Deutsches Institut für Bautechnik

Zulassungsstelle für Bauprodukte und Bauarten

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Authorised and notified according to Article 10 of the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products (89/106/EEC)

Deutsches Institut für Bautechnik

DIBt

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Handelsbezeichnung *Trade name*	Schalungsbausatz "QUAD-LOCK" *Shuttering kit "QUAD-LOCK"*
Zulassungsinhaber *Holder of approval*	QUAD-LOCK Building Systems Blumenstr. 1 80331 München
Zulassungsgegenstand und Verwendungszweck *Generic type and use of construction product*	Nicht lasttragender verlorener Schalungsbausatz "QUAD-LOCK" mit Schalungselementen aus EPS *Non load bearing shuttering kit "QUAD-LOCK" based on shuttering elements of EPS*
Geltungsdauer: *Validity:* vom *from* bis *to*	19 February 2013 11 January 2017
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Diese Zulassung umfasst *This Approval contains*	39 Seiten einschließlich 20 Anhänge *39 pages including 20 annexes*
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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[1], modified by Council Directive 93/68/EEC[2] and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council[3];
- *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[4], as amended by Article 2 of the law of 8 November 2011[5];*
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC[6];
- 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.

4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.

6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

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

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of the product and intended use

1.1 Definition of the construction product

The shuttering system "QUAD-LOCK" is a non load-bearing permanent shuttering kit based on shuttering elements and accessory parts (see Annexes 1 to 7) applicable as formwork for plain and reinforced concrete walls cast in-situ.

The shuttering elements consist of shuttering leaves of expanded polystyrene (EPS shuttering leaves) and ties of high density plastic (polyethylene) (HDPE ties).

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

Finishes are not part of the shuttering system "QUAD-LOCK".

1.1.1 Shuttering elements

The shuttering elements (see Annexes 1 to 7) consist of inner and outer shuttering leaves of high density, expanded polystyrene (EPS shuttering leaves) and HDPE ties. These components are assembled on site.

The EPS shuttering leaves are one-layered and the HDPE ties provide thicknesses of the concrete core of 96 mm, 147 mm, 197 mm, 248 mm, 299 mm and 350 mm, as indicated in Table 1. Additionally the "Extender Tie" enables the extension of the thickness of the concrete core by 305 mm. The thickness of the inner EPS shuttering leaf range is either 57 mm or 108 mm and the thickness of the outer EPS shuttering leaf range is also 57 mm or 108 mm. Additionally the insulation element "Extra Panel" enables the extension of the thicknesses of the inner and outer EPS shuttering leaves by 102 mm. The length of all shuttering elements is 1219 mm and the height is 305 mm (see Annexes 2 and 3).

The EPS shuttering leaves are available in three thicknesses:

- 57 mm [2 $^1/_4$"] thick "Regular Panel" (Annex 2),
- 108 mm [4 $^1/_4$"] thick "Plus Panel" (Annex 2) and
- 102 mm [4"] thick "Extra Panel" (insulation element) (Annex 3).

The insulation element "Extra Panel" is not used as a shuttering element but to improve the insulating property of the wall (see Annexes 3 and 5). The "Extra Panel" has to be incorporated inside the cavity of the concrete core before concreting. Thereby the thickness of the concrete core is reduced by 102 mm. It is possible to combine the "Extra Panel" with the "Regular Panel" or the "Plus Panel" without a negative influence of these shuttering elements.

Ties are moulded from high density plastic (polyethylene) (HDPE ties) and are colour coded in dependence of their length (see Table 1 and Annexes 4, 5 and 7).

Table 1: Wall thicknesses of the EPS shuttering elements

Thickness of the wall [mm]	**HDPE ties (Colour)**	**Thickness of EPS shuttering leaves**		**Thickness of concrete core** [mm]
		inner [mm]	**outer** [mm]	
210	black	57	57	96
260	blue	57	108	96
		57	57	147
311	yellow	108	108	96
		57	108	147
		57	57	197
362	green	108	108	147
		57	108	197
		57	57	248
413	red	108	108	197
		57	108	248
		57	57	299
464	brown	108	108	248
		57	108	299
		57	57	350
210 + 305 or 260 + 305 or 311 + 305 or 362 + 305 or 413 + 305 or 464 + 305	"Extender Tie" * orange	any combination of EPS shuttering leaves as per above		enables the extension of the thickness of the concrete core by 305 mm
* It is possible to combine the "Extender Tie" with every other HDPE-tie of Table 1.				

The top and the bottom of each EPS shuttering leaf incorporate an interlocking arrangement to form a tight joint (see Annexes 2 and 3).

Slots, at 51 mm [2”] centres, are also incorporated in the top and bottom to receive the HDPE ties.

The surfaces are generally smooth. There are also element-high slight vertical grooves at 51 mm [2”] centres with deeper grooves at 305 mm [12”] centres on the outside face of each EPS shuttering leaf. At these points the HDPE ties are installed so that their mid-axis and the mid-axis of the deeper grooves are in alignment with one another. Furthermore there is an internal vertical tapering at the end of the EPS shuttering leaf to form wall corners.

The vertical ends of the EPS shuttering leaves are smooth and form a tight but unsealed joint. Sealing foam is used to seal these vertical joints, where required, and to fill in gaps caused by inaccuracy of foundation level to between any of the formed joints.

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

The formwork requires alignment and support during concrete placing (see Annex 15).

The system can be used to construct straight and curved walls (minimum radius 885 mm to inside face) with right, obtuse and acute angles.

Steel reinforcement can be fixed directly to the HDPE tie web. Flanges incorporated within the HDPE tie design provide a fixing for dry lining, cladding and temporary propping or bracing. The maximum centre distance of HDPE ties in longitudinal direction of the shuttering elements shall be 305 mm [12“]. At rectangular corners, T-walls, non rectangular corners, openings or highly stressed areas the HDPE ties shall be placed closer (see Annexes 9 to 13). In these situations HDPE ties can be split to allow close centres to be achieved.

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

1.1.2 Accessory parts

1.1.2.1 Wire top ties (metal ties, only on top the wall), (Annex 1)

Wire top ties, bent from 5 mm galvanized wire, are used to provide additional support of assembled EPS shuttering leaves at the top of the wall. Combined with metal tracks (see clause 1.1.2.2) they guarantee a clean, straight finish on top of the wall.

1.1.2.2 Metal tracks (only at the bottom and top of wall) (Annex 1)

Pressed steel tracks are available in 57 mm and 108 mm widths and min. 0,8 mm [0,0325“] thick galvanized steel sheet. Track is used at the base of the wall construction, to provide a locating position and add stability during concrete placing, and at the top of the EPS shuttering leaves to protect joints from wet concrete and provide temporary stability.

1.1.2.3 Metal corner brackets (Annex 1)

Inner and outer corners are strengthened during the concrete placing by galvanized steel brackets (for rectangular as well as for non rectangular corners). This eliminates the use of external bracing during the concrete placing.

1.2 Intended use

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

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

According to EOTA TR 034 the following use categories apply:

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

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

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

2 Characteristics of product and methods of verification

2.1 Characteristics of product

2.1.1 General

The shuttering kit "QUAD-LOCK" consists of the following elements:

- shuttering elements and
- accessory parts,

see clauses 2.1.2 and 2.1.3.

2.1.2 Shuttering elements

The shuttering elements (composed of EPS shuttering leaves and HDPE ties) correspond to the information and drawings given in Annexes 1 to 7.

The characteristic data of the shuttering elements are given in Annex 19.

The EPS shuttering leaves are made of expanded polystyrene (EPS) according to EN 13163 composed of polystyrene particle foam. The parameters and characteristics of the EPS are indicated in Table 2.

Table 2: Parameters and characteristics of the EPS according EN 13163

EPS leaves			Designation code of the EPS according EN 13163	Mean value of density ρ [kg/m³]	Nominal value of thermal conductivity λ [W/(m×K)]
Type	Type of EPS element	Thickness [mm]			
"Regular Panel"	shuttering element	57	EPS-EN 13163-T1-L1-W2-S2-P4-DS(70, -)3-BS350-DS(N)5-TR400	30	0,0346
"Plus Panel"	shuttering element	108	EPS-EN 13163-T1-L1-W2-S2-P4-DS(70, -)3-BS200-DS(N)5-TR200	24	0,0370
"Extra Panel"	Insulation element	102	EPS-EN 13163-T1-L1-W2-S2-P4-DS(70, -)3-BS170-DS(N)5-TR200	18	0,0369

The ties are moulded of high density plastic (polyethylene) (HDPE ties).

The tensile strength of the HDPE ties shall be at least 2400 N and the junction tensile strength between the HDPE ties and the "Extender Tie" shall be at least 2400 N. The pull-out strength between HDPE ties and the EPS shuttering leaves leaves shall be at least 1800 N.

The material characteristics, dimensions and tolerances of the shuttering elements not indicated in Annexes 2 to 7 are given in the technical documentation[7] of the ETA.

2.1.3 Accessory parts

The accessory parts correspond to the information and drawings given in Annex 1. The accessory parts are:

- wire top ties made from 5 mm galvanized wires,
- metal tracks made of galvanized steel of 1 mm thickness and
- metal corner brackets made of galvanized steel of 1 mm thickness.

2.2 Methods of verification

2.2.1 General

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

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

2.2.2 Essential Requirement 1: Mechanical resistance and stability

2.2.2.1 Resulting structural pattern

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

2.2.2.2 Efficiency of filling

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

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

2.2.2.3 Possibility of steel reinforcement

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

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

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

2.2.3 Essential Requirement 2: Safety in case of fire

2.2.3.1 Reaction to fire

Shuttering elements "QUAD-LOCK" made of expanded polystyrene (EPS) fulfil the requirement of Class E according to EN 13501-1[8].

2.2.3.2 Resistance to fire

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

According to ETAG 009, Annex C, Table 1, for a continuous type of load-bearing walls ("REI") or non load-bearing walls ("EI") and a minimum concrete strength of C16/20, the system meets the criteria "REI" and "EI" according to Table 3.

Table 3: Determination of "REI" of load-bearing walls and "EI" of non load-bearing walls

Thickness of concrete core [mm]	**"REI"**	**"EI"**
96	–	60
147	90	120
197	120	120
248	120	120
299	120	120
350	120	120

The preconditions for this classification are:

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

2.2.4 Essential Requirement 3: Hygiene, health and environment

2.2.4.1 Content and/or release of dangerous substances

The chemical composition of the shuttering system/kit must comply with the data deposited with Deutsches Institut für Bautechnik.[9]

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

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

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

The content of HBCDD is < 1 % by weight.

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

- no assessment and verification methods are given in this ETA,

or

- the "No performance determined" option is declared,

or

- the chosen verification and assessment method does not comply with the regulatory requirement of a particular Member State,

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

2.2.4.2 Water vapour permeability

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

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

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

2.2.4.3 Water absorption

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

2.2.4.4 Watertightness

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

2.2.5 Essential Requirement 4: Safety in use

2.2.5.1 Bond strength between layers of an EPS shuttering leaf respectively between EPS shuttering leaves and concrete core and resistance to impact load

Under end use conditions the EPS shuttering leaves are durable fixed by the HDPE-ties, included the insulation element "Extra Panel" which can be incorporated inside the cavity of the concrete core. The bond strength is at least equal to the resisting pressure of fresh concrete of the EPS shuttering leaves, see clause 2.2.5.2.

Concrete walls (without consideration of the finishes), constructed with shuttering system "QUAD-LOCK" and designed according EN 1992-1-1 respectively in lack of availability of EN 1992-1-1 according national design rules, lead to the assumption that concrete core insures an adequate resistance of the complete wall under normal used impact loads.

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

2.2.5.2 Resistance to pressure of fresh concrete

To resist the pressure of fresh concrete the bending tensile strength of the EPS shuttering leaves shall be more than

- 200 kPa for the "Plus Panel" respectively
- 350 kPa for the "Regular Panel",

see designation code "BS200" respectively "BS350" of EPS in clause 2.1.2.

Because the insulation element "Extra Panel" is used to improve the insulating property of the wall the verification of the resistance to pressure of fresh concrete respectively the bending tensile strength of 170 kPa of these elements is not necessary, see designation code "BS170" of EPS in clause 2.1.2.

The tensile strength of the HDPE-ties shall be at least 2400 N and the junction tensile strength between the HDPE ties and the "Extender Tie" shall be at least 2400 N. The pull-out strength between HDPE ties and the EPS shuttering leaves shall be at least 1800 N.

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

2.2.5.3 Safety against personal injury by contact

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

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

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

2.2.6 Essential Requirement 5: Protection against noise

2.2.6.1 Airborne sound insulation

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

2.2.6.2 Sound absorption

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

2.2.7 Essential Requirement 6: Energy economy and heat retention

2.2.7.1 Thermal resistance

The nominal value of thermal resistance $R_{D,element}$ of the shuttering elements in end use conditions (see Annex 19, with concrete core without rendering) is the sum of the nominal value of thermal resistance of the EPS shuttering leaves $R_{D,EPS}$ and the concrete core $R_{D,concrete}$. The nominal value of thermal resistance of the EPS shuttering leaves $R_{D,EPS}$ shall be calculated in accordance with EN ISO 6946 with a nominal value of thermal conductivity of the EPS shuttering leaves of λ = 0,0346 W/(m×K) (for 57 mm "Regular Panel"), λ = 0,0370 W/(m×K) (for 108 mm "Plus Panel") respectively λ = 0,0369 W/(m×K) (for 102 mm "Extra Panel") according to EN 13163, clause 4.2.1 and the nominal value of thermal resistance of the concrete core $R_{D,concrete}$ shall be calculated in accordance with EN ISO 6946 with a nominal value of thermal conductivity λ of the concrete core depending on the density ρ tabulated in EN ISO 10456 and considering the influence of the HDPE ties by an reduction factor, see Table 4, according to the influence of the thickness of the EPS shuttering leaves.

Table 4: Reduction factor

Thickness of EPS shuttering leaves		Reduction factor
inner leaf [mm]	**outer leaf** [mm]	
57	57	0,961
57	108	0,967
108	108	1,0
57	210	1,0
108	210	1,0
57	312	1,0
108	312	1,0
159	212	1,0
210	312	1,0

The planner shall consider the metal accessory parts (wire top ties, metal tracks, metal corner brackets, see Annex 1) as thermal bridges, where relevant, for determination of the nominal value of thermal resistance $R_{D,element}$.

2.2.7.2 Heat capacity

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

2.2.8 Aspects of durability and serviceability

2.2.8.1 Resistance to deterioration

Physical agent

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

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

Chemical agent

Ties are made of high density plastic (polyethylene) (HDPE). There is no corrosion of the HDPE ties in concrete.

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

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

Biological agent

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

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

The shuttering system "QUAD-LOCK" does not contain any biocides.

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

2.2.8.2 Resistance to normal use damage

Normal use impacts

Concrete walls (without consideration of the finishes), constructed with shuttering system "QUAD-LOCK" and designed according EN 1992-1-1 respectively in lack of availability of EN 1992-1-1 according national design rules, lead to the assumption that concrete core insures an adequate resistance of the complete wall under normal used impact loads.

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

Incorporation of ducts

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

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

Fixing of objects

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

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

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the Decision 98/279/EC of 5 December 1997[10] amended by the Decision 2001/596/EC[11] of the European Commission system 2+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

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

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

(b) Tasks for the approved body:
  (4) certification of factory production control on the basis of:
    – initial inspection of factory and of factory production control;
    – continuous surveillance, assessment and approval of factory production control.

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

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Initial type-testing of the product

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

[10] Official Journal of the European Communities L /127 of 24 April 1998
[11] Official Journal of the European Communities L /209 of 8 January 2001

3.2.1.2 Factory production control

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

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

The factory production control shall be in accordance with the modified control plan of 1 February 2013 which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.[12]

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

3.2.1.3 Other tasks of the manufacturer

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

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

3.2.2 Tasks for the approved body

The approved body shall perform the

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

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

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

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

3.3 CE marking

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

- the name and the address of the manufacturer (legal entity responsible for the manufacturer)
- 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-06/0189
- the number of the guideline ETAG 009 of the European technical approval
- Reaction to fire: Class according to EN 13501-1 (see clause 2.2.3.1)
- Resistance to fire: Class according to EN 13501-2 in dependence of minimum thickness of the concrete core (see clause 2.2.3.2)
- Protection against noise (see clause 2.2.6)
- the designation code of the expanded polystyrene according to EN 13163 (see clause 2.1.2)
- the nominal value of thermal resistance $R_{D,element}$ of the shuttering elements with concrete core and without rendering (see clause 2.2.7.1)

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

4.1 Manufacturing

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

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

4.2 Installation

4.2.1 General

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

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

In end use conditions concrete walls of a continuous type[13] of plain or reinforced concrete will be formed according to EN 1992-1-1 or according to corresponding national rules.

For structural design purposes the thickness of the wall is shown in Annex 19.

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

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

4.2.2 Installation of the shuttering elements

The shuttering elements are put together on site in layers without mortar or adhesive. To receive stable floor high formworks the vertical joints between two elements of one layer have to be shifted of at least a quarter of the element length, better a half of the element length, to the vertical joints of the previous and next layer (see Annexes 8 and 10 to 12).

The HDPE ties are assembled on site into the inner and outer EPS shuttering leaves to reach complete shuttering elements. The HDPE ties shall be stacked (one upon the other) to avoid segregation of concrete.

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

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

Subsequently, according to the installation guide of the manufacturer, the shuttering elements are to be interlocked to floor height, levelled and fastened to the scaffolding supports (see Annex 15).

The scaffolding supports shall be arranged with a maximum distance of 1,20 m to 1,80 m to be connected over the entire wall height with the shuttering elements and to be fastened to the floor.

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

Rectangular corners, T-walls and non rectangular angles are to be formed according to Annexes 9 to 13. Typical junctions between walls and ceilings are to be formed according to Annex 17.

Further information is given in the installation guide.

4.2.3 Concreting

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

The maximum aggregate size shall be between 8 mm (for nominal concrete core thicknesses of 96 mm and 147 mm) and 16 mm (for nominal concrete core thicknesses of 197 mm to 350 mm).

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

The "Extra Panel" has to be incorporated inside the cavity of the concrete core before concreting.

[13] see ETAG 009, clause 2.2

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

Placing the concrete shall be performed in layers of maximum 1 m at a maximum concreting rate of 3 m/h. For curved and angled walls made with shuttering elements the concreting rate shall not exceed 1 m/h.

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

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

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

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

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

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

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

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

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

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

4.2.4 Ducts crossing and situated inside the wall

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

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

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

4.2.5 Reworking and finishes

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

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

4.2.6 Fixing of objects

Fixing of objects in the EPS shuttering leaves is not possible. The part of fixings which is relevant for the mechanical resistance shall be inside the concrete core. The influence of the fixing to the reduction of the nominal value of thermal resistance $R_{D,element}$ shall be considered according to EN ISO 6946.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

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

5.2 Use, maintenance, repair

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

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

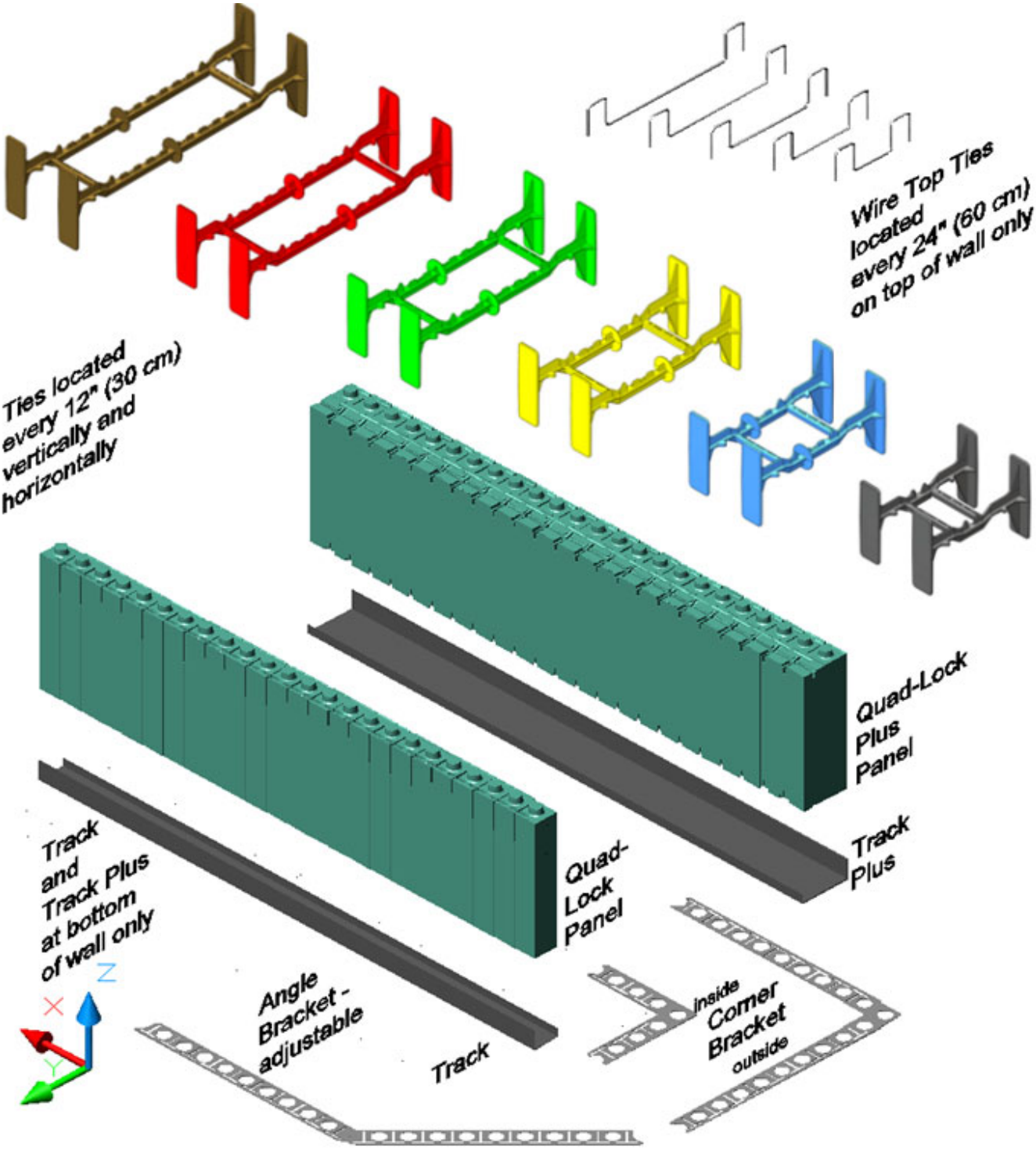
The shuttering elements have to be protected against high temperature, overheating and intensive exposure to weather and UV radiation. If necessary, the shuttering elements have to be covered.

Georg Feistel
Head of Department

beglaubigt:
Schwab

Deutsches Institut für Bautechnik DIBt

QUAD-LOCK components for the constructing of walls, inclusive wall corners (for rectangular as well as for non rectangular corners) and T-walls of various concrete thicknesses and values of thermal resistance



Shuttering kit "QUAD-LOCK"	Annex 1
Components of the Insulating Concrete Forming (ICF) System	

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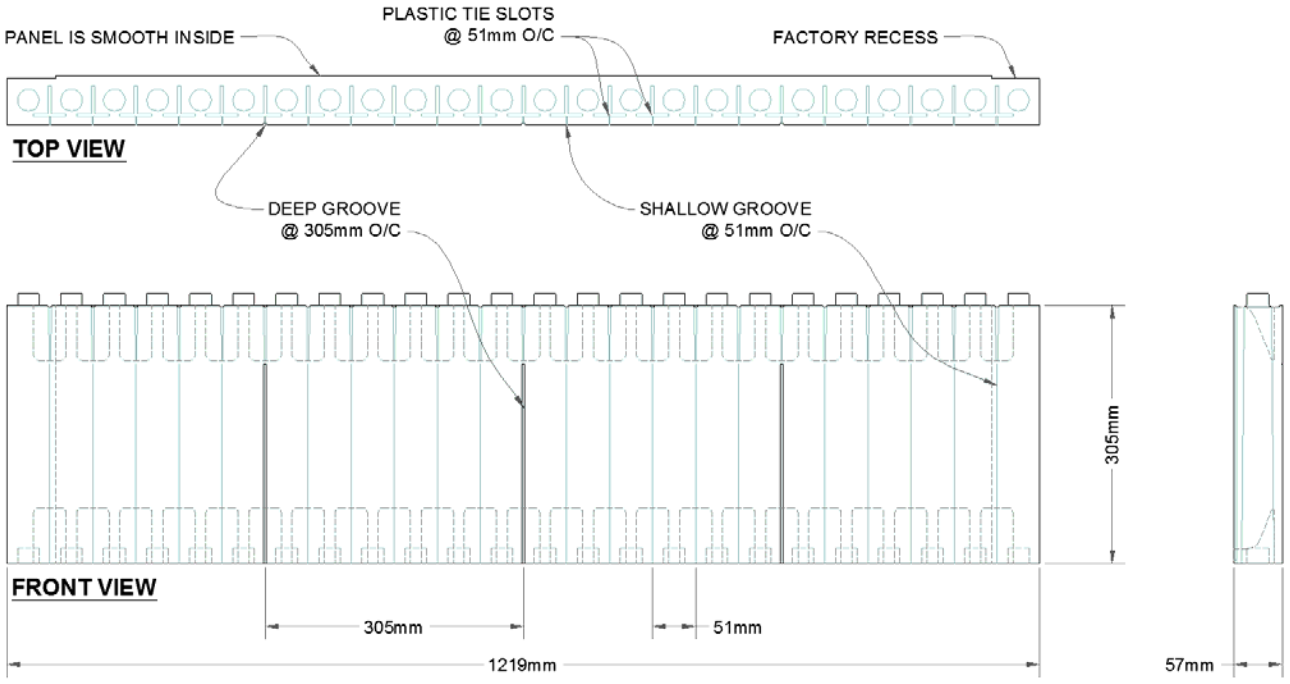
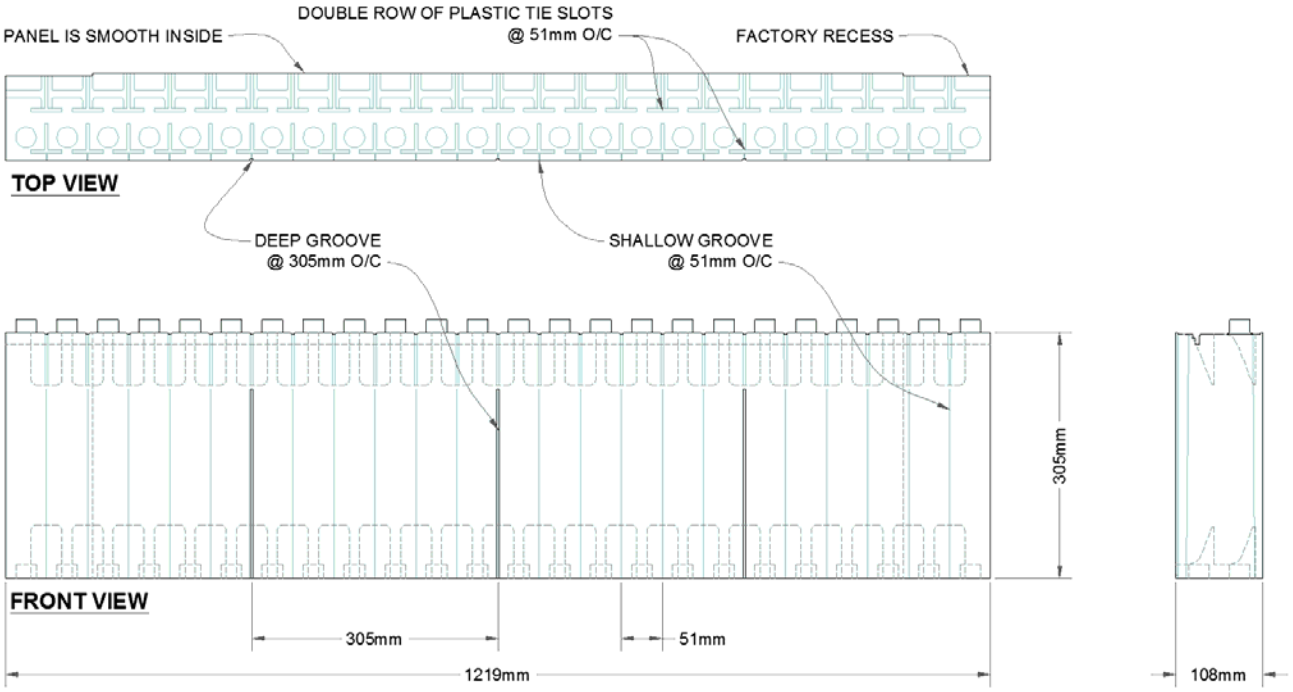
QUAD-LOCK "Regular Panel"



QUAD-LOCK "Plus Panel"



all dimensions in [millimeter]

Shuttering kit "QUAD-LOCK"	Annex 2
Dimensions of the shuttering leaves "Regular Panel" and "Plus Panel" made of expanded polystyrene (EPS shuttering leaves)	

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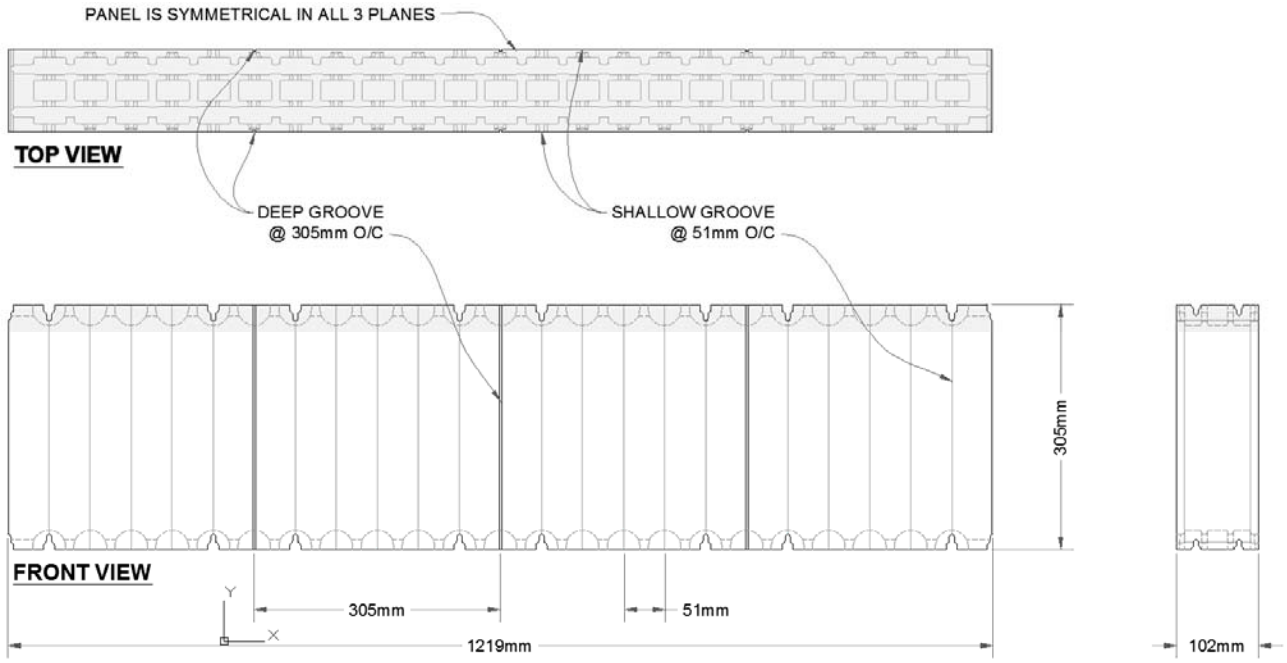
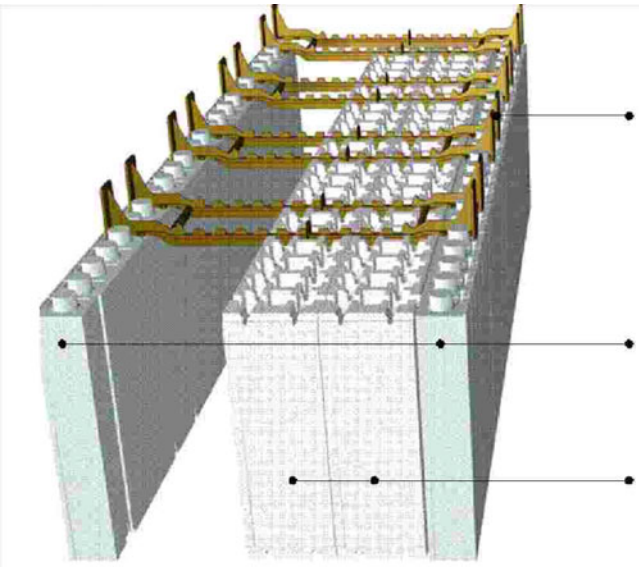
QUAD-LOCK "Extra Panel"



The 102 mm [4"] thick insulation element "Extra Panel" has to be incorporated inside the cavity of the concrete core before concreting. Thereby the thickness of the concrete core is reduced by 102 mm. It is possible to combine the "Extra Panel" with the "Regular Panel" or the "Plus Panel".



HDPE ties according Annex 4

Shuttering leaves according Annex 2

Insulation element "Extra Panel" incorporated inside the cavity of the concrete core before concreting

all dimensions in [millimeter]

Shuttering kit "QUAD-LOCK"	Annex 3
Dimensions of the shuttering leaf "Extra Panel" made of expanded polystyrene (EPS shuttering leaves)	

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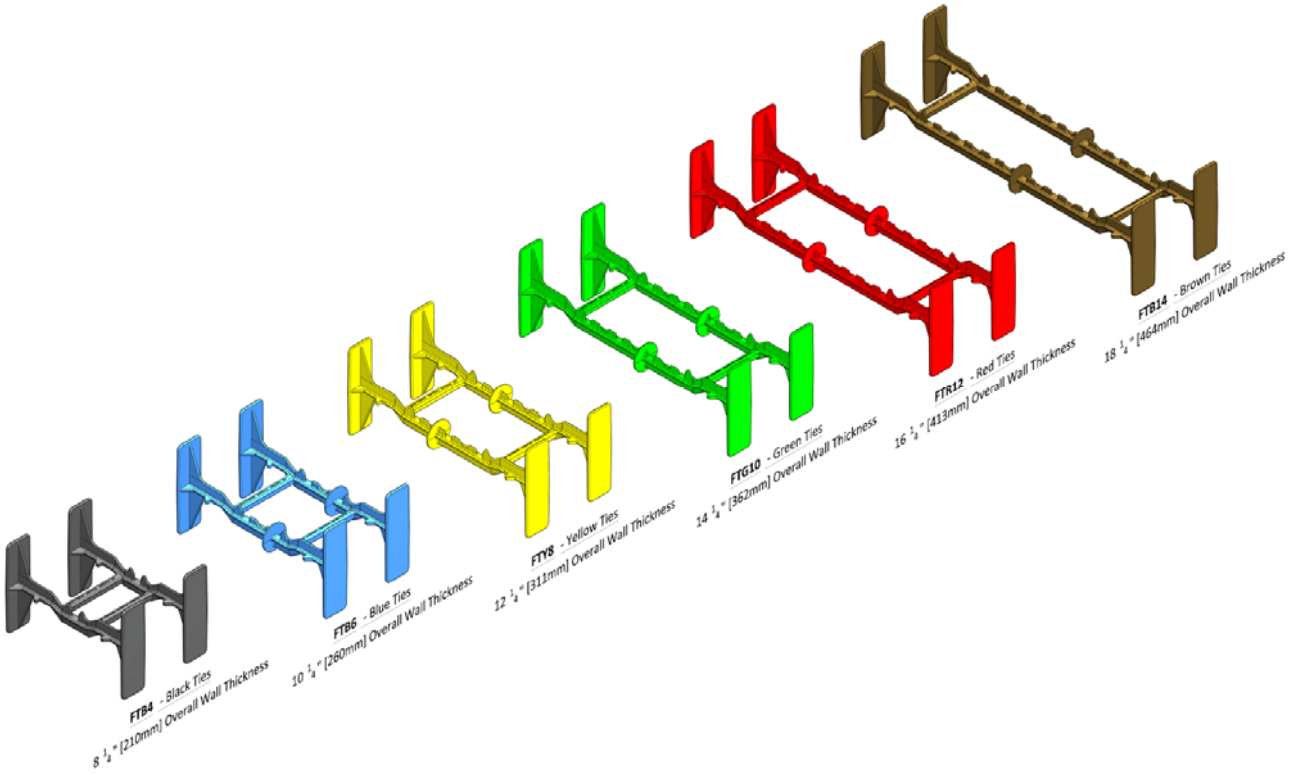
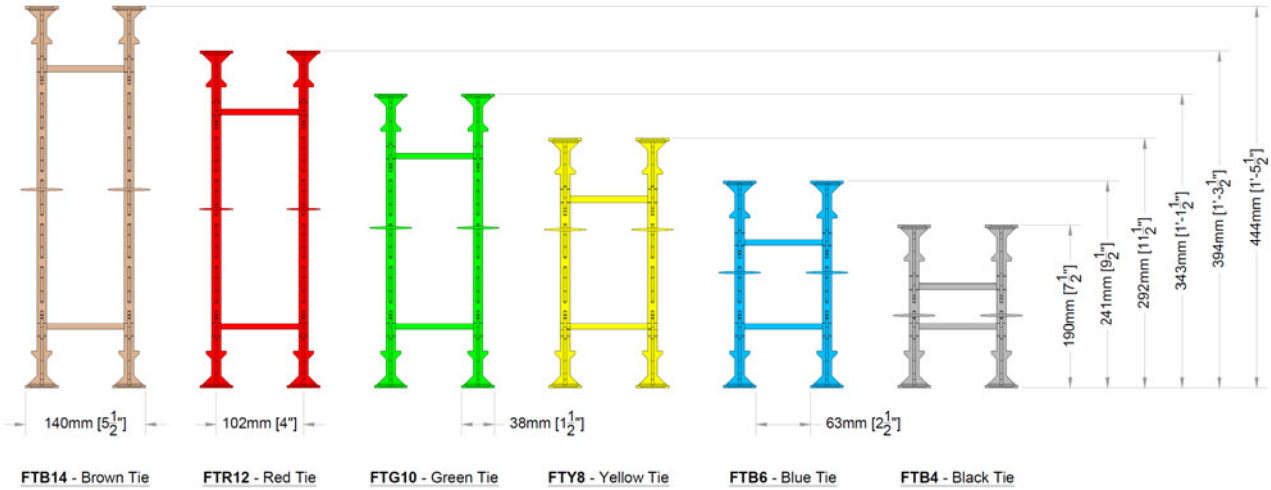
QUAD-LOCK HDPE ties for various wall thicknesses and concrete thicknesses





all dimensions in [millimeter] and [inches]

Shuttering kit "QUAD-LOCK"	Annex 4
Dimensions of the ties made of high density plastic (HDPE ties)	

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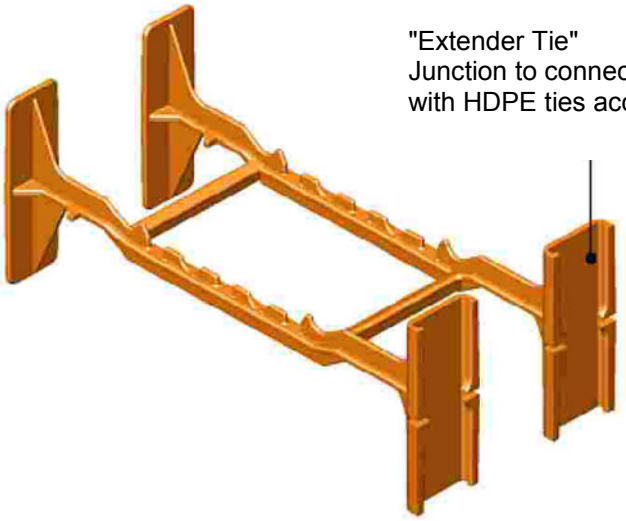
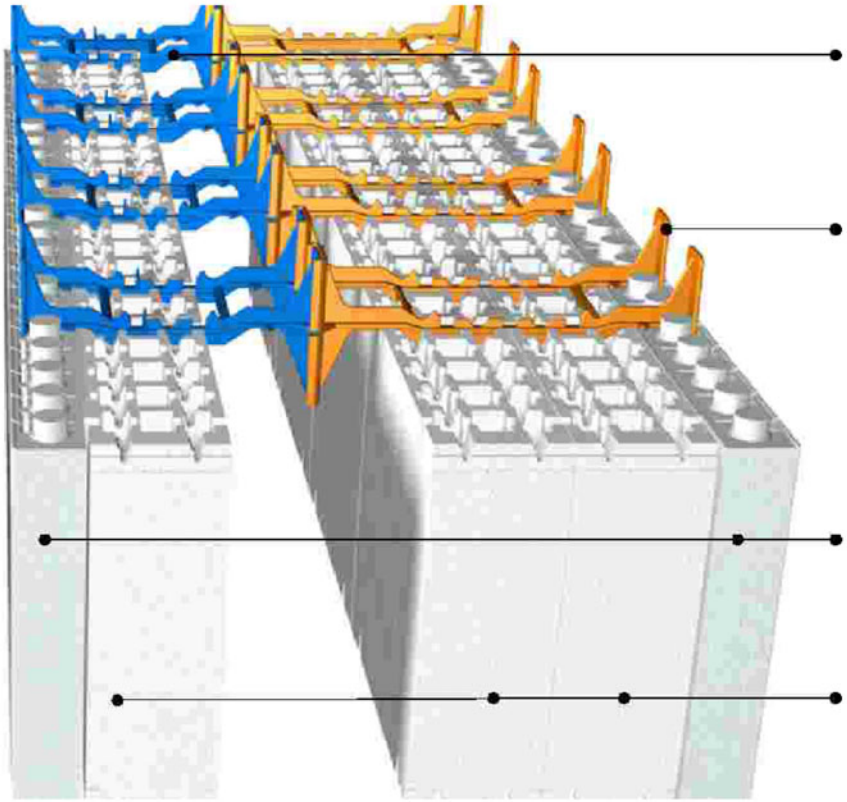
QUAD-LOCK "Extender Tie" enables the extension of the thickness of the concrete core by 305 mm



"Extender Tie"
Junction to connect the "Extender Tie" with HDPE ties according Annex 4



HDPE ties according Annex 4

"Extender Tie"
enables the extension of the thickness of the concrete core by 305 mm

Shuttering leaves according Annex 2

Insulation element "Extra Panel" incorporated inside the cavity of the concrete core before concreting according Annex 3

Shuttering kit "QUAD-LOCK"	Annex 5
Dimensions of the "Extender Tie" made of high density plastic (HDPE tie)	

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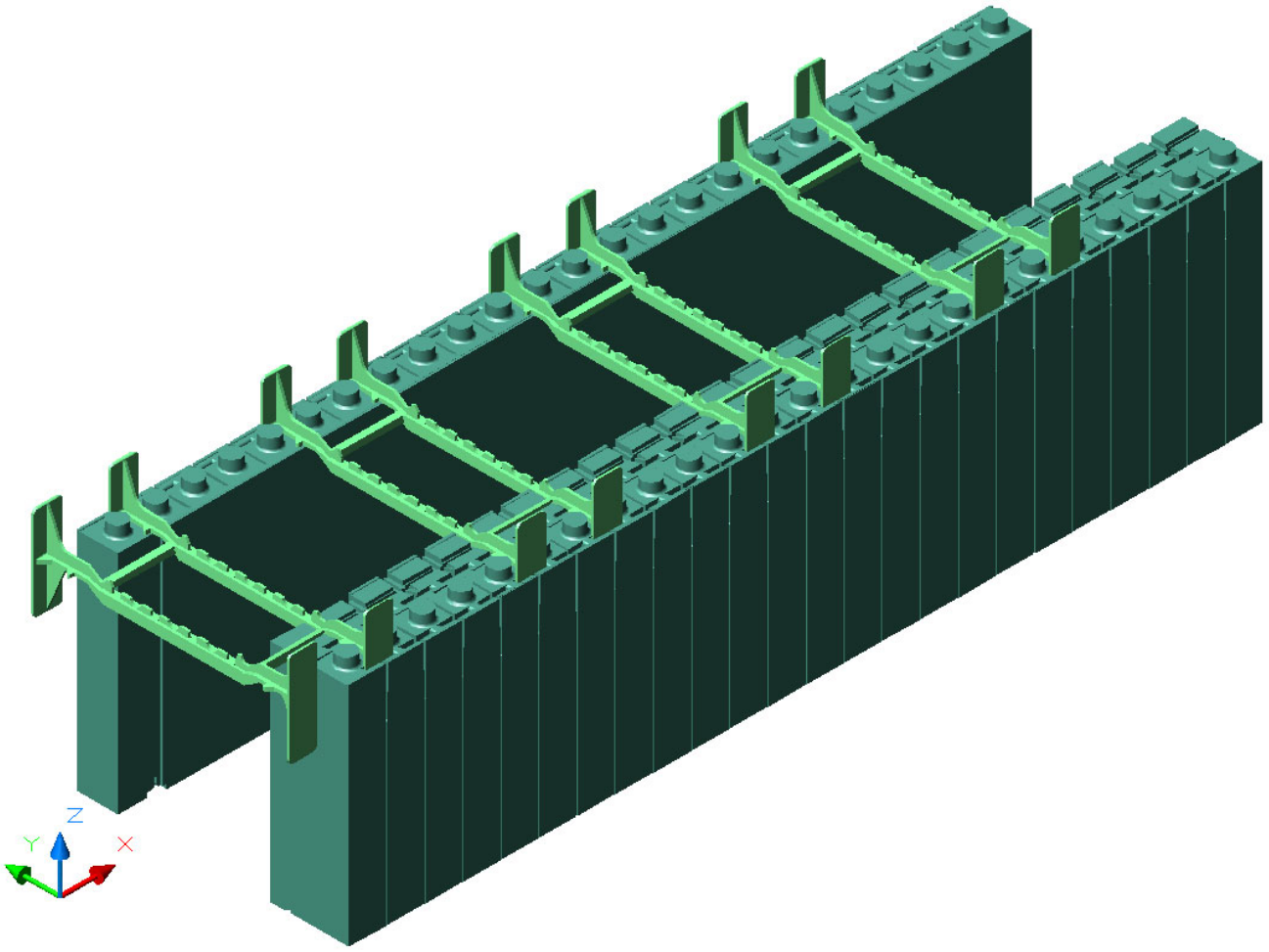

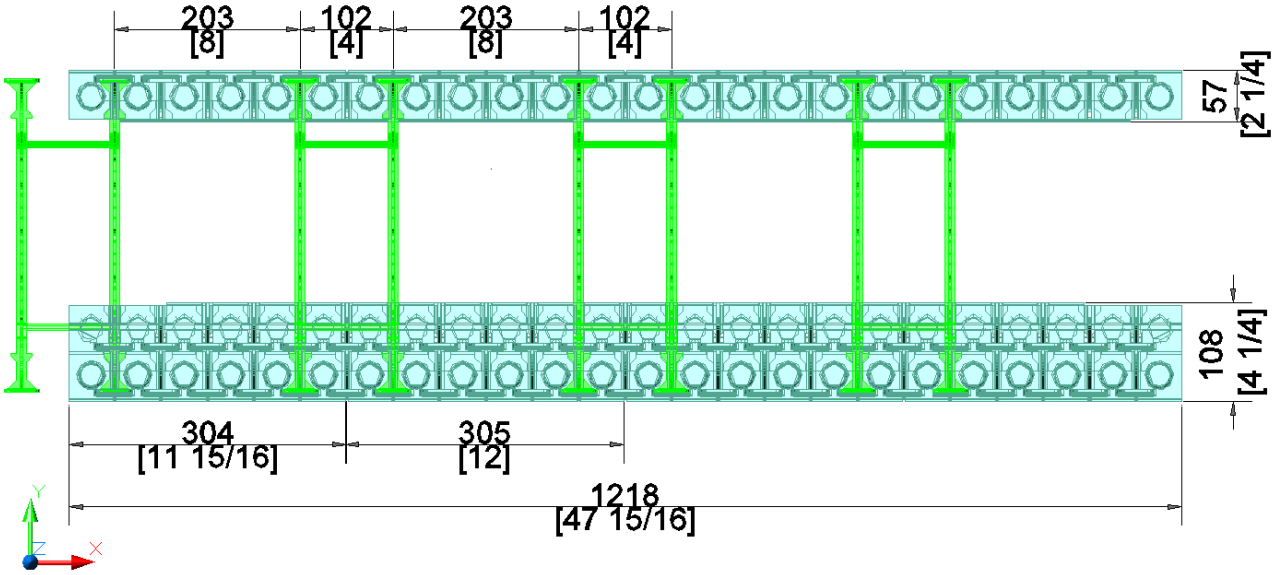

all dimensions in [millimeter] and [inches]

Shuttering kit "QUAD-LOCK"	Annex 6
Placement of the HDPE ties	

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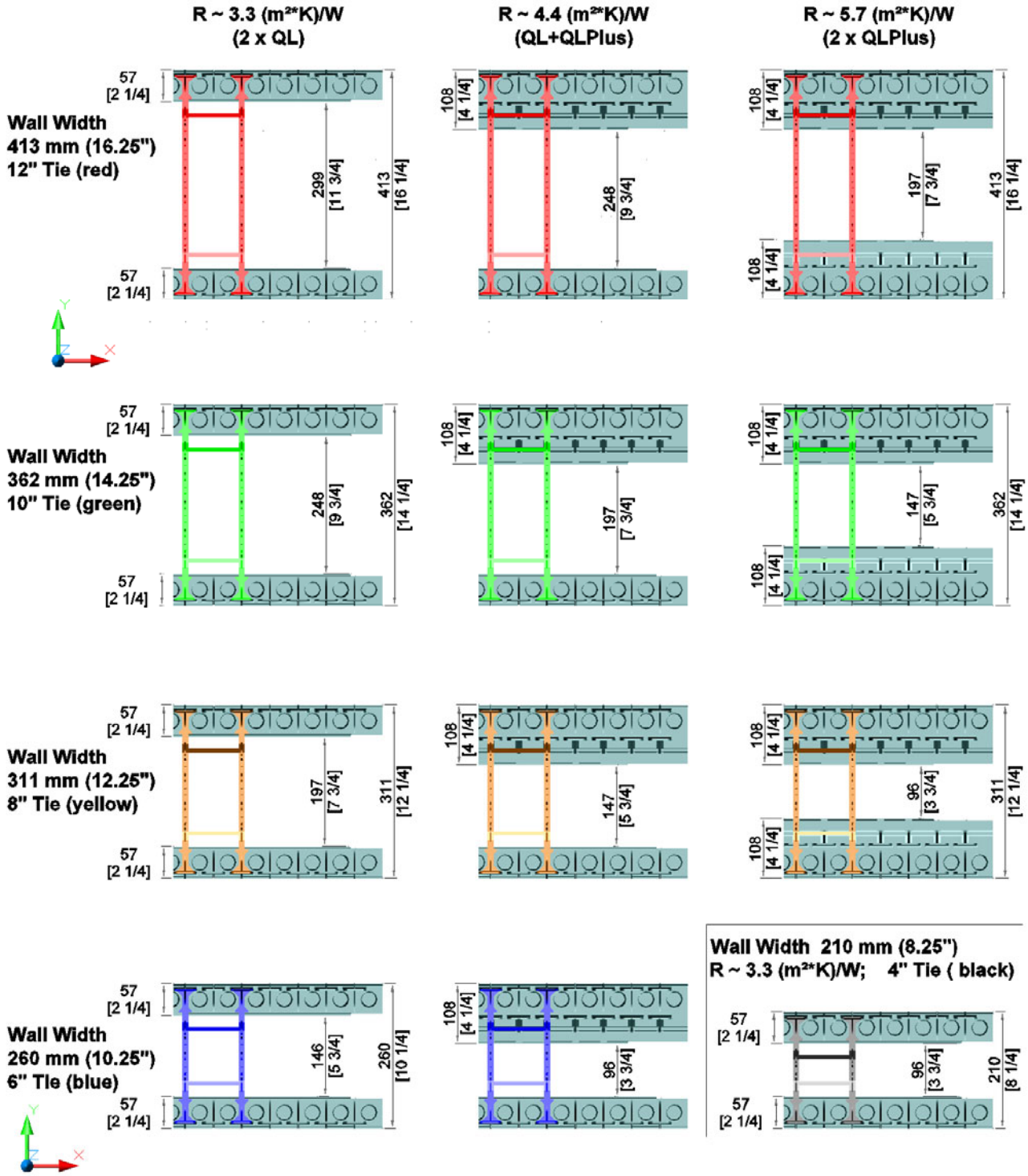

all dimensions in [millimeter] and [inches]

Shuttering kit "QUAD-LOCK"	Annex 7
Thicknesses of walls and concrete cores	

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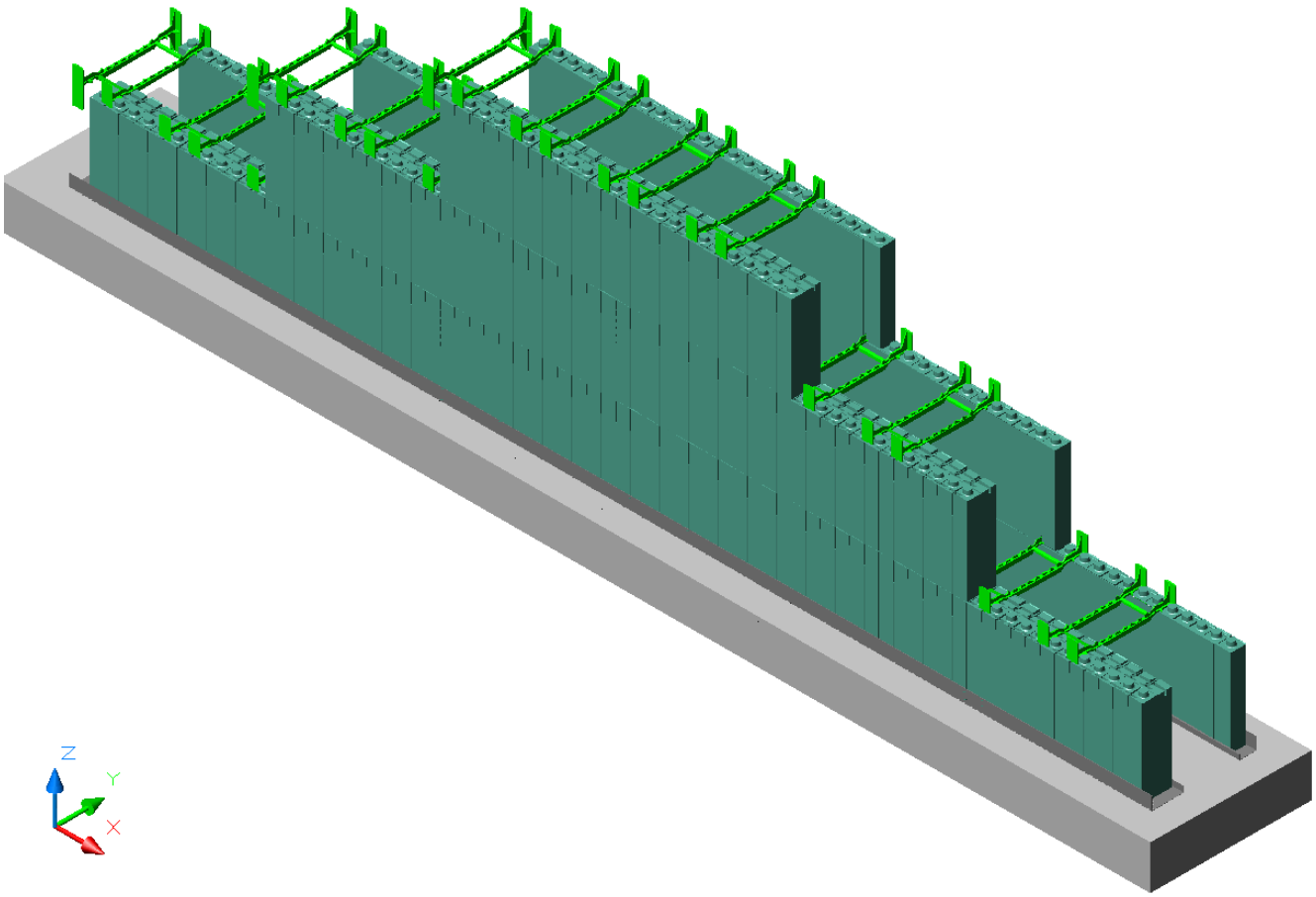
The vertical joints between two elements of one layer shall be shifted of at least a quarter of the element length, better a half of the element length, to the vertical joints of the previous and next layer.

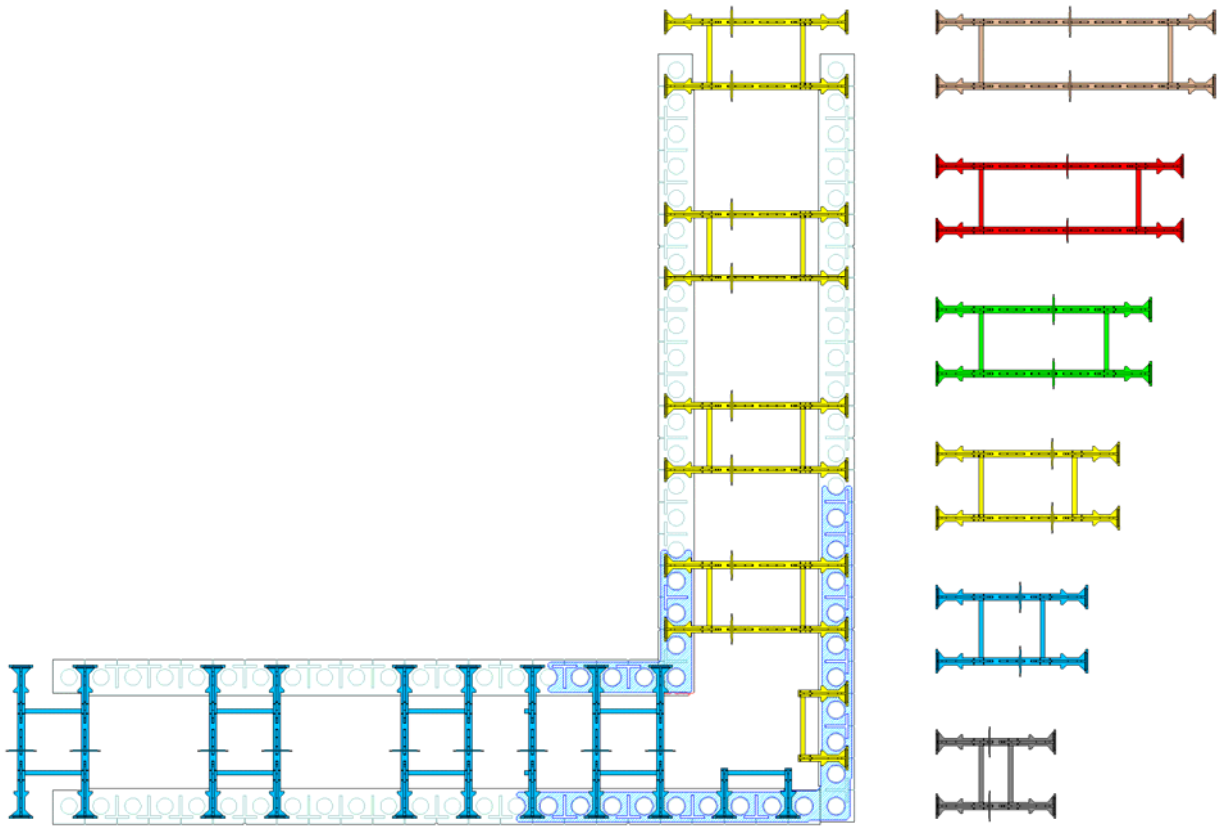
HDPE ties shall be placed every 305 mm [12”] vertically and horizontally in such a way that their mid-axis are in plane with the deeper vertical grooves at 305 mm [12”] centres on the outside face of each EPS shuttering leaf.

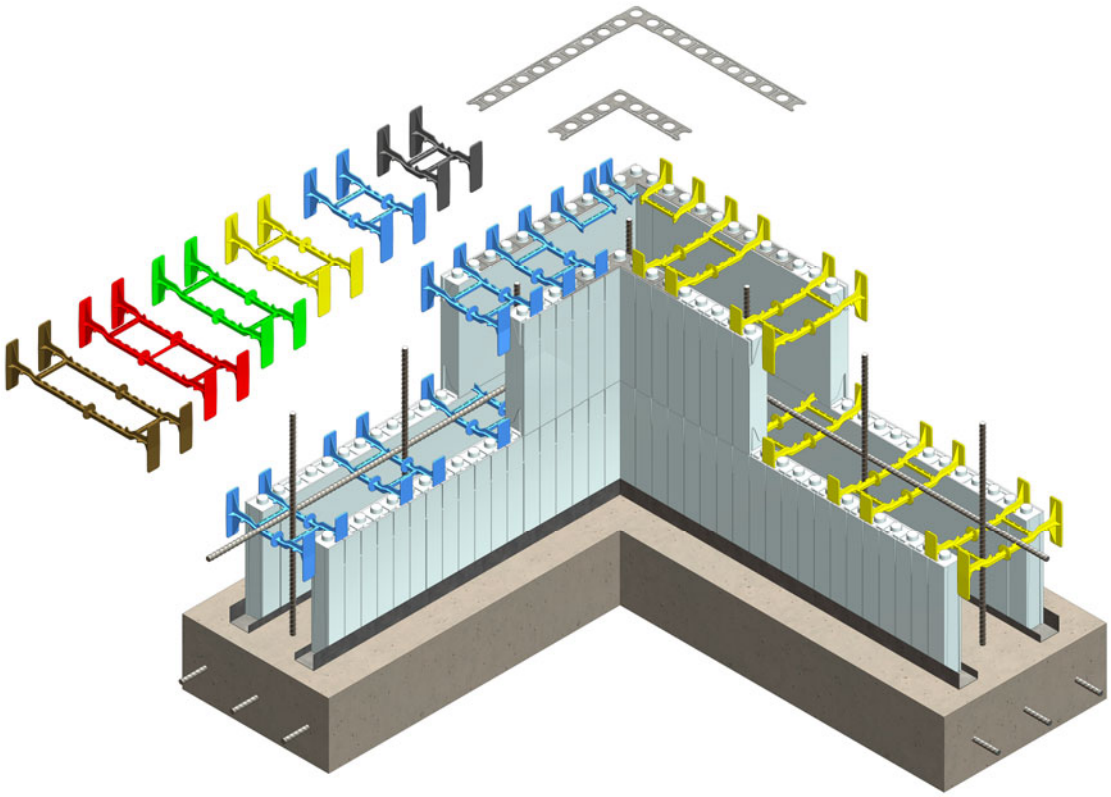
Metal tracks shall be securely fastened to concrete base.



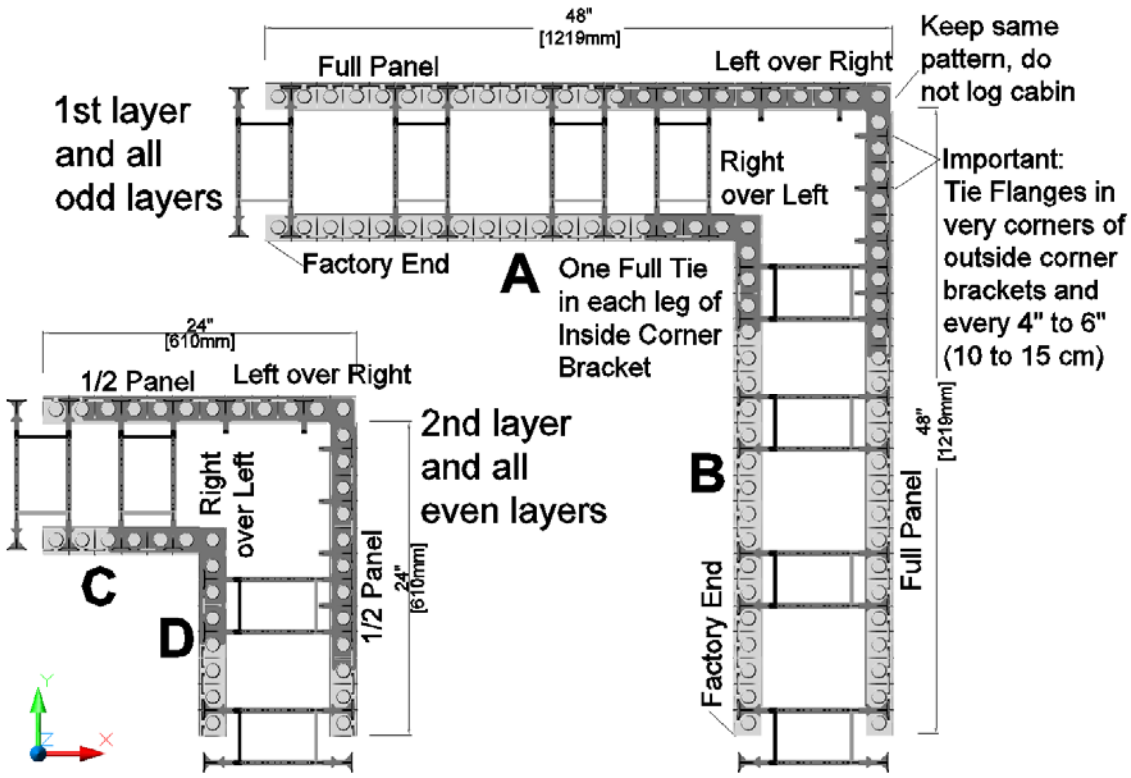
Shuttering kit "QUAD-LOCK"	Annex 8
Arrangement of EPS shuttering leaves and HDPE ties in a straight part of a wall	

Deutsches Institut für Bautechnik DIBt





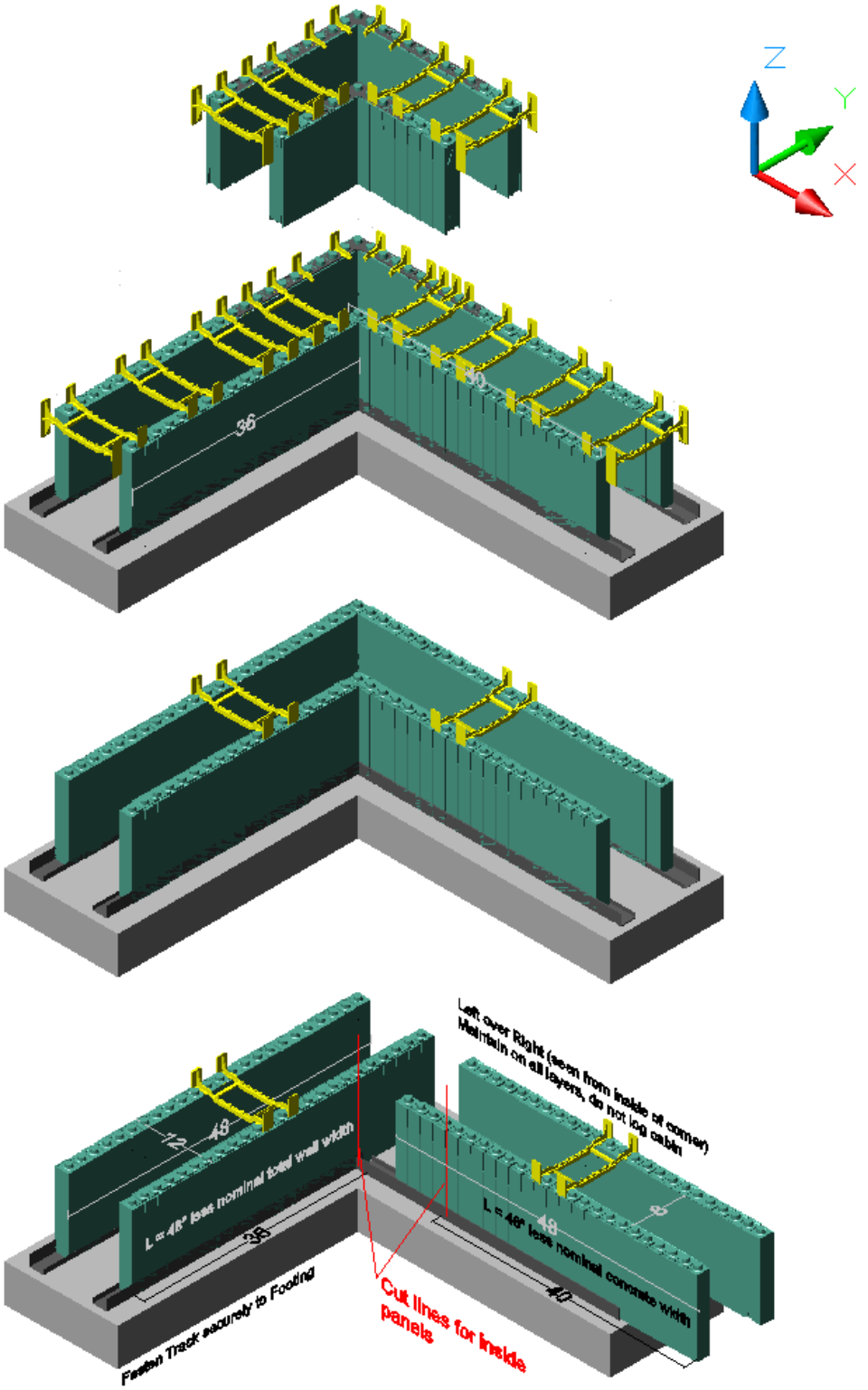
Shuttering kit "QUAD-LOCK"	Annex 9
Construction of rectangular corners: Placement of EPS shuttering leaves, HDPE ties and corner brackets	



all dimensions in [millimeter] and [inches]

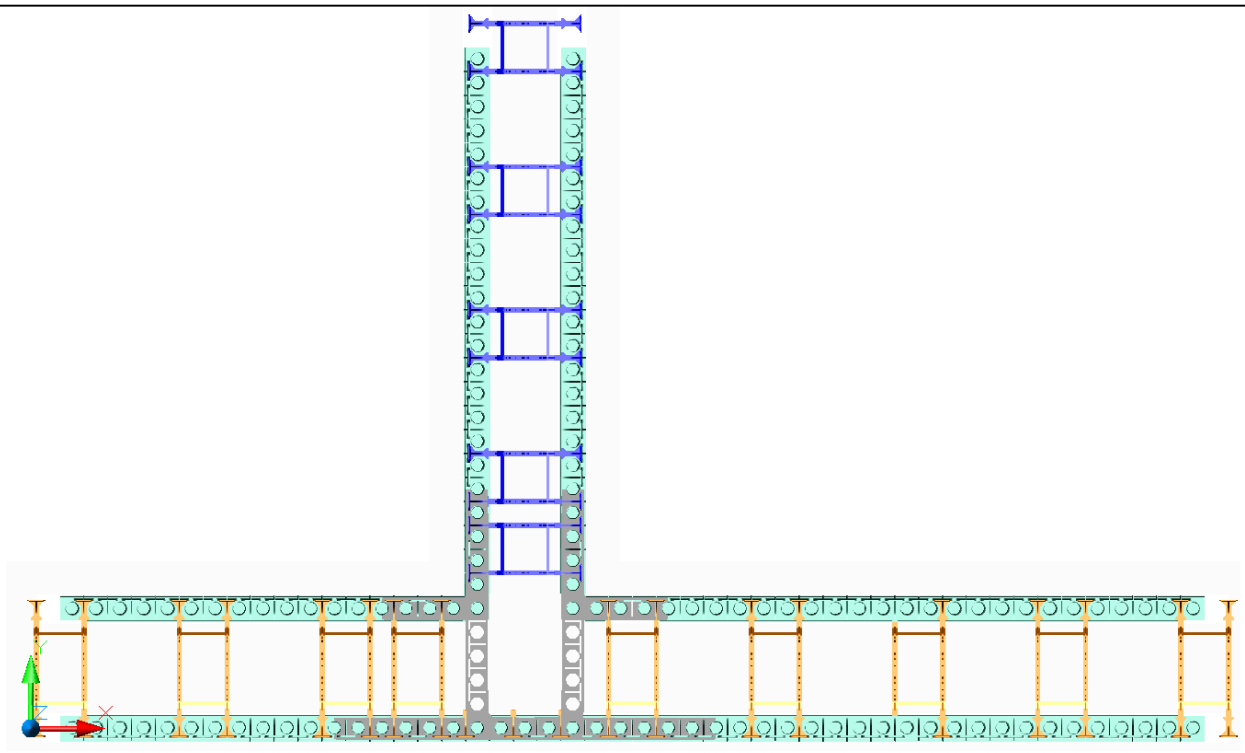
Shuttering kit "QUAD-LOCK"	Annex 10
Construction of rectangular corners: Placement of EPS shuttering leaves, HDPE ties and corner brackets	

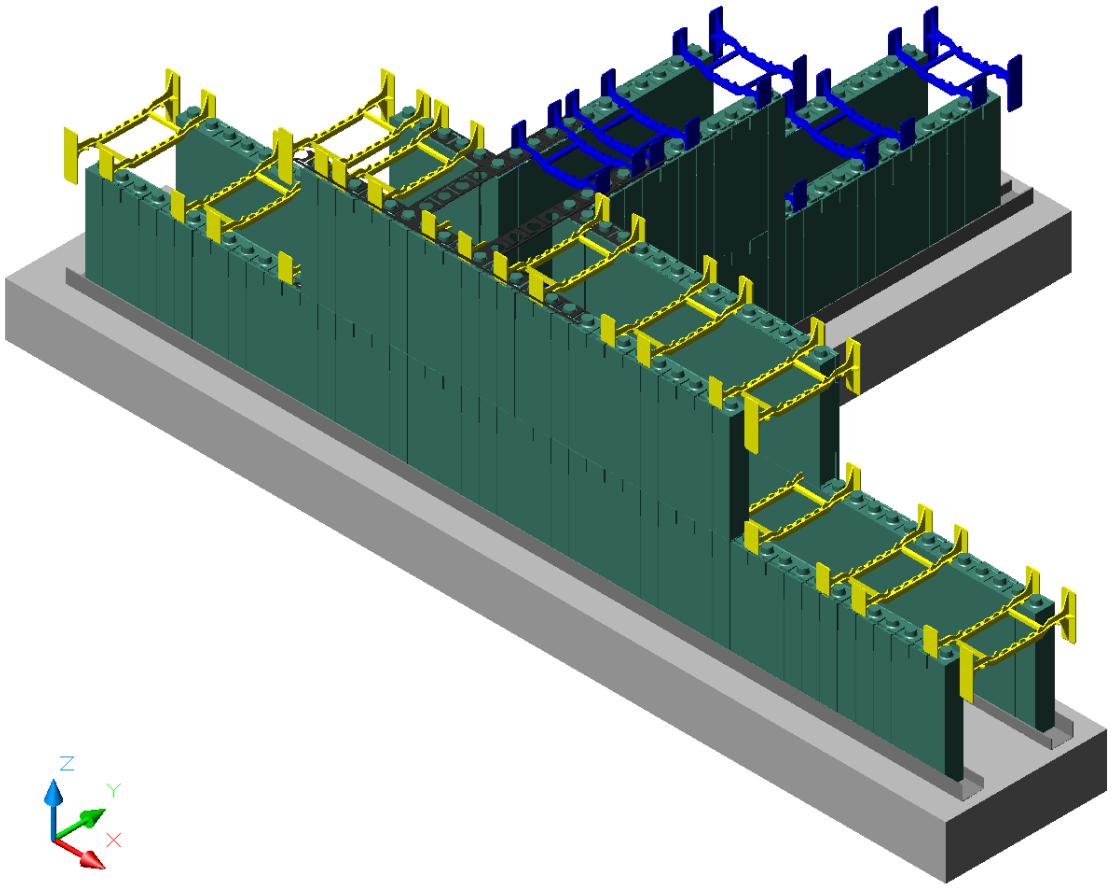
Deutsches Institut für Bautechnik DIBt



Shuttering kit "QUAD-LOCK"	Annex 11
Construction of rectangular corners – sequence: Placement and cutting of EPS shuttering leaves, HDPE ties and corner brackets	

Deutsches Institut für Bautechnik





Shuttering kit "QUAD-LOCK"	Annex 12
Construction of T-walls: Placement of EPS shuttering leaves, HDPE ties and corner brackets	

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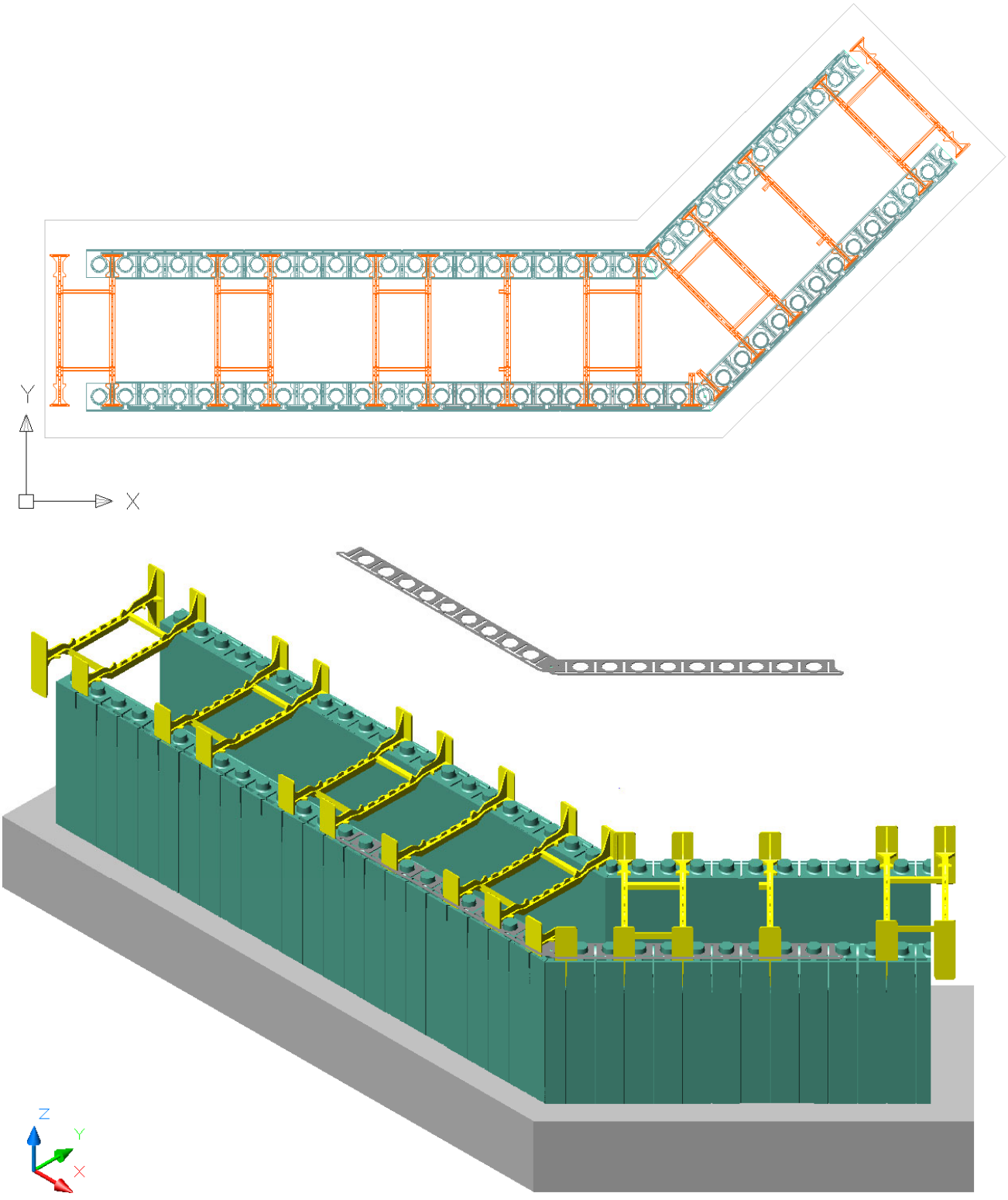
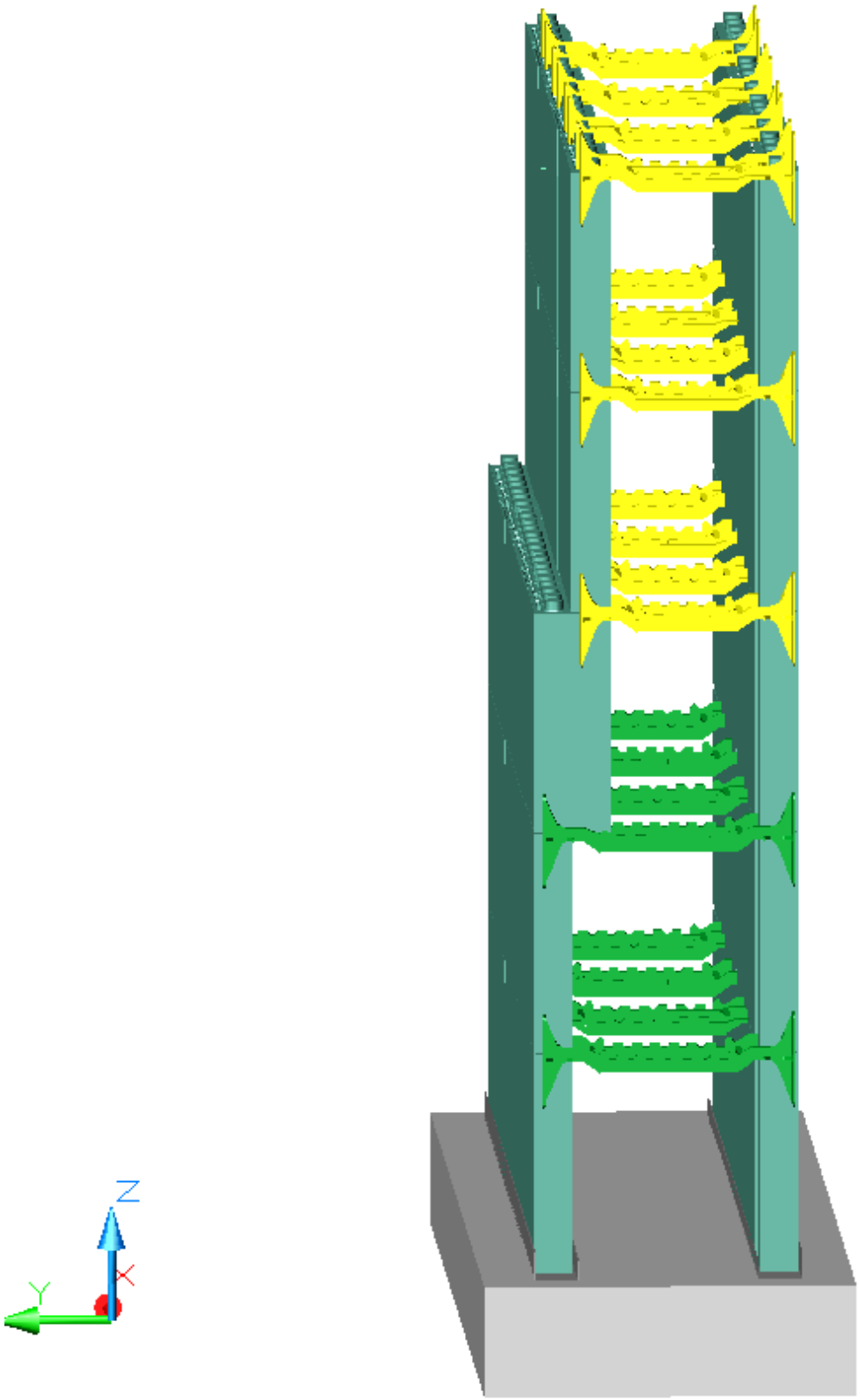


Shuttering kit "QUAD-LOCK"	Annex 13
Construction of non rectangular corners: Placement of EPS shuttering leaves, HDPE ties and angle brackets, no bracing outside required (regular bracing inside only)	



Shuttering kit "QUAD-LOCK"	Annex 14
Construction of a transition between different thicknesses of a wall by using QUAD-LOCK "Plus Panel"	

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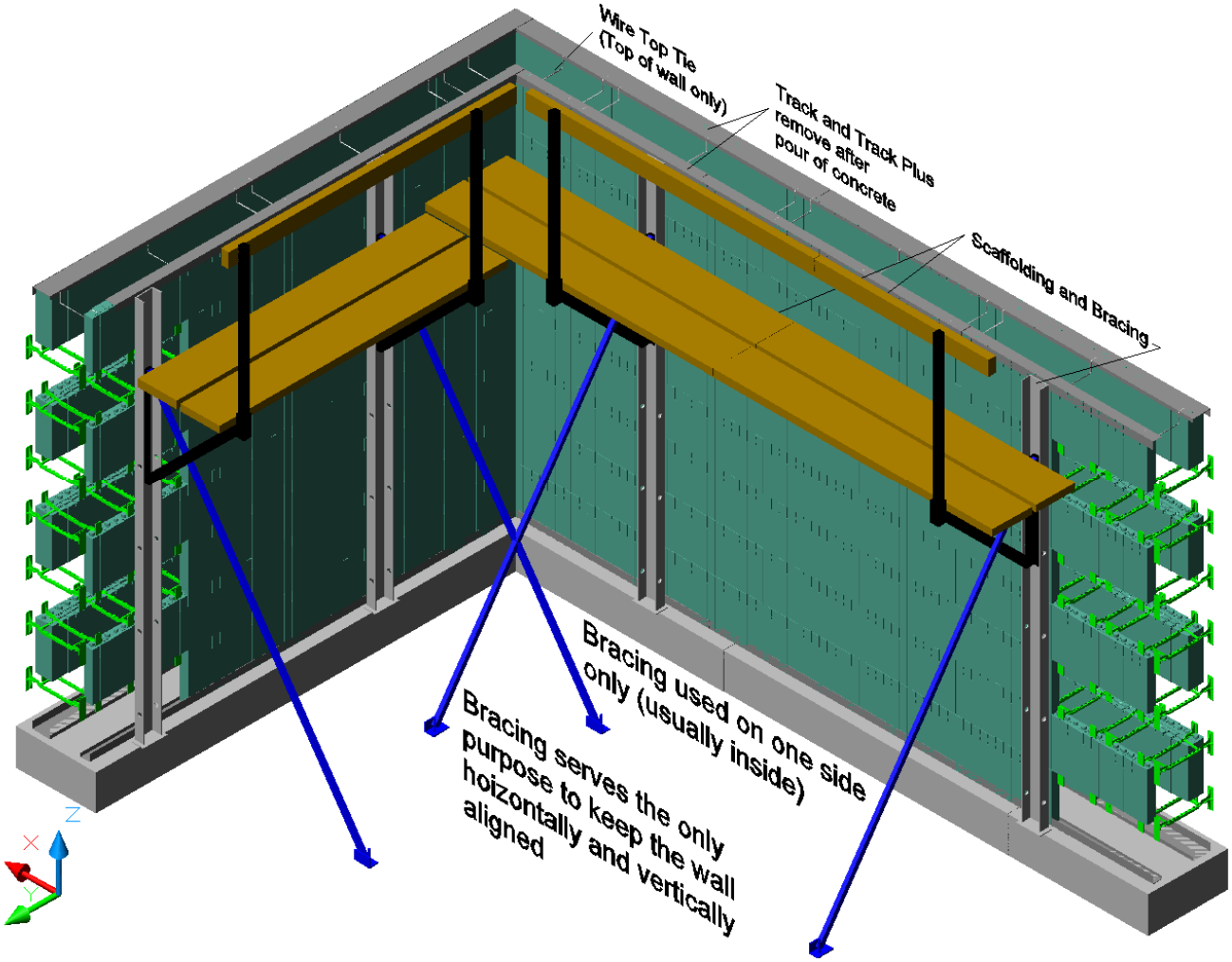
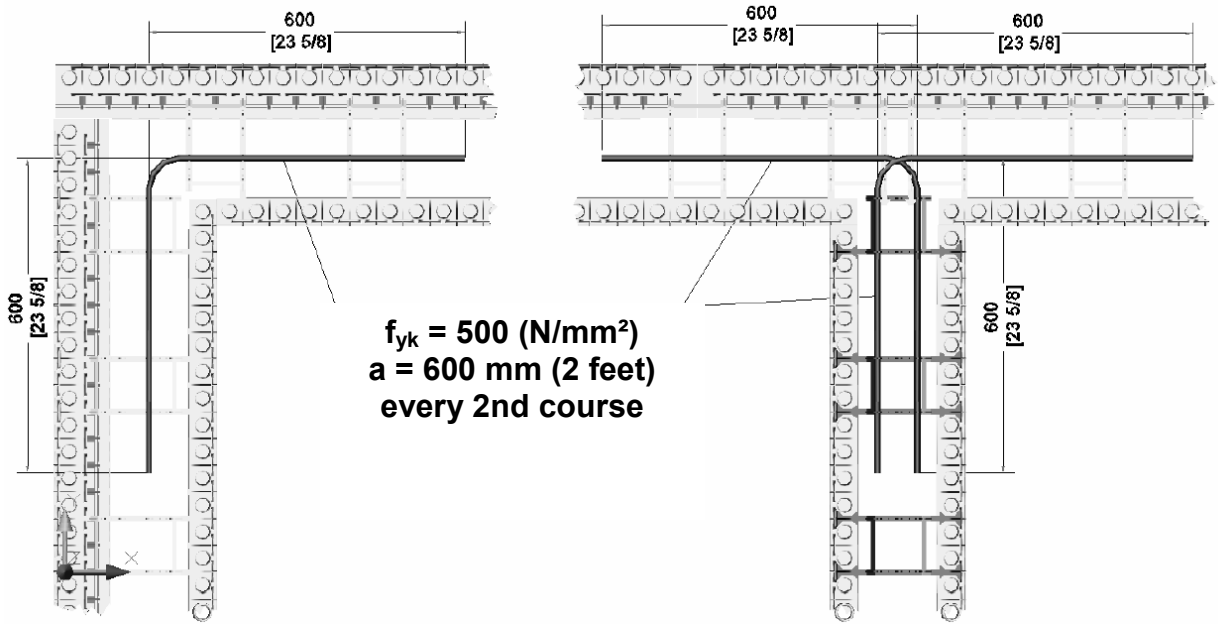


Bracing 60 cm (2 feet) apart the corner and then with a distance of 120 cm to 180 cm (4 to 6 feet)

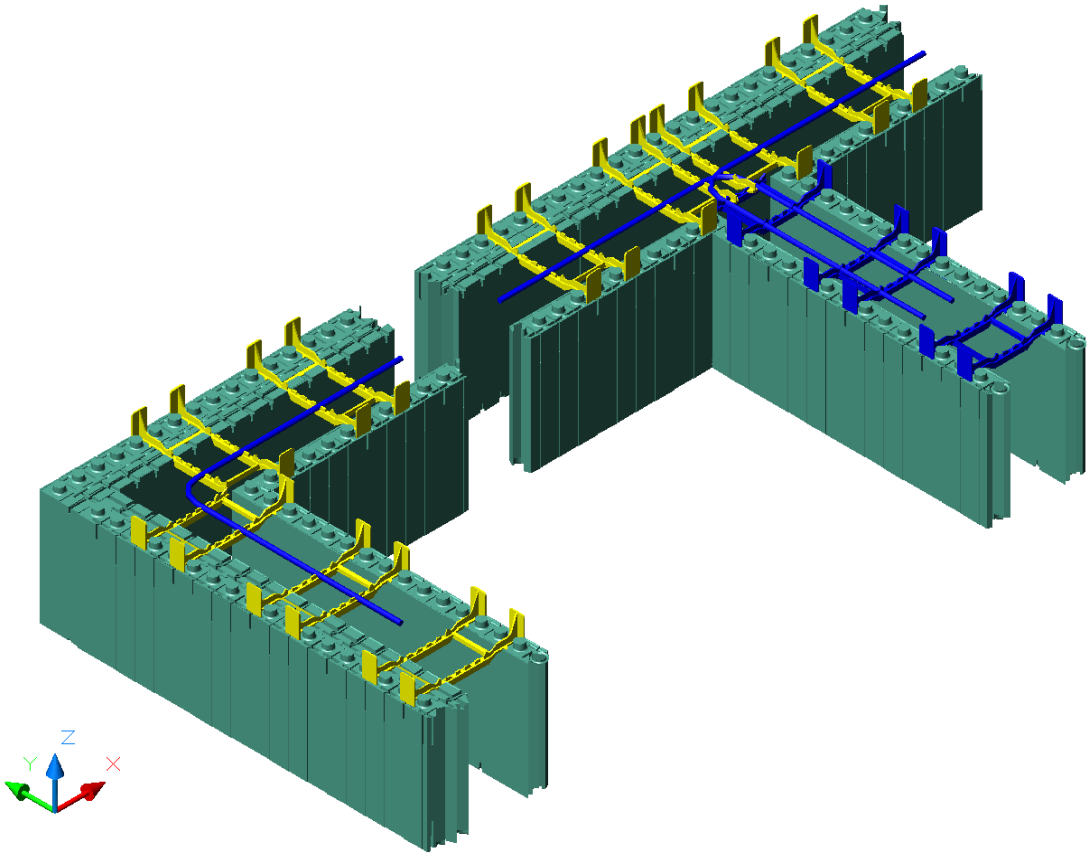
Shuttering kit "QUAD-LOCK"	Annex 15
Bracing in order to keep the wall horizontally and vertically aligned during the placing of concrete	

Deutsches Institut für Bautechnik DIBt

Horizontal reinforcement steel for buildings higher than 5 floors



f_{yk} = 500 (N/mm²)
a = 600 mm (2 feet)
every 2nd course

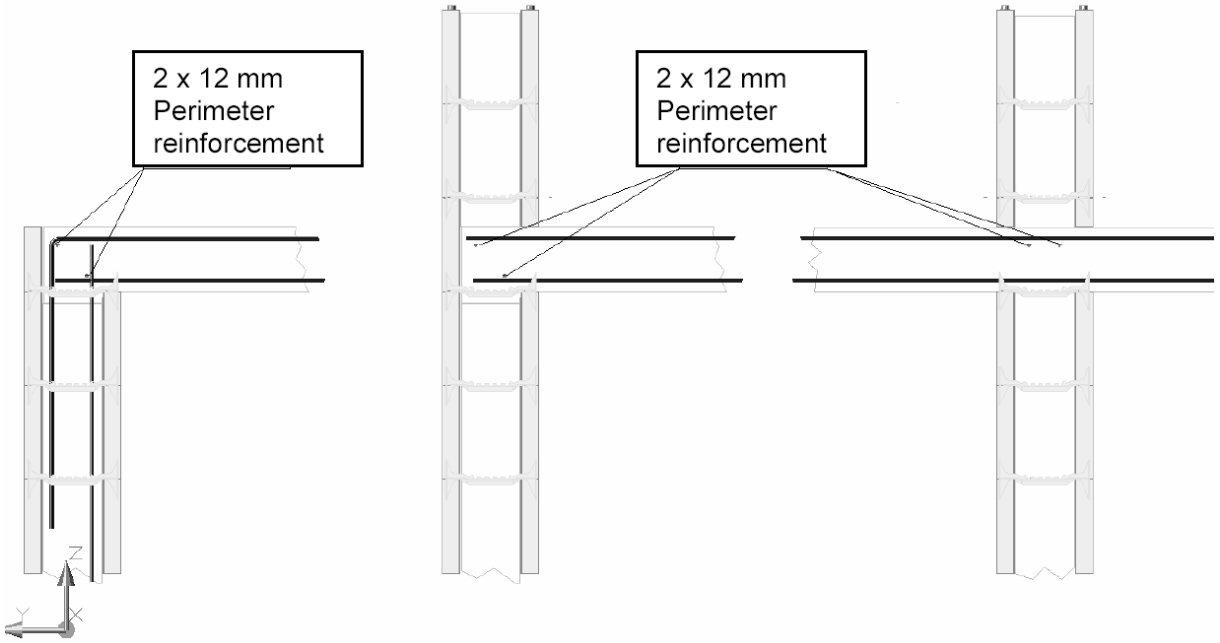


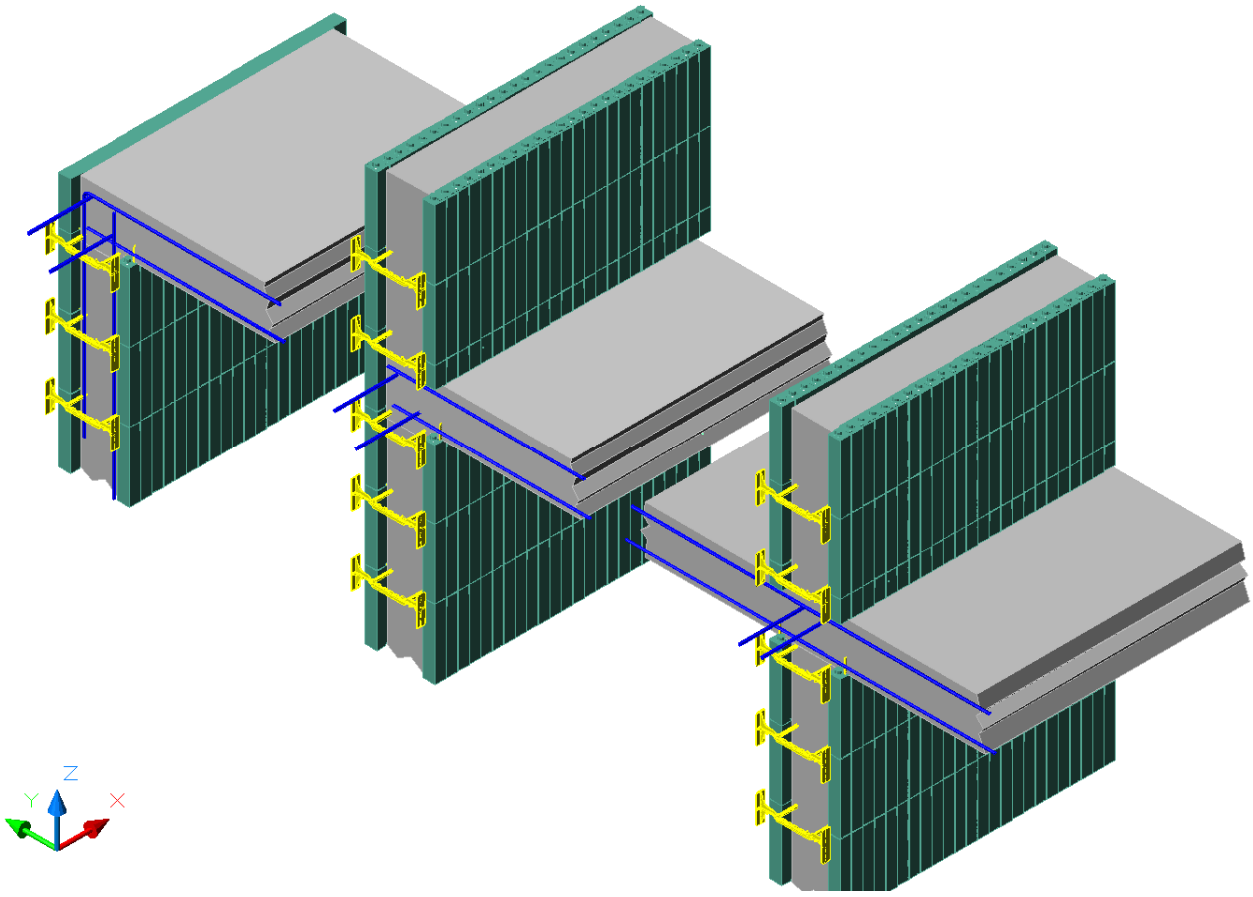
all dimensions in [millimeter] and [inches]

Shuttering kit "QUAD-LOCK"	Annex 16
Placement of horizontal reinforcement steel for buildings higher than 5 floors	

Deutsches Institut für Bautechnik DIBt

Wall and ceiling: vertical sections

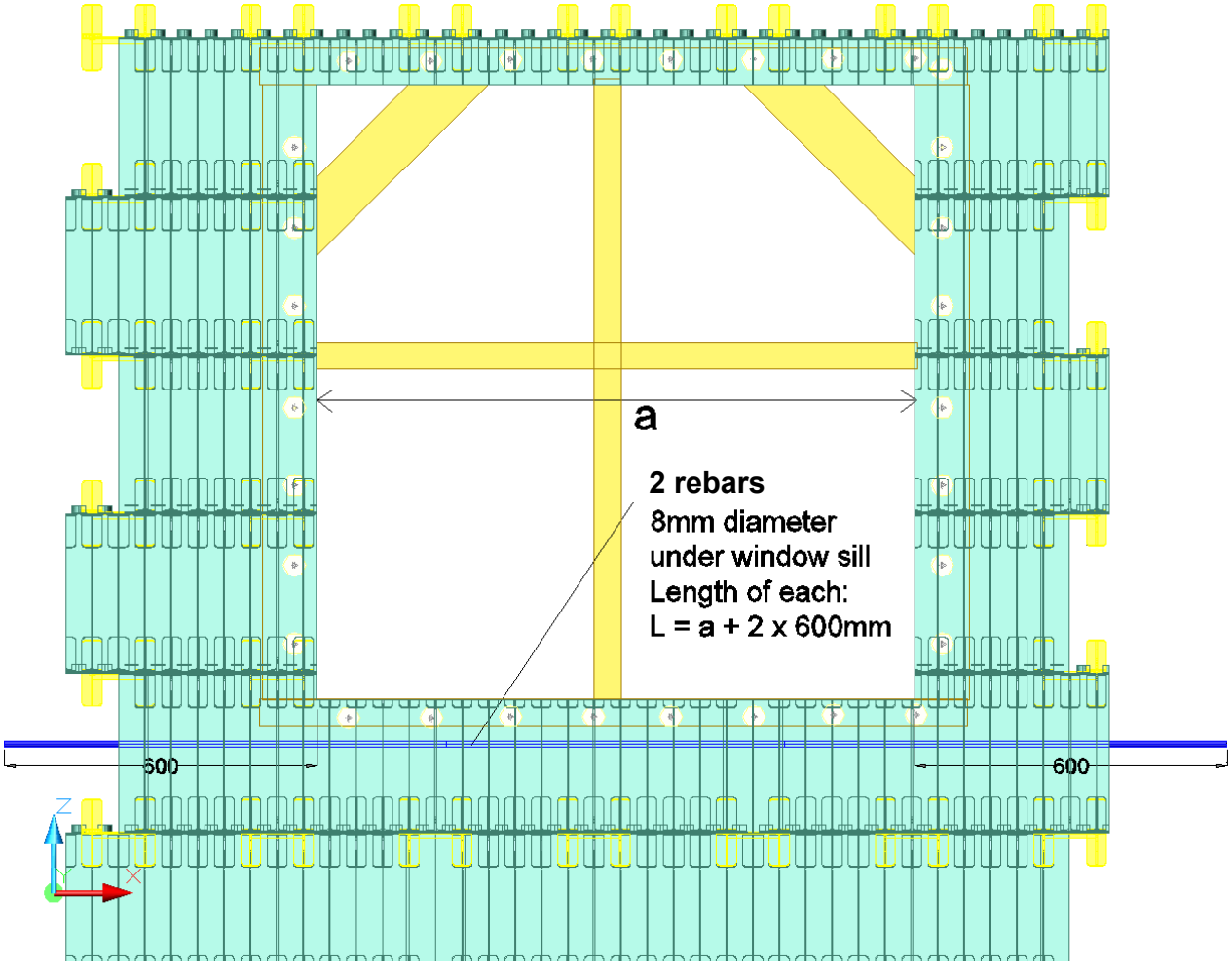


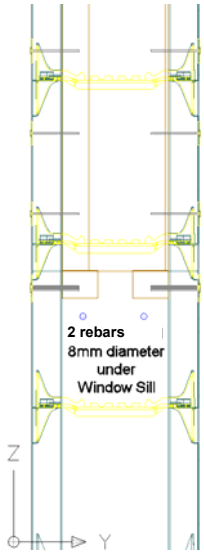


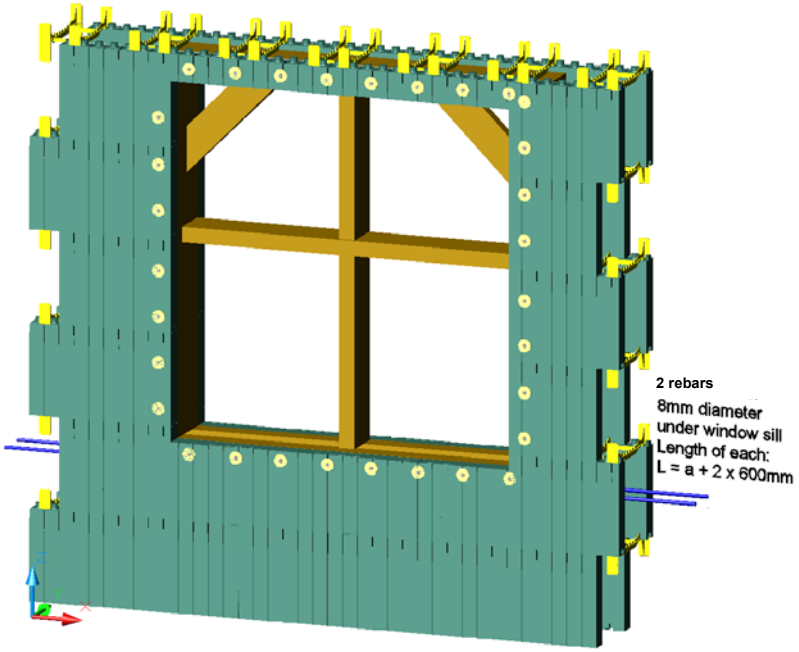
Shuttering kit "QUAD-LOCK"	Annex 17
Vertical sections at concrete floors	

Deutsches Institut für Bautechnik DIBt

Reinforcement under openings







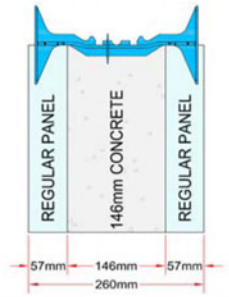
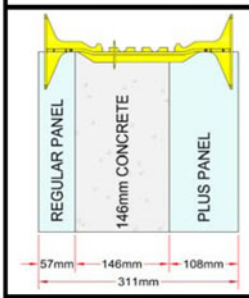
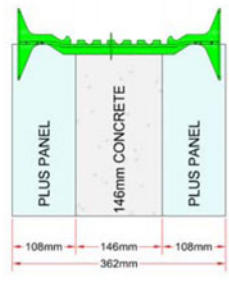
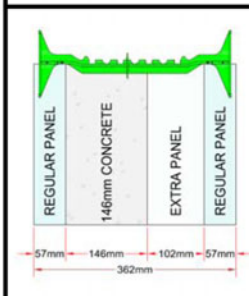
Shuttering kit "QUAD-LOCK"

Reinforcement steel under openings

Annex 18

Deutsches Institut für Bautechnik DIBt

Values of wall elements for some combinations of "QUAD-LOCK" shuttering elements

* The nominal value of thermal resistance of the shuttering elements, the EPS shuttering leaves and the concrete core is calculated in accordance with clause 2.2.7.1 with following factors:	Nominal value of thermal conductivity λ																
	Type		Regular					Plus		Extra		Concrete					
	[W/m×K]		0,0346					0,0370		0,0369		2,5					
Sample with 147 mm concrete core	Concrete core	Thickness of the wall	Regular (QPX2, 57mm)	Plus (QPX2 Plus, 108mm)	EXTRA (QPXTRA, 102mm)	FTB4 (black)	FTB6 (blue)	FTY8 (yellow)	FTG10 (green)	FTR12 (red)	FTB14 (brown)	XT (orange)	Nominal value of thermal resistance of shuttering elements			EPS shuttering leaves	concrete core
													$R_{D,element}$ *	reduction factor (clause 2.2.7.1)	including factor $R_{D,element,factor}$ *	$R_{D,EPS}$ *	$R_{D,concrete}$ *
	[mm]												[m²xK/W]				
	96	210	X			X							3,333	0,961	3,203	3,295	0,038
	147	260					X						3,354	0,961	3,223	3,295	0,059
	197	311						X					3,374	0,961	3,242	3,295	0,079
	248	362							X				3,394	0,961	3,262	3,295	0,099
	299	413								X			3,414	0,961	3,281	3,295	0,120
	350	464									X		3,435	0,961	3,301	3,295	0,140
	400	514				X						X	3,455	0,961	3,320	3,295	0,160
	451	565					X					X	3,475	0,961	3,340	3,295	0,180
	502	616						X				X	3,496	0,961	3,359	3,295	0,201
	553	667							X			X	3,516	0,961	3,379	3,295	0,221
	604	718								X		X	3,536	0,961	3,398	3,295	0,242
	655	769									X	X	3,557	0,961	3,418	3,295	0,262
	96	260	X	X			X						4,605	0,967	4,453	4,566	0,038
	147	311						X					4,625	0,967	4,472	4,566	0,059
	197	362							X				4,645	0,967	4,492	4,566	0,079
	248	413								X			4,666	0,967	4,512	4,566	0,099
	299	464									X		4,686	0,967	4,531	4,566	0,120
	350	514				X						X	4,706	0,967	4,551	4,566	0,140
	400	565					X					X	4,726	0,967	4,570	4,566	0,160
	451	616						X				X	4,747	0,967	4,590	4,566	0,180
	502	667							X			X	4,767	0,967	4,610	4,566	0,201
	553	718								X		X	4,788	0,967	4,630	4,566	0,221
	604	769									X	X	4,808	0,967	4,649	4,566	0,242
	96	311		X				X					5,876	1,0	5,876	5,838	0,038
	147	362							X				5,897	1,0	5,897	5,838	0,059
	197	413								X			5,917	1,0	5,917	5,838	0,079
	248	464									X		5,937	1,0	5,937	5,838	0,099
	299	514				X						X	5,957	1,0	5,957	5,838	0,120
	350	565					X					X	5,978	1,0	5,978	5,838	0,140
	400	616						X				X	5,998	1,0	5,998	5,838	0,160
	451	667							X			X	6,018	1,0	6,018	5,838	0,180
	502	718								X		X	6,039	1,0	6,039	5,838	0,201
	553	769									X	X	6,059	1,0	6,059	5,838	0,221
	96	311	X		X			X					6,097	1,0	6,097	6,059	0,038
	147	362							X				6,118	1,0	6,118	6,059	0,059
	197	413								X			6,138	1,0	6,138	6,059	0,079
	248	464									X		6,158	1,0	6,158	6,059	0,099
	299	514				X						X	6,179	1,0	6,179	6,059	0,120
	350	565					X					X	6,199	1,0	6,199	6,059	0,140
	400	616						X				X	6,219	1,0	6,219	6,059	0,160
	451	667							X			X	6,239	1,0	6,239	6,059	0,180
	502	718								X		X	6,260	1,0	6,260	6,059	0,201
	553	769									X	X	6,280	1,0	6,280	6,059	0,221

Shuttering kit "QUAD-LOCK"

Thicknesses of wall and concrete core and nominal values of thermal resistance R_D

Annex 19
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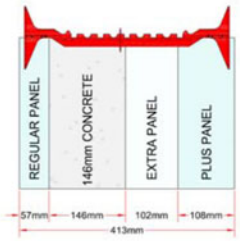
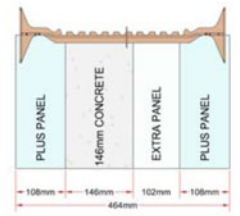
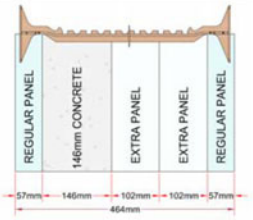
Values of wall elements for some combinations of "QUAD-LOCK" shuttering elements

* The nominal value of thermal resistance of the shuttering elements, the EPS shuttering leaves and the concrete core is calculated in accordance with clause 2.2.7.1 with following factors:	Nominal value of thermal conductivity λ																
	Type		Regular			Plus		Extra	Concrete								
	[W/m×K]		0,0346			0,0370		0,0369	2,5								
Sample with 147 mm concrete core	Concrete core [mm]	Thickness of the wall [mm]	Regular (QPX2, 57mm)	Plus (QPX2 Plus, 108mm)	EXTRA (QPXTRA, 102mm)	FTB4 (black)	FTB6 (blue)	FTY8 (yellow)	FTG10 (green)	FTR12 (red)	FTB14 (brown)	XT (orange)	Nominal value of thermal resistance of shuttering elements $R_{D,element}$ * [m²xK/W]	reduction factor (clause 2.2.7.1)	including factor $R_{D,element,factor}$ *	EPS shuttering leaves $R_{D,EPS}$ *	concrete core $R_{D,concrete}$ *
	96	362	X	X	X				X				7,369	1,0	7,369	7,331	0,038
	147	413								X			7,389	1,0	7,389	7,331	0,059
	197	464									X		7,409	1,0	7,409	7,331	0,079
	248	514				X						X	7,430	1,0	7,430	7,331	0,099
	299	565					X					X	7,450	1,0	7,450	7,331	0,120
	350	616						X				X	7,471	1,0	7,471	7,331	0,140
	400	667							X			X	7,491	1,0	7,491	7,331	0,160
	451	718								X		X	7,511	1,0	7,511	7,331	0,180
	502	769									X	X	7,531	1,0	7,531	7,331	0,201
	96	413		X	X					X			8,640	1,0	8,640	8,602	0,038
	147	464									X		8,661	1,0	8,661	8,602	0,059
	197	514				X						X	8,681	1,0	8,681	8,602	0,079
	248	565					X					X	8,701	1,0	8,701	8,602	0,099
	299	616						X				X	8,722	1,0	8,722	8,602	0,120
	350	667							X			X	8,742	1,0	8,742	8,602	0,140
	400	718								X		X	8,762	1,0	8,762	8,602	0,160
	451	769									X	X	8,782	1,0	8,782	8,602	0,180
	96	413	X		2X					X			8,862	1,0	8,862	8,823	0,038
	147	464									X		8,882	1,0	8,882	8,823	0,059
	197	514				X						X	8,902	1,0	8,902	8,823	0,079
	248	565					X					X	8,922	1,0	8,922	8,823	0,099
	299	616						X				X	8,943	1,0	8,943	8,823	0,120
	350	667							X			X	8,963	1,0	8,963	8,823	0,140
	400	718								X		X	8,983	1,0	8,983	8,823	0,160
	451	769									X	X	9,004	1,0	9,004	8,823	0,180

Shuttering kit "QUAD-LOCK"

Thicknesses of wall and concrete core and nominal values of thermal resistance R_D

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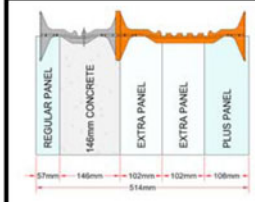
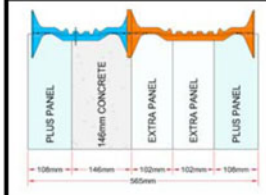
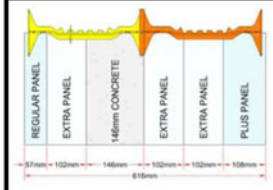
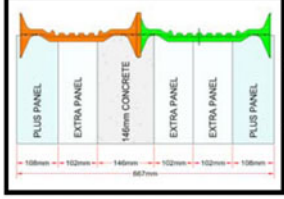
Values of wall elements for some combinations of "QUAD-LOCK" shuttering elements

* The nominal value of thermal resistance of the shuttering elements, the EPS shuttering leaves and the concrete core is calculated in accordance with clause 2.2.7.1 with following factors:						Nominal value of thermal conductivity λ												
						Type		Regular			Plus		Extra		Concrete			
						[W/m×K]		0,0346			0,0370		0,0369		2,5			
Sample with 147 mm concrete core	Concrete core [mm]	Thickness of the wall [mm]	Regular (QPX2, 57mm)	Plus (QPX2 Plus, 108mm)	EXTRA (QPXTRA, 102mm)	FTB4 (black)	FTB6 (blue)	FTY8 (yellow)	FTG10 (green)	FTR12 (red)	FTB14 (brown)	XT (orange)	Nominal value of thermal resistance of shuttering elements [m²xK/W]			EPS shuttering leaves	concrete core	
													$R_{D,element}$ *	reduction factor (clause 2.2.7.1)	including factor $R_{D,element,factor}$ *	$R_{D,EPS}$ *	$R_{D,concrete}$ *	
	147	514	X	X	2X	X						X	10,154	1,0	10,154	10,095	0,059	
	197	565					X					X	10,174	1,0	10,174	10,095	0,079	
	248	616						X				X	10,194	1,0	10,194	10,095	0,099	
	299	667							X			X	10,214	1,0	10,214	10,095	0,120	
	350	718								X		X	10,235	1,0	10,235	10,095	0,140	
	400	769									X	X	10,255	1,0	10,255	10,095	0,160	
	147	565		X	2X		X					X	11,425	1,0	11,425	11,366	0,059	
	197	616						X				X	11,445	1,0	11,445	11,366	0,079	
	248	667							X			X	11,465	1,0	11,465	11,366	0,099	
	299	718								X		X	11,486	1,0	11,486	11,366	0,120	
	350	769									X	X	11,506	1,0	11,506	11,366	0,140	
	147	616	X	X	3X			X				X	12,918	1,0	12,918	12,859	0,059	
	197	667							X			X	12,938	1,0	12,938	12,859	0,079	
	248	718								X		X	12,958	1,0	12,958	12,859	0,099	
	299	769									X	X	12,979	1,0	12,979	12,859	0,120	
	147	667		X	3X				X			X	14,189	1,0	14,189	14,131	0,059	
	197	718								X		X	14,209	1,0	14,209	14,131	0,079	
	248	769									X	X	14,230	1,0	14,230	14,131	0,099	

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

Shuttering kit "QUAD-LOCK"	Annex 20
List of standards and guidelines	