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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)

DIBt

Mitglied der EOTA
Member of EOTA

European Technical Approval ETA-06/0189

English translation prepared by DIBt - Original version in German language

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: vom *Validity: from* bis *to*	24 March 2010 11 January 2012
Herstellwerk *Manufacturing plant*	Q1 Q2 Q3

Diese Zulassung umfasst *This Approval contains*	30 Seiten einschließlich 17 Anhänge *30 pages including 17 annexes*
Diese Zulassung ersetzt *This Approval replaces*	ETA-06/0189 mit Geltungsdauer vom 11.01.2007 bis 11.01.2012 *ETA-06/0189 with validity from 11.01.2007 to 11.01.2012*

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 law of 31 October 2006[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 2006*, p. 2407, 2416
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 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 5) applicable as formwork for plain and reinforced concrete walls cast in-situ.

The shuttering elements consist of shuttering leaves (EPS-panels) and ties (also called spacers) of high density plastic (HDPE).

The accessory parts are metal ties (only on top of wall), metal tracks (only at bottom and top of the wall) and metal corner brackets

The elements are generally used for external load-bearing walls. The thickness of the inner and outer shuttering leaf is 57 to 108 mm. The elements with inner and outer shuttering leaves of 57 mm thickness are also usable for inner walls. The thickness of the concrete core is either 96 mm, 147 mm, 197 mm, 248 mm or 299 mm.

1.1.1 Shuttering elements

The shuttering elements consists of inner and outer shuttering leaves and spacers. They are fit together on site.

The shuttering leaves (EPS-panels) are one-layered and consist of expanded polystyrene (EPS). The EPS-panels are available in two thicknesses: 57 mm [2,25”] thick regular and 108 mm [4,25”] thick "Plus" panels. The density of the expanded polystyrene for the regular panels is 30 kg/m³ and for the "Plus" panels 24 kg/m³.

Spacers (ties) are moulded from high-density plastic (HDPE) and are color coded in dependence of wall thickness (see Table 1 and Annexes 3 and 5).

The dimensions of the elements are 1218 mm length and 305 mm height.

Table 1 Wall thicknesses of the shuttering elements

Thickness of the wall [mm]	Spacers (Color)	Thickness of EPS-panel [mm]		Thickness of concrete core [mm]
		inner	outer	
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

The upper and lower surfaces are moulded to lock panels together (see Annex 2) and contain slots to introduce the spacers.

Vertical mating surfaces are smooth to form a flush fit when joined together.

Elements are dry laid in staggered vertical joints (brick bond).

The surfaces are smooth. The outer surfaces are grooved vertically every 51 mm [2”] over the whole height of the panels. In a distance of 305 mm [12”] these grooves are heavier. At these points the spacers are installed in such a way, that their mid-axis are in plane with the grooves.

The formwork requires alignment and support during concrete filling (see Annexes 13 and 16).

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 spacer web. Flanges incorporated within the spacer design provide a fixing for dry lining, cladding and temporary propping or bracing. The minimum centre distance of spacers in longitudinal direction of the elements shall be 305 mm [12“]. At corners, openings or highly stressed areas the spacers shall be placed closer (see Annexes 8 and 9). In these situations spacers can be split to allow close centres to be achieved.

1.1.2 Accessory parts

1.1.2.1 Wire Top Ties (metal spacers, only on top the wall), (Annex 1)

Wire top ties, bent from 5 mm galvanized wire, are used to provide additional support of assembled panels at the top of the wall. Combined with metal tracks 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 tracking is available in 57 mm and 108 mm widths and rolled 1 mm thick galvanized (20 gauge) steel sheet. Tracking is used at the base of the wall construction, to provide a locating position and aid stability during concrete pouring operations, and at the top of the panel assemblies to protect panel joints from wet concrete and provide temporary stability.

1.1.2.3 Metal Corner Brackets (Annex 1)

Inner and outer corners are strengthened by 24 gauge, galvanized steel brackets (fixed 90° angle or adjustable). This eliminates the use of external bracing during the concrete pour.

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).

When using this type of construction below ground a waterproofing according to applicable national rules shall be provided depending on whether water not exerting pressure or water exerting pressure is to be dealt with. The waterproofing shall be protected from mechanical damage by a smash-resistant protective layer.

The provisions made in this European technical approval are based on an assumed working life of the shuttering kit of 50 years, provided that the conditions laid down in sections 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 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 product and methods of verification

2.1 Characteristics of product

2.1.1 Shuttering elements

The shuttering elements correspond to the information and drawings given in Annexes 1 to 5. They consists of:

- EPS-Panels (Annex 1)
- High Density Plastic (HDPE) Ties (Spacers) (Annex 3)

For the 108 mm thick shuttering leaves of a density of 24 kg/m³ ("Plus"-panels) expanded polystyrene EPS-EN 13163-T1-L1-W2-S2-P4-DS(70,-)3-BS200-DS(N)5-TR200 according to EN 13163 is used and a nominal value of the thermal conductivity of the shuttering leaves λ_{DI} = 0.0381 W/m/K (for 108 mm EPS-Panel) according to EN 13163, chapter 4.2.1.

For the 57 mm thick shuttering leaves of a density of 30 kg/m³ (regular panels) expanded polystyrene EPS-EN 13163-T1-L1-W2-S2-P4-DS(70,-)3-BS350-DS(N)5-TR400 according to EN 13163 is used and a nominal value of the thermal conductivity of the shuttering leaves λ_{DI} = 0.0346 W/m/K (for 57 mm EPS-Panel) according to EN 13163, chapter 4.2.1.

The spacers of HDPE (Annex 3) have a minimum tensile strength of 2400 N.

The material characteristics, dimensions and tolerances of the shuttering elements not indicated in Annexes 2 to 5 are given in the technical documentation[7] of the ETA.

2.1.2 Accessory parts

Wire top ties (spacers) (Annex 1) made from 5 mm galvanized wires

Metal tacks and metal corner brackets (Annex 1) made of galvanised 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 shuttering elements or blocks 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.

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.

2.2.2 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, paragraph 2.2.

2.2.2.2 Efficiency of filling

Considering the instructions of chapter 4.2 and the installation guide of the ETA applicant 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, chapter 6.1.2 are met satisfactorily.

2.2.2.3 Possibility of steel reinforcement

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

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

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 Polystrol (EPS) fulfill the requirement of Class E according to EN 13501-1[8],

2.2.3.2 Resistance to fire

According to Annex C, Table 1, for a continuous type of load-bearing wall and a minimum concrete strength of C16/20, the system meets the criteria "REI" as follows, see Table 2 following "REI".

Table 2 Determination of "REI" of a load bearing wall

Thickness of concrete core [mm]	According to Annex C, Table 1	REI
95	--	--
96	--	--
146	second column, 5th line	90
197	second column, last line	120
248	second column, last line	120
299	second column, last line	120

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 13501-1:2002-06 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.

2.2.4 Essential Requirement 3: Hygiene, health and the environment

2.2.4.1 Release of dangerous substances

According to the manufacturer's declaration the shuttering elements "QUAD-LOCK" taking account of the EU database[9] do not contain any dangerous substances.[10]

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 12524[11] is $\mu = 60$.

The values for the water vapour diffusion resistance of concrete depending on density and type are tabulated in EN 12524.

2.2.5 Essential Requirement 4: Safety in use

2.2.5.1 Bond strength between the shuttering leaves and the concrete core

Under end use conditions the EPS-panels are durable fixed by the spacers. Therefore the determination of bond strength is not necessary.

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

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 for the "Pus"-panels and 350 kPa for the regular panels (see also designation code of EPS in 2.1.1). The tensile strength of the spacers (HDPE) is at least 2400 N and the pull-out strength between ties and the expanded polystyrene plates is at least 1800 N.

The requirements according to ETAG 009, chapter 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 shuttering leaves there is no risk of abrasion or of cutting people.

The requirements according to ETAG 009, chapter 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.

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

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

11 EN 12524:2000 Building materials and products - Hygrothermal properties - Tabulated design values

2.2.7 Essential Requirement 6: Energy economy and heat retention

2.2.7.1 Thermal resistance

The nominal value of the thermal resistance R of the elements in end use conditions (with concrete infill but without rendering) calculated in accordance with EN ISO 6946[12] from the nominal value of the thermal conductivity of the shuttering leaves λ_{DI} = 0.0381 W/m/K (for 108 mm EPS-Panel) respectively λ_{DI} = 0.0346 W/m/K (for 57 mm EPS-Panel) according to EN 13163, chapter 4.2.1, and the thermal resistance of the concrete core R_{DC} (can be calculated by using the values of thermal conductivity depending on the density tabulated in EN 12524) and considering the influence of the plastic-spacers by an reduction factor as follows, see Table 3, according to the influence of the thickness of the shuttering elements.

Table 3 Reduction Factor

inner leaf [mm]	outer leaf [mm]	reduction factor [1]
57	57	0,961
57	108	0,967
108	108	1,0

The planner shall consider the metal accessory parts (Wire Top Ties (Spacers), Metal Tracks, Metal Corner Brackets, see Annex 1) as thermal bridges, where relevant, for determination of the thermal resistance.

2.2.7.2 Thermal inertia

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

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 2.1.1) the dimensions of the shuttering leaves do not differ more than 3 % after exposing them for 48 h at 70 °C (DS(70,-)3).

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

Chemical agent

Spacers are made of plastic. There is no corrosion of spacer 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 "corrosion protection and cleaning agents" according to ETAG 009, chapter 6.7.1.2 are met satisfactorily.

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, chapter 6.7.1.3 are met satisfactorily.

12 EN ISO 6946:1996 Building components and building elements - Thermal resistance and thermal transmittance - Calculation method

2.2.8.2 Resistance to normal use damage

Incorporation of ducts

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

Fixing of objects

Fixing of objects in the shuttering leaves is not possible, the part of fixings which is significant for the mechanical resistance shall be in the concrete 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 05 December 1997[13] amended by the decision 2001/596/EC of the European Commission[14] 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 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 revised Control plan of 11 September 2009 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.[15]

13 Official Journal of the European Communities L /127 of 24. April 1998

14 Official Journal of the European Communities L /209 of 08. January 2001

15 The "control plan" is a confidential part of the European technical approval and only handed over to the approved body/bodies involved in the procedure of attestation of conformity. See section 3.2.2.

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

3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of non-load bearing shuttering systems in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European technical approval ETA-06/0189 issued on 11 January 2007.

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, where relevant, 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-06/0189,
- the number of the guideline ETAG 009 for European technical approval,
- Class E according to EN 13501-1, for thicknesses of EPS-panel from 57 mm to 108 mm and a apparent density of EPS of 24 to 30 kg/m³
- Protection against noise "no performance determined",
- the nominal value of thermal resistance R of the shuttering elements with concrete infill, see ETA.

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

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed data/information, deposited with the 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 the 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 with 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 4.2.2) the site-mixed or ready mixed concrete is brought in and compacted.

In end use conditions concrete walls of a continuous type[16] 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 and the weight per unit area without rendering is shown in Annex 17.

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 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 6 and 8 to 10).

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

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 ETA applicant, the walls are to be interlocked to floor height, leveled and fastened to the scaffolding supports (see Annexes 13 and 16).

The scaffolding supports are to be arranged at 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.

16 see ETAG 009 chapter 2.2

The necessary reinforcement according to the structural analysis shall also be installed according to the instructions in the installation guide provided by the ETA applicant.

Rectangular wall corners and wall junctions are to be formed according to Annex 14. Typical junctions between walls and ceilings are be formed according to Annex 15.

4.2.3 Concreting

For the production of normal concrete EN 206-1:2001-07 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 between 8 mm and 16 mm. The concrete shall have rapid or middle strength development according to EN 206-1:2001-07, Table 12.

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

Placing the concrete shall be performed in layers of 1,0 m at a maximum vertical concreting rate of 3 m/h. For horizontal curved walls made with shuttering elements the vertical concreting rate shall not exceed 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 within the height between the floors vertical composite reinforcement bars shall 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 less 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 until the concrete layer brought in last is not solidified yet 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 may not deviate from the plumb line more than 5 mm per running meter wall height.

The ceiling may only be placed on walls made of 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 applicant and are to be taken into account when designing the wall.

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

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

4.2.5 Reworking and finishes

Walls of the type "QUAD-LOCK" 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 rendering systems used should meet the requirement of ETAG 004[17]. 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 shall be considered according to EN ISO 6946.

5 Indications to the manufacturer

5.1 Packaging, transport and storage

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

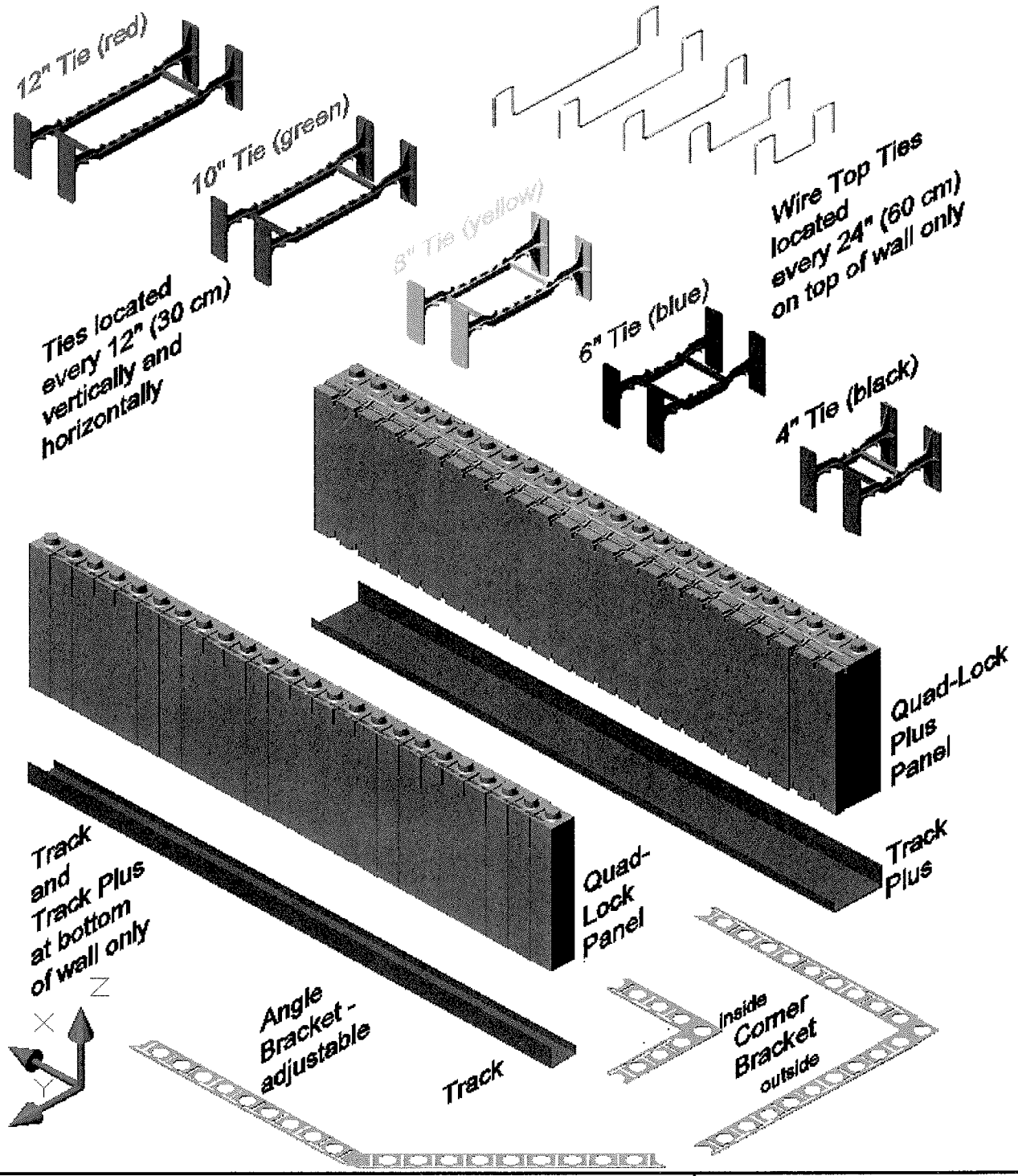
The recommendations on use, maintenance and repair in ETAG 009, section 7.5 shall be considered.

Dipl.-Ing. Georg Feistel
Head of Division Construction Engineering
of Deutsches Institut für Bautechnik
Berlin, 24 March 2010

beglaubigt
Schwab

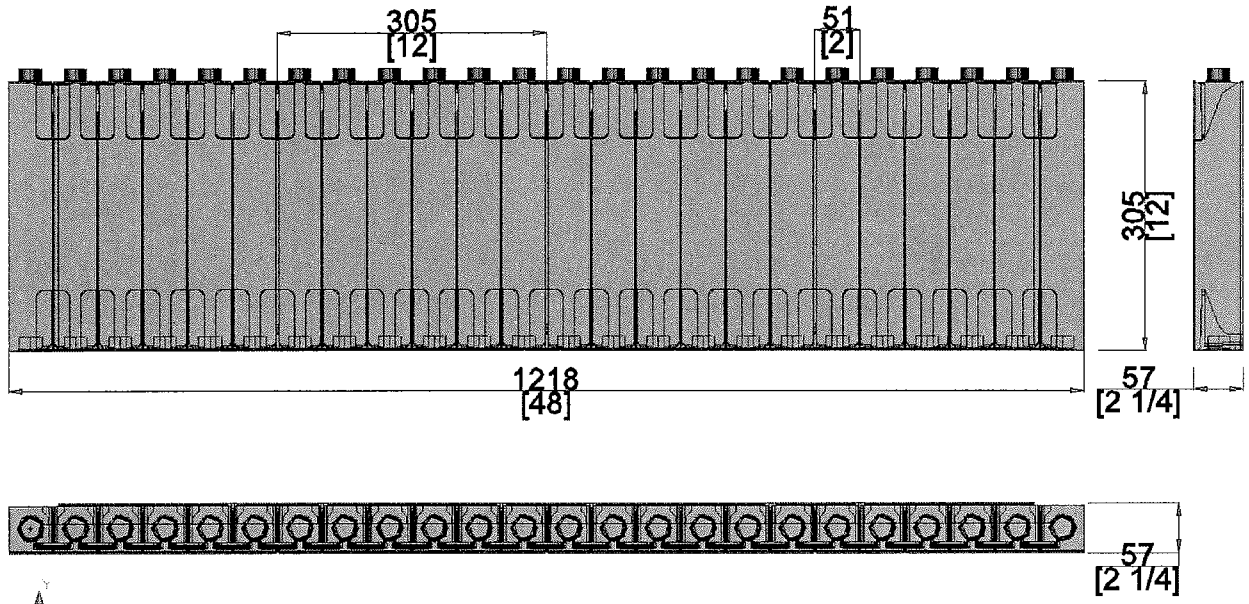
17 EOTA Guideline for External Thermal Insulation Composite Systems with rendering.

Quad-Lock Components for the constructing of walls, inclusive wall corners (right- or arbitrary-angled) and T-Walls of various concrete widths and values of thermal resistance

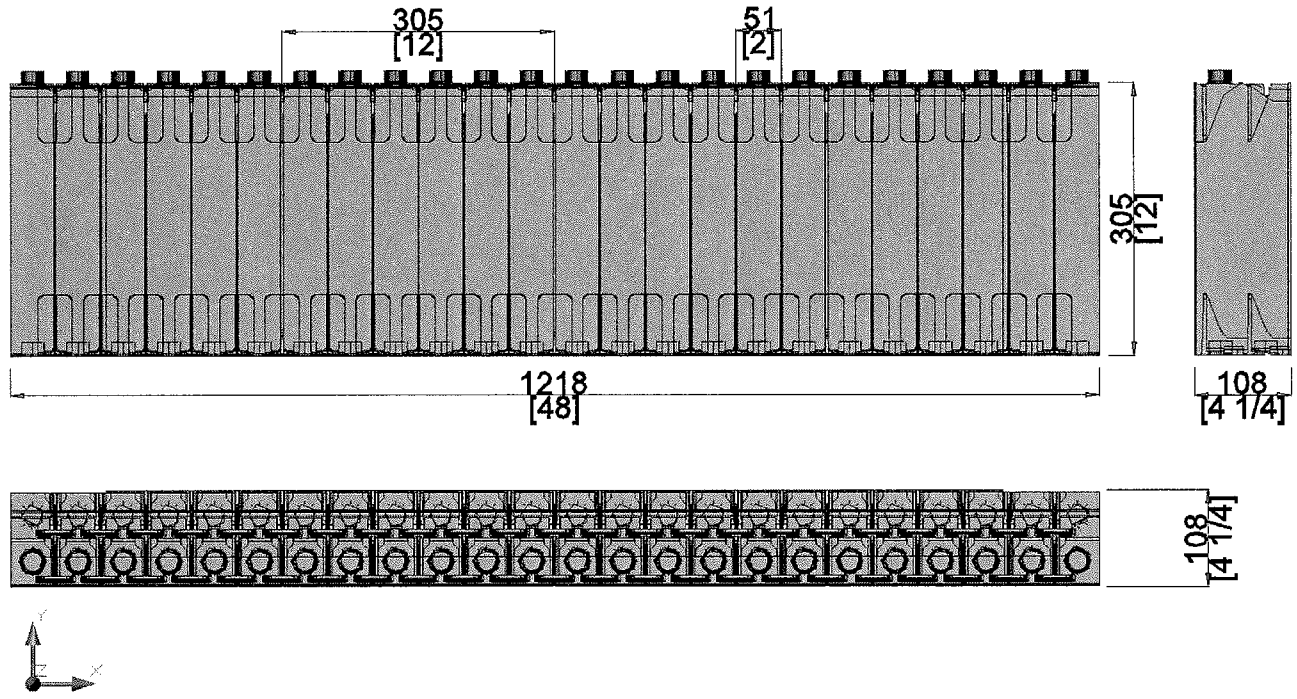


QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 1** of European Technical Approval
Components of the QUAD-LOCK ICF (Insulating Concrete Forming System)	**ETA – 06/0189**

QUAD-LOCK Regular Panel



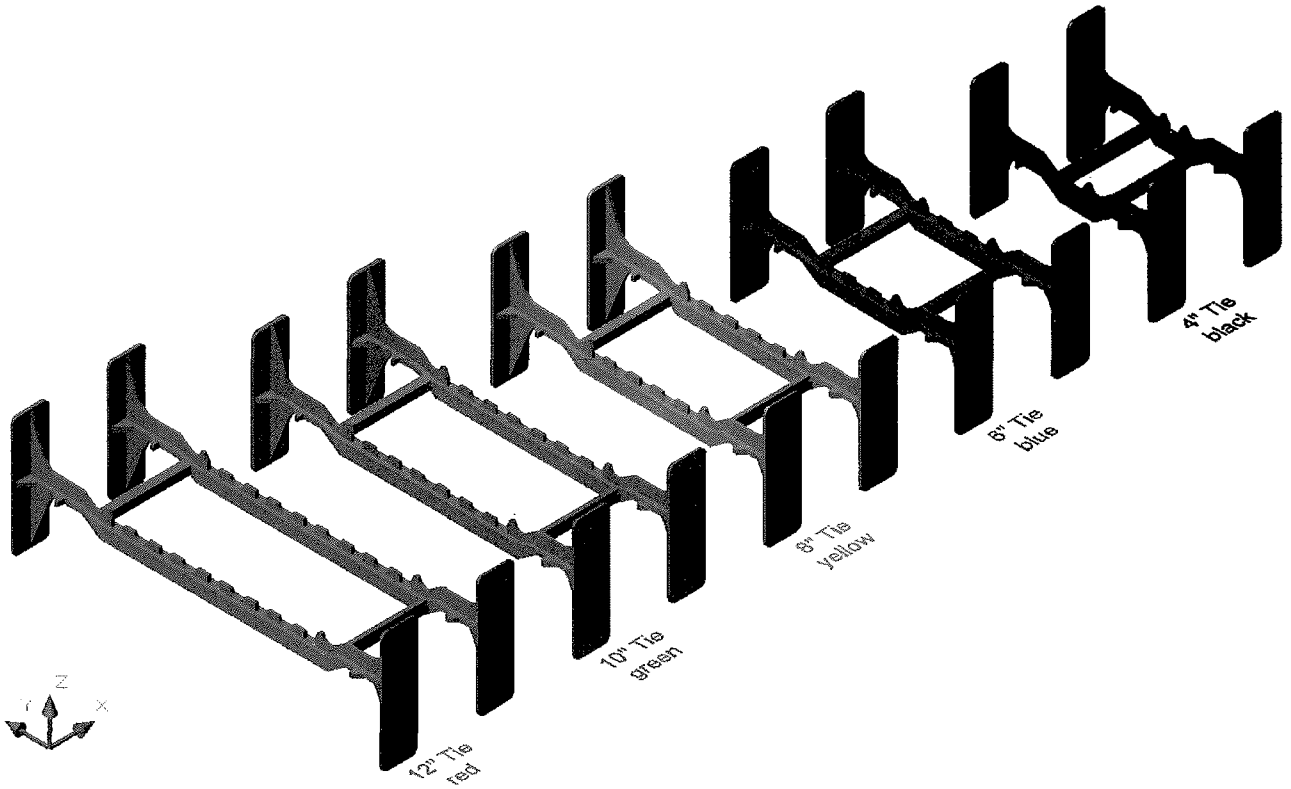
QUAD-LOCK "Plus" Panel

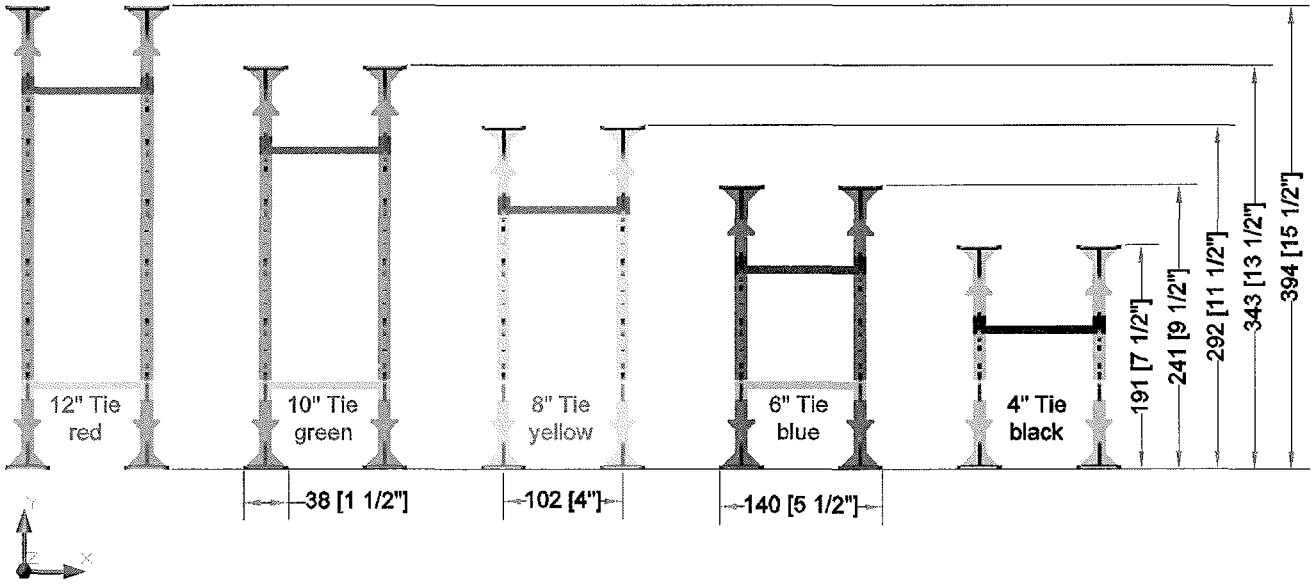


all Dimensions in millimetre and [inches]

QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 2** of European Technical Approval **ETA – 06/0189**
Dimensions of the Panels made of Expanded Polystyrene	

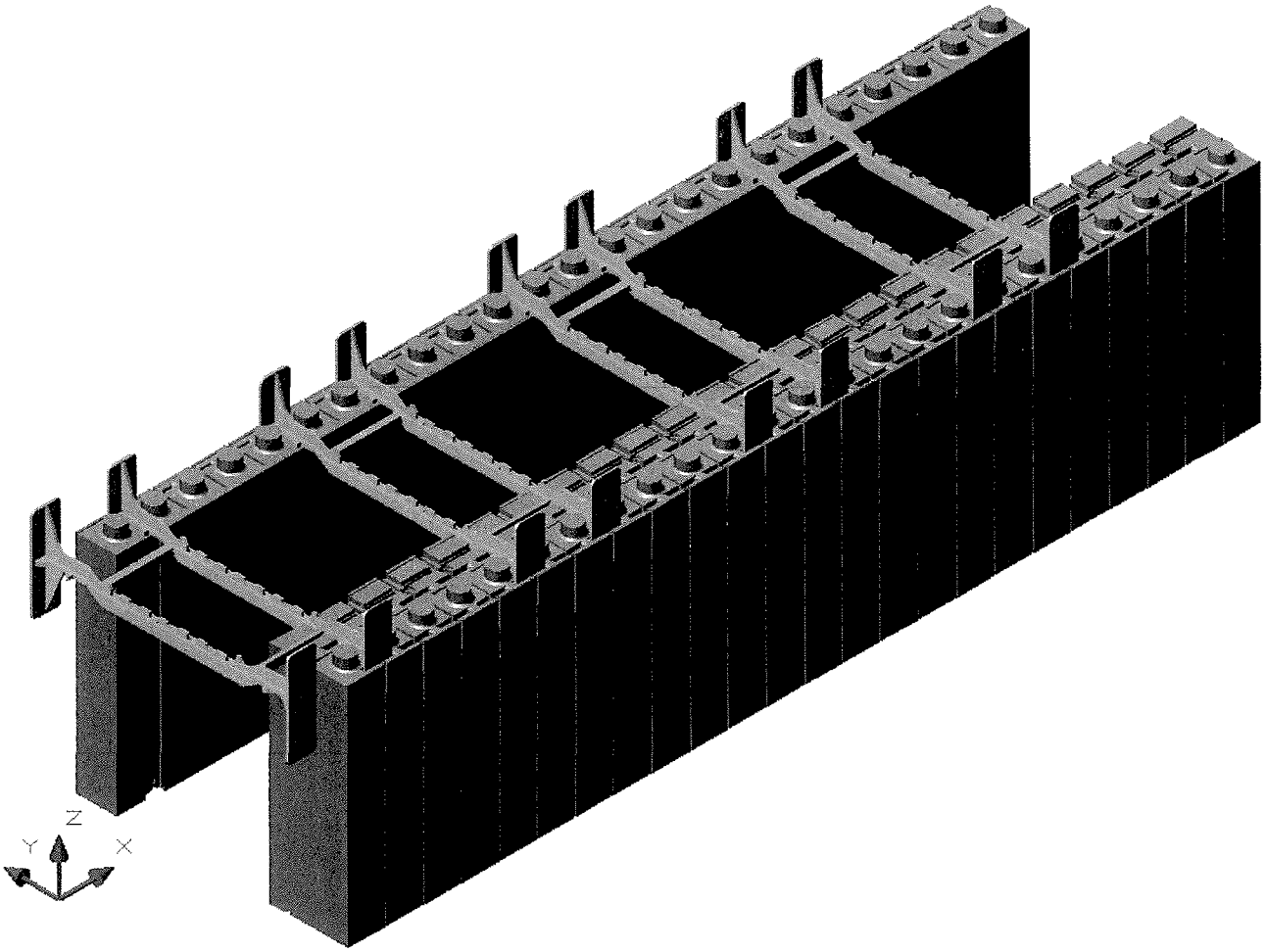
QUAD-LOCK Ties for various Wall Widths and Concrete Widths

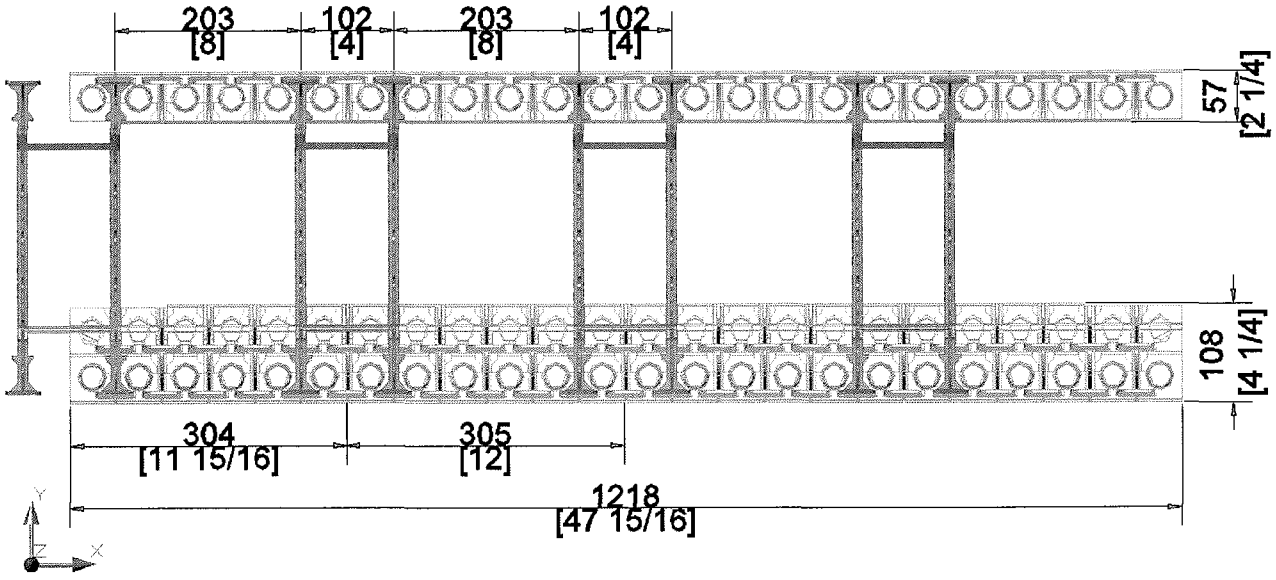




all Dimensions in millimetre and [inches]

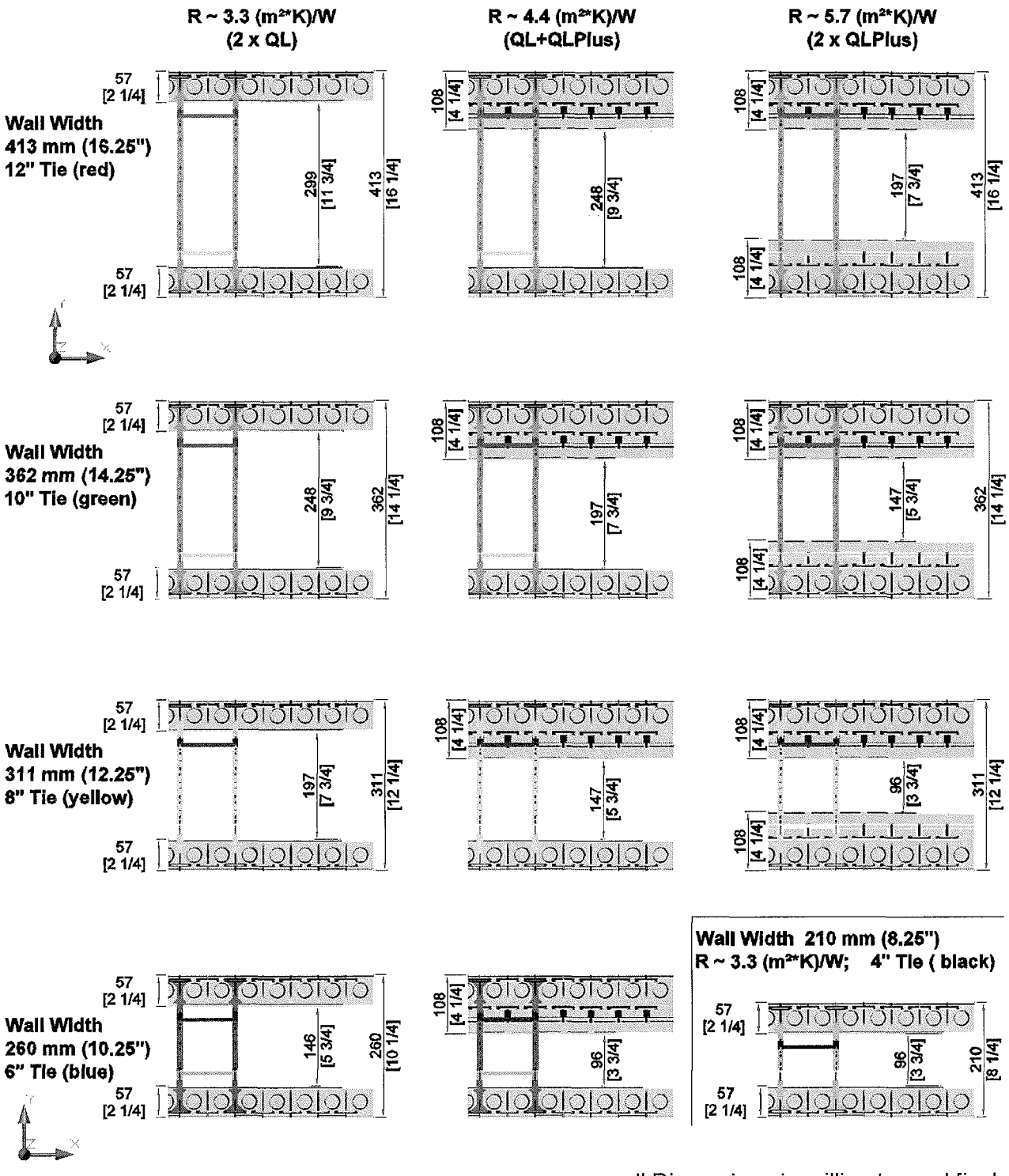
QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 3** of European Technical Approval **ETA – 06/0189**
Dimensions of the Ties made of HDPE	





all Dimensions in millimetre and [inches]

QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 4** of European Technical Approval **ETA – 06/0189**
Placement of the Ties	



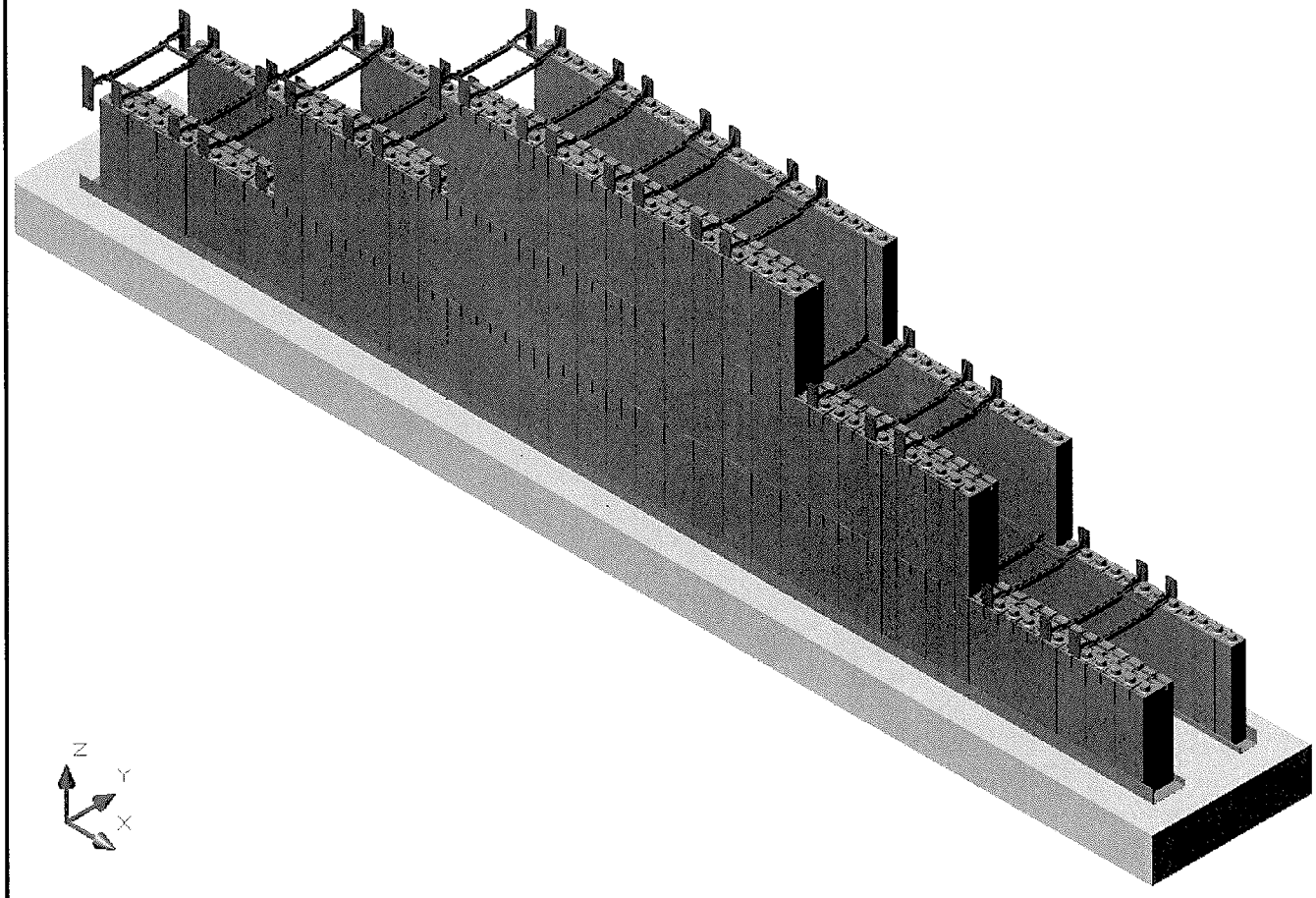
all Dimensions in millimetre and [inches]

QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 5** of European Technical Approval **ETA – 06/0189**
Widths of Walls and Concrete cores and values of thermal resistances (R – Values)	

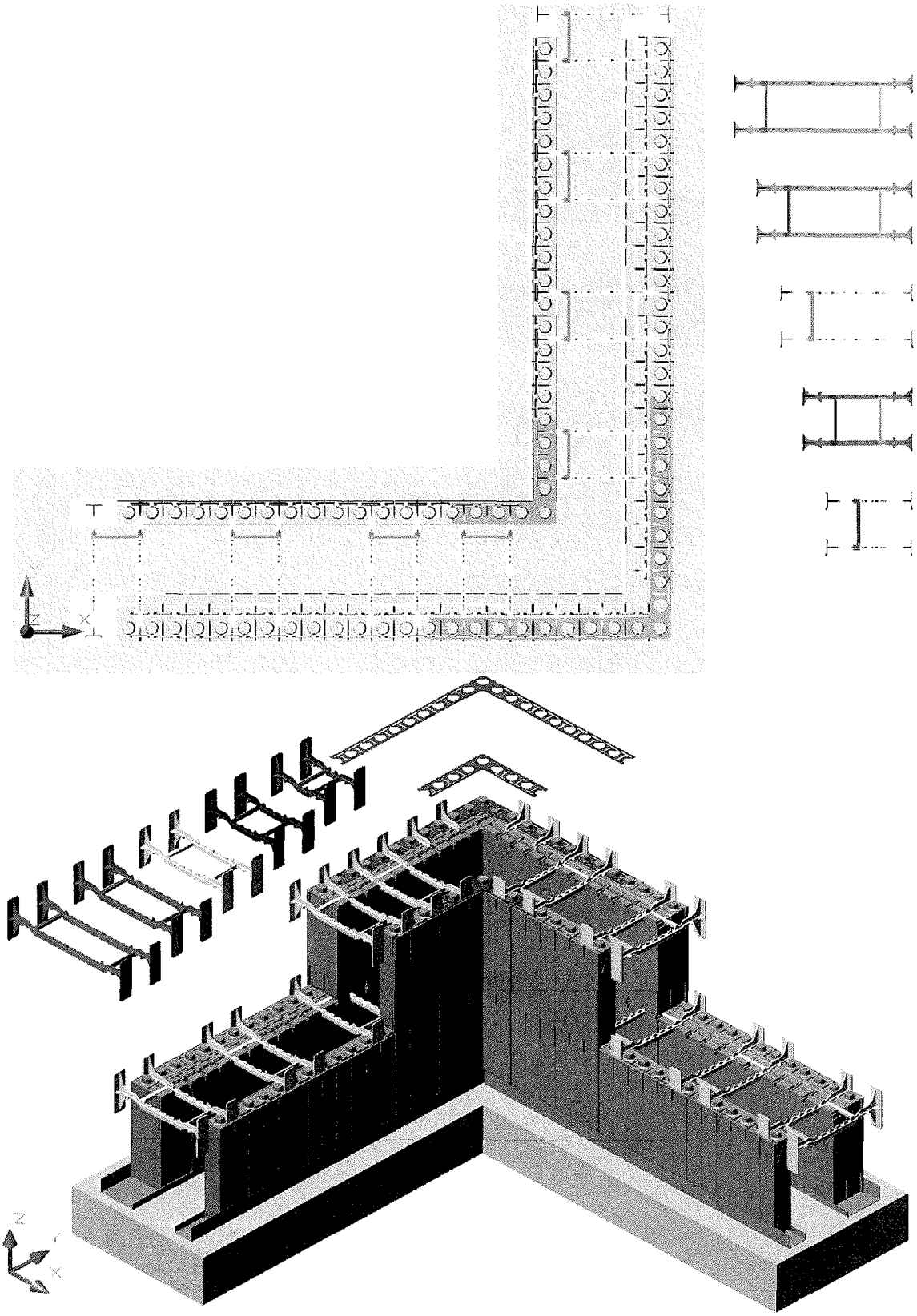
The vertical joints between two elements of one layer have to be shifted of at least a quarter of the element length, better a half of the element length, to the vertical joints of the previous and next layer.

Plastic-Ties must be placed every 305 mm (12") vertically and horizontally in such a way that their mid-axis are in plane with the vertical heavy grooves on the outer surfaces of the EPS-Plates.

Metal-Tracks must be securely fastened to concrete base



QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 6** of European Technical Approval
Arrangement of EPS Panels and Ties in a straight part of a wall	**ETA – 06/0189**

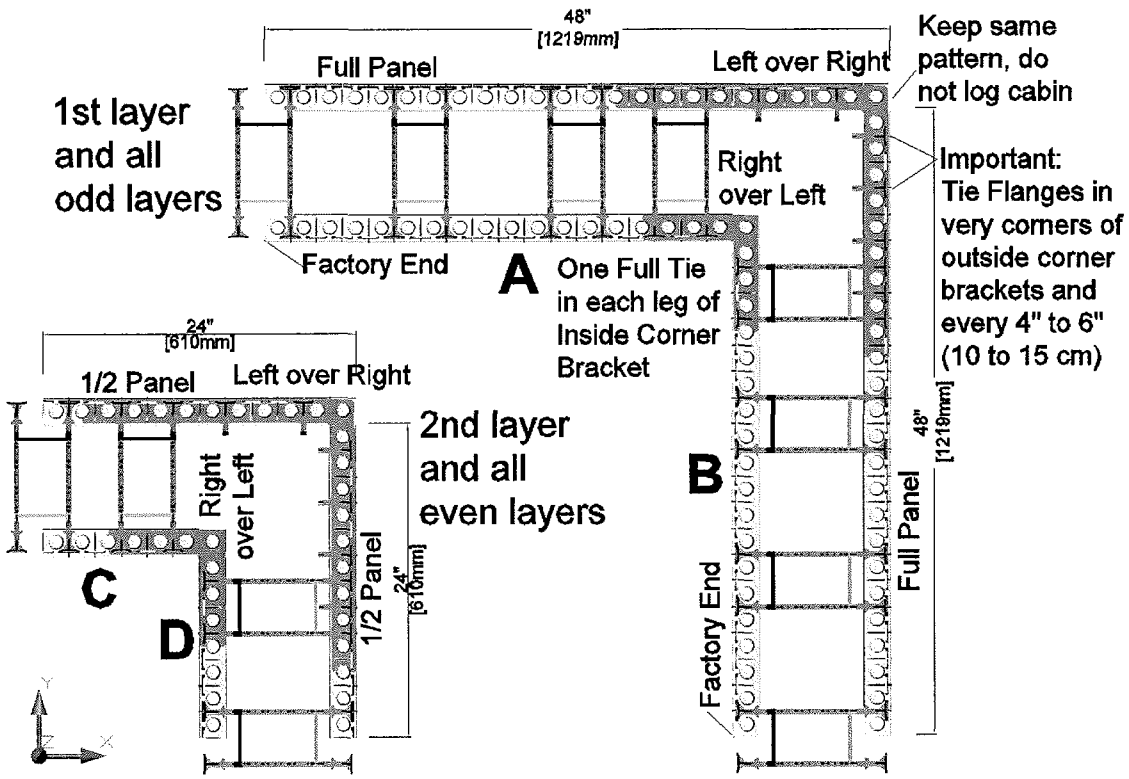


QUAD-LOCK Building Solutions
Permanent Insulating Concrete Forms

Construction of 90° Corners
Placement of EPS Panels, Ties and Corner Brackets

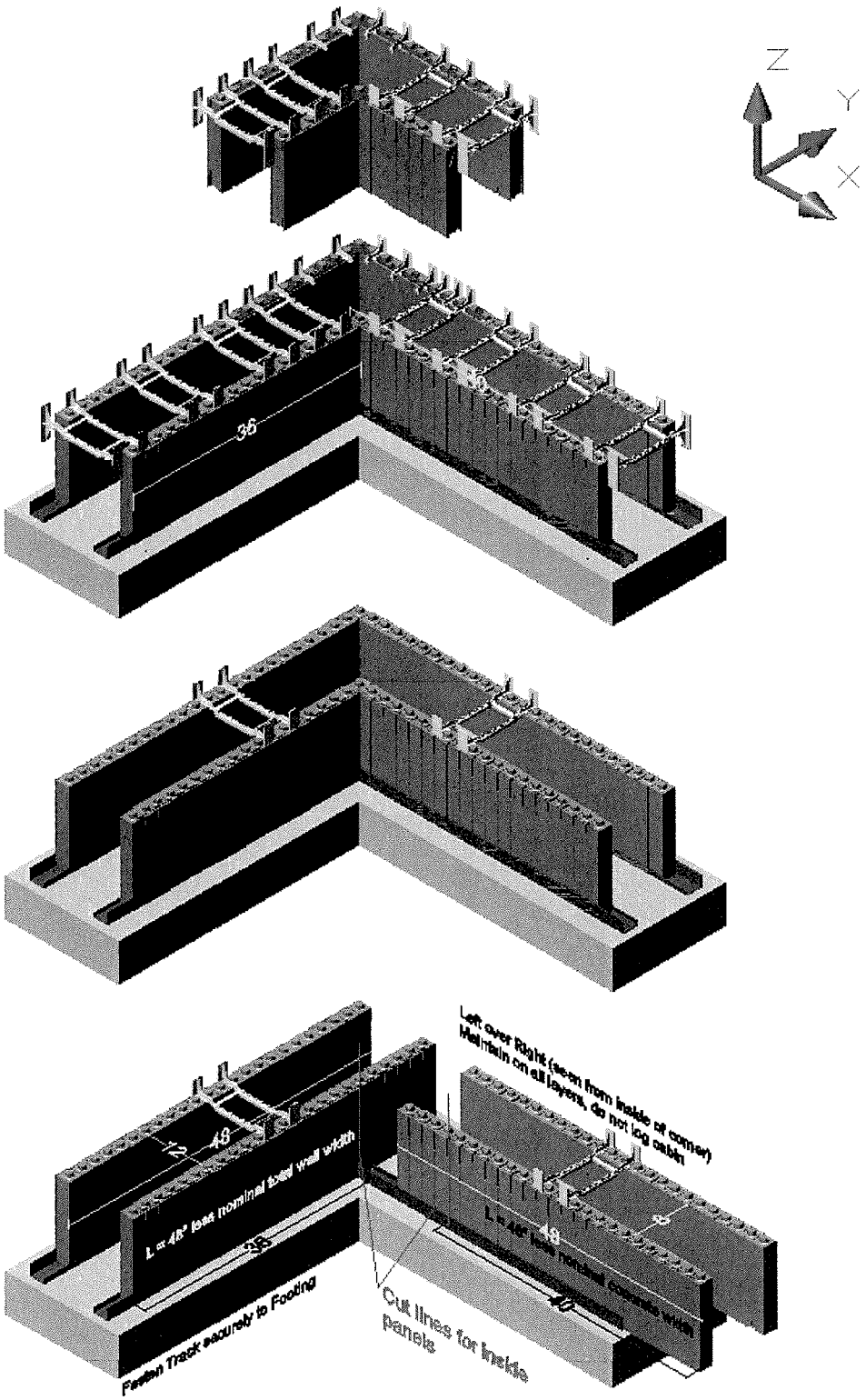
Annex 7
of European
Technical Approval

ETA – 06/0189

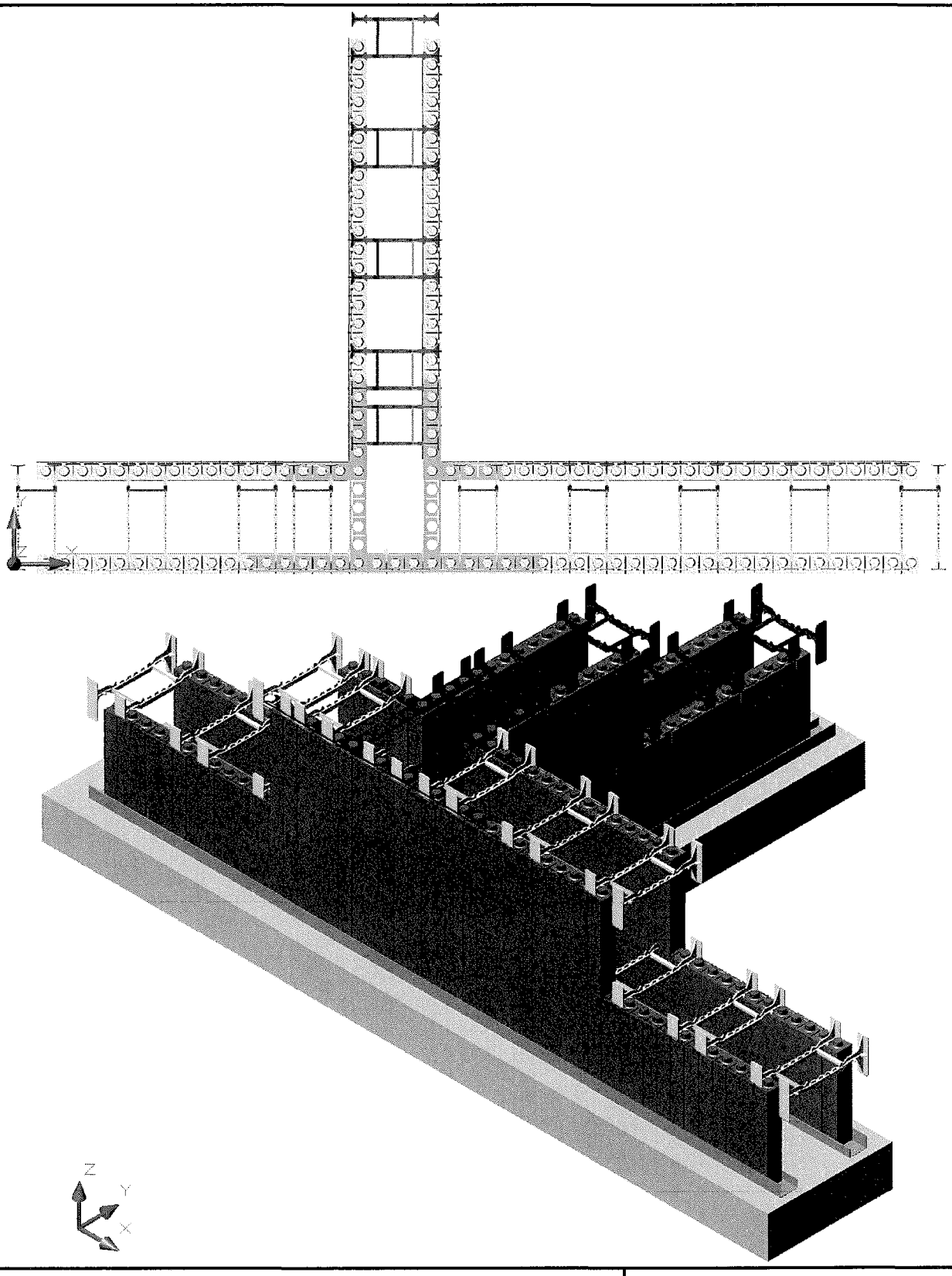


all Dimensions in inches and [millimetre]

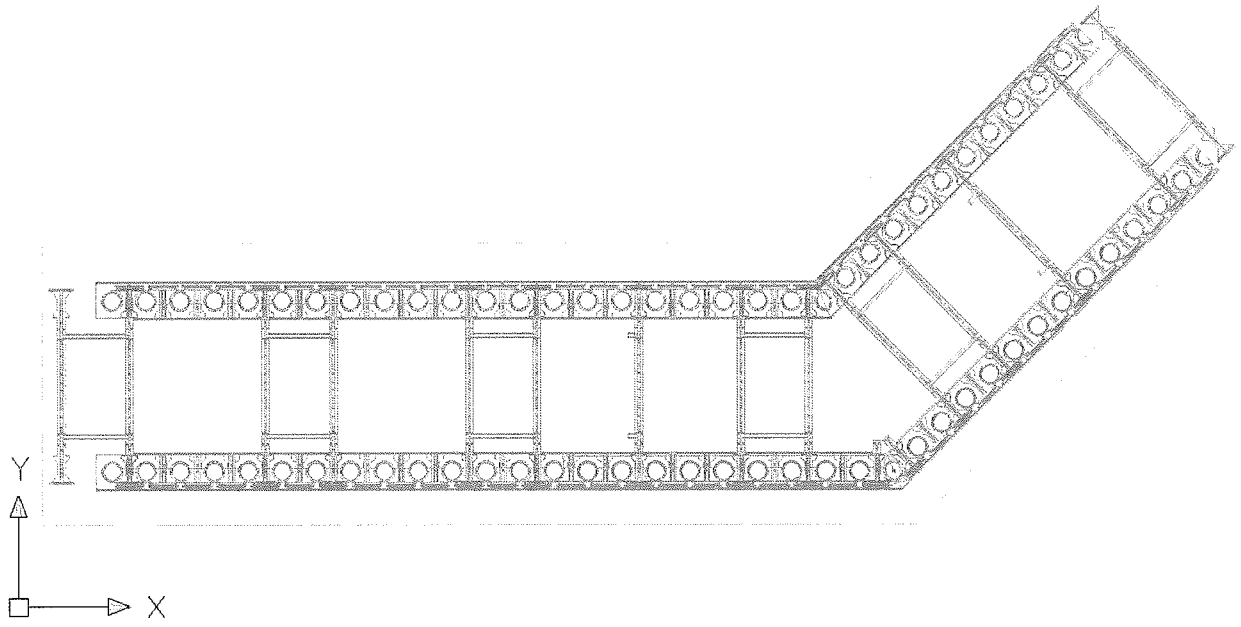
QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 8** of European Technical Approval
Construction of 90° Corners Placement of EPS Panels, Ties and Corner Brackets	**ETA – 06/0189**

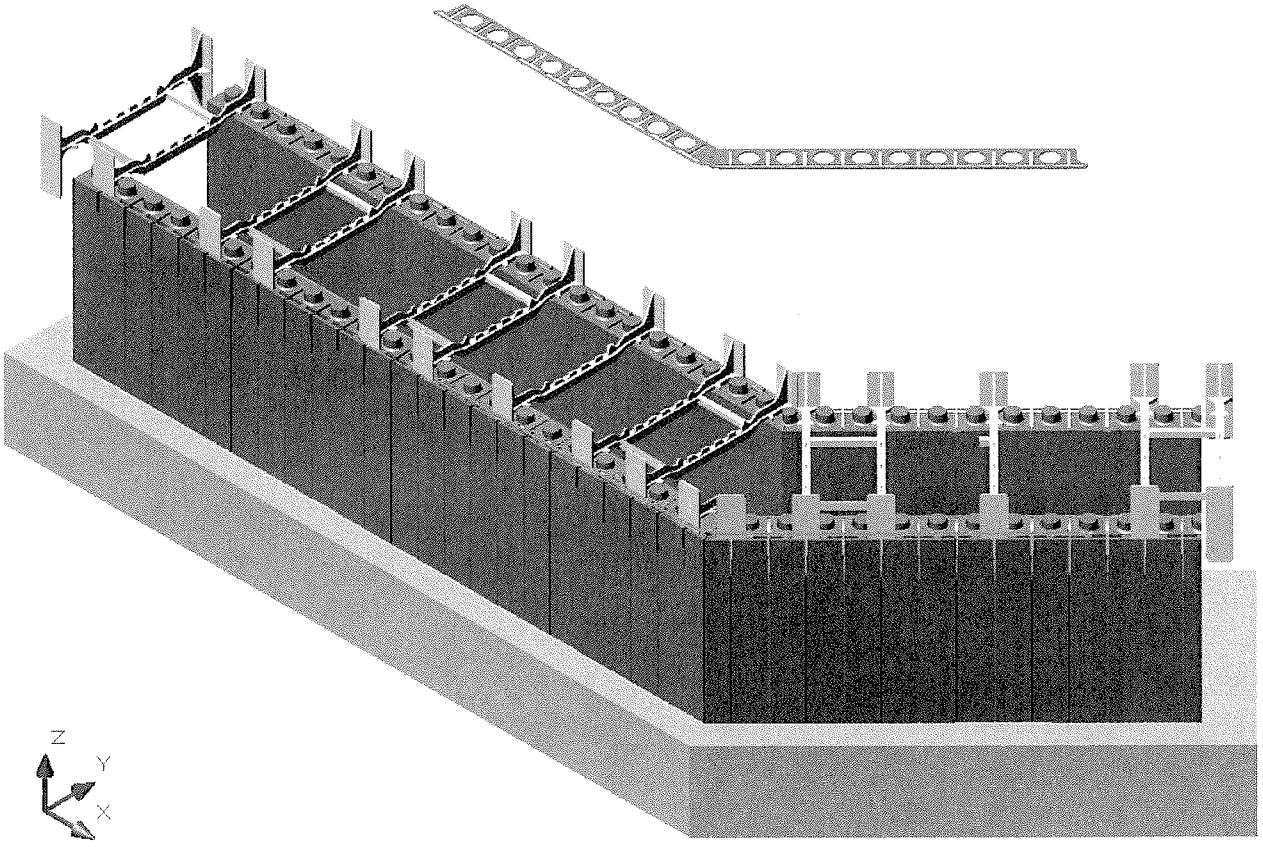


QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 9** of European Technical Approval
Construction of 90° Corners - Sequence Placement and Cutting of EPS Panels, Ties and Corner Brackets	**ETA – 06/0189**

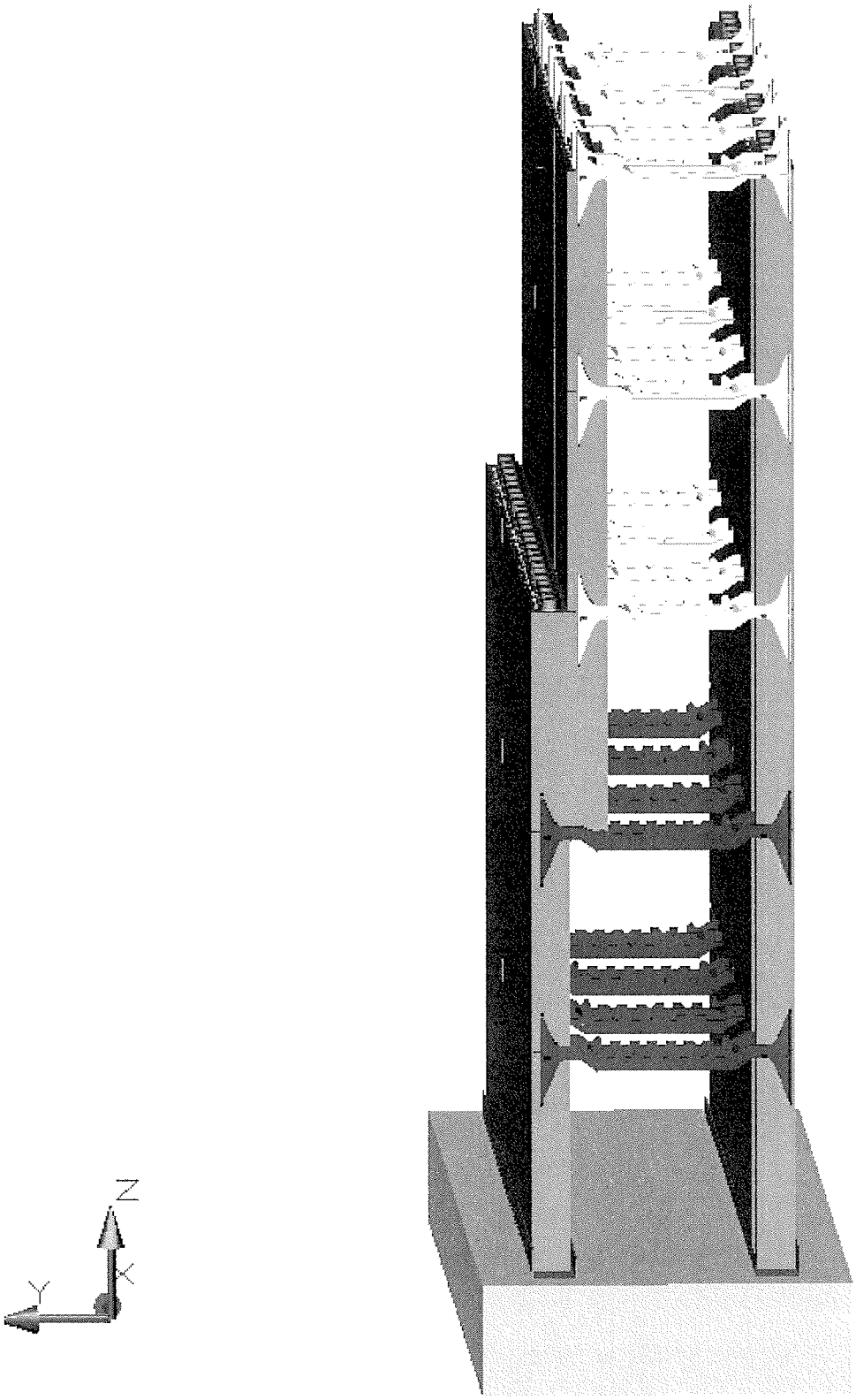


QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 10** of European Technical Approval
Construction of T - Walls Placement of EPS Panels, Ties and Corner Brackets	**ETA – 06/0189**

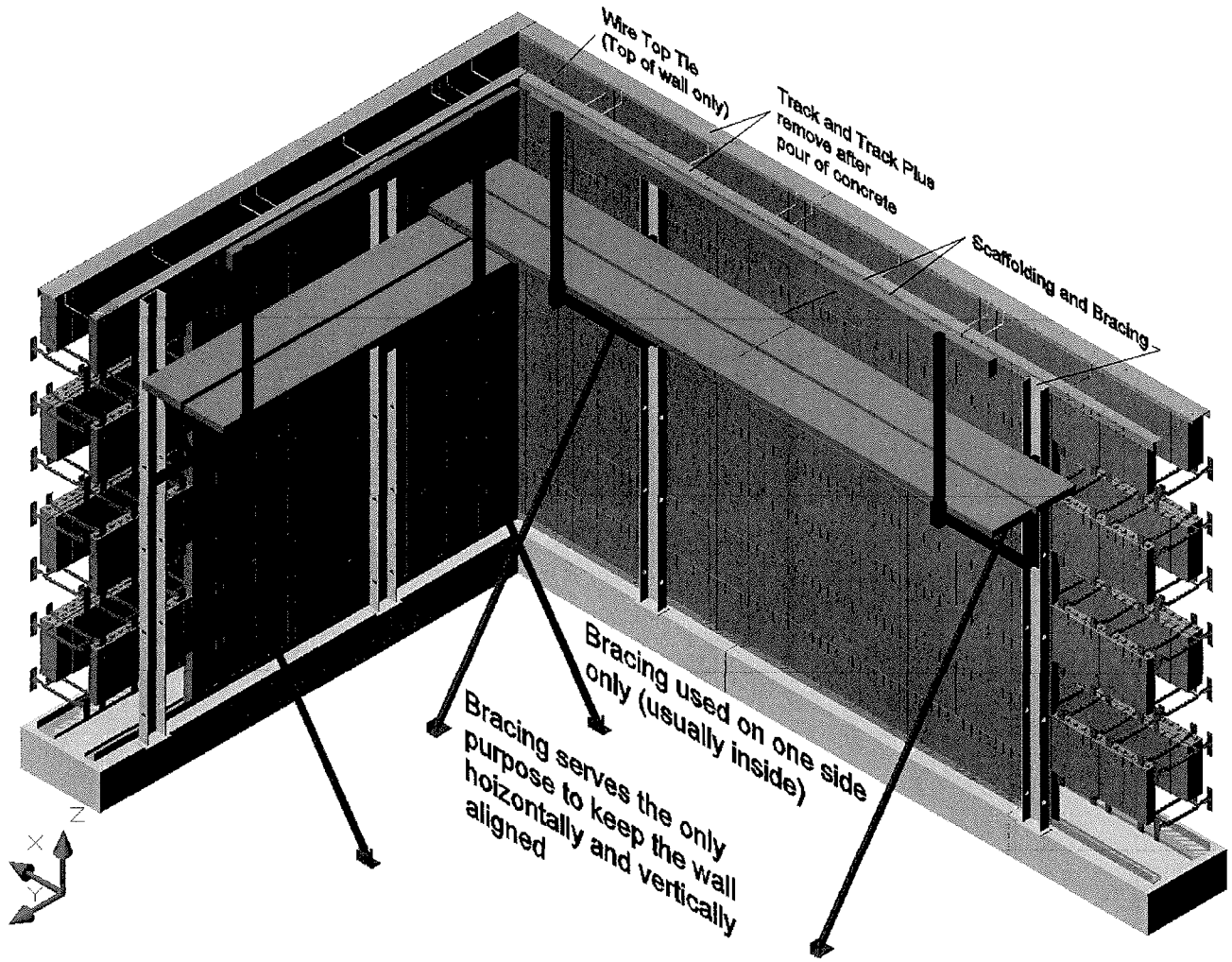




QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 11** of European Technical Approval
Construction of non 90° Angles Placement of EPS Panels, Ties and Angle Brackets No Bracing of outside required (regular bracing inside only)	**ETA – 06/0189**



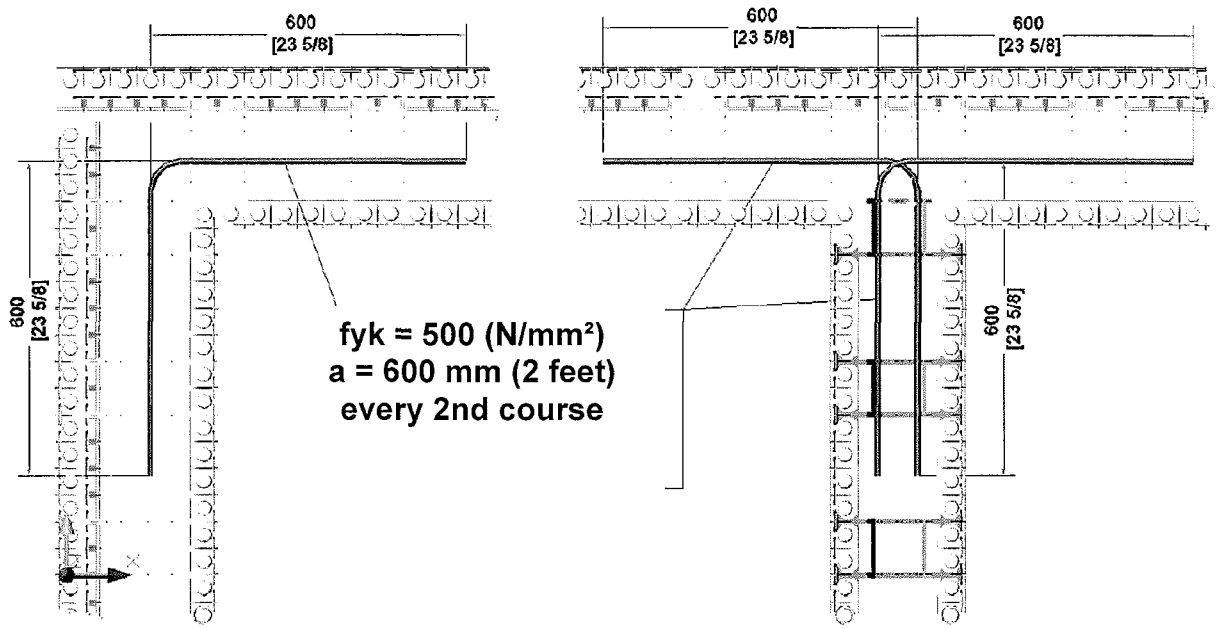
QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 12** of European Technical Approval
Construction of Wall Width Transition Using QUAD-LOCK Plus Panel	**ETA – 06/0189**

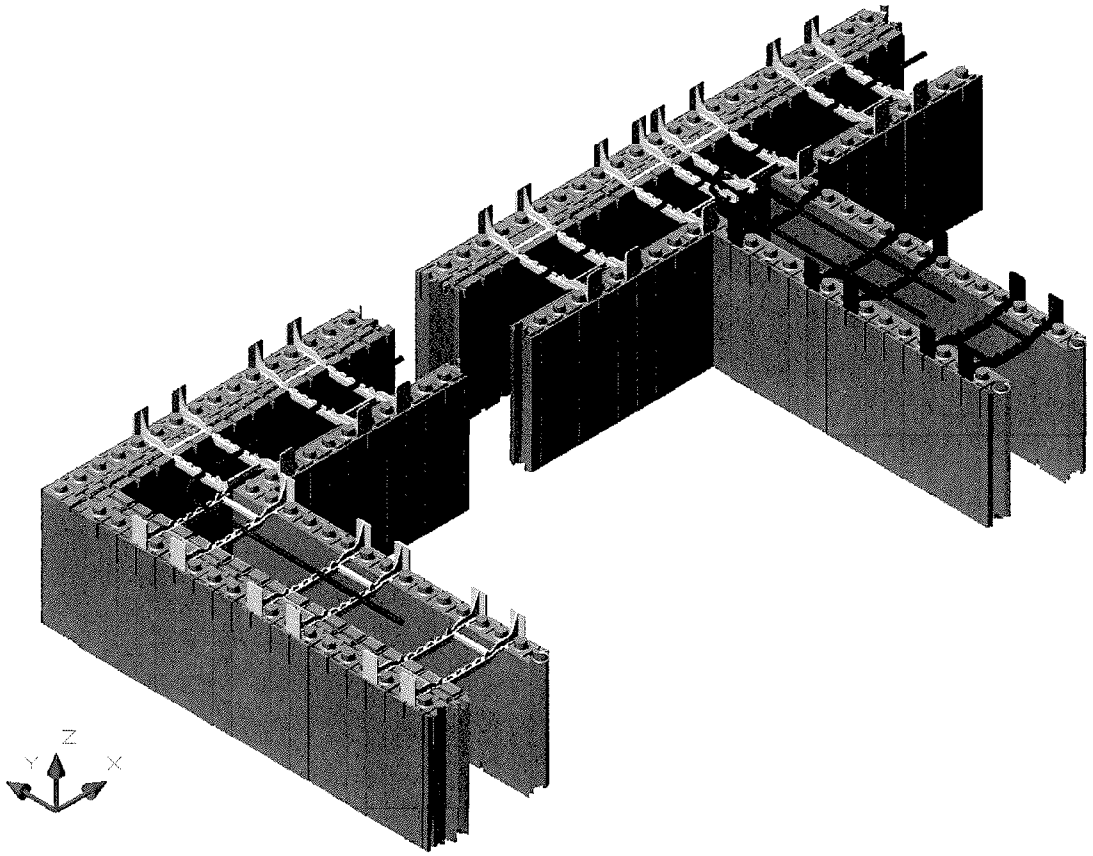


Bracing 60 cm (2 feet) from corner and then every 120 to 180 cm (4 to 6 feet)

QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 13** of European Technical Approval **ETA – 06/0189**
Bracing of QUAD-LOCK in order to keep the wall aligned horizontally and vertically during the pour of concrete, and providing scaffolding for the work crew	

Horizontal Reinforcement Steel for Buildings higher than 5 floors

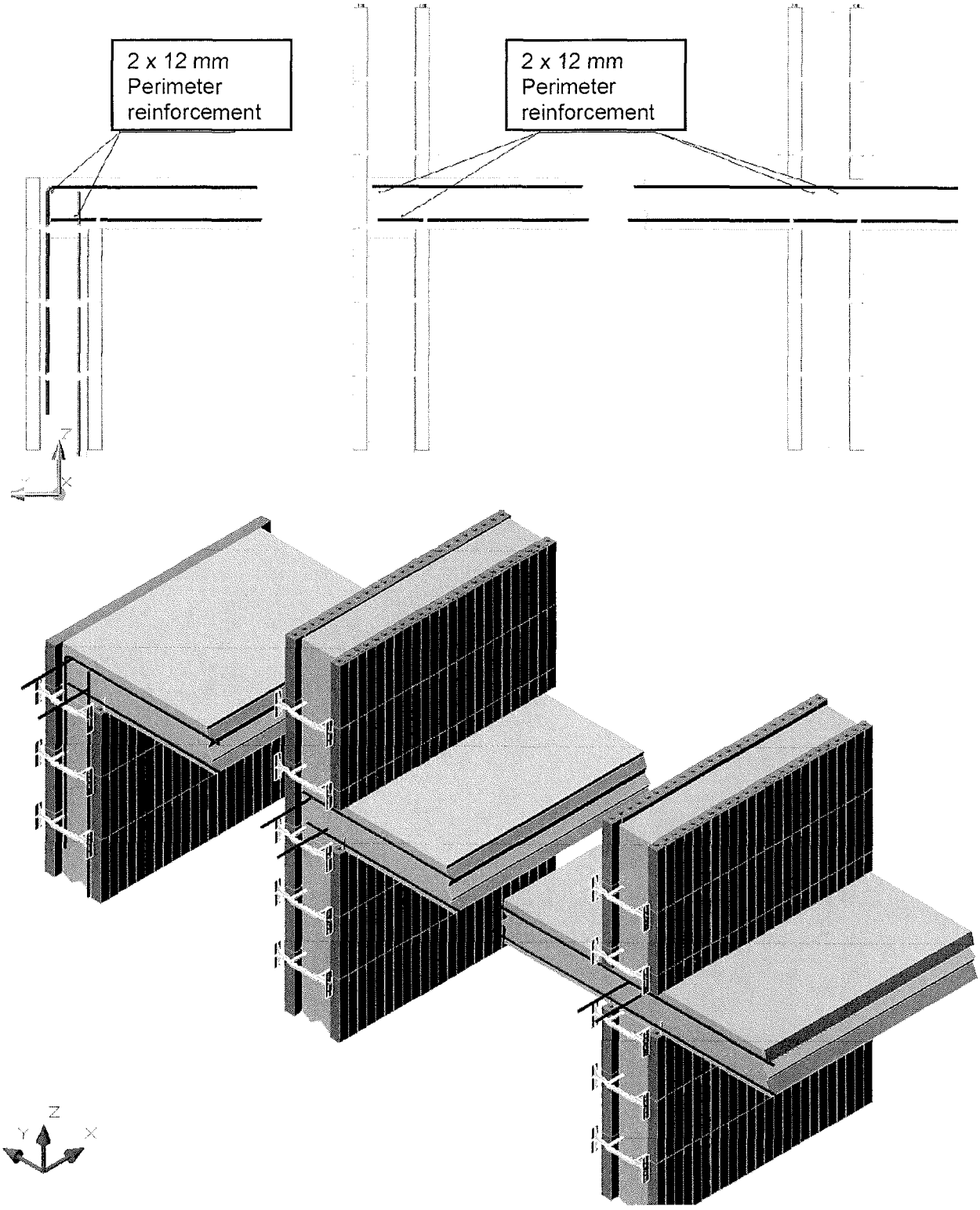




all Dimensions in millimetre and [inches]

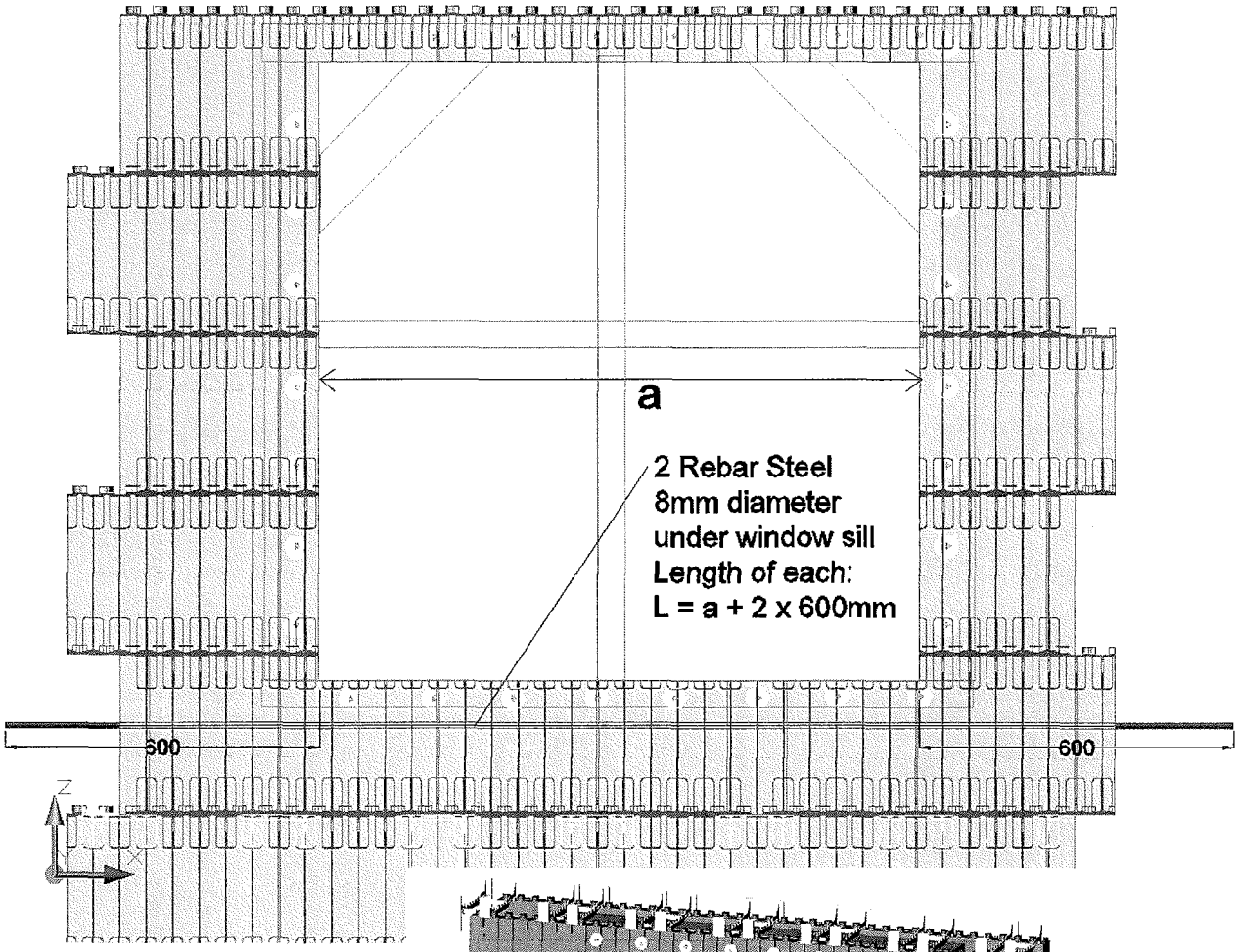
QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 14** of European Technical Approval **ETA – 06/0189**
Placement of horizontal reinforcement steel for buildings higher than 5 floors	

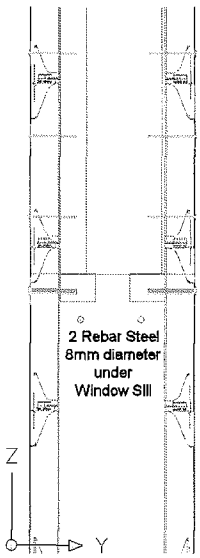
Wall and Ceiling: Vertical Sections

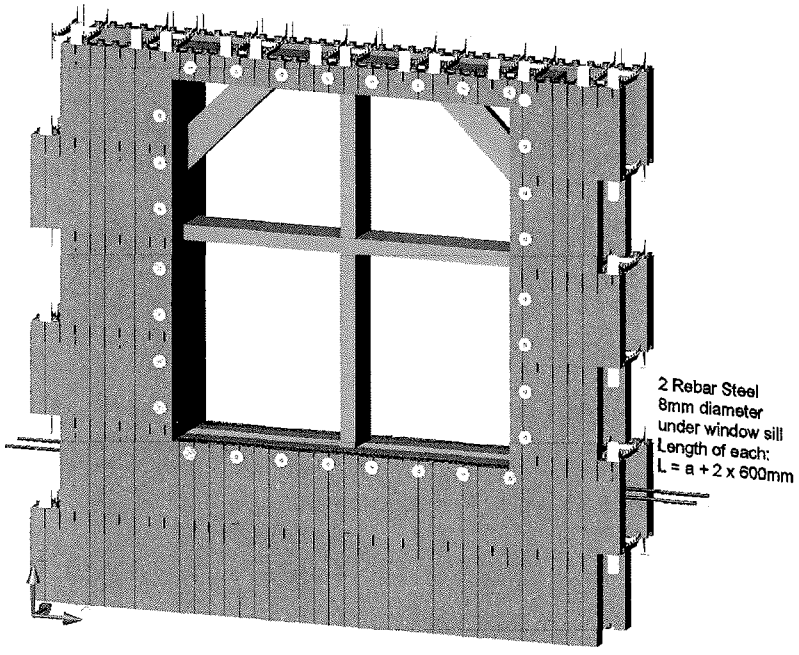


QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 15** of European Technical Approval
Vertical Sections at Concrete Floors	**ETA – 06/0189**

Reinforcement under Openings







QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 16** of European Technical Approval **ETA – 06/0189**
Reinforcement Steel under Openings	

Values of Wall Sections for all Combinations of QUAD-LOCK Walls

Type of Wall	Width of Wall	R-Value*	Ties		Panels made of EPS (Expanded Polystyrene)				Width of Concrete core	Volume of Concrete	Weight of QUAD-LOCK Parts	Weight of Concrete at 23 kN/m³
	W			**T**	outside		inside		**C**		per m²	per m²
Wall Width/ Conrete Width	**mm**	**(m²K) /W**	**Product Name**	mm	Product Name	mm	Product Name	mm	**mm**	m³/m²	kN/m²	kN/m²
QL413/300	**413**	**3.303**	**B 413 blue**	394	**QL**	57	**QL**	57	**299**	0.299	0.48	6.88
QL413/250	**413**	**4.453**	**B 413 blue**	394	**QPlus**	108	**QL**	57	**248**	0.248	0.63	5.70
QL413/200	**413**	**5.763**	**B 413 blue**	394	**QPlus**	108	**QPlus**	108	**197**	0.197	0.79	4.53
QL362/250	**362**	**3.280**	**B362 green**	343	**QL**	57	**QL**	57	**248**	0.248	0.48	5.70
QL362/200	**362**	**4.429**	**B362 green**	343	**QL**	108	**QPN**	57	**197**	0.197	0.63	4.53
QL362/150	**362**	**5.739**	**B362 green**	343	**QPlus**	108	**QPlus**	108	**146**	0.146	0.79	3.36
QL311/200	**311**	**3.256**	**B311 yellow**	292	**QL**	57	**QL**	57	**197**	0.197	0.48	4.53
QL311/150	**311**	**4.406**	**B311 yellow**	292	**QPlus**	108	**QL**	57	**146**	0.146	0.63	3.36
QL311/100	**311**	**5.715**	**B311 yellow**	292	**QPlus**	108	**QPlus**	108	**95**	0.095	0.79	2.19
QL260/150	**260**	**3.233**	**B260 blue**	241	**QL**	57	**QL**	57	**146**	0.146	0.48	3.36
QL260/100	**260**	**4.382**	**B260 blue**	241	**QPlus**	108	**QL**	57	**95**	0.095	0.63	2.19
QL210/100	**210**	**3.210**	**B210 black**	191	**QL**	57	**QL**	57	**96**	0.096	0.48	2.21

* The R-value of the elements is calculated in accordance with chapter 2.2.7.1 with following factors:

- shuttering leaves: λ_{DI} = 0.0381 W/m/K (108 mm EPS-Panel) respectively
  λ_{DI} = 0.0346 W/m/K (57 mm EPS-Panel)
- concrete core: R_{DC} with λ_{DC} = 2,1 W/m/K
- reduction factor: considering the influence of the plastic-spacers

QUAD-LOCK Building Solutions Permanent Insulating Concrete Forms	**Annex 17** of European Technical Approval
Widths of Walls and Concrete core; R- Values; Geometry; Volumes and Weights	**ETA – 06/0189**