

Approval body for construction products  
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and  
Laender Governments



## European Technical Assessment

ETA-08/0134  
of 3 July 2019

English translation prepared by DIBt - Original version in German language

### General Part

Technical Assessment Body issuing the  
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

VELOX

Product family  
to which the construction product belongs

Non-load bearing permanent shuttering system "VELOX"  
based on shuttering elements of wood-chip concrete  
shuttering leaves with steel clips of construction or spacer  
webs of wood chip concrete

Manufacturer

VELOX-Werk Ges.m.b.H  
Dachberg 10  
9422 Maria Rojach  
ÖSTERREICH

Manufacturing plant

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This European Technical Assessment  
contains

25 pages including 14 annexes which form an integral  
part of this assessment

This European Technical Assessment is  
issued in accordance with Regulation (EU)  
No 305/2011, on the basis of

ETAG 009,  
used as EAD according to Article 66 Paragraph 3 of  
Regulation (EU) No 305/2011.

This version replaces

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## Specific Part

### 1 Technical description of the product

#### 1.1 Description of the construction product

The shuttering system "VELOX" is a non-load-bearing permanent shuttering kit for non-reinforced and reinforced, non-load-bearing and load-bearing, internal and external concrete walls cast in situ.

The shuttering elements (see Annexes A2 and A3) consist of inner and outer shuttering leaves of mineral-bonded boards made of wood chips connected by steel clips for construction (see Annexes A2 to A4 and 1.4.1) or by wood-chip concrete spacer webs (see Annexes A5 and 1.4.2). The spacer webs are fixed to mineral-bonded boards made of wood chips using wood screws.

The shuttering elements with steel clips for construction are assembled on site from individual mineral-bonded boards made of wood chips and steel clips for construction (see Annex A3) or prefabricated in the factory for the shuttering of complete wall sections (see Annex A4). The individual shuttering sections for shuttering to the height of one storey are connected together using screwed metal connector plates (see Annex A4).

The shuttering elements with wood-chip concrete spacer webs (see Annex A5) are not assembled on site from individual mineral-bonded boards made of wood chips and spacer webs but are prefabricated in the factory for the shuttering of complete wall sections only.

The "VELOX" shuttering system does not comprise finishes.

#### 1.2 Shuttering elements

The shuttering elements consist of factory-made inner and outer shuttering leaves (see Annexes A2 to A5) of mineral-bonded boards made of wood chips held together with steel clips for construction (see Annex A3 and A4) or with spacer webs made of wood-chip concrete (see Annex A5) in order to resist the pressure of the concrete.

Shuttering elements without internal thermal insulation (see Annex A2, 1.) have inner and outer shuttering leaves made of single-layer wood-chip concrete (see 1.3.1).

The most important dimensions of the shuttering elements without thermal insulation are within the following ranges:

- concrete core thicknesses: 80 to 430 mm
- total wall thicknesses without rendering: 130 to 600 mm
- thickness of inner shuttering leaf: 25 to 85 mm
- thickness of outer shuttering leaf: 25 to 85 mm
- length of standard shuttering leaves: 2000 mm
- height of standard shuttering leaves: 500 mm

Shuttering elements with internal thermal insulation (see Annex A2, 2.) have 2-layer shuttering leaves on the outside, consisting of wood-chip concrete and insulating material (see 1.3.2) and on the inside, single-layer shuttering leaves made of wood-chip concrete (see 1.3.1).

The most important dimensions of the shuttering elements with thermal insulation are within the following ranges:

- concrete core thicknesses: 120 to 430 mm
- total wall thicknesses without rendering: 190 to 930 mm
- thickness of inner shuttering leaf: 25 to 85 mm
- thickness of outer shuttering leaf: 25 to 85 mm

- thickness of thermal insulation layer: 20 to 330 mm
- length of standard shuttering leaves: 2000 mm
- height of standard shuttering leaves: 500 mm

Prefabricated shuttering for complete wall sections as per Annexes A4 and A5 has a maximum length of 6 m and a maximum height of 4 m.

The system can be used to construct straight walls.

### 1.3 Components of the shuttering kit

#### 1.3.1 Shuttering leaves without internal thermal insulation

Shuttering leaves without internal thermal insulation (see Annex A2, 1.) are single-layer and consist of wood-chip concrete in accordance with EN 14474. The thickness of these shuttering leaves is 85 mm maximum. The apparent densities of the wood-chip concrete panels used are as follows:

- WS 35, WS 35 rot, WS 50, WS 75 max 810 kg/m<sup>3</sup>
- WSD 30, WSD 35, WSD 50 max 1200 kg/m<sup>3</sup>

The material data sheets for the composition of the shuttering leaves are deposited with DIBt.

The single-layer shuttering leaves can be up to 2000 mm long and up to 500 mm high.

#### 1.3.2 Shuttering leaves with internal thermal insulation

Shuttering leaves with internal thermal insulation (see Annex A2, 2.) have 2 layers consisting of wood-chip concrete and insulating material. Shuttering leaves as per 1.3.1 are used for the wood-chip concrete layer. The maximum thickness of the wood-chip concrete shuttering leaves is 85 mm. The maximum thickness of the 2-layer outer shuttering leaf is 365 mm.

The two-layer shuttering leaves can be up to 2000 mm long and up to 500 mm high.

### 1.4 Accessory parts

#### 1.4.1 Steel clips for construction (Annexes A3, B5.1 to B5.4)

The inner and outer wood-chip concrete shuttering leaves are connected by steel clips for construction. The following steel clips for construction are available:

1. Steel clips for construction for the base of the first shuttering layer:
  - ES (one-sided): mounted directly on the floor (see figures in Annex A3 and Annex B4.4, bottom),
  - AB ("Aufsatzbügel"): for the extension of existing walls in vertical direction (also for the extension of existing masonry walls) (see Annex B4.4, bottom),
  - HB ("Deckenrost-Stecksystem"): below the floor level for fixation of the floor edge shuttering when concreting floors on top of existing walls (also for concreting floors on top of existing masonry walls) (see Annex B4.4, top).
2. Steel clips for construction between the shuttering layers:
  - DS (double-sided) (see Annex A3),
3. Steel clips for construction within a shuttering layer:
  - STB ("Steckbügel") halfway up a shuttering layer, holes are drilled into the shuttering leaves, steel clips for construction are fed through and fixed on the unsecured side with a nail (see top figure in Annex A3).
4. Steel clips for construction at the top of the topmost shuttering layer of the storey wall:
  - RB ("Rostbügel"): below the floor level for fixation of the floor edge shuttering (see bottom figure in Annex B4.1).

The steel clips for construction are made of stove-enamelled steel. The nails are made of steel or galvanised steel.

**1.4.2 Wood-chip concrete spacer webs**

The inner and outer wood-chip concrete shuttering leaves can also be screw-connected using wood-chip concrete spacer webs. The webs are made from the same material as the WSD 50 mineral-bonded boards made of wood chips (see Annex A5).

**1.4.3 Wood screws for screwing the wood-chip concrete spacer webs to the mineral-bonded boards made of wood chips for prefabricated wall shuttering.**

The connection between the shuttering leaf and the wood-chip concrete spacer web is made by wood screws according to EN 14592. The wood screws shall be at least 4 mm in diameter. The minimum penetration in the spacer webs is 9 times the screw diameter (see also Annex A5). The edge distance must be between 5 cm and 6 cm. The vertical centre distance of the wood screws within a distance strip may not exceed 10 cm.

**1.4.4 Metal connector plates for prefabricated wall shuttering**

Metal connector plates in accordance with Annex A4 (see bottom) are used, which are connected to the shuttering leaves using nails in accordance with 1.4.5, as set out in Annex A4.

**1.4.5 Nails (Annex A3)**

Nails in accordance with EN 14592 are used to interconnect the wood-chip concrete shuttering leaves to form a tight joint between the wood-chip concrete shuttering leaves in horizontal and vertical direction as well as at head joints or corners. For this, three nails are distributed over the height and one nail over the length of the shuttering leaf, see Annex 3, B4.1 and B4.2)

The nails are made of steel or galvanised steel.

**1.4.6 Wall end leaves (vertical and horizontal) (Annex A3, B4.1 and B4.2)**

Wall end leaves are used to define the vertical (e.g. for door or window openings) and horizontal edges (e.g. for parapets or lintels) of a wall; they are inserted at the ends of the shuttering leaves between the inner and outer wood-chip concrete shuttering leaves and are fixed using nails. All panels listed in Section 1.3.1 can be used for this purpose.

**2 Specification of the intended use in accordance with the applicable European Assessment Document**

The kit is intended to be used for the construction of internal and external walls above or below ground, either load-bearing or non-load-bearing, including walls subject to fire safety regulations.

When this type of construction is used below ground, a waterproofing liner in accordance with the national regulations shall be provided, depending on the presence of pressurised or non-pressurised water. The waterproofing liner shall be protected from mechanical damage by an impact resistant protective layer.

In accordance with EOTA TR 034 the following use categories apply:

- Category IA 2: product with indirect contact to indoor air (e.g. covered by impermeable products).
- Category S/W 3: product with no contact to soil-, ground- or surface water

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

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

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

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

##### **3.1.1 Resulting structural pattern**

Under end-use conditions, walls made with "VELOX" shuttering elements and steel clips for construction are continuous type walls in accordance with ETAG 009, Section 2.2.

Under end-use conditions, walls made with "VELOX" shuttering elements and spacer webs made from wood-chip concrete panels are grid type walls in accordance with ETAG 009, Section 2.2.

##### **3.1.2 Efficiency of filling**

Efficient filling is possible considering the manufacturer's instructions, without bursting of the shuttering, formation of voids or insufficient concrete coverage of the reinforcement within the concrete core.

The requirements of ETAG 009, Section 6.1.2 have been met.

##### **3.1.3 Possibility of steel reinforcement**

The manufacturer's instructions allow for the incorporation of wall steel reinforcement in accordance with EN 1992-1-1 or the corresponding national regulations.

The requirements of ETAG 009, Section 6.1.3 have been met.

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

##### **3.2.1 Reaction to fire**

- a) "Velox" shuttering elements without thermal insulation (see Annex A2, 1.) meet the requirements of class A2-s1, d0 in accordance with EN 13501-1. This classification applies to wood-chip concrete shuttering leaves in accordance with the material datasheets deposited with DIBt with apparent densities of between 500 and 825 kg/m<sup>3</sup> and a minimum shuttering leaf thickness of 25 mm.
- b) "Velox" shuttering elements with thermal insulation (see Annex A2, 2.) as well as storey-height wall elements made from them meet the requirements of class B-s1, d0 in accordance with EN 13501-1 under the following conditions:
  - The insulation layer is made from EPS with a minimum fire classification of class E, an apparent density of 15 kg/m<sup>3</sup> ± 10% and a maximum thickness of 165 mm.
  - The minimum thickness of the shuttering leaf is 35 mm and the minimum apparent density of the wood-chip concrete is 560 kg/m<sup>3</sup>.
- c) Shuttering elements with an insulation layer which does not meet the conditions set out in Section 3.2.1 b) are classified as class E in accordance with EN 13501-1 as long as the integrated insulation material also meets the requirements of class E in accordance with EN 13501-1.

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

#### 3.3.1 Content and/or release of dangerous substances

Composition	Findings
Composition deposited with DIBt	BWR 3 not relevant

#### 3.3.2 Water vapour permeability

The maximum nominal value of the wood-chip concrete shuttering leaves water vapour transmission coefficient is  $\mu = 30$ .

Tabulated water vapour transmission coefficient values for the concrete columns, depending on type and apparent density as well as the thermal insulation can be found in EN ISO 10456.

Using these values, the calculation of the maximum annual interstitial condensation in accordance with EN ISO 13788 showed a safe margin.

#### 3.3.3 Water absorption

The maximum nominal value for water absorption by the wood-chip concrete shuttering leaves after short-term partial immersion is  $W_p = 8 \text{ kg/m}^2$ .

The requirements of ETAG 009, Section 6.3.3 have been met.

#### 3.3.4 Watertightness

Since the "VELOX" shuttering system does not comprise finishes, the option "No performance assessed" given in ETAG 009, Table 3 applies.

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

#### 3.4.1 Bond strength between the shuttering leaves and the concrete core and resistance to impact load

The bond strength is at least equal to the resistance of the wood-chip concrete shuttering leaves to the pressure of fresh concrete, see Section 3.4.2.

For concrete walls (without consideration of finishes) constructed using the "VELOX" shuttering system and designed in accordance with EN 1992-1-1 or in accordance with the relevant national regulations, it can be assumed that the concrete core will ensure sufficient resistance to impact load for the entire wall under normal use conditions.

The requirements of ETAG 009, Section 6.4.1 have been met.

#### 3.4.2 Resistance to filling pressure

In order to provide appropriate resistance to the pressure of fresh concrete, the following shall be fulfilled:

- The bending tensile strength of the wood-chip concrete shuttering leaves shall be at least 500 kPa (shuttering leaf type WS) or at least 1000 kPa (shuttering leaf type WSD).
- The connection between steel clip for construction and shuttering leaf (see 1.4.1) resp. between spacer web and shuttering leaf (see 1.4.2) shall resist a load of at least 1.5 kN.
- As factory-applied thermal insulation for the shuttering element according to (see Annex A2, 2.), only insulating materials in accordance with harmonised European product standards or European Assessment Documents (EADs) shall be used. In addition, the stress at 10% compression and/or the compressive strength (if both are given, the lower value shall be taken) shall not be lower than 80 kPa. Furthermore, in order to ensure that the thermal conductivity is not compromised, the fresh concrete shall not penetrate into the integrated thermal insulation. If this cannot be guaranteed, a waterproof sheet must be applied to the inside of the integrated thermal insulation in such a way that it prevents the penetration of fresh concrete into the integrated thermal insulation when the concrete is poured.

The requirements of ETAG 009, Section 6.4.2 have been met.

### 3.4.3 Safety against personal injury by contact

The wood-chip concrete shuttering leaves do not show sharp or cutting edges upon delivery to the site.

Since, due to the rough surface of the wood-chip concrete shuttering leaves, there is a risk of abrasion or cutting wounds to persons, gloves should be worn when working on the construction site.

The requirements in accordance with ETAG 009, Section 6.4.3 have been met.

## 3.5 Protection against noise (BWR 5)

### 3.5.1 Airborne sound insulation

The values for the weighted sound insulation rating  $R_w$  in accordance with EN ISO 717-1 of walls made with "VELOX" shuttering elements are tabulated in Table 1 depending on the mass per wall area (including plaster).

Table 1: Weighted sound insulation rating  $R_w$  depending on the mass per wall area (including gypsum plaster of 1,5 cm thickness inn- and outside) and the shuttering element types.

Shuttering element type	Mass per wall area (including rendering)	Weighted sound insulation rating $R_w$ in accordance with EN ISO 717-1
	[kg/m <sup>2</sup> ]	[dB]
TT25	≥ 487	60
GT25	≥ 460	60
TT27	≥ 537	60
TT30	≥ 597	63
TT35	≥ 713	63
GT30	≥ 566	64
GU30	≥ 550	62
XG30	≥ 492	61

The option "No performance assessed" in ETAG 009, Table 3 is applied for walls made of other types of "VELOX" shuttering elements.

### 3.5.2 Sound absorption

The option "No performance assessed" in ETAG 009, Table 3 applies.

## 3.6 Energy economy and thermal insulation (BWR 6)

### 3.6.1 Thermal resistance

The nominal thermal conductivity value  $\lambda_{D,w}$  determined in accordance with EN ISO 10456, Annex B.2 of the wood-chip concrete of the shuttering leaves depending on the dry apparent density  $\rho_{dry,w}$  is shown in Table 2.



**Table 2:** Nominal thermal conductivity value  $\lambda_{D,w}$  of wood-chip concrete depending on dry apparent density  $\rho_{dry,w}$

Dry apparent density $\rho_{dry,w}$ [kg/m <sup>3</sup> ]	Nominal thermal conductivity value $\lambda_{D,w}$ [W/(m × K)]
475	0,100
550	0,114
650	0,123
800	0,200
1000	0,370

### 3.6.2 Influence of moisture transfer on thermal capacity of the wall

Using the values from Section 3.3.2, the calculation of the maximum annual interstitial condensation in accordance with EN ISO 13788 showed a safe margin.

### 3.6.3 Heat capacity

The heat capacity value  $c$  of the wood-chip concrete shuttering leaves is  $c^\circ = 1.50^\circ \text{kJ}/(\text{kg}^\circ \times \text{K})$  in accordance with EN 15498, Section 5.2.8.2.

Tabulated heat capacity values  $c$  for the concrete columns and the thermal insulation layers are set given in EN ISO 10456.

## 3.7 General aspects

### 3.7.1 Resistance to deterioration

#### Physical agents

The relative changes in thickness  $\Delta \varepsilon_d$  of the wood-chip concrete shuttering leaves shall not exceed a value of 3 % and the relative changes in the length  $\Delta \varepsilon_l$  and the width  $\Delta \varepsilon_b$  of the wood-chip concrete shuttering leaves shall not exceed a value of 0.5 %.

The requirements in accordance with ETAG 009, Section 6.7.1.1 have been met.

#### Chemical agents

The steel components of the shuttering kit "VELOX" which are subject to a risk of corrosion are steel clips for construction, wood screws and nails. The steel clips for construction are protected against corrosion by a stove-enamel finish and the wood screws and nails are made of galvanized steel. There is no corrosion within the concrete caused by the steel components of the shuttering kit.

Finishes are not covered by this ETA. Therefore it is not possible to indicate suitable cleaning products for the surface.

The requirements in accordance with ETAG 009, Section 6.7.1.2 have been met.

#### Biological agents

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

The wood-chip concrete and thermal insulation do not present a food source and in general do not form voids in which vermin could nest.

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

The requirements in accordance with ETAG 009, Section 6.7.1.3 have been met.

### 3.7.2 Resistance to normal use damages

#### Normal use impacts

For concrete walls (without consideration of finishes) constructed with the "VELOX" shuttering system and designed in accordance with EN 1992-1-1 or in accordance with the relevant national regulations, it can be assumed that the concrete core will ensure sufficient resistance to impact for the entire wall in normal use.

The requirements in accordance with ETAG 009, Section 6.7.2.1 have been met.

#### Incorporation of ducts

The manufacturer's instructions show how to produce horizontal perforations through the walls which are necessary for passing through ducts.

The requirements in accordance with ETAG 009, Section 6.7.2.2 have been met.

#### Fixing of objects

It is not possible to fix objects to the wood-chip concrete shuttering leaves. The part of the fixings required for mechanical stability must be anchored within the concrete core.

The requirements in accordance with ETAG 009, Section 6.7.2.3 have been met.

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

In accordance with the Guideline for European Technical Approval ETAG 009, June 2002, used as European Assessment Document (EAD) in accordance with Article 66 Paragraph 3 of Regulation (EU) No. 305/2011, Commission Decision 98/279/EC applies, as last amended by Commission Decision 2001/596/EC.

For shuttering elements classified as A2-s1, d0 or B-s1, d0 system 1 applies with regard to reaction to fire, since the conditions in the footnote (\*) in accordance with Decision 1998/279/EC, as last amended by Decision 2001/596/EC apply (limitation of organic materials content).

In all other cases, system 2+ applies.

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

The technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with DIBt.

Issued in Berlin on 3 July 2019 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow  
Head of Department

*beglaubigt:*  
Dr.-Ing. Alex

### Characteristics of product

The shuttering kit "VELOX" consists of the following components:

- inner and outer shuttering leaves of mineral-bonded boards made of wood chips and
- accessory parts,

see section 1 of the "Special Part".

#### 1. Mineral-bonded boards made of wood chips

Examples for the use of the mineral-bonded boards made of wood chips for the inner and outer shuttering leaves are given Annex A2. In the Table of Annex A2 are also given the dimensions of the shuttering leaves.

The most important material characteristics of the shuttering leaves of wood chip concrete are given in Table 1.

Table 1: Characteristics of the mineral-bonded boards made of wood chips according to EN 13168

Type of shuttering leaf	Characteristics
Same properties of WS and WSD	Tolerances of the dimensions of the wood-chip concrete shuttering leaves Length according to EN 822: +3 mm, -5 mm Width according to EN 822: ±3 mm Thickness according to EN 823: +3 mm, -2 mm Squereness according to EN 824: ≤ 4 mm/m Chloride content according to Annex D.1 of EN 13168: ≤ 0,35 % Dimensional stability after 48 h storage at (70 ± 2) ° C and (90 ± 5)% relative humidity: Change in thickness: +3 %, Change in length: +0,5 %, Change in width: +0,5 %
WS	Nominal value of bulk density: max 810 kg/m <sup>3</sup> Compressive stress at 10% compression or compressive strength according to EN 826: ≥ 1000 kPa Bending strength as a function of the thickness according to EN 12089: ≥ 500 kPa
WSD	Nominal value of bulk density: max 1200 kg/m <sup>3</sup> Compressive stress at 10% compression or compressive strength according to EN 826: ≥ 1000 kPa Bending strength as a function of the thickness according to EN 12089: ≥ 1000 kPa

The nominal values of the thermal conductivity of the wood-chip concrete shuttering leaves as a function of the apparent density correspond to Table 2 of the "Special Part" of the ETA.

As factory-applied thermal insulation for the shuttering element according to (see Annex A2, 2.), only insulating materials in accordance with harmonised European product standards or European Assessment Documents (EADs) shall be used. In addition, the stress at 10% compression and/or the compressive strength (if both are given, the lower value shall be taken) shall not be lower than 80 kPa. Furthermore, in order to ensure that the thermal conductivity is not compromised, the fresh concrete shall not penetrate into the integrated thermal insulation. If this cannot be guaranteed, a waterproof sheet must be applied to the inside of the integrated thermal insulation in such a way that it prevents the penetration of fresh concrete into the integrated thermal insulation when the concrete is poured.

VELOX	Annex A1 Page 1 of 2
Characteristics of product	

## 2. Accessory parts

The accessory parts include:

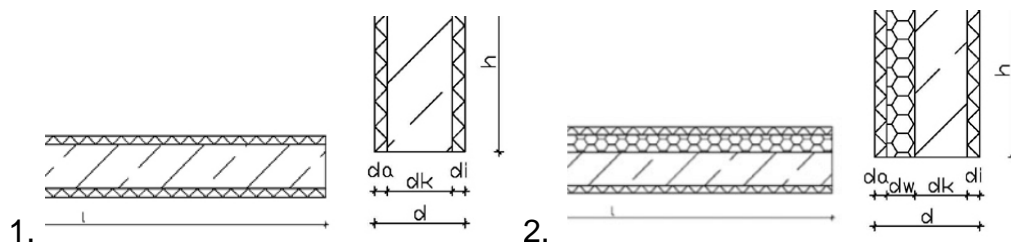
- steel clips for construction ES, DS, RB, AB, HB and STB (see section 1.4.1),
- wood-chip concrete spacer webs (see section 1.4.2),
- wood screws for screwing the wood-chip concrete spacer webs to the mineral-bonded boards made of wood chips for prefabricated wall shuttering (see section 1.4.3),
- metal connector plates for prefabricated wall shuttering (see section 1.4.5),
- nails (see section 1.4.5) and wall end leaves (see section 1.4.6).

VELOX

Characteristics of product

Annex A1  
Page 2 of 2

English translation prepared by DIBt



Type	Fig.	L	d	d <sub>k</sub>	d <sub>a</sub>	d <sub>i</sub>	d <sub>w</sub>	h
		[mm]	[mm]	[mm]	[mm]	[mm]	(mm)	[mm]
NN18	1	2000	180	120	30	30	-	500
TT15	1	2000	150	80	35	35	-	500
TT20	1	2000	200	130	35	35	-	500
TT22	1	2000	220	150	35	35	-	500
TT25	1	2000	250	180	35	35	-	500
TT27	1	2000	270	200	35	35	-	500
TT30	1	2000	300	230	35	35	-	500
GT25	1	2000	250	165	50	35	-	500
GT30	1	2000	300	215	50	35	-	500
GG25	1	2000	250	150	50	50	-	500
GG30	1	2000	300	200	50	50	-	500
XG30	1	2000	300	175	50	75	-	500
GU30	1	2000	300	200	50	50	-	500
ET27	2	2000	270	150	35	35	50	500
ET30	2	2000	300	150	35	35	80	500
ET32	2	2000	320	150	35	35	100	500
ET33,5	2	2000	335	150	35	50	100	500
ET34	2	2000	340	150	35	35	120	500
ET35	2	2000	350	130	35	35	150	500
ET35,5	2	2000	355	150	35	50	120	500
ET37	2	2000	370	150	35	35	150	500
ET38,5	2	2000	385	150	35	50	150	500
ET40	2	2000	400	180	35	35	180	500

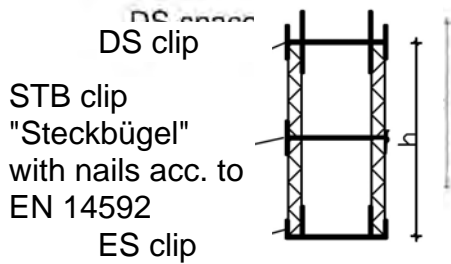
electronic copy of the eta by dibt: eta-08/0134

VELOX

Examples of types of shuttering elements

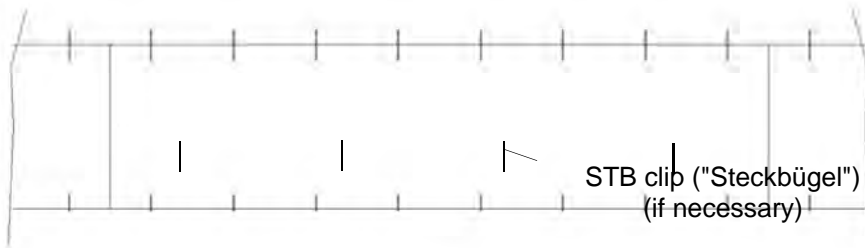
Annex A2

# Shuttering system VELOX

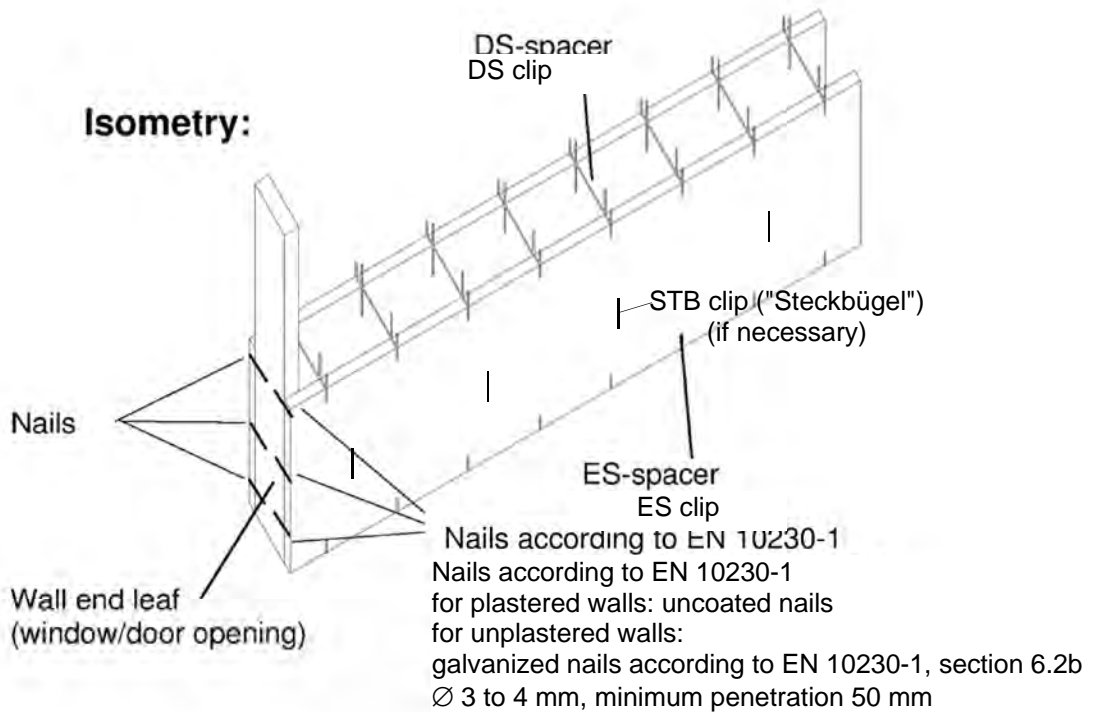


**Cross section:**  
1. layer

**View:**



**Isometry:**



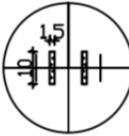
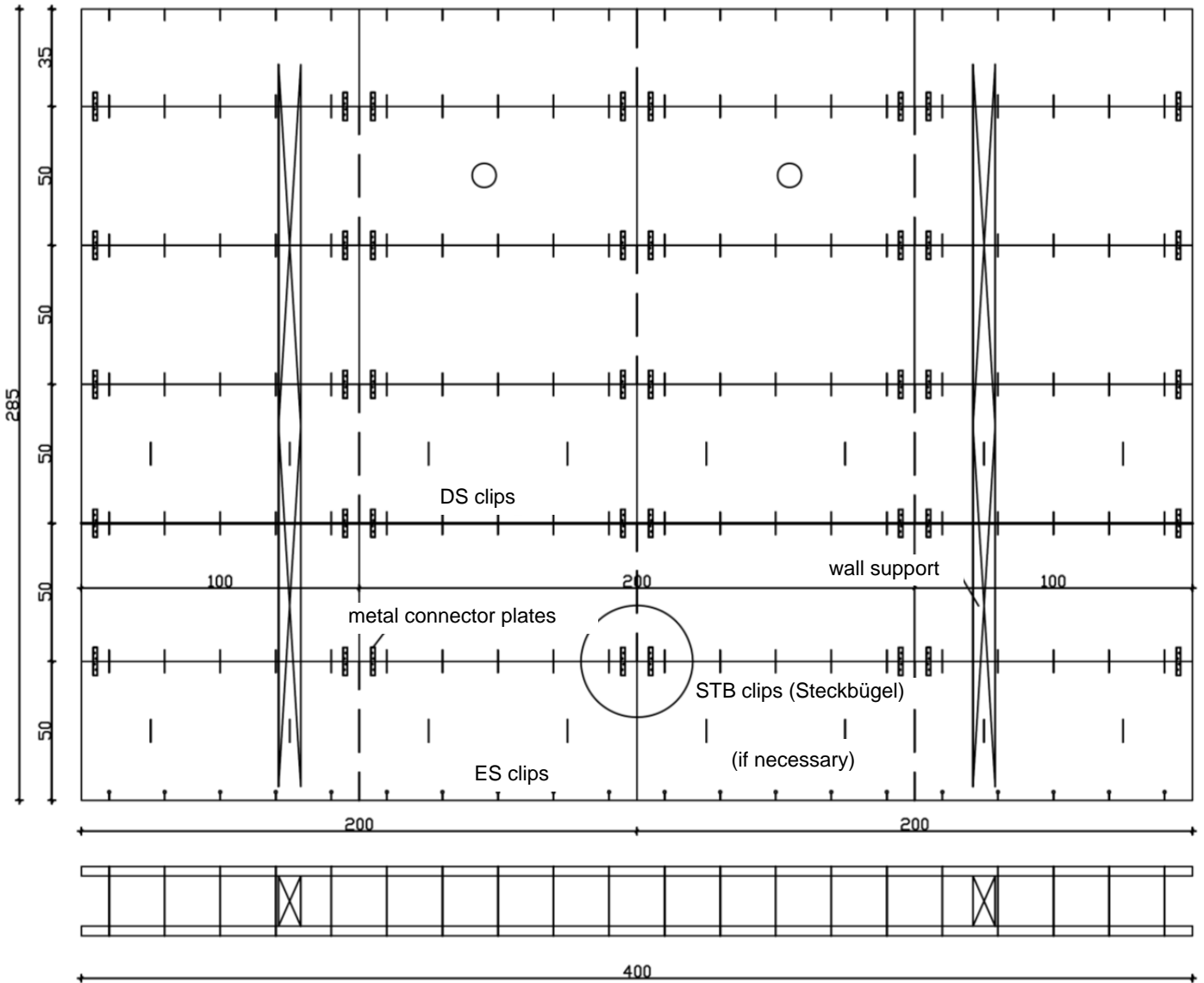
VELOX

Shuttering system "VELOX"

Annex A3

# Prefabricated wall section with steel clips for construction

dimensions in cm



Shank nails according to EN 14592  
 Ø 3 to 4 mm,  
 Minimum penetration:  
 boards up to 35 mm thick: 33 mm  
 boards up to 55 mm thick: 48 mm

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VELOX	Annex A4
Prefabricated wall section with steel clips for construction	





Standards and Guidelines		Issue	Title
EN	206	2013+A1:2016	Concrete – 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	2012+A2:2016	Thermal insulation products for buildings – Factory made products of expanded polystyrene (EPS) – Specification
EN	13168	2012+A1:2015	Thermal insulation products for buildings – Factory made products of expanded cork (ICB) – Specification
EN	13501-1	2007+A1:2009	Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests
EN	13501-2	2016	Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services
EN	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	717-1	2013	Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation
EN ISO	6946	2017	Building components and building elements – Thermal resistance and thermal transmittance – Calculation method
EN ISO	10456	2007+AC:2009	Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values
EN ISO	13788	2001	Hygrothermal performance of building components and building elements – Internal surface temperature to avoid critical surface humidity and interstitial condensation – Calculation methods
ETAG	004	2013-06	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"
VELOX			Annex B1
List of standards and guidelines			

### Instructions for determining the resistance to fire for the intended use

The walls are only exposed to fire on one side.

The fire resistance of non-load-bearing walls constructed with the shuttering elements "VELOX" with wood-chip concrete spacer webs (see chapter 1.4.2 in the "Special Part" and Annex A5) may be determined under the following conditions according to EN 1992-1-2, Table 5.3 in conjunction with national annexes in force at the place of use:

- The reaction to fire class according to 3.1.6 of the shuttering elements "VELOX" corresponds to at least B-s1, d0.
- The concrete of the concrete core meets at least the concrete strength class C16/20.
- As wall thickness according to EN 1992-1-2, Table 5.3 is used the thickness of the concrete core.
- All requirements according to EN 1992-1-2, sections 5.1 and 5.2 with the national annexes in force at the place of use are fulfilled.

The fire resistance of load-bearing walls constructed with the shuttering elements "VELOX" with wood-chip concrete spacer webs (see chapter 1.4.2 in the "Special Part" and Annex A5) may be determined under the following conditions according to EN 1992-1-2, Table 5.4, columns "wall exposed on one side" in conjunction with national annexes in force at the place of use:

- The reaction to fire class according to 3.1.6 of the shuttering elements "VELOX" corresponds to at least B-s1, d0.
- The wall was designed in accordance with EN 1992-1-1 only taking into account the load-bearing effect of the concrete or reinforced concrete.
- The concrete of the concrete core meets at least the concrete strength class C16/20.
- As wall thickness according to EN 1992-1-2, Table 5.4 is used the thickness of the concrete core
- All requirements according to EN 1992-1-2, sections 5.1 and 5.2 with the national Annexes in force at the place of use are fulfilled.

If the class of reaction to fire according to 3.1.6 of the used "VELOX" shuttering elements with wood-chip concrete spacer webs (see chapter 1.4.2 in the "Special Part" and Annex A5) is lower than B-s1, d0, the fire resistance of the therewith erected walls may be determined with regard to stability (structural safety criterion R) under the following conditions according to EN 1992-1-2, Table 5.4, columns "Wall exposed on two sides" in conjunction with national annexes in force at the place of use:

- The wall was designed in accordance with EN 1992-1-1 only taking into account the load-bearing effect of the concrete or reinforced concrete.
- The concrete of the concrete core meets at least the concrete strength class C16/20.
- As wall thickness according to EN 1992-1-2, Table 5.4 is used the thickness of the concrete core.
- All requirements according to EN 1992-1-2, sections 5.1 and 5.2 with the national annexes in force at the place of use are fulfilled.
- The fulfilment of the thermal insulation criterion I and integrity criterion E of such walls is not detectable in this case without additional investigations.

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.

VELOX	Annex B2 Page 1 of 2
Instructions for determining the resistance to fire for the intended use	

- A normal weight concrete as defined in EN 206 shall be used. As far as European standards EN 206 is 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.
- The shuttering elements 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 "VELOX" regarding to fire resistance are valid only for walls without openings (for windows or doors for examples).

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VELOX	Annex B2 Page 2 of 2
Instructions for determining the resistance to fire for the intended use	

### Instructions for determining the thermal resistance for the intended use

The nominal value of the thermal resistance  $R_{D,wall}$  of the walls made of shuttering elements "VELOX" (with core concrete and, if present, with thermal insulation and plaster) shall be obtained in accordance with EN ISO 6946. The nominal value of the thermal conductivity of the wood-chip concrete shuttering elements  $\lambda_{D,w}$  shall be taken from Table 2 of the "Special" Part ", the nominal value of the thermal conductivity of the core concrete  $\lambda_C$  is given in EN ISO 10456 as a function of the density  $\rho$  and the nominal value of the thermal conductivity  $\lambda_D$  shall be taken from the declaration of performance (DoP) of the manufacturer of the thermal insulation insert used.

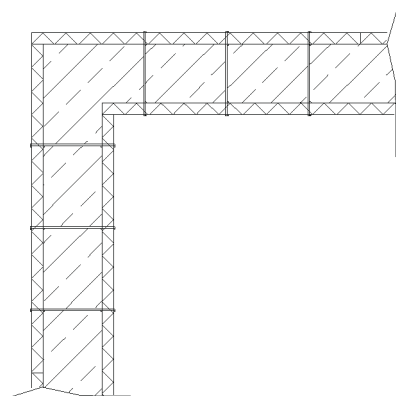
The consideration of the influence of the steel clips for construction can be made by exact procedures according to EN ISO 946, section 5.3 or approximately according to EN ISO 6946, F.3.

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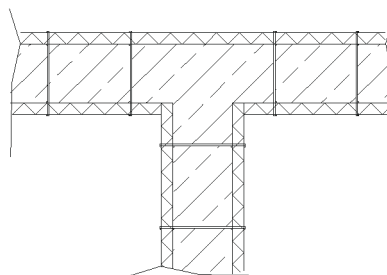
VELOX	Anhang B3
Instructions for determining the thermal resistance for the intended use	

## Internal and external walls

**Layout:**  
Rectangular corner



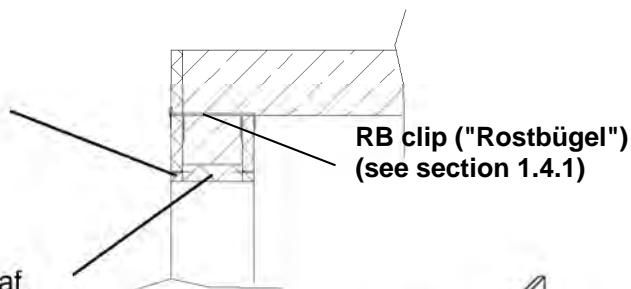
**Layout:**  
T-wall



**Layout:**  
window/door opening



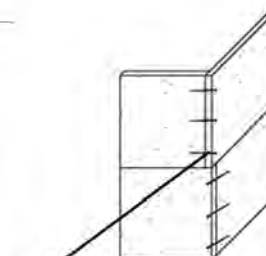
**Cross section:**  
lintel/ceiling construction



**Nails:**  
drive in slightly angled  
(~15°)

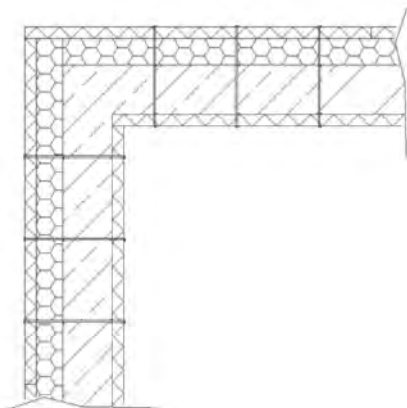


Nails

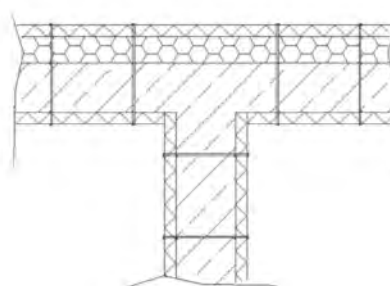


## External walls

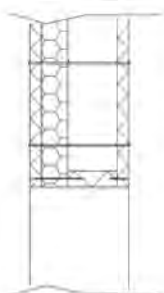
**Layout:**  
Rectangular corner



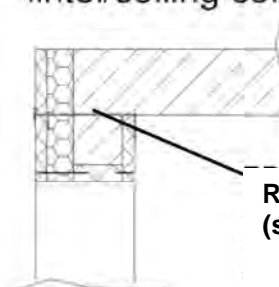
**Layout:**  
T-wall



**Layout:**  
window/door opening



**Cross section:**  
lintel/ceiling construction



RB clip ("Rostbügel")  
(see section 1.4.1)

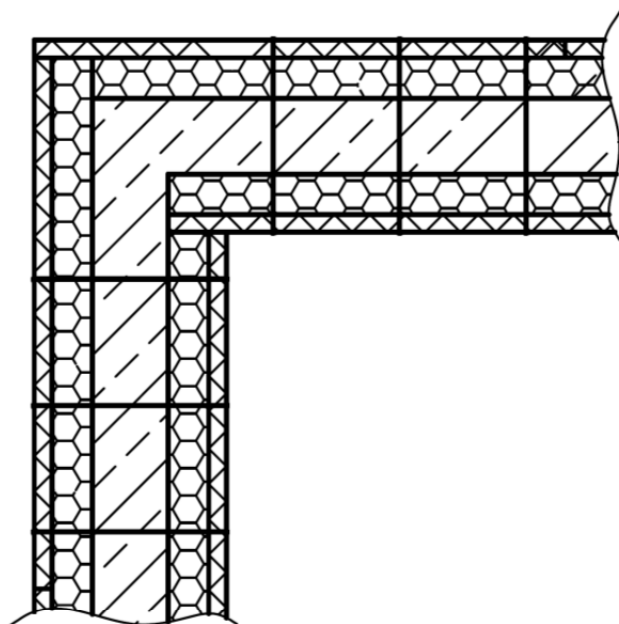
VELOX

External walls

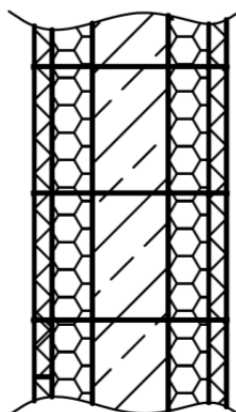
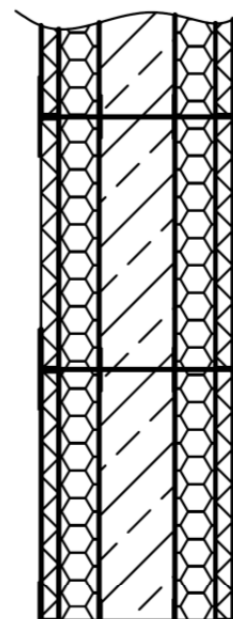
Annex B4.2

# Attic and parapet walls

top view



section



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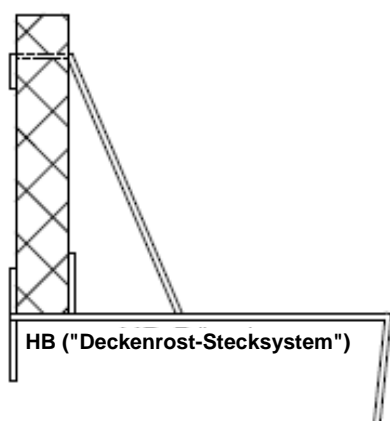
VELOX

Attic and parapet walls

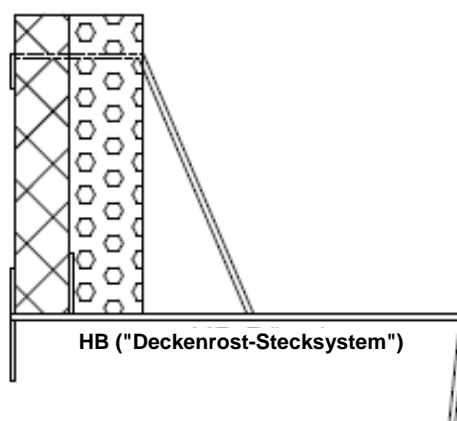
Annex B4.3

## Ceiling grate and wall grate

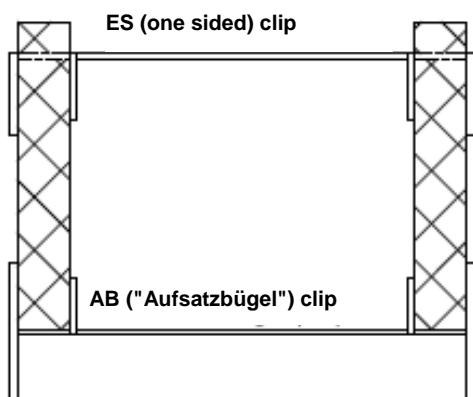
**Ceiling grate without thermal insulation**



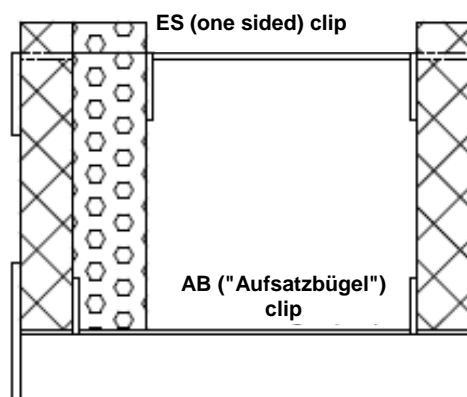
**Ceiling grate with thermal insulation**



**Wall grate without thermal insulation**



**Wall grate with thermal insulation**



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VELOX

Ceiling grate and wall grate

Annex B4.4



Type	Case according to Annex A2	Types of shuttering leaves		Assumed weight of the wall (without rendering) [kg/m <sup>2</sup> ]	Unit weight of the wood-chip concrete	
		outside	inside		Outer leaf [kg/m <sup>3</sup> ]	Inner leaf [kg/m <sup>3</sup> ]
NN18	1	WSD 30	WSD 30	319	750	750
TT15	1	WSD 35	WSD 35	239	750	750
TT20	1	WSD 35	WSD 35	349	750	750
TT22	1	WSD 35	WSD 35	382,5	750	750
TT25	1	WSD 35	WSD 35	448,6	750	750
TT27	1	WSD 35	WSD 35	492,6	750	750
TT30	1	WSD 35	WSD 35	558,6	750	750
GT25	1	WS 50	WSD 35	415,6	560	750
GT30	1	WS 50	WSD 35	527,3	595	750
GG25	1	WS 50	WS 50	390	595	595
GG30	1	WS 50	WS 50	500	595	595
XG30	1	WS 75	WS 50	565	560	595
GU30	1	WS 50	WSD 50	540	595	750
ET27	2	WS-EPS 85	WSD 35	353,0	650	750
ET30	2	WS-EPS 115	WSD 35	270,0	650	750
ET32	2	WS-EPS 135	WSD 35	387,3	650	750
ET33,5	2	WS-EPS 135	WS 50	395	650	595
ET34	2	WS-EPS 155	WSD 35	390	650	750
ET35	2	WS-EPS 185	WSD 35	345	650	750
ET35,5	2	WS-EPS 155	WS 50	395	650	595
ET37	2	WS-EPS 185	WSD 35	391	650	750
ET38,5	2	WS-EPS 185	WS 50	396	650	595
ET40	2	WS-EPS 185	WSD 35	455	650	750
VELOX					Annex B5	
Thickness of concrete core and weight of the wall per m <sup>2</sup> without plaster for the examples of according elements according to Annex A2						