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# DIBt

Mitglied der EOTA  
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## European Technical Approval ETA-08/0134

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung  
*Trade name*

VELOX Mantelbetonsystem  
*Velox permanent shuttering system*

Zulassungsinhaber  
*Holder of approval*

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

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

Nichttragendes verlorenes Schalungssystem "Velox" mit  
Platten aus Holzspanbeton  
*Non-load bearing permanent shuttering system "Velox" with plates of wood  
cheep aggregate concrete*

Geltungsdauer: vom  
*Validity: from*  
bis  
*to*

8 July 2008  
8 July 2013

Herstellwerke  
*Manufacturing plants*

VELOX-Werk Ges.m.b.H  
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Diese Zulassung umfasst  
*This Approval contains*

22 Seiten einschließlich 8 Anhänge  
*22 pages including 8 annexes*



Europäische Organisation für Technische Zulassungen  
European Organisation for Technical Approvals

## 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 products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - 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 1998<sup>4</sup>, zuletzt geändert durch Gesetz vom 06.01.2004<sup>5</sup>;
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>;
  - Guideline for European technical approval of "Nonload-bearing permanent shuttering systems based on hollow blocks or panels of insulating materials and sometimes concrete", ETAG 009.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
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- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

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1 Official Journal of the European Communities L 40, 11.02.1989, p. 12  
2 Official Journal of the European Communities L 220, 30.08.1993, p. 1  
3 Official Journal of the European Union L 284, 31.10.2003, p. 25  
4 Bundesgesetzblatt I, p. 812  
5 Bundesgesetzblatt I, p.2, 15  
6 Official Journal of the European Communities L 17, 20.01.1994, p. 34



## **II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL**

### **1 Definition of product and intended use**

#### **1.1 Definition of product**

##### **1.1.1 General**

The modular wall system "Velox" is a non load-bearing permanent shuttering kit based on plates of thermal isolating material for the shuttering leaves and accessory parts. The accessory parts are spacers of steel, nails and plates for end or bottom leaves.

An incorporated finish is not part of the shuttering kit.

##### **1.1.2 Plates for shuttering leaves**

The shuttering leaves of the system "Velox" consists of plates of wood-chip aggregate concrete according to EN 13168 which are put together on site. The thermal resistance may be improved by layers of polystyrene according to EN 13163 at the inner site of these plates.

##### **1.1.3 Accessory parts**

###### **1.1.3.1 Spacers of steel**

The distance between shuttering leaves is realised by spacers of steel (see Annexes 2 and 3) and ranges from 130 to 280 mm (see Annex 1). There are two types of spacers ES- and DS-spacers. ES-spacers are used at the bottom of the first layer of shuttering leaves and at the top of the last layer of shuttering leaves at wall height. In all other horizontal joints DS-spacers are used.

###### **1.1.3.2 Nails**

To have a tight fit in the vertical and horizontal joints between the leaves they are nailed together with 3 nails over the height of a plate and 4 nails per meter over the length of a plate (see Annex 2 and 3). A form fit between the joints of the plates is not foreseen.

###### **1.1.3.3 Plates for the shuttering of the wall ends and bottoms of lintels**

Plates for end leaves are used to close the whole between the shuttering leaves at window or door openings. The same plates are also used for the bottom of the lintels. The connection between this end and bottom leaves to the normal shuttering leaves (see 1.1.2) is also made by nails (see Annex 2 and 3).

#### **1.2 Intended use**

The kit is intended to be used for construction of load-bearing (structural) or non load-bearing (non structural) internal and external walls above or below ground, 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 ground water not exerting pressure or ground water exerting pressure is to be dealt with. The waterproofing shall be protected from mechanical damage by a smash-resistant protective layer.

The provisions made in this ETA are based on an assumed working life of the shuttering kit of at least 50 years, provided that the shuttering system in end use conditions is subjected to an appropriate use and maintenance.

The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer or the approval body. They are to be regarded only as a means for the specifiers to choose the appropriate criteria for shuttering kits in relation to the expected economically reasonable working life of the works.



## 2 Characteristics of products and methods of verification

### 2.1 Characteristics of products

#### 2.1.1 Plates for shuttering leaves

The plates WS75, WS50, WS35 and WSD35 are 75 mm, 50 mm and 35 mm thick. Also their density is different (see Annex 8). These plates are products according to EN 13168 with the following designation code:

*WW 35, 50, 75-EN 13168- L2-W1-T1-S2-P1-CS(10/Y)1000-BS2500(1200)-CI3-MU15*

The plates WS-EPSxxx are plates WS35 added by an EPS-layer. The values xxx prescribe the whole thicknesses of the plates, which are 85 mm, 115 mm, 135 mm and 185 mm, that means the thickness of EPS-layers is 50 mm, 80 mm, 100 mm and 150 mm. The length of all plates is 2000 mm and the height is 500 mm.

The plates WS-EPS-WS50 are used as separating plates between two row houses (see Annex 6). The section consists of 3 layers:

- 15 mm wood-chip aggregate concrete layer (density 580 kg/m<sup>3</sup>)
- 20 mm EPS-core
- 15 mm wood-chip aggregate concrete layer (density 580 kg/m<sup>3</sup>)

The EPS-layers consist of material

*EPS-EN 13163-T1-L1-W1-S1-P3-DS(70,-)3-BS50-DS(N)5*

The EPS-material is delivered CE marked according to EN 13163 in form of plates and has to be cut to the length (2000 mm) and height (500 mm) of the leaves. The reaction to fire class of the EPS material according to EN 13501-1 at least shall be E.

The different types of leaves are combined to different wall sections (see Annex 1). Which type of plate at which wall is used can be seen in Annex 7.

The material characteristics, dimensions and tolerances of the shuttering plates not indicated in the Annexes are given in the technical documentation<sup>7</sup> of the ETA.

#### 2.1.2 Accessory parts

##### 2.1.2.1 Spacers of steel

The material characteristics, dimensions and tolerances of spacers are given in the technical documentation<sup>8</sup> of the ETA. The spacers are corrosion protected by a baked enamel finish.

##### 2.1.2.2 Nails

Zinc coated nails from 80 to 100 mm length according to EN 10230-1 are used.

##### 2.1.2.3 Plates for the shuttering of the wall ends and bottoms of lintels

To close the gaps between the shuttering leaves at window or door openings and at the bottom of lintels plates WS50 are used. They may be prefabricated to appropriate dimensions or cut on site from plates WS50 according to 2.1.1.

### 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 blocks of insulating materials and sometimes concrete", edition June 2002.

<sup>7</sup> 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.

<sup>8</sup> 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.



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

## 2.2.2 ER 1 Mechanical resistance and stability

### 2.2.2.1 Resulting structural pattern

In end use conditions walls made with the shuttering system "Velox" are walls of continuous type according to ETAG 009, paragraph 2.2.

### 2.2.2.2 Efficiency of filling

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

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

### 2.2.2.3 Possibility of steel reinforcement

The instructions of chapter 4.2.3 and in the installation guide of the ETA holder are appropriate to install steel reinforcement for walls according to EN 1992-1-1 or corresponding national rules.

The requirements according to ETAG 009, chapter 6.1.3 are met satisfactorily under the above declared limitations.

## 2.2.3 ER2 Safety in case of fire

### 2.2.3.1 Reaction to fire

The surface of all types of shuttering leaves without inner EPS-layers (WSxx and WSDxx see Annex 7) meets the requirements for Euroclass A2-s1 d0 according to EN 13501-1.

The surface of all types of shuttering leaves with inner EPS-layers (WS-EPSxx see Annex 7) meets the requirements for Euroclass E according to EN 13501-1.

### 2.2.3.2 Resistance to fire

According to Annex C, Table 1, third column of ETAG 009 depending on the thickness of the concrete core the walls meet the requirements according to Table 1.

Table 1: Fire resistance in dependence of thickness of concrete core

Fire resistance REI [minutes]	Minimum thickness of the concrete core [mm]
60	130
90	150
120	≥170

The preconditions for these classifications are:

- The design of the building shall take the secondary effects of fire into account. Especially constraints, introduced by thermal strain, should be sufficiently low and appropriate building joints should be foreseen. The rules, effective at the place of use, shall apply. Structural requirements under normal conditions, applicable at the place of use, may require larger dimensions. Concrete cover for the reinforcement shall be observed according to the rules, applicable at the place of use.



- A normal weight concrete as defined in EN 206-1-2000 Concrete – Part 1: Specification, performance, production and conformity shall be used. If EN 206 is not in force, an equivalent concrete according to national rules, applicable at the place of use, is acceptable.
- The strength of concrete shall be between C16/20 and C50/60 according to EN 206. Due to the lack of availability of the European standard EN 206, alternatively a concrete according to national rules, applicable at the place of use, with a compressive strength which fits in the interval given above, is also considered as appropriate.
- The walls on both sides shall 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 sealing shall be based on inorganic aggregates, gypsum, cement or lime or on suitable combinations of these three binders.
- The walls are exposed to fire on only one side

## 2.2.4 ER3 Hygiene, health and the environment

### 2.2.4.1 Release of dangerous substances

According to the manufacturer's declaration the shuttering system "Velox" taking account of the EU database<sup>9</sup> does not contain any dangerous substances.<sup>10</sup>

### 2.2.4.2 Water vapour permeability

The values for the water vapour permeability in dependence on the density of the wood chip aggregate concrete are listed in Annex 8.

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

The values for the water vapour diffusion resistance of concrete in dependence of density and type and of the EPS layers are tabulated in EN 12 524.

## 2.2.5 ER4 Safety in use

### 2.2.5.1 Bond strength between the shuttering leaves and the concrete core

The bond strength is at least equal to the resisting concrete pressure of the shuttering leaves according to 2.2.5.2.

The requirements according to ETAG 009, chapter 6.4.1.3 are met satisfactorily.

### 2.2.5.2 Resistance to filling pressure

Considering the rules for the placing of concrete according to 4.2.4 the requirements of ETAG 009, chapter 6.4.2 are met satisfactorily.

### 2.2.5.3 Safety against personal injury by contact

As delivered on site the shuttering leaves do not have sharp or cutting edges even if they are curtailed at door or window openings.

Since there is a certain risk of abrasion or of cutting people because of the rough surfaces of the shuttering leaves handling on site shall be done with gloves.

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

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<sup>9</sup> Notes are stated in Guidance Paper H: "A harmonized approach relating to dangerous substances under the Construction Products Directive", Brussels, 18 February 2000

<sup>10</sup> 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 EC Construction Products Directive, these requirements need also to be complied with, when and where they apply.



## 2.2.6 ER5 Protection against noise

### 2.2.6.1 Airborne sound Insulation

In Table 2 the rated values of sound insulation  $R_w$  according to EN ISO 717-1 in dependence of the mass per area of the wall (inclusive rendering layers) and the type of the element is listed.

Table 2: Rated values of sound insulation according to EN ISO 717-1 in dependence of the mass per area (inclusive rendering layers) and the type of element

Type of element	Mass per area of the wall (inclusive rendering) [kg/m <sup>2</sup> ]	Rated value of sound insulation $R_w$ according to EN ISO 717-1 (measured values) [dB]
TT25	≥493	60
TT 27	≥537	60
TT 30	≥603	63
TT 35	≥713	63

The values are valid for the following wall section:

- 1.5 cm plaster,
- assembled shuttering filled with concrete in dependence of the wall type.
- 1.5 cm plaster.

### 2.2.6.2 Sound absorption

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

## 2.2.7 ER6 Energy economy and heat retention

### 2.2.7.1 Thermal resistance

In Table 3 are given the declared values of the thermal conductivity and thermal resistance  $R_{D1}$  of the shuttering leaves "Velox" without additional EPS-layers.

Table 3: Declared values of the thermal conductivity and thermal resistance of the shuttering leaves "Velox" without additional EPS-layers

Type of plate	Density of the wood-chip aggregate concrete [kg/m <sup>3</sup> ]	Declared value of thermal conductivity [W/m/K]	Thickness of plates [mm]	Declared value of thermal resistance $R_{D1}$ [K*m <sup>2</sup> / W]
WS35	580	0.110	35	0.32
WS50	560	0.110	50	0.45
WS75	540	0.095	75	0.79
WSD35	750	0.15	35	0.23
WSD50	750	0.15	50	0.33

In Table 4 are given the declared values of the thermal conductivity and thermal resistance  $R_{D1}$  of the EPS-layers of the shuttering leaves "Velox".

Table 4: Declared values of the thermal conductivity and thermal resistance  $R_{DI}$  of the of the EPS-layers of the shuttering leaves "Velox"

Plate type	Plates for the outside shuttering leaves	Plates for the inside shuttering leaves	Declared value of thermal conductivity for the EPS layer according to EN 13163 chapter 4.2.1 [W/m/K]	Thick-ness of EPS-Layer [mm]	Declared value of thermal resistance for the EPS layer according to EN 13163 chapter 4.2.1 [m <sup>2</sup> K/W]
WS-EPS85	WS35	-	0.04	50	1.25
WS-EPS115	WS35	-	0.04	80	2
WS-EPS135	WS35	-	0.04	100	2.5
WS-EPS185	WS35	-	0.04	150	3.75
WS-EPS-WS50	WS15	WS15	0.04	20	0.5

The determined increase of the thermal transmittance according to the action of the spacers is  $\Delta U = 0,03 \text{ W}/(\text{m}^2 \text{ K})$  for the wall type ET30 (see Annex 1). For all other wall types (see Annex 1)  $\Delta U = 0,07 \text{ W}/(\text{m}^2 \text{ K})$  shall be applied.

Since the declared values are not equal to the calculation values the thermal resistance of the whole wall is not given in the ETA, but may be determined as for an wall of homogenous layers according to EN ISO 6946, clause 6.1 and 7, taking in consideration the above given increase of thermal transmittance due to the action of the spacers.

#### 2.2.7.2 Thermal inertia

The heat capacity of wood-chip aggregate concrete can be assumed to be equal to concrete with light aggregates in EN 12524, Table 2.

The values for the heat capacity of concrete and expanded polystyrene are also tabulated in EN 12524.

#### 2.2.8 Aspects of durability and serviceability

##### 2.2.8.1 Resistance to deterioration

###### Physical agent

Since the thermal expansion coefficient of wood-chip concrete is not higher than of normal weight concrete the dimensions of the shuttering leaves does not differ more than 0.07% after exposing them for 48 h at 70°C.

As given in the designation code of the EPS material used (see 2.1.1) the dimensions of the shuttering leaves do not differ more than 3 % after exposing them for 48 h at 70 °C (DS(70,-)3).

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

###### Chemical agent

The only steel parts in the shuttering system "Velox" are the spacers and the nails. The spacers of steel are protected against corrosion by a baked enamel finish. The nails are zinc coated according to EN 10230-1, chapter 6.2 b.

Therefore the requirement "corrosion protection" according to ETAG 009, chapter 6.7.1.2 is met satisfactorily.



#### Biological agent

If the walls are protected by standard finishes and the conditions of use of the building are considered, the application of wood-chips aggregate concrete as insulating material has shown for decades that it sufficiently protects against fungi, bacteria, algae and insects.

Wood-chips aggregate concrete and the expanded polystyrene do not provide a food value and in general it does not contain voids suitable for habitation by vermin.

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

#### 2.2.8.2 Resistance to normal use damage

##### Incorporation of ducts

The instructions in the installation guide of the ETA holder are appropriate to install horizontally passing ducts on site.

##### Fixing of objects

Fixing of objects in the shuttering leaves is not possible, the part of fixings which is significant for the mechanical resistance shall be in the concrete.

### 3 Evaluation and attestation of conformity and CE marking

#### 3.1 System of attestation of conformity

According to the decision on the procedure of attestation of conformity 98/279/EC of 5 December 1997<sup>11</sup> amended by the decision 2001/596/EC of the European Commission the system 2+ of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

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

(a) Tasks for the manufacturer:

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

(b) Tasks for the approved body:

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

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

#### 3.2 Responsibilities

##### 3.2.1 Tasks for the manufacturer

##### 3.2.1.1 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 initial and constituent materials stated in the technical documentation of this European Technical Approval.

The factory production control shall be in accordance with the "control plan" of 25.06.2008 relating to the European Technical Approval ETA - 08/0134 issued on xx.06.2008 which is part of the technical documentation of this European Technical Approval. The "control plan"

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11 Official Journal of the European Communities L /127 of 24.04.1998

is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik.<sup>12</sup>

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

#### 3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of non-load bearing shuttering systems in order to undertake the actions laid down in section 3.2.2. For this purpose, the "control plan" referred to in sections 3.2.1.1 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 the European technical approval ETA-08/0134 issued on 8 July 2008.

#### 3.2.2 Tasks of approved bodies

The approved body shall perform the

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

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

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

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

### 3.3 CE marking

The CE marking shall be affixed to every plate and/or to the accompanying commercial documents. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (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,
- Euroclass according to EN 13501-1 (see 2.2.3.1)
- Fire resistance class according to EN 13501-2 in dependence of minimum thickness of concrete core (see 2.2.3.2)
- the declared values of thermal resistance  $R_{D1}$  of the shuttering leaves (see 2.2.7.1)

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<sup>12</sup> The "control plan" is a confidential part of the documentation of the European Technical Approval, but not published together with the ETA and only handed over to the approved body involved in the procedure of attestation of conformity.  
See section 3.2.2.



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

### **4.1 Manufacturing**

The European Technical Approval is issued for the product on the basis of agreed data/information, deposited at 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 ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA shall be necessary.

### **4.2 Installation**

#### **4.2.1 General**

The manufacturer shall ensure that the requirements in accordance with sections 1, 2, and 4 are made known to those involved in planning and execution. The installation guide is deposited at DIBt and shall be present at every construction site. If the manufacturer's instructions contain other specifications than those stated here, the specifications of the ETA shall apply.

After installation of the shuttering (see 4.2.2) the site-mixed or ready mixed concrete is brought in and compacted.

In end use conditions concrete walls of continuous type<sup>13</sup> of plain or reinforced concrete according to EN 1992-1-1 or corresponding national rules will be formed.

For structural design dimension and weights given in Annex 7 have to be used.

In end use conditions the wood-chips concrete leaves and the EPS-layers are the main part of the thermal insulation of the walls.

#### **4.2.2 Installation of the shuttering**

The plates are put together on site in layers without adhesive according to the installation guide of the manufacturer.

To receive stable formworks the vertical joints between two shuttering leaves of one layer have to be shifted of at least 25 cm to the vertical joints of the previous and next layer. The length of a single shuttering leave shall not be less than 40 cm.

The thickness of concrete core is realised by spacers of steel (see Annexes 2 and 3). Four spacers per meter shall put up to the lower and upper flanges of the shuttering leaves.

The installation shall start at the corner of the building. To avoid opening of the joints during concreting the shuttering leaves shall be connected by three nails over the height of the vertical joints and four nails per meter of the horizontal joints.

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13 see ETAG 009 chapter 2.2



The first layer of shuttering leaves shall be laid exactly according to the planed elevation and alignment for the entire floor plan. Afterwards leveling to the subsoil is performed (foundation, bottom plate, ceiling). Voids between the shuttering leaves and the uneven subsoil are to be sealed with PU foam before concreting.

Subsequently the shuttering leaves are to be stacked in bond. Thereby the necessary reinforcement also shall be installed according to the installation guide.

The shuttering of the wall types TTxx, GTxx, XTxx, ETxx, EExx and TLT36 (see Annex 1) only resists concrete pressure of 1m height. That means concreting shall taken place already after the installation of not more than two layers of the plates.

The shuttering of the wall types XU35, XX35 and GGxx (see Annex 1) may be filled with concrete after installing it for the height between the floors.

Rectangular wall corners and connection of inside and outside walls are to be formed according to Annex 4. The bottoms of the shuttering of the lintels shall be supported to resist the concrete pressure.

#### 4.2.3 Concreting

For the production of normal concrete EN 206-1:2001-07 shall apply. Concrete within and below the lower flow class range F3 shall be compacted by shaking. Concrete within and above the upper flow class range F3 sufficiently can be compacted by poking. The flow class of fresh concrete shall not be higher than F5 and depending on the thickness of the concrete core not lower than given in ETAG 009, sub-clause 7.2.2. The maximum aggregate sizes depending on the thickness of the concrete core shall be in accordance with ETAG 009, sub-clause 7.2.2. The concrete shall have rapid or middle strength development according to EN 206-1:2001-07, 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. To allow a safe handling an independent self-supporting carrying scaffolding is necessary.

The maximum vertical filling rate shall not exceed 1 m/h. The concrete shall be placed in layers of approximately 1 m height. Before further concreting after the a layer the concrete shall be hardened for the wall types TTxx, GTxx, XTxx, ETxx, EExx and TLT36 (see Annex 1). This is not necessary for the wall types XU35, XX35 and GGxx.

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

In horizontal day joints vertical connection reinforcement bars has to be installed. The connection reinforcement shall comply the following requirements:

- two adjacent vertical connection reinforcement bars shall not be situated in the same plane parallel to the surface of the wall,
- the distance between two connection reinforcement bars in wall direction shall be at least 10 cm and not larger than 50 cm,
- the total section area of the connection reinforcement bars shall not be smaller than 1/2000 of the section area of the concrete core,
- anchorage length of the connection reinforcement bars on both sides of the day joint shall at least be 20 cm

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



If no day joint is planned, placing of concrete in layers may only be interrupted as long as the brought in concrete is not yet solidified 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 compressed lower concrete layer.

The concrete may fall freely only up to a height of 2 m, beyond that the concrete shall be poured through discharge pipes or concreting tubes with a maximum diameter of 100 mm and shall be led almost directly to the place of installation.

Pouring cones are to be avoided by short distances between the places of fill in.

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

The ceiling may only be placed on walls made of hollow blocks if a sufficient strength of the infill concrete exists.

#### 4.2.4 Ducts crossing and lying in the wall

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

Horizontal ducts lying in the wall cores are to be avoided. If absolutely necessary, these are to be taken into account when designing the wall.

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

#### 4.2.5 Reworking and finishes

Walls of the type "Velox" are to be protected by finishes. Finishes are not part of the kit and therefore not considered in this ETA. For external surfaces preferably the used rendering systems should meet the requirement of ETAG 004<sup>14</sup>. The execution of the rendering shall be performed according to applicable national rules.

Before rendering the roof of the building shall be closed and the surfaces of the walls shall be free from impureness.

#### 4.2.6 Fixing of objects

Fixing of objects in the shuttering leaves is not possible, the part of fixings which is significant for the mechanical resistance shall be in the concrete. The influence of the fixing to the reduction of the thermal resistance has to be considered according to EN ISO 6946.

## **5 Indications to the manufacturer**

### **5.1 Packaging, transport and storage**

The plates have to be protected against damage and moisture penetration. They shall be stored flat and accurate on level.

### **5.2 Use, maintenance, repair**

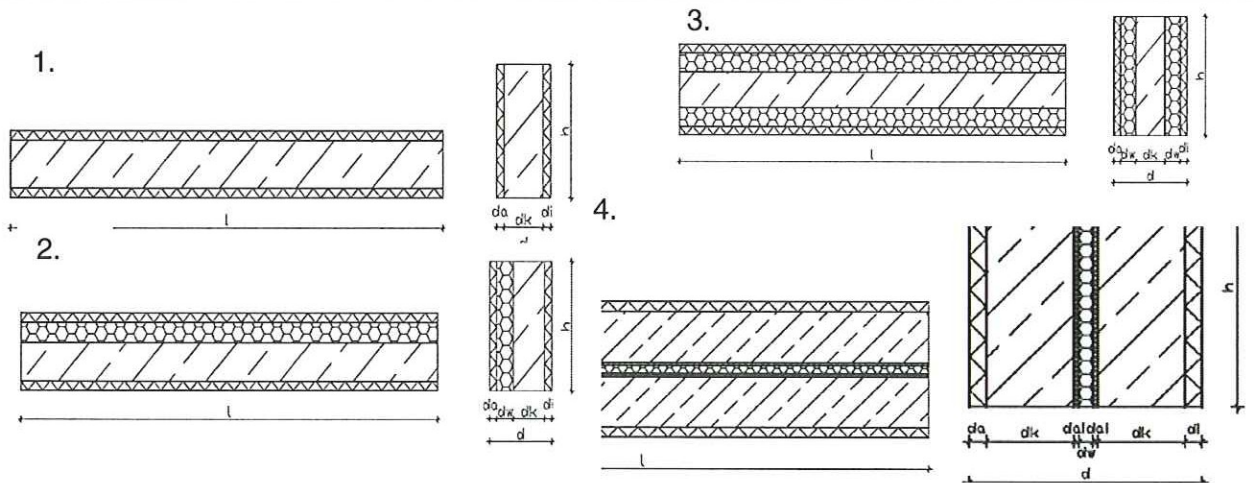
Regular checks should be carried out on render finishes to ensure that any damage is detected and repaired as soon as possible.

Concerning recommendations on use, maintenance and repair ETAG 009, section 7.5 shall apply.

Dipl.-Ing. E. Jasch  
President of Deutsches Institut für Bautechnik  
Berlin, 8 July 2008

*beglaubigt:*  
Dr. Alex





Type of wall	Picture	L	d	d <sub>k</sub>	d <sub>a</sub>	d <sub>ai</sub>	d <sub>i</sub>	d <sub>w</sub>	h
		[mm]	[mm]	[mm]	[mm]	[mm]	(mm	[mm]	[mm]
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
TT35	1	2000	350	280	35	-	35	-	500
GT25	1	2000	250	165	50	-	35	-	500
GT30	1	2000	300	215	50	-	35	-	500
XT30	1	2000	300	190	75	-	35	-	500
XT35	1	2000	350	240	75	-	35	-	500
XU35	1	2000	350	225	75	-	50	-	500
XX35	1	2000	350	200	75	-	75	-	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
ET35	2	2000	350	200	35	-	35	80	500
ET35	2	2000	350	130	35	-	35	150	500
EE30	3	2000	300	130	35	-	35	100	500
EE35	3	2000	350	180	35	-	35	100	500
GG25	1	2000	250	150	50	-	50	-	500
GG30	1	2000	300	200	50	-	50	-	500
GG35	1	2000	350	250	50	-	50	-	500
TLT36	4	2000	360	120	35	15	35	20	500

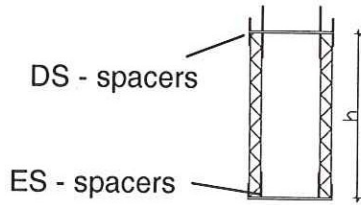
Velox

Velox shuttering systems

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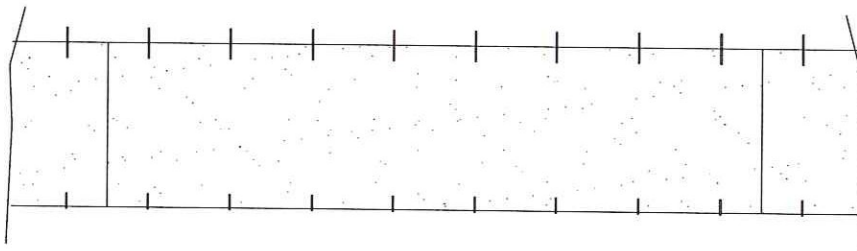
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# Details of the VELOX shuttering system

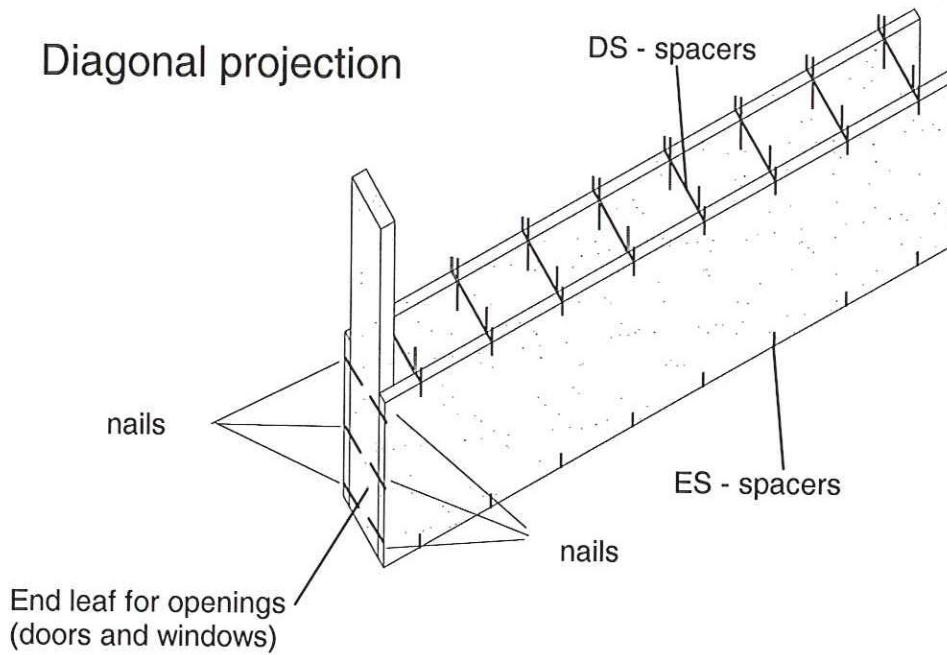


Vertical projection:  
1. Layer

Elevation



Diagonal projection

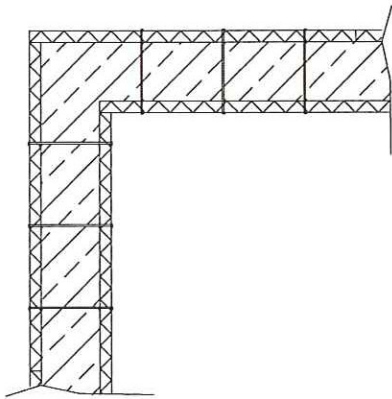


<p><b>Velox</b></p>	<p><b>Annex 2</b> of European Technical Approval  <b>ETA – 08/0134</b></p>
<p>Velox shuttering systems</p>	

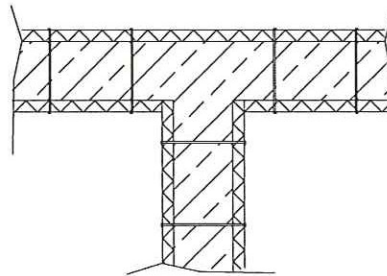


# Walls according to picture 1 of Annex 1 – Inside and outside walls

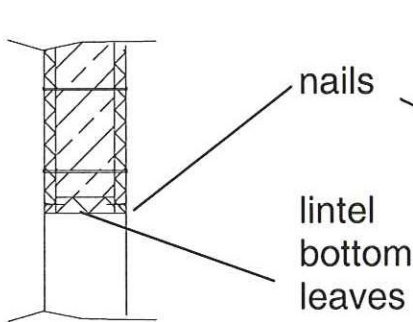
**Horizontal section:**  
Wall corner



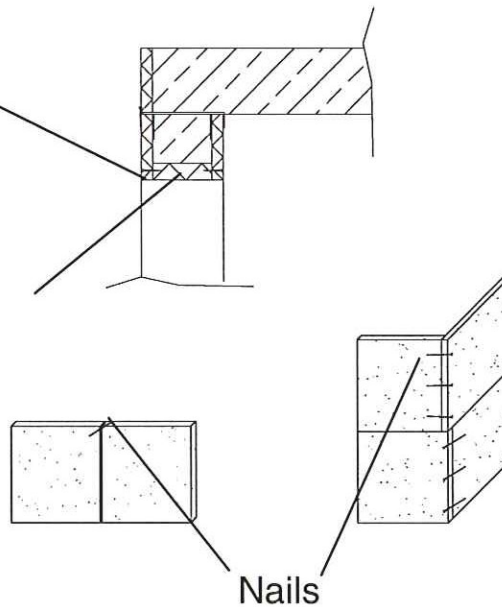
**Horizontal section:**  
Connection of inside and outside walls



**Horizontal section:**  
Construction of  
Structural reveals



**Vertical section:**  
Construction of lintel elements and  
of outside plankings for  
ceilings



**Nailing:**  
Slightly diagonal in  
construction (~15°)

**Velox**

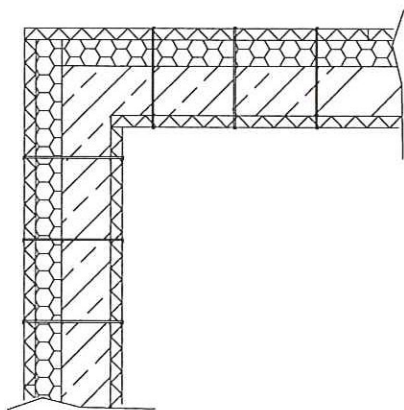
Velox shuttering systems - Inside and outside walls

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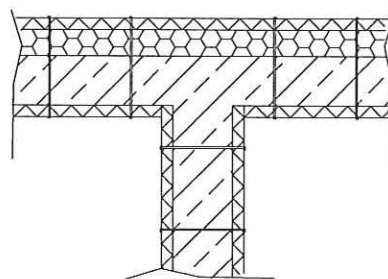
**ETA – 08/0134**

## Walls according to picture 2 of Annex 1 – Outside walls

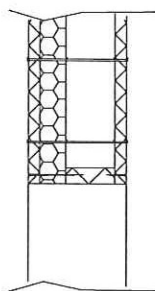
**Horizontal section:**  
Wall corner



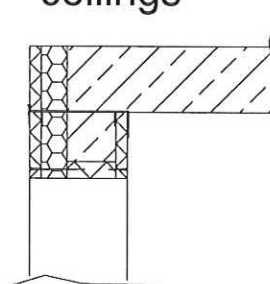
**Horizontal section:**  
Connection of inside and  
outside walls



**Horizontal section:**  
Construction of  
Structural reveals



**Vertical section:**  
Construction of lintel elements  
and of outside plankings for  
ceilings



**Velox**

Velox shuttering systems - Outside walls

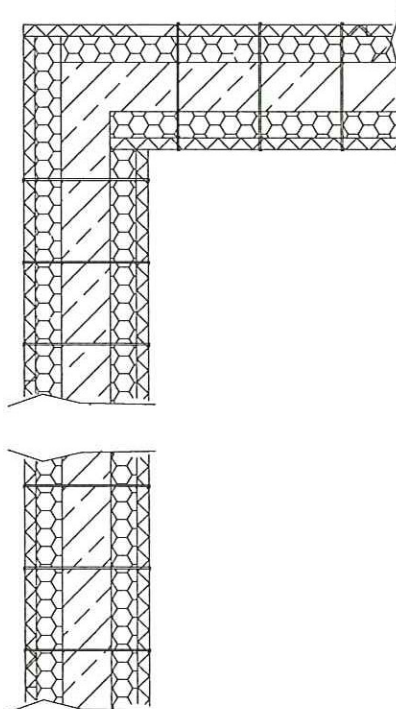
**Annex 4**  
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# Description of picture 3 of Annex 1 – Attic and parapet

Horizontal projection



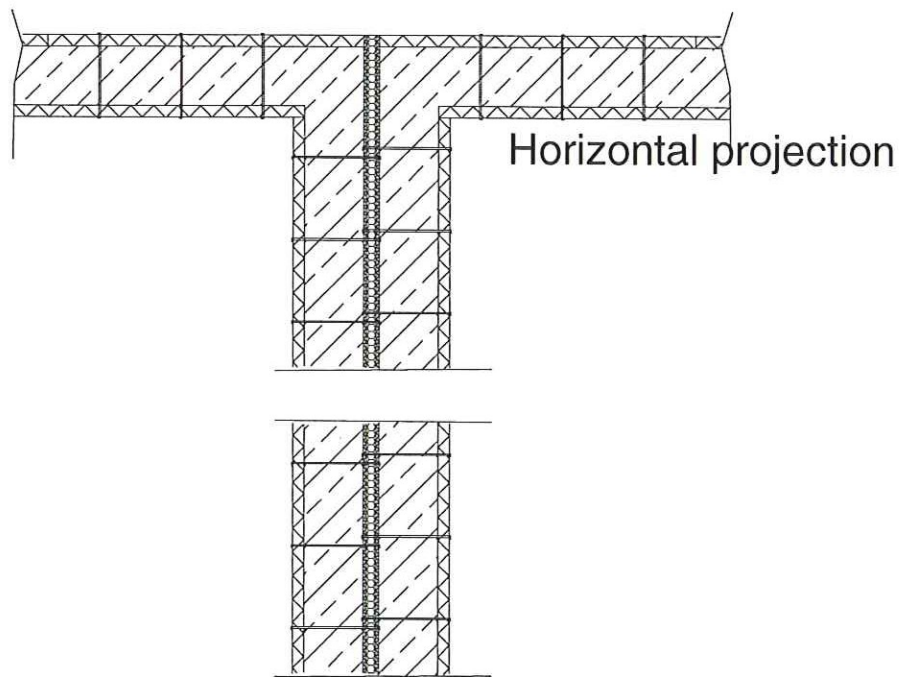
**Velox**

Velox shuttering systems - Attic and parapet

**Annex 5**  
of European  
Technical Approval

**ETA – 08/0134**

## Description of picture 4 of Annex 1 – Use only as separating plate



**Velox**

Velox shuttering systems - Separating plate

**Annex 6**  
of European  
Technical Approval

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## VELOX Wall types

### Wall weights and densities of shuttering leaves

Wall types	Type of plate outside	Thickness of concrete core	Type of plate inside	Wall weights (without rendering) kg/m <sup>2</sup>	Density in kg/m <sup>3</sup> of the	
					outside plate	insite plate
TT20	WSD35	130	WSD35	335,00	750	750
TT22	WSD35	150	WSD35	382,50	„	„
TT25	WSD35	180	WSD35	448,60	„	„
TT27	WSD35	200	WSD35	492,60	„	„
TT30	WSD35	230	WSD35	558,60	„	„
TT35	WSD35	280	WSD35	668,60	„	„
GT25	WS50	165	WSD35	415,60	560	750
GT30	WS50	215	WSD35	527,30	560	750
XT30	WS75	190	WSD35	484,80	540	750
XT35	WS75	240	WSD35	595,60	540	750
XU35	WS75	225	WSD50	573,00	540	750
XX35	WS75	200	WS75	521,00	540	540
ET27	WS-EPS85	150	WSD35	353	580	750
ET30	WS-EPS115	150	WSD35	270	580	750
ET32	WS-EPS135	150	WSD35	387,30	580	750
ET35	WS-EPS115	200	WSD35	497,30	580	750
ET35	WS-EPS185	130	WSD35	342,30	580	750
EE30	WS-EPS85	130	WS-EPS85	327,20	580	580
EE35	WS-EPS85	180	WS-EPS85	437,20	580	580
GG25	WS50	150	WS50	386,00	560	560
GG30	WS50	200	WS50	496,00	560	560
GG35	WS50	250	WS50	606,00	560	560

Wall types	Type of plate outside	Thick-ness of first con-crete core	Type of the plate in the centre of the two concrete cores	Thick-ness of second con-crete core	Type of plate inside	Wall weights (without rendering) kg/m <sup>2</sup>	Density in kg/m <sup>3</sup> of the		
							outer shut-tering leave	middle shut-tering leave	inner shut-tering leave
TLT36	WSD35	120	WS-EPS-WS50	120	WSD35	598,20	750	580	750

### Velox

Velox shuttering systems – Wall weights and densities of shuttering leaves

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VELOX types of shuttering leaves

	WS 75	WS 50	WS 35	WSD 35	WSD 50
	540kg/m <sup>3</sup>	560kg/m <sup>3</sup>	580kg/m <sup>3</sup>	750kg/m <sup>3</sup>	
Diffusion resistance $\mu$	9				
Thermal conductivity W/mK	0,095				
Diffusion resistance $\mu$		9			
Declared thermal conductivity W/mK		0,110			
Diffusion resistance $\mu$			11		
Thermal conductivity W/mK			0,110		
Diffusion resistance $\mu$				14	
Declared thermal conductivity W/mK				0,150	

**Velox**

**Annex 8**  
of European  
Technical Approval

Velox shuttering systems – Wood shavings concrete boards  
Categories of moulded density

**ETA – 08/0134**