



## European Technical Approval ETA-07/0117

English translation prepared by DIBt - Original version in German language

|   |   |
|---|---|
| Handelsbezeichnung<br><i>Trade name</i>         | "IZODOM 2000 POLSKA"  |
| Zulassungsinhaber<br><i>Holder of approval</i>  | izodom 2000 polska<br>ul. Ceramiczna 2<br>98-220 Zdunska Wola<br>POLEN  |
| Zulassungsgegenstand<br>und Verwendungszweck    | Nicht lasttragender verlorener Schalungsbausatz "IZODOM 2000<br>POLSKA" bestehend aus EPS-Schalungselementen  |
| Generic type and use<br>of construction product | <i>Non-load bearing permanent shuttering kit "IZODOM 2000 POLSKA"<br/>based on shuttering elements of EPS</i> |
| Geltungsdauer:<br><i>Validity:</i>              | vom<br><i>from</i><br>8 June 2007<br>bis<br><i>to</i><br>8 June 2012  |
| verlängert<br><i>extended</i>                   | vom<br><i>from</i><br>8 June 2012<br>bis<br><i>to</i><br>8 June 2017  |
| Herstellwerk<br><i>Manufacturing plant</i>      | izodom 2000 polska<br>ul. Ceramiczna 2<br>98-220 Zdunska Wola<br>POLEN  |

Diese Zulassung umfasst  
*This Approval contains*

96 Seiten einschließlich 78 Anhänge  
*96 pages including 78 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 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>, as amended by law of 31 October 2006<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.
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<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12

<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1

<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25

<sup>4</sup> *Bundesgesetzblatt Teil I 1998*, p. 812

<sup>5</sup> *Bundesgesetzblatt Teil I 2006*, p. 2407, 2416

<sup>6</sup> Official Journal of the European Communities L 17, 20 January 1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of product/ products and intended use

#### 1.1 Definition of the construction product

The shuttering kit "IZODOM 2000 POLSKA" is used to construct non-load bearing permanent formwork for plain and reinforced concrete walls cast in-situ.

The "IZODOM 2000 POLSKA" system comprises five types of walls:

- "STANDARD",
- "KING BLOK",
- "SUPER KING BLOK",
- "SUPER KING BLOK PLUS" and
- "UNIVERSAL".

These wall types are differentiated by:

- thickness of foam material in one of the shuttering walls,
- design of the elements and
- thickness of the concrete wall core.

All elements are available in two types of foam material:

- Styropor (white expanded polystyrene) and
- Neopor (graphite-enriched expanded polystyrene)

In every type of wall standard shuttering elements, special shuttering elements and accessory parts are included. Special shuttering elements are height adjuster elements, angel joint elements (45°) for inner and outer corners, hinge elements to realise walls with arbitrary angles, header elements (for lintels), floor support elements and door head elements. Accessory parts are auxiliary elements, height adjuster elements, trimming strips, plugs and closing elements as well as the ties.

#### 1.1.2 Standard shuttering elements

The system contains the following types of shuttering elements:

|         |  |
|---------|--|
| MC      | shuttering elements completely made of EPS (Styropor or Neopor)  |
| MCF     | shuttering elements with shuttering leaves of EPS (Styropor or Neopor) and <u>embedded</u> plastic ties (see Annex 51) to connect both shuttering leaves                                       |
| MCFU    | shuttering elements with shuttering leaves of EPS (Styropor or Neopor) and <u>dismountable</u> plastic ties (see Annexes 52 to 55) to connect both shuttering leaves                           |
| MCFU-St | shuttering elements with shuttering leaves of EPS (Styropor or Neopor) and <u>dismountable</u> ties of plastic parts and steel wires (see Annexes 56 and 57) to connect both shuttering leaves |

Shuttering elements MC form walls of the grid type and shuttering elements MCF, MCFU and MCFU-St form walls of the continuous type according to ETAG 009, section 2.2. The main difference between the shuttering elements MCF and MCFU is that shuttering elements MCF are delivered to the site in form of completed shuttering elements meanwhile elements MCFU and MCFU-St are delivered on site in single parts (shuttering leaves and ties) and are completed to shuttering elements before sticking together the formwork. In Table 1 the main dimensions of the different shuttering element types in dependence on the wall types are given. The two numbers after the above explained shuttering element type nomination (MC, MCF, MCFU or MCFU-St) prescribes the length of the element in [m] and the thickness of the element in [cm].

**Table 1:** Main dimensions of the standard shuttering elements for different wall types

| Wall type            | Thickness [mm] of     |               |                       | Type of shuttering element | Annex |
|----------------------|-----------------------|---------------|-----------------------|----------------------------|-------|
|                      | inner shuttering leaf | concrete core | outer shuttering leaf |                            |       |
| STANDARD             | 50                    | 150           | 50                    | MC 1/25                    | 1     |
|                      |                       |               |                       | MC 2/25                    | 2     |
|                      |                       |               |                       | MCF 1/25                   | 3     |
|                      | 40                    | 70            | 40                    | MCF 1/15                   | 5     |
| KING BLOK            | 50                    | 150           | 150                   | MC 1/35                    | 13    |
|                      |                       |               |                       | MC 2/35                    | 14    |
| SUPER KING BLOK      | 50                    | 150           | 250                   | MC 1/45                    | 22    |
|                      |                       |               |                       | MC 2/45                    | 23    |
| SUPER KING BLOK PLUS | 50                    | 200           | 50                    | MCF 1/30                   | 26    |
|                      | 50                    | 200           | 250                   | MCF 1/50                   | 27    |
| UNIVERSAL            | 50                    | 150           | 50                    | MCFU 1/25                  | 28    |
|                      |                       |               |                       | MCFU 2/25                  | 29    |
|                      |                       |               |                       | MCFU-St 1/25               | 34    |
|                      |                       |               |                       | MCFU-St 2/25               | 35    |
|                      | 50                    | 150           | 150                   | MCFU 1/35                  | 30    |
|                      |                       |               |                       | MCFU 2/35                  | 31    |
|                      |                       |               |                       | MCFU-St 1/35               | 36    |
|                      |                       |               |                       | MCFU-St 2/35               | 37    |
|                      | 50                    | 400           | 50                    | MCFU 1/50                  | 32    |
|                      |                       |               |                       | MCFU 2/50                  | 33    |
|                      |                       |               |                       | MCFU-St 1/50               | 38    |
|                      |                       |               |                       | MCFU-St 2/50               | 39    |

The horizontal surfaces at the top of the shuttering leaves are castellated and the horizontal surfaces at the bottom are alternatively grooved. The vertical mating surfaces are smooth. The tightness of the vertical joints between the leaves of the shuttering elements is ensured. They may not open during concreting because of the form fit in the horizontal joints. To facilitate works on site, all elements in the system have vertical grooves on external surfaces. One groove is 3 mm wide and 1 mm deep and the distance between the grooves is 5 cm. The grooves are used as cutting line, if the length of an element needs to be adjusted to the length of the wall.

Interior of the shuttering leaves T-shaped guides in the distance of 5 cm are placed. The guides are featured in all types of shuttering elements, regardless the wall thickness, core thickness and the type of used ties. They are necessary to fix OH and OB plugs at the narrow side of the uncut shuttering elements MC and the OC closing elements at the narrow sides of the shuttering elements MCF, MCFU or MCFU-St respectively at the opened narrow sides of the cut shuttering elements MC. The grooves and the T-shaped guides allow the application of the smallest modular dimension of 5 cm in horizontal direction.

A vertical modularity is ensured by using (depending on the needs) three types of height adjuster elements which are featured in the system. The height of the adjusters is 5 cm to enable construction of all wall types in the smallest modular dimension of 5 cm in vertical direction.

### 1.1.2 Special shuttering elements

For all wall types special shuttering elements are available. Additional to the shuttering type nomination (MC, MCF, MCFU and MCFU-St) for special shuttering elements the following nominations are used:

|           |   |
|-----------|---|
| ML        | Header elements (for lintels)               |
| MLI / MLA | Door head elements                          |
| MP        | Floor support elements                      |
| MH        | Height adjuster elements                    |
| MHF       | Height adjuster elements for hinge elements |

For the description of the angel joint elements the following additional nominations are used:

|   |              |
|---|--------------|
| L | left         |
| R | right        |
| I | inner corner |
| A | outer corner |

**Table 2:** Main dimensions of the special shuttering elements for different wall types

| Wall type              | Thickness [mm] of     |               |                       | Type of special shuttering element | Annex |
|------------------------|-----------------------|---------------|-----------------------|------------------------------------|-------|
|                        | inner shuttering leaf | concrete core | outer shuttering leaf |                                    |       |
| <b>STANDARD</b>        | 50                    | 150           | 50                    | MCF 0.7/25                         | 4     |
|                        |                       |               |                       | ML 1/25                            | 6     |
|                        |                       |               |                       | MP 1/25                            | 7     |
|                        |                       |               |                       | MH 1/25                            | 8     |
|                        |                       |               |                       | MHF 0.7/25                         | 9     |
|                        |                       |               |                       | MLI 1.2/25                         | 10    |
|                        |                       |               |                       | MCF 25L                            | 11    |
|                        |                       |               |                       | MCF 25R                            | 12    |
| <b>KING BLOK</b>       | 50                    | 150           | 150                   | ML 1/35                            | 15    |
|                        |                       |               |                       | MP 1/35                            | 16    |
|                        |                       |               |                       | MLA 1.2/35                         | 17    |
|                        |                       |               |                       | MCF 35EA/R                         | 18    |
|                        |                       |               |                       | MCF 35EA/L                         | 19    |
|                        |                       |               |                       | MCF 35EI/L                         | 20    |
|                        |                       |               |                       | MCF 35EI/R                         | 21    |
| <b>SUPER KING BLOK</b> | 50                    | 150           | 250                   | ML 1/45                            | 24    |
|                        |                       |               |                       | MP 1/45                            | 25    |

The surfaces of the special shuttering leaves (horizontal and vertical) are equal to the surfaces of the standard shuttering elements (see section 1.1.1).

### 1.1.3 Accessory parts

#### 1.1.3.1 Auxiliary elements MD 1/10 (Annex 47)

Auxiliary elements MD 1/10 are single shuttering leaves which are used for the construction of rectangular corners for walls with a thickness of 35 cm and 45 cm. The assembly of such wall corners is given in the Annexes 71 to 74.

#### 1.1.3.2 Height adjuster elements MHD 1/10 (Annex 48)

Since shuttering leaves of the height adjuster elements MH and MHF are only 5 cm thick the extension with height adjuster elements MHD 1/10 always is necessary if the outer shuttering leaves of the used shuttering elements are thicker than 5 cm.

#### 1.1.3.3 Trimming strips (Annex 49)

Two types of trimming strips are included in the kit:

- with a castellated surface
- with a grooved surface

The opposite side of the strips is always smooth. The strips are used for finishing of:

- bottoms of header elements and door head elements
- overhang parts of the walls

When packaging all castellated and grooved surfaces of all types of shuttering elements are covered by trimming strips. They provide the protection of the castellated and grooved surfaces during storage and transport.

**1.1.3.4 Plugs (Annexes 40 and 41)**

Upper plugs OH (Annex 40) and lower plugs OB (Annex 41) are half-elliptical elements used to close the ends of the shuttering elements MC of the wall types "STANDARD", "KING BLOK" and "SUPER KING BLOK". The plugs are used to build wall corners, window and door openings and blunt-ended inside walls. The form fit between the profiled contact surfaces of the plugs and the ties provide a tight connection of the plugs. The plug can be installed in the tie axis as well as 5 cm before the axis and 5 cm behind the axis.

**1.1.3.5 Closing elements (Annexes 42 to 46)**

It allows closing of the open narrow sides at corners, door openings and blunt-ended inside walls. The closing elements are installed vertically inside the shuttering element, by sliding it on the vertical T-guides made of foam material. The following closing elements are included in the kit:

- OC (Annex 42) to close the narrow sides of the shuttering elements of the systems with 150 mm concrete core thickness ("STANDARD", "KING BLOK", "SUPER KING BLOK" and "UNIVERSAL" (MCFU x/25, MCFU x/35, MCFU-St x/25 and MCFU-St x/35))
- OC BIS (Annex 43) the same as OC but resisting the concrete pressure without additional support,
- OC 0.2/1 (Annex 44) to close the narrow sides of the shuttering elements of the "SUPER KING BLOK PLUS" system
- OC 0.2/2 (Annex 45) the same as OC 0.2/1 but resisting the concrete pressure without additional support
- OC 0.4/2 (Annex 46) to close the narrow sides of the shuttering elements of the "UNIVERSAL" system with 40 cm thickness of concrete core (MCFU x/50 and MCFU-St x/50).

### 1.1.3.6 Ties

In Table 3 an overview is given which ties are used for which shuttering elements:

Table 3: Correlation between ties and shuttering elements

| Tie in Annex | STANDARD                                       | KING BLOK  | SUPER KING BLOK | SUPER KING BLOK PLUS | UNIVERSAL  |
|--------------|--|--|-----------------|----------------------|--|
| 51           |  |  |                 |                      | MCFU 1/25<br>MCFU 2/25<br>MCFU 1/35<br>MCFU 2/35             |
| 52           |  |  |                 |                      | MCFU 1/50<br>MCFU 2/50                                       |
| 53           | MCF 1/15                                       |  |                 |                      |  |
| 54           | MCF 1/25<br>MCF 0.7/25<br>MCF 25 L<br>MCF 25 R | MCF 35EA/R<br>MCF 35EA/L<br>MCF 35EI/R<br>MCF 35EI/L |                 |                      |  |
| 55           |  |  |                 | MCF 1/30<br>MCF 1/50 |  |
| 56           |  |  |                 |                      | MCFU-St 1/25<br>MCFU-St 2/25<br>MCFU-St 1/35<br>MCFU-St 2/35 |
| 57           |  |  |                 |                      | MCFU-St 1/50<br>MCFU-St 2/50                                 |

### 1.2 Intended use

The kit is intended to be used for 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 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 impact resistant protective layer.

The provisions made in this European technical approval are based on an assumed working life of the shuttering kit in end use condition of at least 50 years, provided that the conditions laid down in sections 4.2, 5.1 and 5.2 for 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 producer, 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.



## 2 Characteristics of products and methods of verification

### 2.1 Characteristics of products

#### 2.1.1 Standard shuttering elements and special shuttering elements

The standard shuttering elements and special shuttering elements correspond to the information and drawings given in the Annexes (see Table 1).

For the shuttering leaves, expanded polystyrene made of polystyrene particle foam EPS-EN 13163-T1-L1-W2-S2-P4-DS(70,-)3-BS200-DS(N)5-TR100 according to EN 13163 is used.

More information to the material characteristics, dimensions and tolerances of the shuttering elements are given in the technical documentation<sup>7</sup> of the ETA.

#### 2.1.2 Accessory parts

Auxiliary elements, height adjuster elements, trimming strips, plugs and closing elements correspond to the drawings given in the Annexes (see sections 1.1.3.1 to 1.1.3.5). They are made of the same material as the shuttering leaves of the shuttering elements.

The ties correspond to the drawings given in the Annexes (see Table 3).

More information to the material characteristics, dimensions and tolerances of the accessory parts are given in the technical documentation of the ETA.

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

#### 2.2.2 ER 1 Mechanical resistance and stability

##### 2.2.2.1 Resulting structural pattern

In end use conditions walls made with shuttering elements MC form walls of the grid type and with elements MCF, MCFU and MCFU-St walls of the continuous type according to ETAG 009, section 2.2.

##### 2.2.2.2 Efficiency of filling

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

The requirements according to ETAG 009, section 6.1.2 are met satisfactory.

##### 2.2.2.3 Possibility of steel reinforcement

The instructions in the installation guide of the ETA holder are appropriate to install steel reinforcement for walls according to EN 1992-1-1 or corresponding national rules (see e. g. Annexes 63 to 70 and 76).

The requirements according to ETAG 009, section 6.1.3 are met satisfactory.

<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.

## 2.2.3 ER 2 Safety in case of fire

### 2.2.3.1 Reaction to fire<sup>8</sup>

Both expanded polystyrene materials (Styropor and Neopor) fulfill the conditions for Class E according to EN 13501-1.

### 2.2.3.2 Resistance to fire

According to ETAG 009 Annex C, Table 2, the grid system (shuttering elements MC) meets the criteria of **R 30**.

According to ETAG 009, Annex C, Table 1, first column, last line the continuous type system (shuttering elements MCF, MCFU and MCFU-St) meets the criteria of **REI 120**.

The preconditions for these classifications are:

- The design of the building has to 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 has to be observed according to the rules, applicable at the place of use.
- A normal weight concrete as defined in EN 206-1 shall be used. If EN 206-1 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 206-1. Due to the lack of availability of the European standard EN 206-1, 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 ER 3 Hygiene, health and the environment

### 2.2.4.1 Content and/or release of dangerous substances<sup>9</sup>

According to the manufacturer's declaration the shuttering elements "IZODOM 2000 POLSKA" taking account of the EU database<sup>10</sup> does not contain any dangerous substances.

### 2.2.4.2 Water vapour permeability

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

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

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

<sup>9</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 Construction Products Directive, these requirements need also to be complied with, when and where they apply.

<sup>10</sup> Notes are stated in Guidance Paper H: "A harmonized approach relating to dangerous substances under the Construction Products Directive", Brussels, 18 February 2000

## 2.2.5 ER 4 Safety in use

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

The expanded polystyrene is bonded to the concrete by mechanical interlocking of the T-guides running vertically in the inner surfaces of the shuttering leaves over the whole element height with a horizontal distance of 5 cm. Since the width of the T-guides is 20 mm the effective area for transmission of tensile forces is  $0.02 \times 1 \text{ m}^2/\text{unit} \times 20 \text{ unit}/\text{m}^2 = 0.4 \text{ m}^2/\text{m}^2$ . This is more than 20 % of the whole area of the shuttering leaves and leads to the effective bond strength of  $0.04 \text{ N}/\text{mm}^2$ , this is sufficient to meet the requirements in ETAG 004, section 6.1.4.1.3.

The requirements according to ETAG 009, section 6.4.1.3 are met satisfactory.

### 2.2.5.2 Resistance to filling pressure

To resist the filling pressure the bending tensile strength of the shuttering leaves shall be more than 200 kPa (see also designation code of EPS in section 2.1.1) and the strength to pull out of the ties more than 700 N.

The requirements according to ETAG 009, section 6.4.2 are met satisfactory.

### 2.2.5.3 Safety against personal injury by contact

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

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

The requirements according to ETAG 009, section 6.4.3 are met satisfactory.

## 2.2.6 ER 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 ER 6 Energy economy and heat retention

### 2.2.7.1 Thermal resistance

In the following Tables 4 to 6 are listed the thermal resistances for all wall sections which are included in the system "IZODOM 2000 POLSKA" (see Table 1 and 2). These values have been determined by numerical calculations (finite differences) taking the influence of the polystyrene, plastic and plastic combined with steel ties into account. In these calculations the following thermal conductivities according to EN 13163 of the expanded polystyrene were used:

- for Styropor  $0.035 \text{ W}/(\text{m K})$  and
- for Neopor  $0.032 \text{ W}/(\text{m K})$

For the concrete the value of  $2.1 \text{ W}/(\text{m K})$  was used, which is higher than given in EN ISO10456.

**Table 4:** Thermal resistance values (calculated without plaster) and equivalent thermal conductivities in dependence of the type of shuttering element, type of expanded polystyrene and the thickness of the outer layer of expanded polystyrene (in every case is the thickness of inner layer of expanded polystyrene 50 mm and the thickness of concrete core 150 mm)

| Type of shuttering element | Material | Thickness of the concrete core 150 mm       |                                      |  |                                      |  |                                      |
|----------------------------|----------|---|--------------------------------------|--|--------------------------------------|--|--------------------------------------|
|                            |          | Exterior thermal insulation thickness 50 mm |                                      | Exterior thermal insulation thickness 150 mm |                                      | Exterior thermal insulation thickness 250 mm |                                      |
|                            |          | R [m <sup>2</sup> K/W]                      | λ <sub>eq</sub> [W/m <sup>2</sup> K] | R [m <sup>2</sup> K/W]                       | λ <sub>eq</sub> [W/m <sup>2</sup> K] | R [m <sup>2</sup> K/W]                       | λ <sub>eq</sub> [W/m <sup>2</sup> K] |
| MC                         | Styropor | 2.77  | 0.0901                               | 5.84   | 0.0600                               | 8.56   | 0.0526                               |
|                            | Neopor   | 3.02  | 0.0827                               | 6.37   | 0.0549                               | 9.34   | 0.0482                               |
| MCFU                       | Styropor | 2.70  | 0.0926                               | --   | --                                   | --   | --                                   |
|                            | Neopor   | 2.94  | 0.0851                               | --   | --                                   | --   | --                                   |
| MCF                        | Styropor | 2.68  | 0.0933                               | 5.45   | 0.0642                               | --   | --                                   |
|                            | Neopor   | 2.91  | 0.0859                               | 5.92   | 0.0592                               | --   | --                                   |
| MCFU-St                    | Styropor | 2.68  | 0.0933                               | 5.44   | 0.0643                               | --   | --                                   |
|                            | Neopor   | 2.91  | 0.0859                               | 5.91   | 0.0592                               | --   | --                                   |

**Table 5:** Thermal resistance values (calculated without plaster) and equivalent thermal conductivities in dependence of the type of shuttering element, type of expanded polystyrene and the thickness of the outer layer of expanded polystyrene (in every case is the thickness of inner layer of expanded polystyrene 50 mm and the thickness of concrete core 200 mm)

| Type of shuttering element | Material | Thickness of the concrete core 200 mm       |                                      |  |                                      |  |                                      |
|----------------------------|----------|---|--------------------------------------|--|--------------------------------------|--|--------------------------------------|
|                            |          | Exterior thermal insulation thickness 50 mm |                                      | Exterior thermal insulation thickness 150 mm |                                      | Exterior thermal insulation thickness 250 mm |                                      |
|                            |          | R [m <sup>2</sup> K/W]                      | λ <sub>eq</sub> [W/m <sup>2</sup> K] | R [m <sup>2</sup> K/W]                       | λ <sub>eq</sub> [W/m <sup>2</sup> K] | R [m <sup>2</sup> K/W]                       | λ <sub>eq</sub> [W/m <sup>2</sup> K] |
| MCFU                       | Styropor | 2.75  | 0.109                                | --   | --                                   | 7.93   | 0.0630                               |
|                            | Neopor   | 2.99  | 0.100                                | --   | --                                   | 8.62   | 0.0580                               |

**Table 6:** Thermal resistance values (calculated without plaster) and equivalent thermal conductivities in dependence of the type of shuttering element, type of expanded polystyrene and the thickness of the outer layer of expanded polystyrene (in every case is the thickness of inner layer of expanded polystyrene 50 mm and the thickness of concrete core 400 mm)

| Type of shuttering element | Material | Thickness of the concrete core 400 mm       |   |  |   |  |   |
|----------------------------|----------|---|---|--|---|--|---|
|                            |          | Exterior thermal insulation thickness 50 mm |   | Exterior thermal insulation thickness 150 mm |   | Exterior thermal insulation thickness 250 mm |   |
|                            |          | R<br>[m <sup>2</sup> K/W]                   | λ <sub>eq</sub><br>[W/m <sup>2</sup> K] | R<br>[m <sup>2</sup> K/W]                    | λ <sub>eq</sub><br>[W/m <sup>2</sup> K] | R<br>[m <sup>2</sup> K/W]                    | λ <sub>eq</sub><br>[W/m <sup>2</sup> K] |
| MCF                        | Styropor | 2.85  | 0.175                                   | --   | --                                      | --   | --                                      |
|                            | Neopor   | 3.08  | 0.162                                   | --   | --                                      | --   | --                                      |
| MCFU-St                    | Styropor | 2.85  | 0.176                                   | --   | --                                      | --   | --                                      |
|                            | Neopor   | 3.08  | 0.162                                   | --   | --                                      | --   | --                                      |

#### 2.2.7.2 Thermal inertia

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

### 2.2.8 Aspects of durability and serviceability

#### 2.2.8.1 Resistance to deterioration

##### Physical agent

As given in the designation code of the EPS material used (see section 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, section 6.7.1.1 are met satisfactory.

##### Chemical agent

Corrosion may only occur with the ties MCFU-St, which have parts of steel which in end use conditions are embedded in the concrete. After hardening of the concrete the bond between concrete and shuttering leaves is given by the T-guides running vertically on the inner surfaces of shuttering leaves (see section 2.2.5.1).

Therefore the requirement "corrosion protection" according to ETAG 009, section 6.7.1.2 is met satisfactory.

##### Biological agent

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

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

The requirements according to ETAG 009, section 6.7.1.3 are met satisfactory.

#### 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 produce horizontal perforations through the walls, which are necessary for the passing through ducts.

#### Fixings for hanging objects

The anchorage of fixings for hanging objects in the shuttering leaves is not possible. Such fixings only shall be anchored in the concrete core.

### **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 1997<sup>11</sup> amended by the Decision 2001/596/EC<sup>12</sup> of the European Commission system 2+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

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

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

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 has to 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 data, 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.

<sup>11</sup> Official Journal of the European Communities/Union L /127 of 24.04.1998

<sup>12</sup> Official Journal of the European Communities/Union L /209 of 08.01.2001

The factory production control shall be in accordance with the control plan of 16 May 2007, modified on 7 May 2012 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.<sup>13</sup>

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 for the 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 according to ETAG 009 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 this European technical approval.

#### 3.2.2 Tasks for the 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 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 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 packing 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 address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate for the factory production control,
- the number of the European technical approval ETA-07/0117,
- the number of the guideline ETAG 009 for European technical approval,
- Reaction to fire: Class E according to EN 13501-1 (see section 2.2.3.1),
- Resistance to fire: Class according to EN 13501-2 in dependence of minimum thickness of the concrete core (see section 2.2.3.2),
- Protection against noise "No performance determined",
- designation code of the insulating material (see section 2.1.1),

<sup>13</sup>

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 section 3.2.2.



- the nominal value of thermal resistance  $R_D$  of the shuttering elements in end use conditions (with concrete but without rendering see Table 4 to 5) according to EN 13163, section 4.2.1 (see section 2.2.7.1).

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

##### **4.1 Manufacturing**

The shuttering elements are manufactured in accordance with the provisions of the European technical approval using the automated manufacturing process as identified during the inspection of the plant by 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 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 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 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 provisions which differ from those stated here, the specifications of the ETA shall apply.

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

In end use conditions concrete walls of grid (MC) and continuous type<sup>14</sup> (MCF, MCFU and MCFU-St) of plain or reinforced concrete according to EN 1992-1-1 or corresponding national rules will be formed.

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

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

The shuttering elements are put together on site in layers without mortar or adhesive. To receive stable floor high formworks the vertical joints between two elements of one layer have to be shifted of at least a quarter of the element length to the vertical joints of the previous layer.

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

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, according to the installation guide of the manufacturer, the walls are to be interlocked to floor height, leveled and fastened to the scaffolding supports.

<sup>14</sup> see ETAG 009 section 2.2



The scaffolding supports are to be arranged at a distance of 1.20 m to 1.50 m at the most, to be connected over the entire wall height with the shuttering elements and to be fastened to the floor.

The necessary reinforcement according to static calculation also shall be installed in an appropriate way. Rectangular wall corners are to be formed according to Annex 71 to 74. Further information are given in the installation guide.

#### 4.2.3 Concreting

For the production of normal concrete EN 206-1 shall apply. The consistency of concrete on compacting by shaking shall be within the lower consistency range F3 and on compacting by poking within the upper consistency range F3. The maximum aggregate size shall be at least 8 mm and shall not exceed 16 mm. The concrete shall have rapid or middle strength development according to EN 206-1, Table 12.

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

The maximum filling height amounts to 0.6 m at a concreting velocity of 1 m/h.

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

Horizontal day joints are to be arranged preferably at the height of the floor. If day joints can not be avoided before reaching the floor height vertical composite reinforcement bars has to be installed. The composite reinforcement shall comply the following requirements:

- Two adjacent composite reinforcement bars shall not be situated in the same plane parallel to the surface of the wall.
- The distance between two composite reinforcement bars in wall direction shall be at least 10 cm and not larger than 50 cm.
- The total section area of the composite reinforcement bars shall not be minor than 1/2000 of the section area of the concrete.
- Anchorage length of the composite reinforcement bars on both sides of the day joint at least shall be 20 cm.

Before the 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 if the concrete layer brought in last has 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 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 pouring 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 shall not deviate from the plumb line more than 5 mm per running meter wall height.

The ceiling shall only be placed on walls made of shuttering elements if a sufficient strength of the concrete core exists.

#### 4.2.4 Ducts crossing and situated inside 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 situated inside the wall cores and running parallel to the wall surfaces 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 "IZODOM 2000 POLSKA" are to be protected by finishes. Finishes are not part of the kit and therefore not considered in this ETA. Preferably for external surfaces the used rendering systems should meet the requirement of ETAG 004. The execution of the rendering shall be performed according to applicable national rules.

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

#### 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.

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

Georg Feistel  
Head of Department

*beglaubigt:*  
Schwab