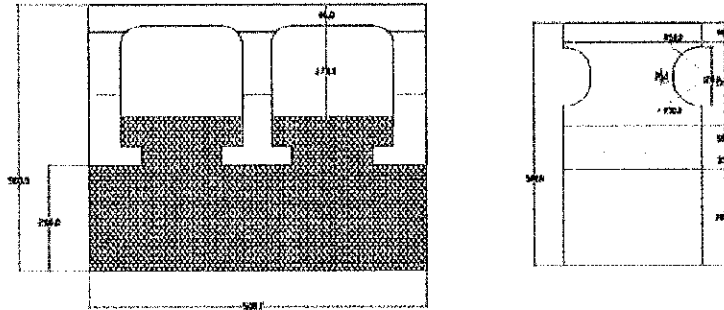


Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
H 30/14/12	248	300	497	140	0	40	30	120	40	108	205	108	120	60	60	128	113
H 37,5/14/19,5	248	375	497	140	0	40	30	195	40	108	205	108	120	60	60	128	113
H 37,5/16/17,5	248	375	497	160	0	40	30	175	40	108	205	108	120	60	60	128	113
H 37,5/18/15,5	248	375	497	180	0	40	30	155	40	108	205	108	120	60	60	128	113
H 40/14/22	248	400	497	140	0	40	30	220	40	108	205	108	120	60	60	128	113
H 40/16/20	248	400	497	160	0	40	30	200	40	108	205	108	120	60	60	128	113
H 40/18/18	248	400	497	180	0	40	30	180	40	108	205	108	120	60	60	128	113
H 42/16/22	248	420	497	160	0	40	30	220	40	108	205	108	120	60	60	128	113
H 42/18/20	248	420	497	180	0	40	30	200	40	108	205	108	120	60	60	128	113
H 44/18/22	248	440	497	180	0	40	30	220	40	108	205	108	120	60	60	128	113

DUROFIX II - shuttering blocks made of wood-chip concrete

H shuttering blocks H with thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 800 kg/m³

Annex 6.2

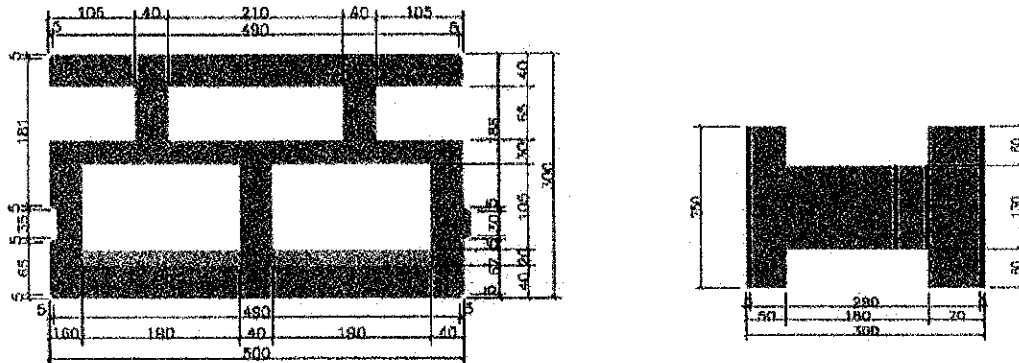


Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
D 30/12/14	248	300	497	120	0	40	0	140	45	45	180	180	80	40	40	168	50,2
D 32,5/12/16,5	248	325	497	120	0	40	0	165	45	45	180	180	80	40	40	168	50,2
D 35/12/19	248	350	497	120	0	40	0	190	45	45	180	180	80	40	40	168	50,2
D 37,5/12/21,5	248	375	497	120	0	40	0	215	45	45	180	180	80	40	40	168	50,2
D 40/12/24	248	400	497	120	0	40	0	240	45	45	180	180	80	40	40	168	50,2
D 42,5/12/26,5	248	425	497	120	0	40	0	265	45	45	180	180	80	40	40	168	50,2
D 45/12/29	248	450	497	120	0	40	0	290	45	45	180	180	80	40	40	168	50,2
D 47,5/12/31,5	248	475	497	120	0	40	0	315	45	45	180	180	80	40	40	168	50,2
D 50/12/34	248	500	497	120	0	40	0	340	45	45	180	180	80	40	40	168	50,2
B 30/14/12	248	300	497	140	0	40	0	120	45	45	180	180	80	40	40	168	50,2
B 32,5/14/14,5	248	325	497	140	0	40	0	145	45	45	180	180	80	40	40	168	50,2
B 35/14/17	248	350	497	140	0	40	0	170	45	45	180	180	80	40	40	168	50,2
B 37,5/14/19,5	248	375	497	140	0	40	0	195	45	45	180	180	80	40	40	168	50,2
B 40/14/22	248	400	497	140	0	40	0	220	45	45	180	180	80	40	40	168	50,2
B 42,5/14/24,5	248	425	497	140	0	40	0	245	45	45	180	180	80	40	40	168	50,2
B 45/14/27	248	450	497	140	0	40	0	270	45	45	180	180	80	40	40	168	50,2
B 47,5/14/29,5	248	475	497	140	0	40	0	295	45	45	180	180	80	40	40	168	50,2
B 50/14/32	248	500	497	140	0	40	0	320	45	45	180	180	80	40	40	168	50,2
B 30/17/9	248	300	497	170	0	40	0	90	45	45	180	180	80	40	40	168	50,2
B 32,5/17/11,5	248	325	497	170	0	40	0	115	45	45	180	180	80	40	40	168	50,2
B 35/17/14	248	350	497	170	0	40	0	140	45	45	180	180	80	40	40	168	50,2
B 37,5/17/16,5	248	375	497	170	0	40	0	165	45	45	180	180	80	40	40	168	50,2
B 40/17/19	248	400	497	170	0	40	0	190	45	45	180	180	80	40	40	168	50,2
B 42,5/17/21,5	248	425	497	170	0	40	0	215	45	45	180	180	80	40	40	168	50,2
B 45/17/24	248	450	497	170	0	40	0	240	45	45	180	180	80	40	40	168	50,2
B 47,5/17/26,5	248	475	497	170	0	40	0	265	45	45	180	180	80	40	40	168	50,2
B 50/17/29	248	500	497	170	0	40	0	290	45	45	180	180	80	40	40	168	50,2

DUROFIX II - shuttering blocks made of wood-chip concrete

HI shuttering blocks D and B with thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 800 kg/m³

Annex 7

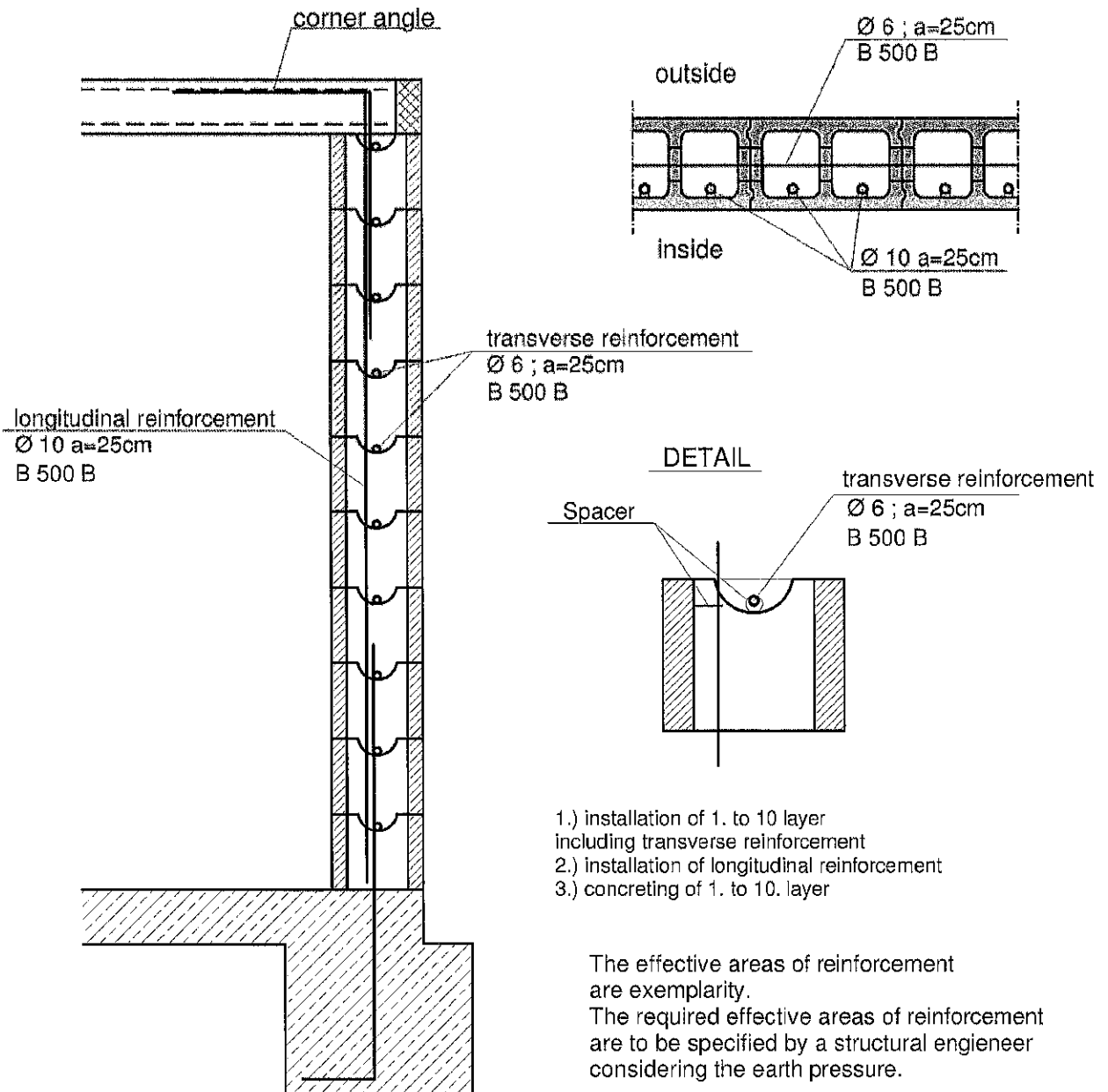


Type	h	t	l	tc	ts1	ts2	r	t1	tw1	tw2	a1	a2	wR	hR1	hR2	hw	AR
RF 30/22	248	300	497	125	40	40	65	0	30	0	210	190	60	220	220	130	264
RF 30/20/2	248	300	497	105	40	40	65	20	30	0	210	190	60	200	200	130	240
RF 30/18/4	248	300	497	85	40	40	65	40	30	0	210	190	60	180	180	130	216
RF 30/16/6	248	300	497	65	40	40	65	40	30	0	210	190	60	160	160	130	192
RF 25/17,4	248	250	997	71	38	32	71	0	32	0	204	204	48	0	155	140	268
RF 30/22	248	300	497	125	40	40	65	0	30	0	210	190	60	220	220	130	264
RF 30/20/2	248	300	497	105	40	40	65	20	30	0	210	190	60	200	200	130	240
RF 30/18/4	248	300	497	85	40	40	65	40	30	0	210	190	60	180	180	130	216
RF 30/16/6	248	300	497	65	40	40	65	40	30	0	210	190	60	160	160	130	192
RF 25/17,4	248	250	997	71	38	32	71	0	32	0	204	204	48	0	155	140	268

DUROFIX II - shuttering blocks made of wood-chip concrete

RF shuttering blocks RF **without** thermal insulation inserts
Material oven dry density ρ_{dry} of wood-chip concrete of 800 kg/m³

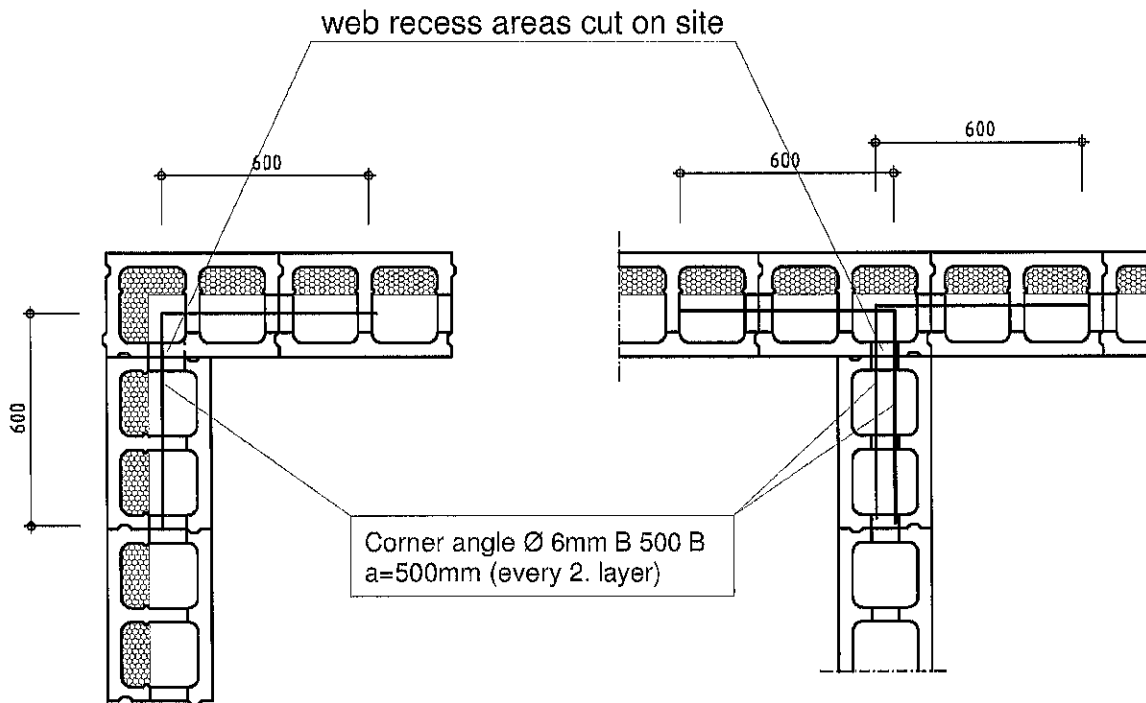
Annex 8



DUROFIX II - shuttering blocks made of wood-chip concrete

Reinforcement system of basement walls

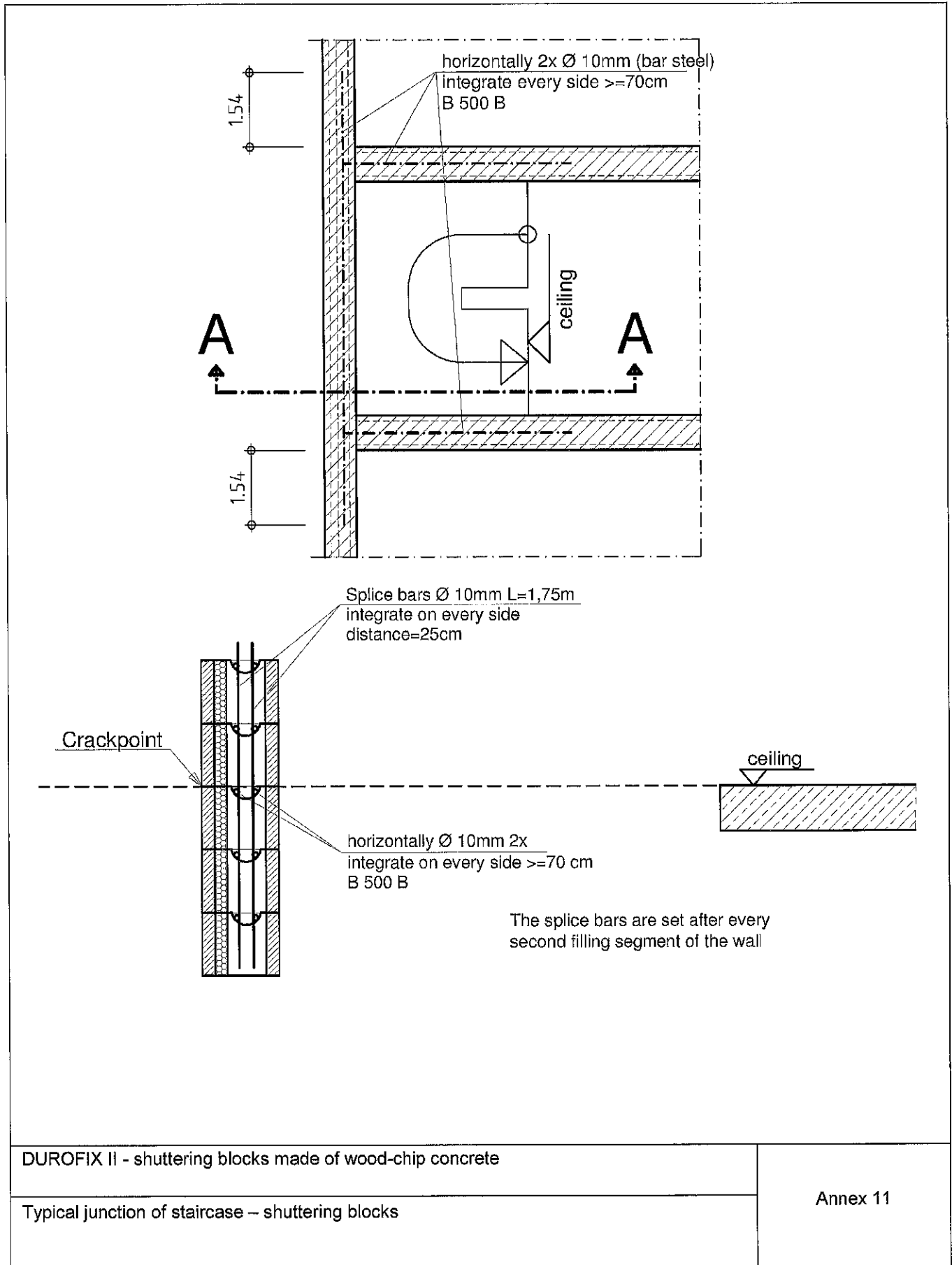
Annex 9

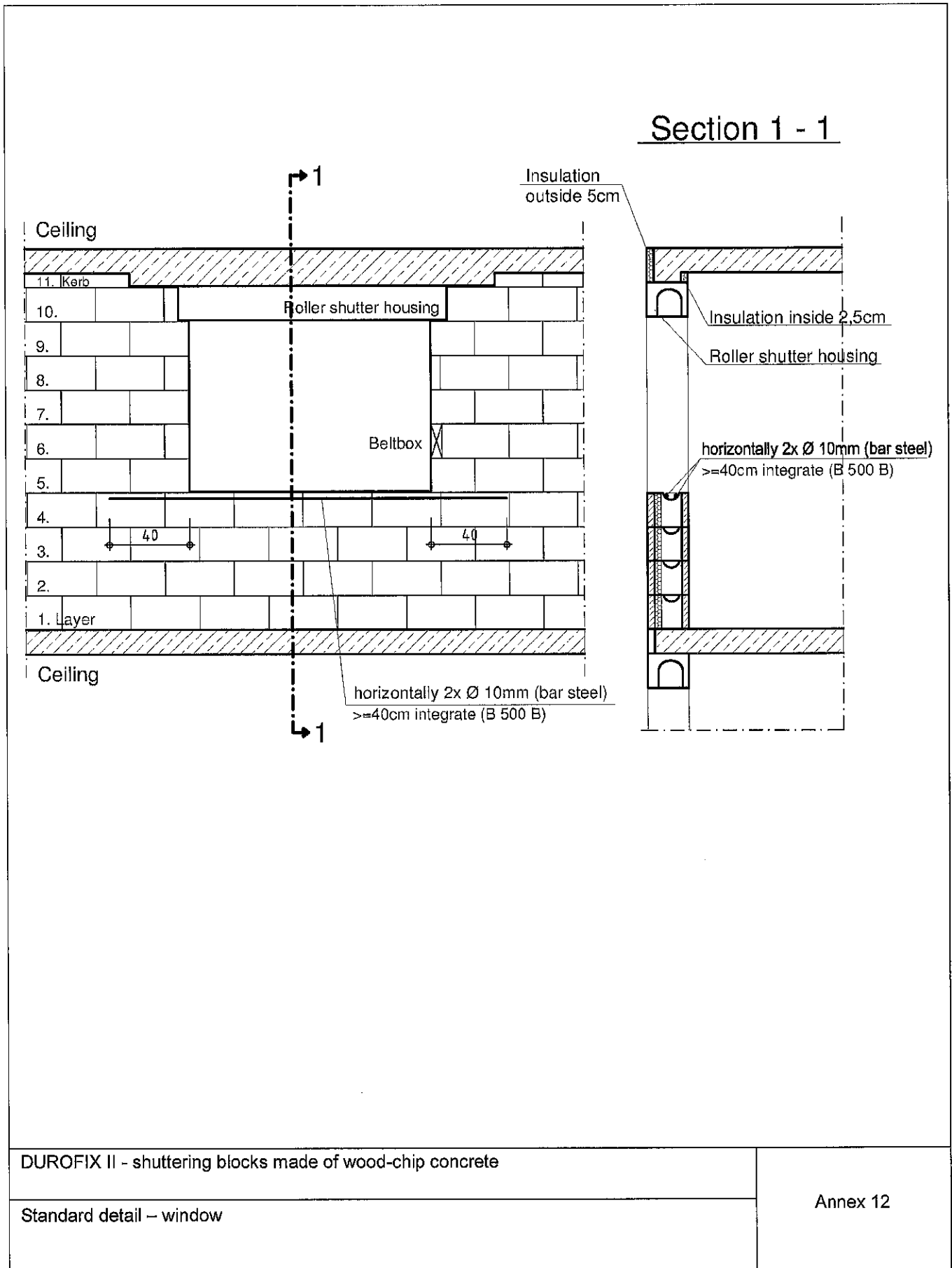


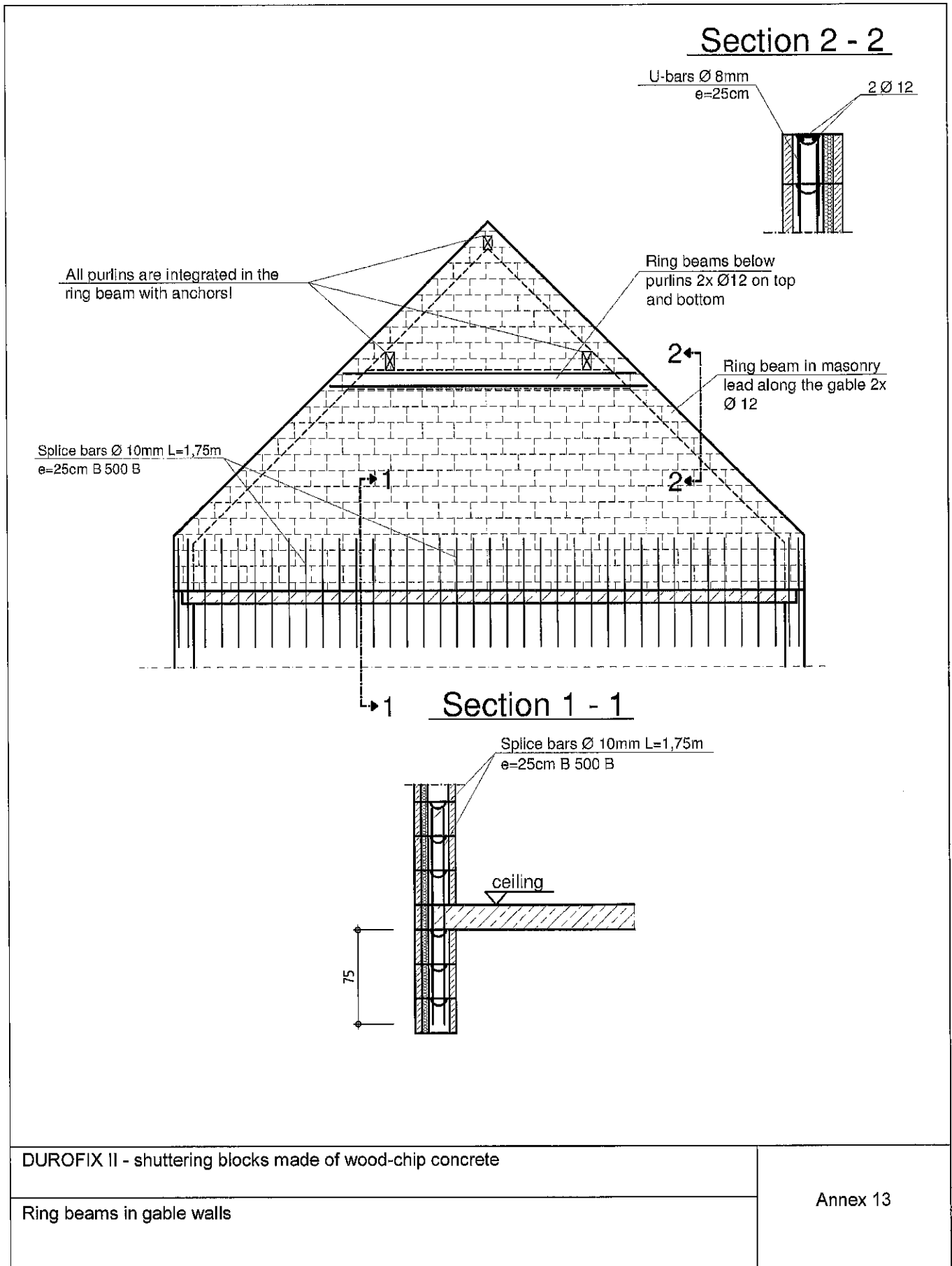
DUROFIX II - shuttering blocks made of wood-chip concrete

Horizontal reinforcement in case of more than 5 full storeys

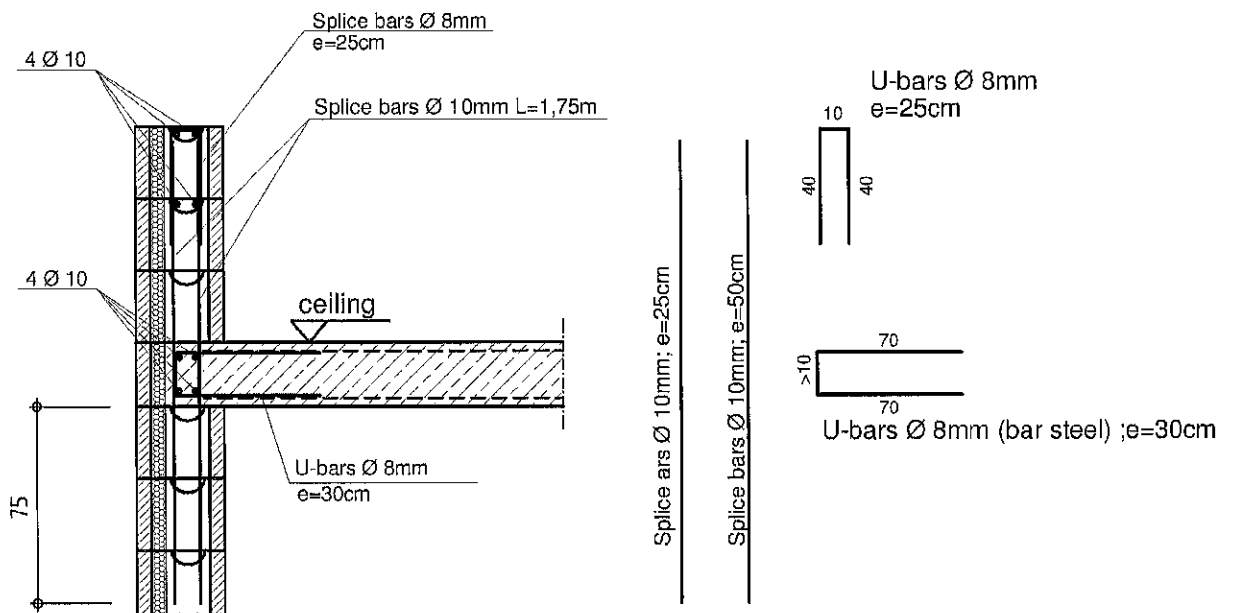
Annex 10







Section 1 - 1

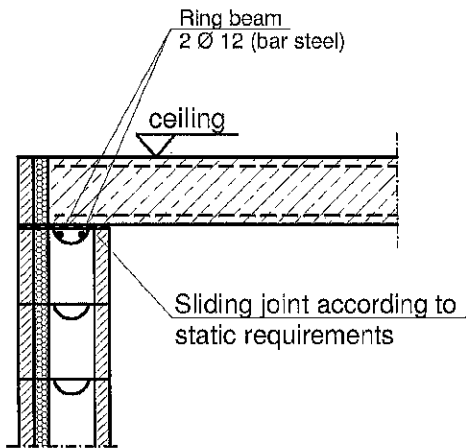


DUROFIX II - shuttering blocks made of wood-chip concrete

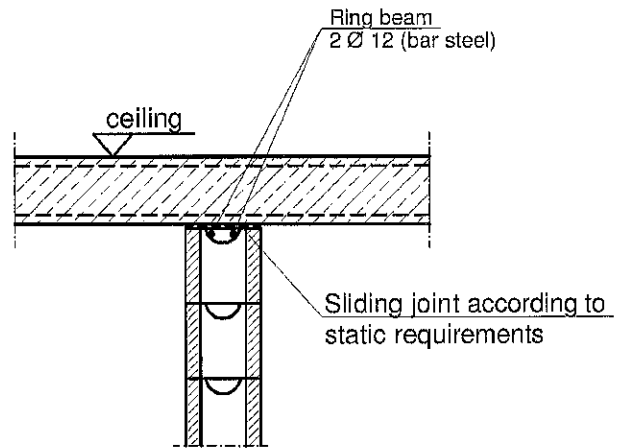
Jamb wall combined with ring beams

Annex 14

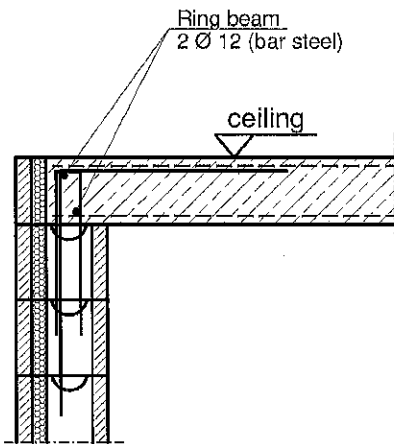
Cross section



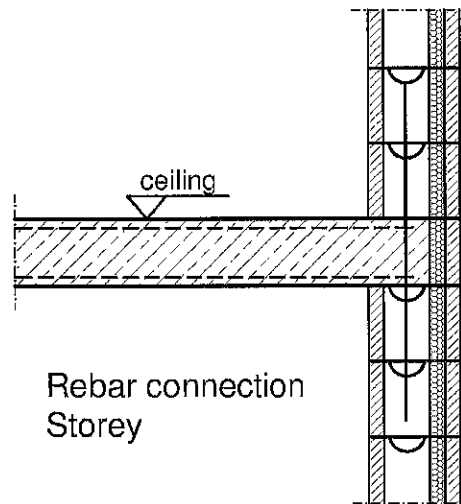
Cross section



Cross section



Cross section



Rebar connection
Storey

Splice bars \varnothing 10mm; e=1,00m; L=1,00m

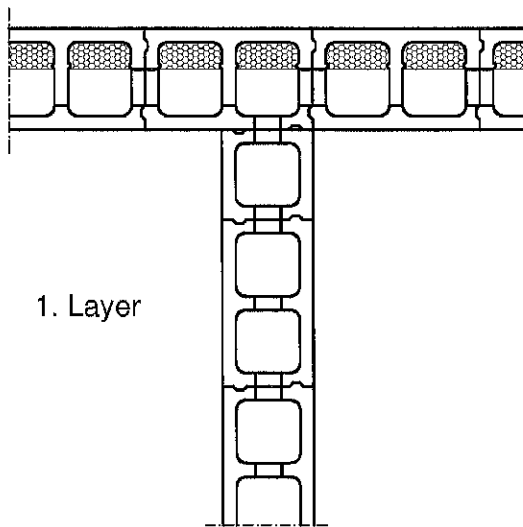
DUROFIX II - shuttering blocks made of wood-chip concrete

Typical junctions between walls / ring beams and ceilings

Annex 15

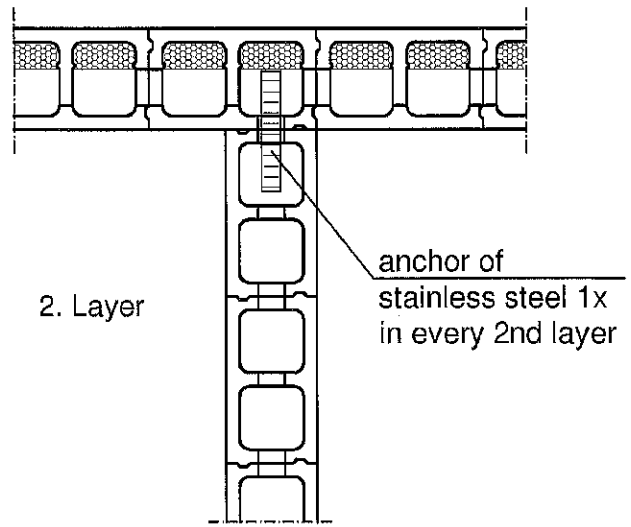
Horizontal section

Bond of shuttering blocks with thermal insulation inserts-wall junction by scarf joint



Horizontal section

Bond of shuttering blocks with thermal insulation inserts-wall junction by scarf joint



DUROFIX II - shuttering blocks made of wood-chip concrete

Typical junctions between walls up to 4 full storeys

Annex 16

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	13162	2012 Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification
EN	13163	2012 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	14474	2004 Precast concrete products - Concrete with wood-chips as aggregate - Requirements and test methods
EN	15498	2008 Precast concrete products – Wood-chip concrete shuttering blocks – Product properties and performance
EN ISO	6946	2007 Building components and building elements – Thermal resistance and thermal transmittance – Calculation method
EN ISO	10211	2007 Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations
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"
DUROFIX II - shuttering blocks made of wood-chip concrete		Annex 17
List of standards and guidelines		