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Authorised and notified according to Article 10 of the 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

MEMBER OF EOTA

European Technical Approval No. ETA-08/0092

Trade name:	BeWi Byggesystem
Holder of approval:	BeWi Produkter AS N- 7263 Hamarvik Norway Tel. + 47 72 44 88 88 Fax+ 47 72 44 88 99
Generic type and use of construction product:	Permanent shuttering system made of polystyrene
Valid from:	13.05.2008
to:	13.05.2013
Manufacturing plant:	BeWi Produkter AS N- 7263 Hamarvik Norway Tel. + 47 72 44 88 88 Fax+ 47 72 44 88 99
This European Technical Approval contains:	14 pages including 1 Annex which form an integral part of the document



European Organisation for Technical Approvals

I LEGAL BASIS AND GENERAL CONDITIONS

- 1 This European Technical Approval is issued by SINTEF Building and Infrastructure, in the following called SINTEF, 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 products¹, modified by the Council Directive 93/68/EEC² and Regulation (EC) N°1882/2003 of the European Parliament and of the Council³
 - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical approvals set out in the Annex of Commission Decision 94/23/EC⁴
 - ETA Guideline 009 "Nonload-bearing permanent shuttering systems based on hollow blocks or panels of insulating materials and sometimes concrete", edition June 2002.
- 2 SINTEF is authorised 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 of this European Technical Approval.
- 4 This European Technical Approval may be withdrawn by SINTEF pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
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- 6 The European Technical Approval is issued by the approval body in its official language. This version corresponds fully to the version circulated in EOTA. Translations into other languages have to be designated as such.

¹ Official Journal of the European Communities N° L40, 11.2.1989, p. 12

² Official Journal of the European Communities N° L 220, 30.08.1993, p. 1

³ Official Journal of the European Union N° L 284, 31.10.2003, p. 1

⁴ Official Journal of the European Communities N° L17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

1.1 Definition of the product

BeWi Byggesystem is a non-loadbearing permanent shuttering system based on elements made of EPS and HDPE with rib parts of HDPE (see Annex 1) applicable as formwork for reinforced concrete walls cast in-situ.

The shuttering elements consist of two one-layered, 80 mm thick expanded polystyrene (EPS) leaves. High density polyethylene (HDPE) rail anchors are integrated in the shuttering leaves when they are moulded. The rail anchors are vertical and serve as clamps for fastening of the spacers between the outer and inner shuttering leaves. The spacers are made of the same high density polyethylene (HDPE) as the rail anchors.

The upper and lower surfaces of the shuttering leaves are staggered to ensure precise locking between the elements. The outer and inner surfaces as well as the vertical end surfaces of the shuttering elements are smooth.

The distance between the rail anchors are 200 mm. The rail anchors are visible at the inner surface of the shuttering elements where the spacers are fastened. The spacers are made in lengths of 90 mm, 140 mm, 190 mm and 240 mm, providing a concrete thickness of 90 mm, 140 mm, 190 mm or 240 mm.

The shape of the spacers makes them suitable for precise location of the reinforcement bars for the concrete and secures a correct position of the reinforcement.

The kit consists of the following elements:

- standard shuttering leaves
- corner shuttering leaves 45° and 90°
- spacers 90, 140, 190 and 240 mm

For the shuttering leaves expanded polystyrene particle foam designated EPS-EN 13163-T1-L1-W1-S1-P4-BS250-DS (70,-)1-CS(10)120 according to EN 13163 is used. The material characteristics, dimensions and tolerances of the shuttering elements not indicated in Annex 1 are given in the technical documentation⁵ of the ETA.

The technical documentation of the ETA is deposited with SINTEF 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.

Assembly of the shuttering kit is done at the construction site.

⁵ The technical documentation of the ETA is deposited with SINTEF 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.

1.2 Intended use

The kit is intended to be used for construction of loadbearing (structural) and non loadbearing (non structural) internal walls and insulated external walls above or below ground, including walls which have to meet fire regulations.

When using this type of construction below ground a waterproofing according to applicable national rules must be provided.

The provisions made in this ETA are based on an assumed intended working life of the shuttering kit of at least 50 years, provided that the shuttering system in end use conditions is subjected to an appropriate use and maintenance. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

2 Characteristics of products and methods of verification

2.1 *ER 1 Mechanical resistance and stability*

2.1.1 *Resulting structural pattern*

In end use conditions walls made with shuttering elements "BeWi Byggesystem" are continuous type concrete walls according to ETAG 009, paragraph 2.2.

2.1.2 *Efficiency of filling*

Considering the instructions in chap. 4.2 and the installation guide of the ETA holder the efficient filling of concrete without bursting of the shuttering and without voids or any uncovered reinforcement in the concrete core is possible, and the requirements according to ETAG 009, chapter 6.1.2 are considered satisfied.

2.1.3 *Possibility of steel reinforcement*

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

2.2 *ER 2 Safety in case of fire*

2.2.1 *Reaction to fire*

Euroclass F according to EN 13501-1, no performance determined.

2.2.2 *Resistance to fire*

According to fire resistance test, the fire resistance class of walls with the thickness of the continuous concrete core of 190 mm with a minimum concrete strength B20 is REI 60. The fire resistance class of walls with the thickness of the continuous concrete core of 140 mm with a minimum concrete strength B20 is REI 30.

2.3 ER 3 Hygiene, health and the environment

2.3.1 Release of dangerous substances

According to the manufacturer's declaration the shuttering elements "Bewi Byggesystem" do not contain any dangerous substances according to the EU database^{6,7}.

2.3.2 Water vapour permeability

The tabulated design value of the water vapour diffusion resistance coefficient of expanded polystyrene (EPS) according to EN 12524⁸ is $M_y = 60$. The values for the water vapour diffusion resistance of concrete depending on density and type are tabulated in EN 12524.

2.3.3 Water absorption

No performance determined.

2.3.4 Water tightness of finishes

No performance determined.

2.4 ER 4 Safety in use

2.4.1 Bond strength between the shuttering leaves and the concrete core

No performance required. Under end use conditions the EPS is durable fixed by the spacers, and the determination of bond strength is not necessary.

2.4.2 Resistance to filling pressure

To resist the filling pressure the bending tensile strength of the shuttering leaves shall be more than 250 kPa (see also designation code of EPS in clause 1.1) and the pull out resistance of the spacers more than 1500 N.

2.4.3 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.

2.5 ER 5 Protection against noise

2.5.1 Airborne sound insulation

Airborne sound insulation has been measured according to: ISO 140-3:1995 "Laboratory measurements of airborne sound insulation of building elements". Main measured results given in accordance with EN ISO 717-1 "Acoustics – Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound isolation" is shown in Table 1.

⁶ Notes are stated in Guidance Paper H: "A harmonized approach relating to dangerous substances under the Construction Products Directive", Brussels, 18 February 2000

⁷ 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.

⁸ EN 12524:2000 Building materials and products -Hygrothermal properties -Tabulated design values

Table 1

Airborne sound insulation laboratory test results.

Type of Wall	Weighted sound reduction index, R_w (dB)	Spectrum adaptation term for spectrum $C_{100-5000}$ (dB)	Spectrum adaptation term for spectrum * $C_{50-5000}$ (dB)
ig. 1 Basic wall	42	-2	-2
ig. 2 Basic wall, with 13 mm gypsum board extra insulation at both faces	45	0	0
ig. 3 Basic wall with 13 mm gypsum board , extra insulation at one face, and 2x13 mm gypsum board on 25 mm Gyproc acoustic profiles at the other face	56	-1	-1

* *Spectrum for extended frequency range*

2.5.2 Sound absorption

No performance determined.

2.6 ER 6 Energy economy and heat retention

26.1 Thermal resistance

Table 2 shows the thermal resistance R of the elements in end use conditions (with concrete infill and rendering applied on the outside of the EPS surface), calculated in accordance with EN ISO 6946⁹ from the declared value of thermal conductivity $\lambda_D = 0.034$ W/mK according to EN 13163 for the shuttering leaves. The thermal conductivity of the concrete core, gypsum board and wood are according to EN 12524..

Table 2

Thermal resistance of walls made with BeWi Byggesystem

Wall construction ^{*)}	Resistance R , m^2K/W
Without additional insulation ^{**)}	4,61
With extra 80 mm EPS on the outside ^{**)}	7,00
With 48 mm mineral wool and 48mm x 48mm wooden studs spaced c/c600 on the inside	5,67

*) *Including rendering on the outside EPS surface***) *Including 13 mm gypsum board on the inside****) *The declared value of thermal conductivity for the mineral wool is $\lambda_D = 0.037$ W/mK*

2.6.2 Thermal inertia

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

⁹ EN ISO 6946:1996. Building components and building elements -Thermal resistance and thermal transmittance -Calculation method

2.7 Aspects of durability and serviceability

2.7.1 Resistance to deterioration

Based on the declared properties of the EPS and HDPE materials used for the BeWi Byggesystem the shuttering blocks are considered to have adequate resistance towards deterioration from relevant physical, chemical and biological agents.

2.7.2 Resistance to normal use damage

Resistance to impact load

No performance determined. The finishes of the wall are not part of the ETA.

Incorporation of ducts

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

Fixing of objects

Fixing of objects to the shuttering leaves is possible by screws fastened in the anchoring rail. Screw dimensions and capacities are given in the installation guide of the ETA holder. Large loads require fixing to the concrete core.

3 Evaluation of conformity and CE marking

3.1 Attestation of conformity System

According to the decision on the procedure of attestation of conformity 98/279/EC of 05 December 1997¹⁰ amended by the decision 2001/596/EC of the European Commission the system 2+ of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

(a) Tasks for the manufacturer:

- (1) Factory production control;
- (2) Initial type-testing of the product;
- (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.

3.2 Responsibilities

3.2.1 Tasks of 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, procedures and a control plan, 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.

¹⁰ Official Journal of the European Communities L /127 of 24.04.1998

The factory production control shall be in accordance with the factory control plan relating to the European Technical Approval ETA -08/0092, 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 at Norwegian Building Research Institutes.¹¹

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

3.2.1.2 Other tasks of manufacturer

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

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of the European Technical Approval ETA -08/0092.

3.2.2 Tasks of the approved body

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 of 31 January 2008, issued by SINTEF, relating to the European Technical Approval ETA -08/0092. 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 factory production control 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 SINTEF without delay.

3.3 CE marking

The CE marking shall be affixed on every package of shuttering elements and/or 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:

- name and address of producer (legal entity responsible for the manufacturer),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate for the factory production control,
- the number of the European Technical Approval,
- the number of the guideline ETAG 009.

¹¹ The control plan is a confidential part of the documentation of the European Technical Approval, but not published together with the ETA and only handed over to the approved body/bodies involved in the procedure of attestation of conformity.
See section 3.2.2.

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

4.1 Manufacturing

The ETA is issued on the basis of agreed data/information, deposited with SINTEF, 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 SINTEF before the changes are introduced. SINTEF will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alterations to the ETA shall be necessary.

4.2 Installation

4.2.1 General

The manufacturer shall ensure that the requirements in accordance with sections 1, 2 and 4 are made known to those involved in design and execution of construction works. The installation guide is deposited with SINTEF and shall be available at every construction site.

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

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

4.2.2 Installation of the shuttering elements

The shuttering elements are put together on site in layers without adhesive. The elements shall be installed with staggered vertical joints, where the distance between joints in adjacent layers is minimum one quarter of the element length.

Bracings according to the installation guide of the ETA-holder are to be used in order to keep the walls aligned vertically during installation. The bracing supports are installed on one side of the wall at a maximum distance of 2.0 m.

4.2.3 Installation of the reinforcement

The necessary steel reinforcement according to static calculation shall be installed. Minimum and maximum distance between reinforcing bars and the required concrete cover shall be in accordance with EN 1992-1-1 or corresponding national rules.

4.2.4 Concrete

The maximum aggregate size shall be 16 mm and the slump class of the concrete shall be S4 according to EN 206-1 table 3. The concrete shall be compacted by poking. The concrete shall have rapid or middle strength development according to EN 206-1, Table 12.

Pouring the concrete shall only be performed by persons who have been instructed in the works and in the proper handling of the shuttering system. The concrete may fall freely up to a height of 3.0 m. Pouring of the concrete shall be performed at a maximum vertical height rate of 1 m/h, and otherwise be in accordance with the requirements of the installation guide of the ETA-holder.

After the concrete has been poured the wall's deviation from a vertical line should not be more than 5 mm per running meter of the wall height.

When equivalent national rules are not available the following shall be considered:
Vertical steel reinforcement bars shall be installed if horizontal concrete construction joints cannot be avoided. Before pouring the concrete all loose cement and concrete must be removed from the surfaces, and construction joints must be pre-wetted when required in order to secure good adhesion to the older concrete. If no construction joints are planned, the pouring of the concrete in layers must be done continuously until the last layer is completed.

A protection element for protection of the horizontal surfaces of the shuttering leaves during concrete pouring is available.

4.2.5 *Ducts crossing the wall or placed inside the wall*

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

Horizontal ducts placed inside the wall core 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 the diameter exceeds 1/6 of the thickness of the concrete core, or if the distance between pipes is less than 2 m, special structural design has to be performed.

4.2.6 *Rendering and finishes*

Walls of the type "BeWi Byggesystem" 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. The execution of the rendering shall be performed according to applicable national rules.

4.2.7 *Fastening of objects*

Fastening of objects in the shuttering leaves is possible by screws fixed to the anchoring rail. Screw dimensions and capacities are given in the installation guide of the ETA applicant. Large loads require fixing to the concrete core. The reduction of the thermal resistance due to fasteners fixed to the concrete core shall be considered according to EN ISO 6946 or relevant standards concerning thermal bridges.

5 Recommendations for the manufacturer

5.1 Recommendations on packaging, transport and storage

The shuttering elements shall be protected against damage, soil contact and intensive water exposure during transport and storage. If necessary the elements shall be covered.

5.2 Recommendations on 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.

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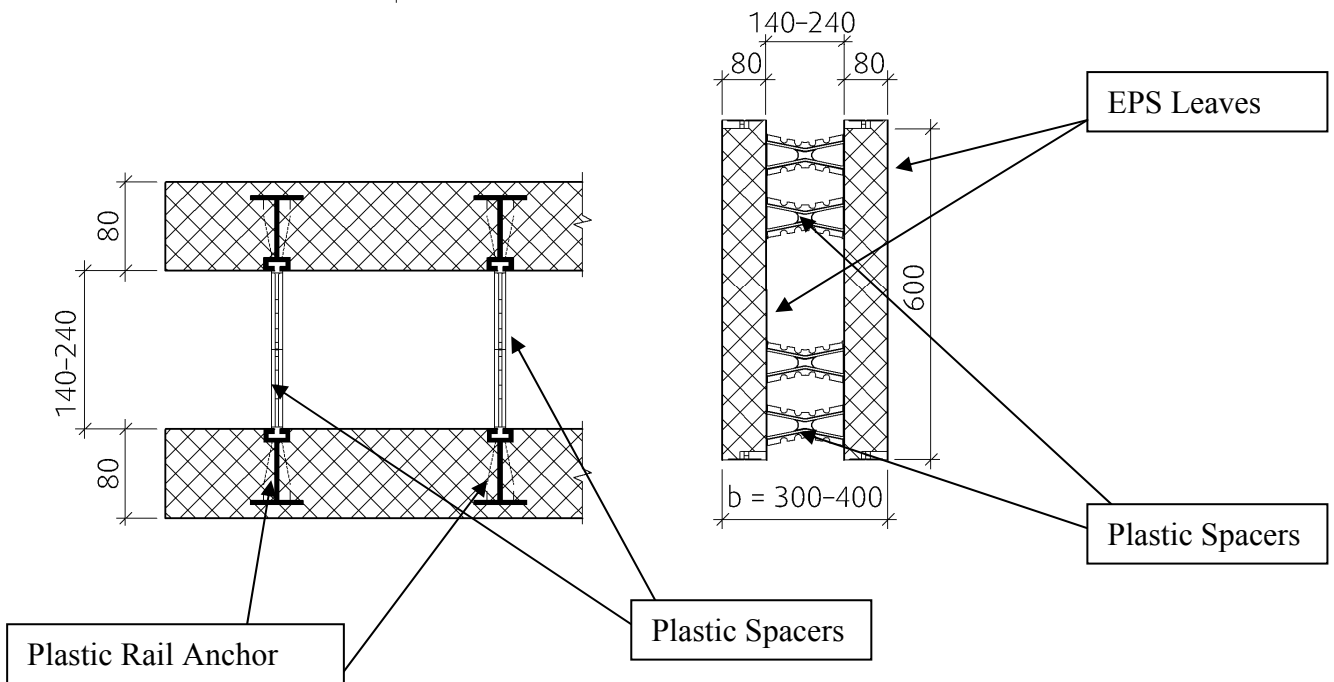
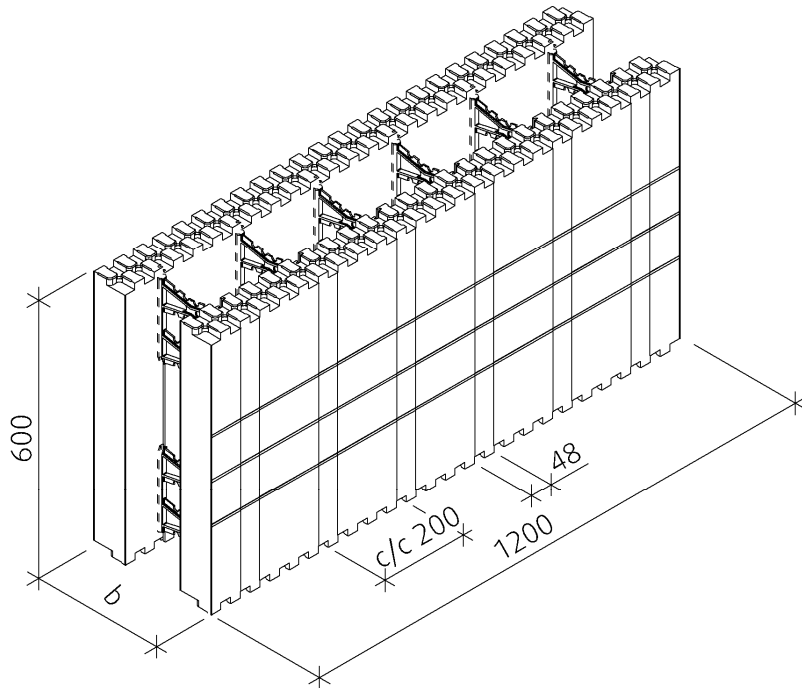


Trond Ø. Ramstad
Approval manager

Annex 1: Component and material specifications

ANNEX 1

**BeWi Byggesystem
Component and material specifications**



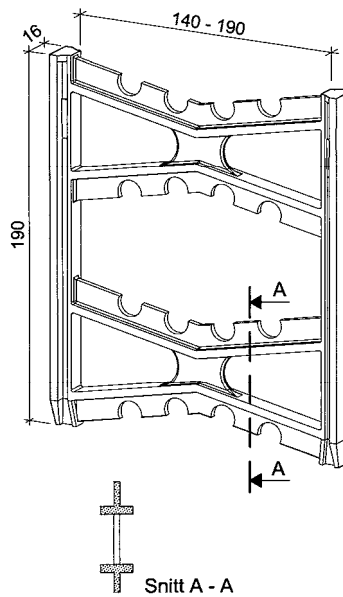
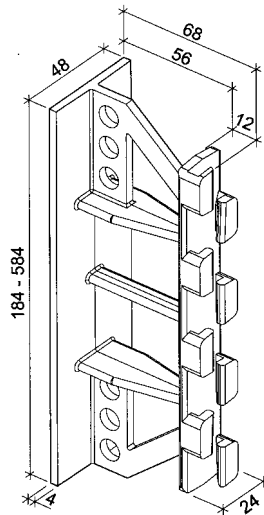
Material characteristics for the EPS:

Bending strength $\sigma_b \geq 250$ kPa according to EN 12089

Dimension stability change ≤ 1 % according to EN 13163 and EN 1604

Compressive stress at 10% relative deformation $\sigma_{10} \geq 120$ kPa according to EN 826

BeWi Byggesystem	Annex 1.1
Standard elements	ETA-08/0092

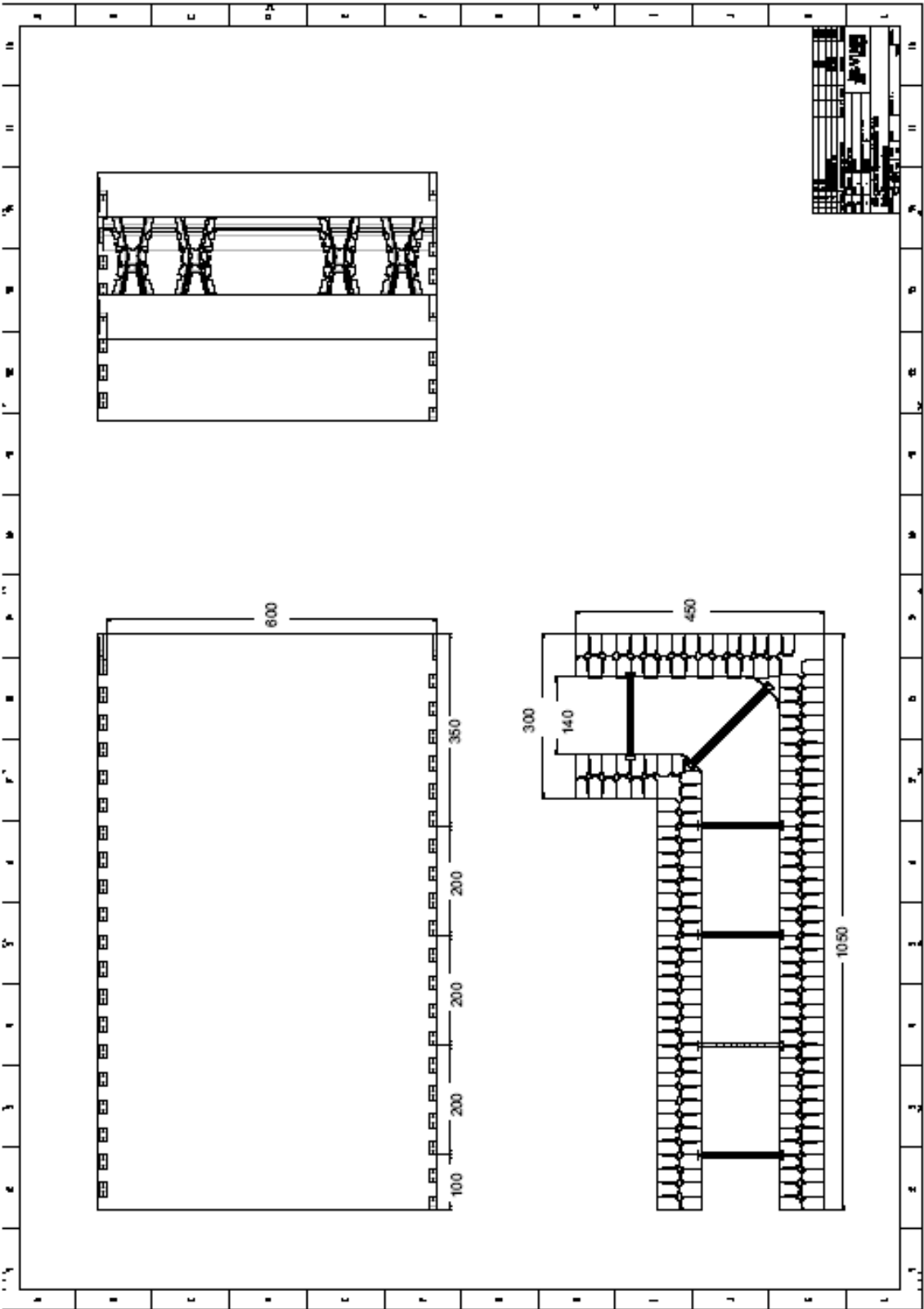


Material characteristics for HDPE:

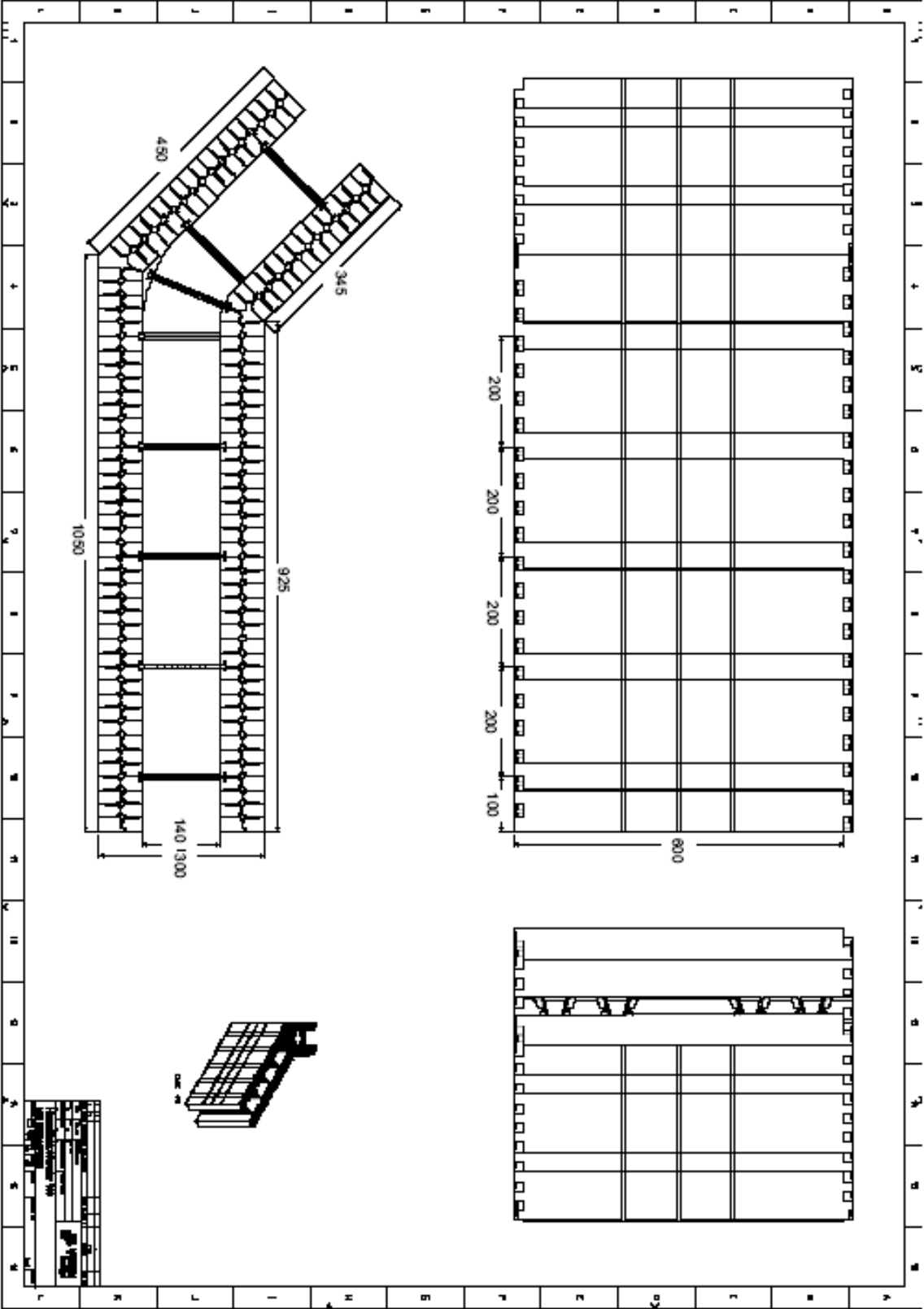
Yield strength (tensile stress at yield) $\sigma_y \geq 25$ MPa According to ISO 527-1

Young's Modulus ≥ 1100 MPa According to ISO 527-1

BeWi Byggesystem	Annex 1.2
Plastic rails and plastic spacers	ETA-08/0092



BeWi Byggesystem	Annex 1.3
Corner element	ETA-08/0092



BeWi Byggesystem Corner element element	Annex 1.4 ETA- 08/0092
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