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le futur en construction

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European Technical Assessment

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GENERAL PART

Technical Assessment Body issuing the European Technical Assessment:	Centre Scientifique et Technique du Bâtiment (CSTB)
Trade name of the construction product:	REVERBLOC 2
Product family to which the construction product belongs:	Product area code: 34 Non load-bearing permanent shuttering kits/systems based on hollow blocks or panels of insulating materials and sometimes concrete
Maker:	Rhône-Alpes Coffrage 10 rue Victor Hugo 07100 ANNONAY
Manufacturing plant(s):	KNAUF INDUSTRIES EST Zac Grenoble Air Parc FR-38590 SAINT ETIENNE DE SAINT GEOIRS
This European Technical Assessment contains	21 pages including 10 Appendices as an integral part of this evaluation
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	European Assessment Document (EAD) EAD 340309-00-0305
This version cancels and replaces :	ETA 13/0040 du 20/02/2018
This version incorporates the following changes:	<ul style="list-style-type: none">• Trade description of the product;• Modification of the geometry of the blocks at the level of their interlocking and extension of panels thickness.• Declaration of thermal and acoustic performance.

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1. SPECIFIC PART

1.1 Technical description of the product

The REVERBLOC 2 formwork system is a non-load-bearing insulating formwork kit, consisting of two factory-molded expanded polystyrene panels for the implementation of concrete walls.

The formwork kit consists of two expanded polystyrene panels, assembled in the factory using polypropylene spacers. The components of the kit are described below.

Exterior coatings, coatings, and plasterboard are not covered by this document. The structural evaluation of the concrete core is not covered by this document.

Components	Characteristics (specifications and tolerances)	
REVERBLOC 2 block EPS	Nature	Expanded polystyrene colored pearl grey
	Density according to NF EN 1602	30 ± 3 kg/m ³
	Thermal conductivity λ (W/m.K) according to NF EN 12667	0,033
	Compressive strength (10% deformation) according to NF EN 826	≥ 160 kPa
	Bending strength according to NF EN 12089	≥ 280 kPa
	Perpendicular tensile strength according to NF EN 1607	≥ 180 kPa
	Reaction to fire according to NF EN 13501-1	E
	Ignifugeant	Oui
	Water vapour diffusion resistance factor according to EN 12086	30-70
	Water absorption according to NF EN 16535	≤ 2,5 %
	Dimensional stability according to NF EN 1604	Class S2

Table 1: Characteristics of the insulation of the REVERBLOC 2 formwork kit

Components	Characteristics (specifications and tolerances)	
Blocks (see ANNEX APPENDIX 1)	Length	1050 ± 6 mm
	Thickness of the outer panel	63.5 – 123.5 - 183.5 - 243.5 – 303.5 mm (± 1 mm)
	Thickness of the inner panel	63.5 mm (± 1 mm)
	Height	300 ± 3 mm
	Geometry of block interlocks	See ANNEX APPENDIX 2
Spacers(See ANNEX ANNEX 9)	Nature	Polypropylene
	Total length	260 ± 1 mm
	Total height	170 ± 0,7 mm
	Center stem height	45 ± 0,5 mm
	Center stem length	165 ± 0,5 mm
	Strap spacing	175 ± 1 mm
	Tensile strength of the spacer alone	≥ 2000 N
Accessories (of the same nature and density as EPS panels)		
Wall tip caps (see APPENDIX ANNEX 7)	Length	174 ± 6 mm
	Thickness	62,50 ± 1 mm
	Height	300 ± 3 mm
Lintel underside caps (see ANNEX ANNEX 7)	Width	174 ± 1 mm
	Thickness	60 ± 1 mm
	Length	525 ± 6 mm
Blocks for 90° out/retract angle		See ANNEX APPENDIX 4
Blocks for out/retract angle 45°		See ANNEX APPENDIX 5
Pinion end blocks		See ANNEX ANNEX 8
Internal enhancement	Thickness: 50 mm Length: 1050 mm Width: 63.5 mm	See ANNEX ANNEX 6
External Enhancement	Thickness: 50 mm Length: 1050 mm Width: 63.5 mm - 123.5mm – 183.5mm - 243.5 mm – 303.5 mm	See ANNEX ANNEX 6
Planelle only	Height: 300 mm Length: 1050 mm Width: 63.5 mm - 123.5 mm - 183.5 mm - 243.5 mm - 303.5 mm	See ANNEX APPENDIX 3
Other accessories		
Fixed wooden planelle		See ANNEX ANNEX 10

Table 2 : Characteristics of the REVERBLOC 2 formwork kit system

1.2 Specification of intended use

1.3 Planned employment

In accordance with the applicable European Evaluation Document (DEE 340309-00-0305), the system is intended for the construction of load-bearing and non-load-bearing walls of buildings, with or without steel reinforcement. Once filled with concrete on site, the EPS formwork is left on the wall, as a permanent formwork, and thus contributes to the overall thermal resistance of the wall.

Infill concrete	Compressive strength class (EN 206+A2/CN)	C25/30
	Consistency class (EN 206+A2/CN)	S4
	Max particle size (EN 206+A2/CN)	12 mm
	Implementation	No vibration
	Thickness concrete core	160 mm (excluding grooving)

Table 3: Characteristics of infill concrete for the REVERBLOC 2 formwork kit system

When the formwork is used partly buried, a waterproofing membrane compatible with EPS and complying with the national rules in force must be returned to the outer face. The membrane must be implemented in accordance with the manufacturer's specifications and must be protected by using impact resistant protection.

For the intended use, it is essential to protect the formwork from the weather and solar radiation.

1.4 Lifespan / Durability

The provisions made in this ETA are based on an assumed lifespan of at least 50 years. The service life indications cannot be interpreted as a guarantee given by the Manufacturer or the Technical Evaluation Body but should only be considered as a means of choosing suitable products for the economically reasonable expected life of the works.

The design, implementation, maintenance and repair of the construction work must take into account the principles given in § 1.2.2 of EAD 340309-00-0305 and must be carried out in accordance with national instructions.

2. Product Performance

The performance of the REVERBLOC 2 process in relation to the basic requirements for construction works has been determined in accordance with § 2 of EAD 340309-00-0305.

These performances are given in the following paragraphs and are valid as long as the components of the REVERBLOC 2 process are those described in § 1.1 of this ETA.

2.1 Basic Requirement 1: Mechanical strength and stability

2.1.1 Resulting structural scheme

Under normal conditions of use, the walls made with the REVERBLOC 2 formwork kit are walls of continuous type, as defined in § 1.3.3 of EAD 340309-00-0305.

The specifications of the components and their dimensional characteristics and tolerances are as given in Table 2.

2.1.2 Filling efficiency

The filling efficiency is verified by concrete filling test:

- no bursting of the formwork,
- no concrete gaps,
- No coating defect of the reinforcements.

The filling efficiency determined under the following test conditions:

- Filling method: vibration-free
 - Scrap wall and non-scraped wall
 - Characteristics of filler concrete: See Table Table 3.
 - Maximum wall height: 3 m,
 - Maximum concrete drop height: 3 m
 - Filling in successive layers of up to 1 m,
- The requirements of § 2.2.2 of EAD 340309-00-0305 are met.

2.1.3 Feasibility of the implementation of steel reinforcements

The instructions of the REVERBLOC 2 installation manual are adapted to the use of steel reinforcements for the construction of a wall, in accordance with EN 1992-1-1 and national requirements.

The feasibility of placing the reinforcement with sufficient coverage and keeping it in the right place during concrete pouring is considered satisfactory for normal situations.

Additional structural reinforcements, in particular those required for construction in seismic zones, have not been assessed in this ETA.

Requirements § 2.2.3 of EAD 340309-00-0305 are met under these conditions.

2.2 Basic Requirement 2: Fire Safety

2.2.1 Reaction to fire

The EPS panelle of the REVERBLOC 2 formwork is classified Euroclass E in accordance with EN 13501-1.

Attention is drawn to the fact that the panels of the formwork kit are intended to be covered with plasterboard or coatings benefiting from a European Technical Assessment. The reaction-to-fire classification shall then be verified taking into account the scope of application.

2.2.2 Fire resistance

The fire resistance of a wall implemented with the REVERBLOC 2 system has been tested in accordance with EN 1365-1. The test results are recorded in test reports RS22-025 (CSTB,1/12/2022), and lead to the following classification:

Thickness of concrete core (mm)	REI Ranking
160	REI 120
Sail height: ≤ 3 m Permissible load ≤160 kN/ml	

Table 4: Wall fire resistance made with the REVERBLOC 2 formwork kit system

The requirements to obtain this classification are given and detailed in report RS22-025 (CSTB,1/12/2022):

- With inner face of the wall finished in plasterboard glued by studs on the inner panelle.
- Or installation of a counter-partition consisting of a metal frame and a plasterboard screwed on the frame.

In all cases, layers likely to be involved in a fire situation shall be subjected to classification tests. Additional assessment in accordance with national provisions (e.g. based on a large-scale test) may be necessary to demonstrate compliance with Member States' regulations or administrative provisions.

2.3 Basic requirement 3: Hygiene, health and environment

2.3.1 Emission of hazardous substances

The formwork kit belongs to Category S/W2, according to EOTA Technical Report No. 034.

In addition to the specific clauses on hazardous substances included in this ETA, it is possible that other requirements apply to the formwork kit in relation to its scope (e.g. transposition of European and national legislation, regulations and administrative provisions). In order to comply with the provisions of Regulation (EU) No 305/2011, these requirements must also be met when and where they apply.

2.3.2 Water vapour permeability

In accordance with § 2.2.7 of EAD 340309-00-0305, the water vapour diffusion resistance factor of EPS according to EN 12086 is mentioned in Table Table 1.

2.3.3 Water absorption

In accordance with § 2.2.8 of DEE 340309-00-0305, the water absorption characteristic of EPS according to EN 16535 is mentioned in Table Table 1.

2.3.4 Sealing

Not applicable

2.4 Core Requirement 4: Safety of Use and Accessibility

2.4.1 Liaison forces

Characteristics	Specifications and tolerances
Tensile strength of the spacer of the blocks embedded on each side in the EPS panelles/liaison	≥ 1000 N
Shear strength of horizontal junctions between blocks	≥ 1400 N
Formwork surface adhesion (mortar layer on EPS)	$\geq 0,04$ MPa

Table 5: Linking characteristics of the REVERBLOC 2 formwork system

The tensile tear strength of the block spacer, as well as the shear strength of the horizontal junctions are sufficient to ensure the bonding of the formwork block panels when pouring concrete.

The requirements of § 2.2.10 of EAD 340309-00-0305 are met.

2.4.2 Impact resistance

The resistance to the impact load of the wall is normally governed by the filling of the concrete (concrete sections, concrete strength, reinforcement, distance between grid or column elements, if applicable, ...). The finishes to be incorporated on site are not part of the formwork kit.

The requirements of § 2.2.11 of DEE 340309-00-0305 are met.

2.4.4 Filling pressure resistance

Model test – resistance to filling pressure.

Description of the filling test	
Shoring system	Every 120 cm
Panel thickness	63,5 mm
Thickness of the concrete core	160 mm
Wall height	3 m
Length	3 m
Consistency class of concrete	S4
Filling speed	Filling in successive layers of 1 meter in height with a waiting time between each layer of 10 to 20 minutes.
Maximum deformation	4,9 mm

Table 6: Filling pressure resistance

The requirements of § 2.2.12 of EAD 340309-00-0305 are met.

2.4.5 Personal injury safety

As delivered to construction sites, the formwork elements do not have a sharp edge. The smooth surface of the formwork does not carry a risk of abrasion or cuts.

The requirements of § 2.2.13 of EAD 340309-00-0305 are met.

2.5 Basic Requirement 5: Noise Protection

2.5.1 Sound insulation

Performance determined in accordance with EN ISO 10140-2 by testing the airborne noise insulation of walls for intended conditions of use (see CSTB Test and Study Report No. AC16-26060283, CSTB Study Report AC22-09700-Rev01).

Walls configuration of REVERBLOC 2 insulating formwork blocks (exterior/concrete core/interior)		
Acoustic performance indices from basic tests and acoustic studies by simulations	R _w (C;Ctr) [dB] according to NF EN ISO 717-1	
Exterior finishing	Coated 20 mm	
Interior finishing	BA13 glued	Counterpartition on metal frame and plasterboard facing BA13
60/160/60	53(-1;-4)	73(-6;-12)
120/160/60	51(-3;-5)	72(-6;-14)
180/160/60	52(-3;-6)	71(-5;-13)
240/160/60	53(-3;-6)	70(-4;-12)
300/160/60	54(-3;-7)	69(-4;-12)
Note: The results of the simulations provide information on the behaviour and trends generated by parametric variations in the systems studied. The announced acoustic performances are estimated with an uncertainty of ± 1 to 3 dB depending on the systems studied, as well as the test results governed by the NF EN ISO 12999-1 standard.		

Table 7: Sound insulation

2.5.3 Sound absorption

Not applicable according to § 2.2.15 of EAD 340309-00-0305

2.6 Basic Requirement 6: Energy Saving and Thermal Performance

2.6.1 Thermal resistance

Once molded and stabilized, EPS has a density of 30 kg/m³, and a nominal thermal conductivity of 0.033 W/(m.K). The thermal conductivity of the expanded polystyrene insulation of REVERBLOC 2 is a manufacturer's declared value ($\lambda = 0.033$ W/m.K).

The thermal resistances of walls made with the REVERBLOC 2 kit are determined according to ISO 6946 with the assumptions mentioned in Table Table 8 (See CSTB Report No. DEB/R2EB–2022/159-LB/NZ).

Materials	Characteristic	Thermal conductivity W/(m.K)
EPS insulation ep= 63.5 mm → Interior ep= variable → Exterior	Not certified	0.033 (declared value)
Reinforced concrete (160 mm thick sail)	Taken by default	2,3
Polypropylene	Taken by default	0,22

Table 8: Thermal characteristics of REVERBLOC 2 system components

Trade description of REVERBLOC2 blocks	Areal transmission coefficient Up W/ (m ² . K)	Thermal resistance Rp (m ² K)/W
60/160/60	0,27	3,53
120/160/60	0,18	5,39
180/160/60	0,14	6,97
240/160/60	0,11	8,92
300/160/60	0,09	10,94

Note: The impact of polypropylene spacers is overlooked

Table 9: Thermal characteristics of walls with the REVERBLOC 2 system

Coefficient Ψ_i in W/(m.K) (NF EN ISO 10211)	REVERBLOC 2		
	60-60	120-60	180-60
Link type	0,07	0,04	0,03
Retracting angle	0,05	0,05	0,05
T-shaped vertical walls	0,15	0,08	0,06
Intermediate floor with balcony (rupteur)	0,36	0,29	0,27
Low floor on crawl space - cross split	0,10	0,05	0,04
Low floor on crawl space - T-slitting	0,11	0,06	0,04
Low floor on crawl space - inverted T-slitting	0,32	0,31	0,29
High floor - cross split	0,11	0,05	0,04
High floor - inverted T slitting	0,11	0,05	0,04
Intermediate floor	0,24	0,11	0,07
Low floor on insulated median under face	0,33	0,27	0,26
Low floor on the ground with hourdis	0,22	0,19	0,17
Low floor on crawl space – hourdis EPS - under base Concrete	0,39	0,40	0,42
Low floor on crawl space - hourdis EPS - under base REVERBLOC 2	0,28	0,25	0,24
Low floor on crawl space - insulated under face - under base Concrete	0,55	0,53	0,50
Low floor on crawl space - insulated under face - underside REVERBLOC 2	0,39	0,33	0,31
Exterior bare carpentry - lintel	0,02	0,02	0,01
Exterior bare carpentry - wall support board	0,05	0,05	0,03
Interior bare carpentry - lintel	0,02	0,04	0,06
Interior bare carpentry - wall support board	0,04	0,06	0,08
Tunnel joinery	0,01	0,03	0,04
Lightweight high floor - facade	0,03	0,03	0,04
Lightweight high floor - gable	0,11	0,12	0,14
High floor with insulated acroterium	0,27	0,24	0,22

Table 10: Thermal bridge values of wall connections made with the REVERBLOC 2 system

2.6.2 Thermal inertia

Tabulated values of heat capacity and diffusivity of concrete and expanded polystyrene are given in EN ISO 10456.

2.7 Durability and fitness for purpose aspects

2.7.1 Resistance to deterioration

The formwork kit does not have built-in finishes.

The requirements given for duct incorporation in the manufacturer's installation guide are suitable for making perforations through the wall to pass ducts. In general, the ducts must be incorporated into the formwork before pouring concrete.

The implementation of fasteners of heavy elements in formwork is not allowed. The fasteners must be anchored in the concrete core.

3. System for evaluating and verifying consistency of performance

In accordance with Decision 98/279/EC (Commission Decision of 5 December 1997, as amended by Commission Decision 2001/596/EC of 8 January 2001), the EVCP systems given in the following table apply:

Product REVERBLOC 2	Intended use	EVCP system (see § 3 EAD 340309-00-0305)
Non-load-bearing lost formwork system based on insulating material	exterior and interior walls subject to fire regulations	System 2+ for all essential features of the formwork kit including the E-grade fire reaction of the insulated formwork.
EVCP systems are described in Annex V of Regulation (EU) No 305/2011, as amended by Delegated Regulation (EU) No 568/2014.		

Table 11: Applicable EVCP Systems

4. Technical details required to implement the EVCP system

The technical details necessary for the implementation of the EVCP system as provided for in the applicable EAD are specified in the manufacturer's detailed control plan and filed with the CSTB (Reference REVERBLOC 2 QUALITY PLAN).

These self-checks are aimed in particular at:

- Incoming raw materials;
- The dimensions of the blocks;
- Density of insulation (volume);
- Thermal conductivity;
- Ignition test;
- Tensile strength of the spacer of the blocks.
- Mass of the spacers.

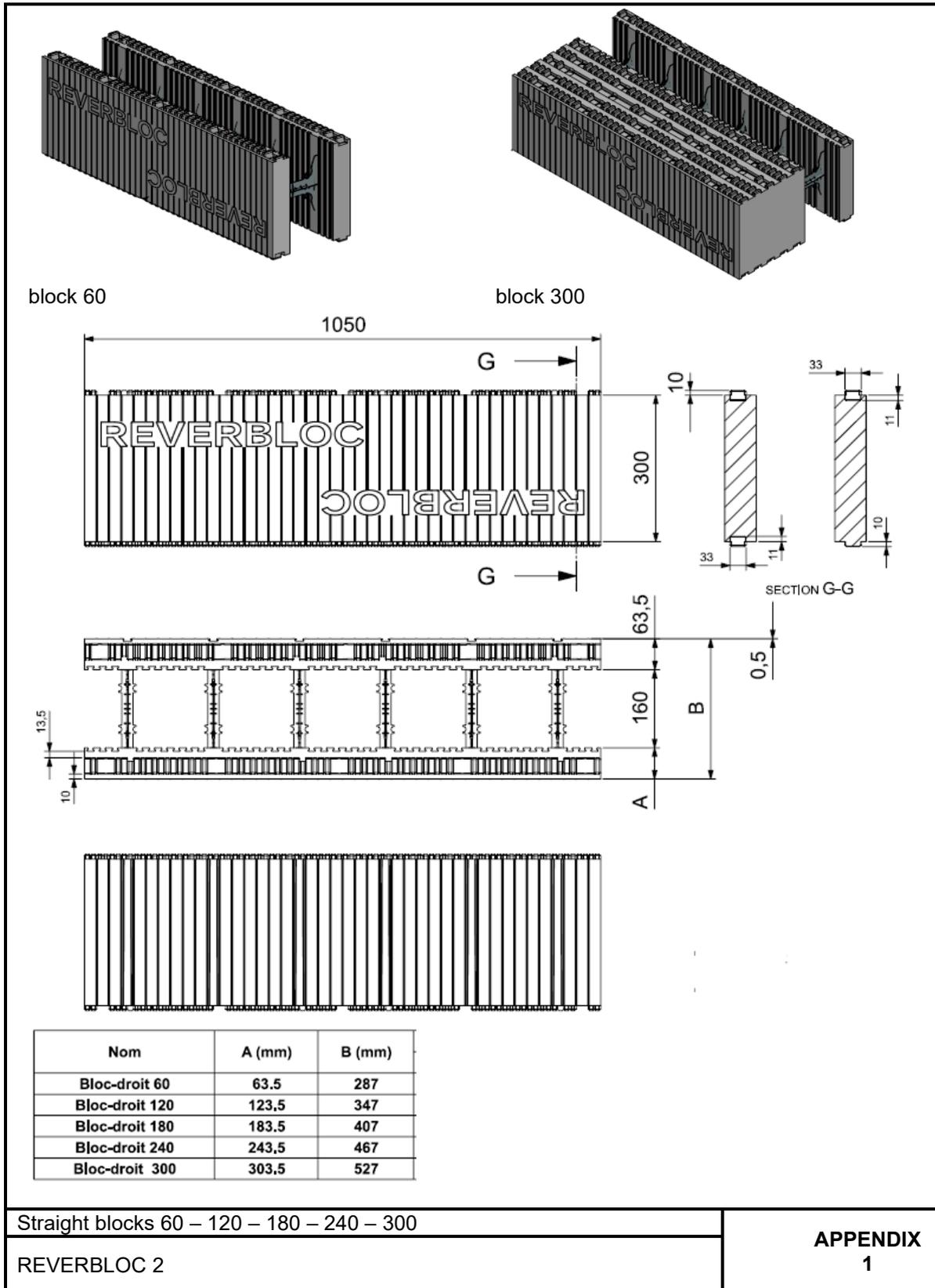
The annual verification in system 2+ is carried out by the CSTB organization.

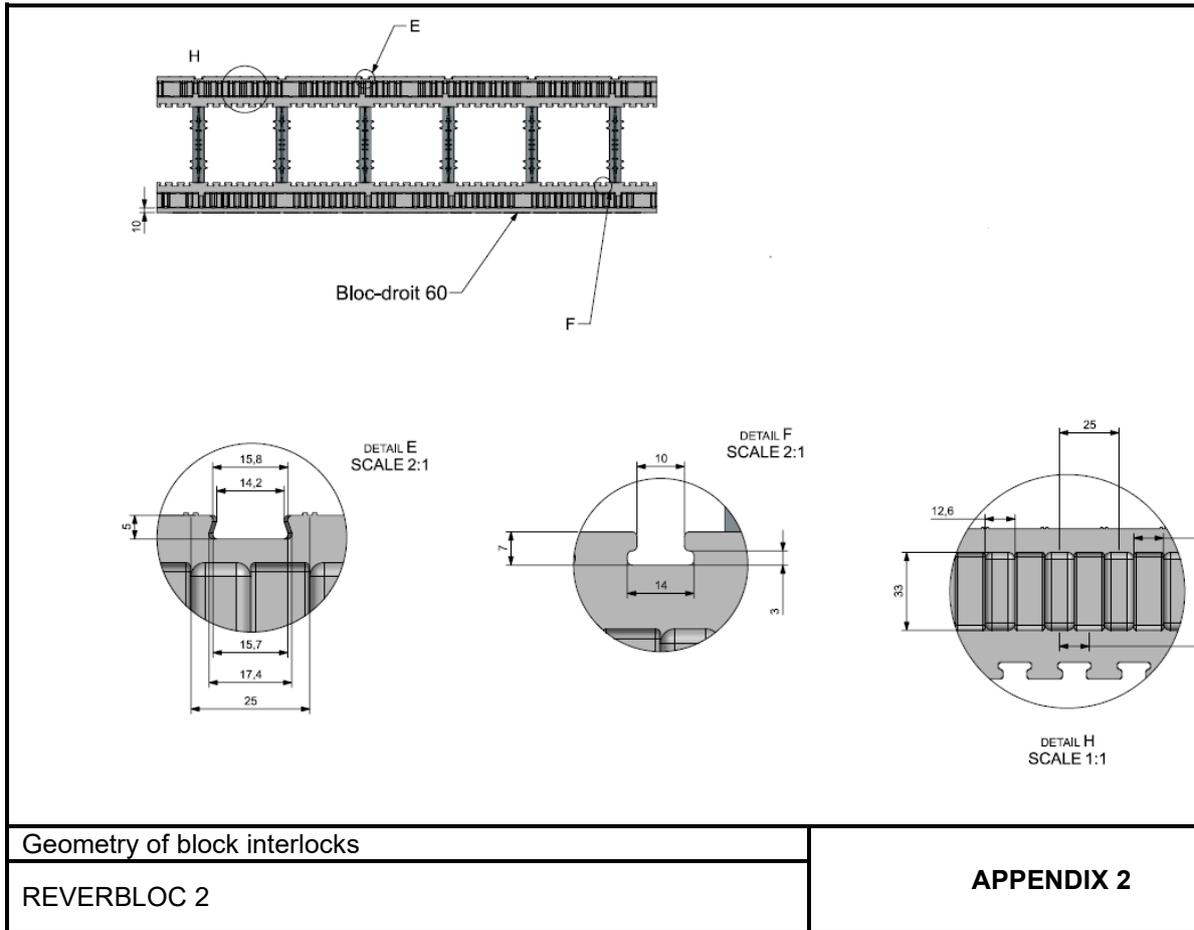
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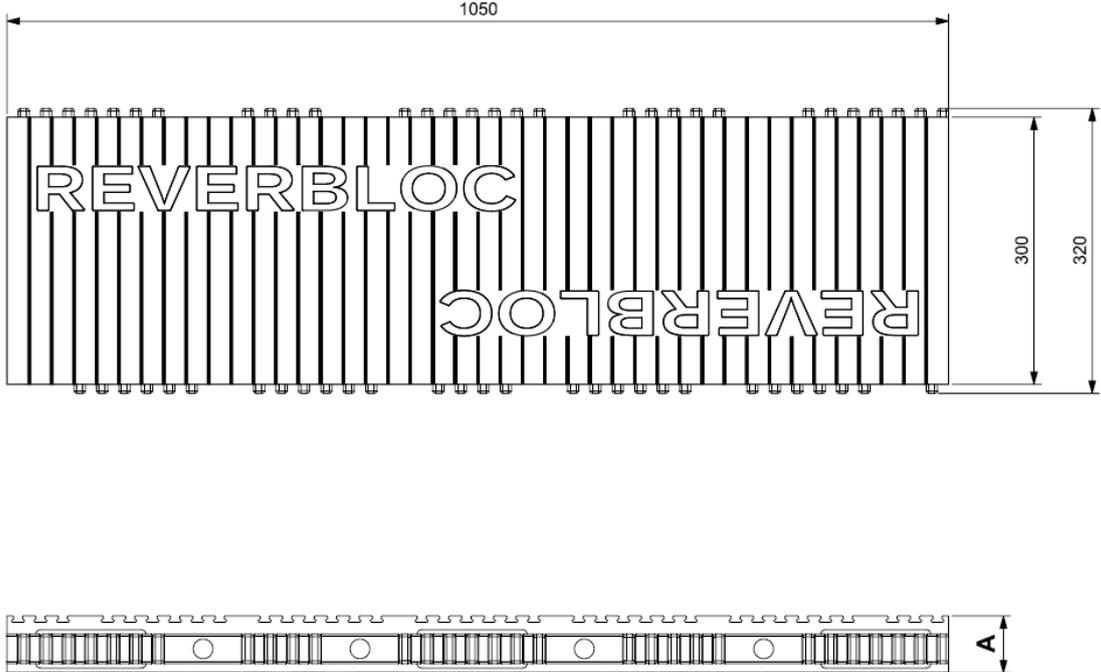
Anca CRONOPOL

Head of the Structure, Masonry, Partition Division

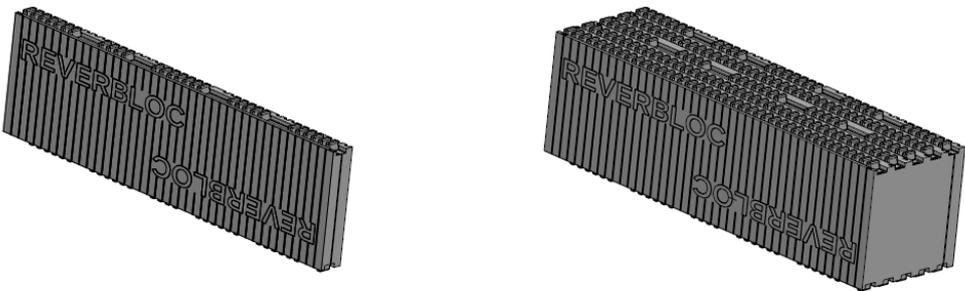
5. Annexes



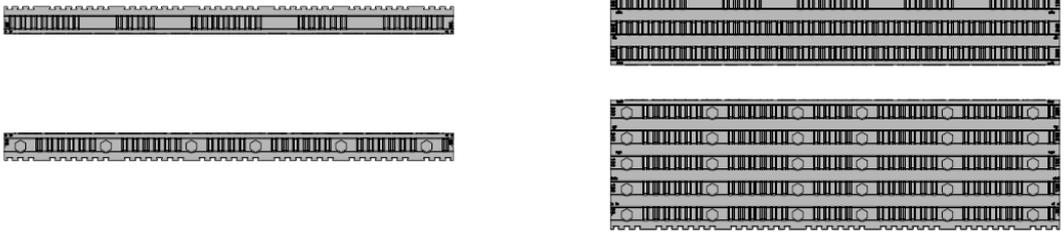




Nom	A (mm)
Planelle 60	63,5
Planelle 120	123,5
Planelle 180	183,5
Planelle 240	243,5
Planelle 300	303,5



Note: Planelle 60

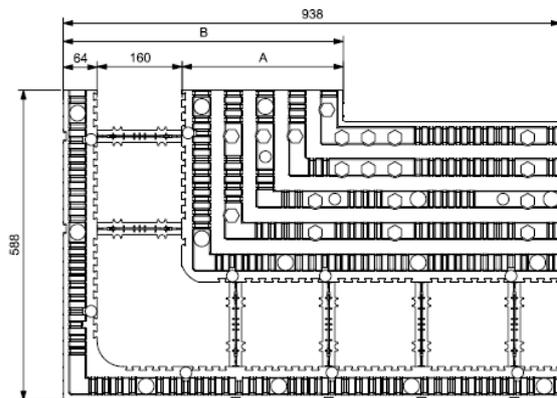
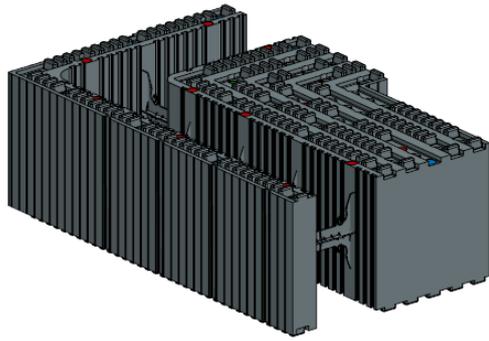


Note: Planelle 300

Planelles thickness - 60 – 120 – 180 – 240 – 300 mm

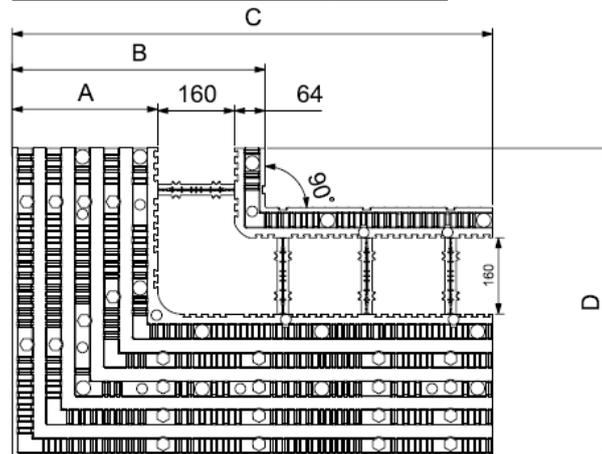
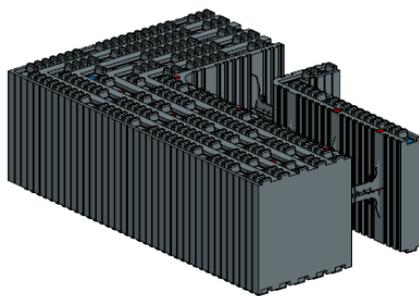
REVERBLOC 2

APPENDIX 3



Corner blocks retracting 90°

Nom	A (mm)	B (mm)
Bloc-angle droit ep 60	63,5	287
Bloc-angle droit ep 120	123,5	347
Bloc-angle droit ep 180	183,5	407
Bloc-angle droit ep 240	243,5	467
Bloc-angle droit ep 300	303,5	527



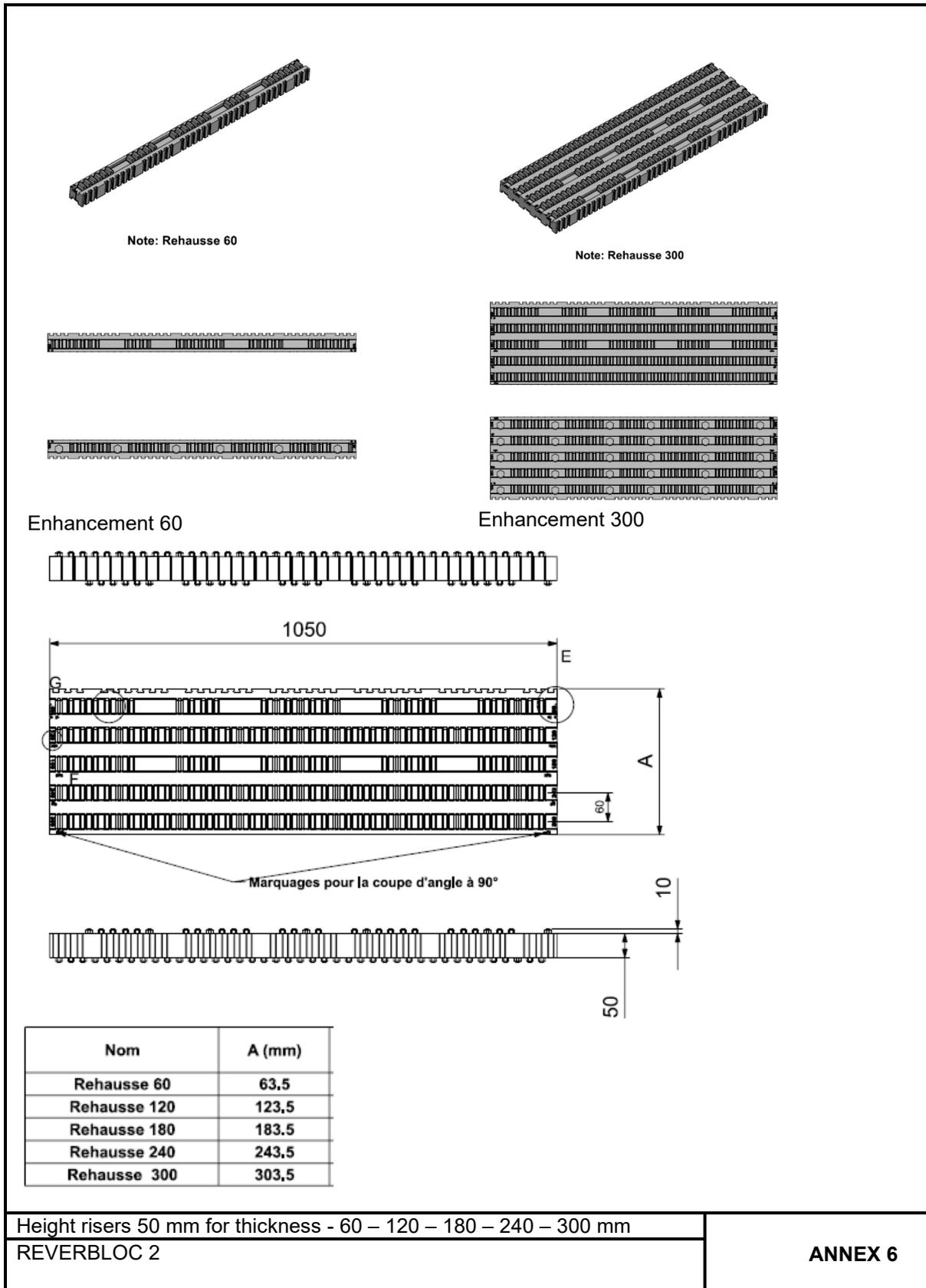
90° outgoing corner blocks

Nom	A (mm)	B (mm)	C (mm)	D (mm)
Bloc-angle droit ep 60	63,5	287	762	412
Bloc-angle droit ep 120	123,5	347	822	472
Bloc-angle droit ep 180	183,5	407	882	532
Bloc-angle droit ep 240	243,5	467	943	592
Bloc-angle droit ep 300	303,5	527	1002	652

Corner blocks 90° - 60 - 120 - 180 - 240 - 300

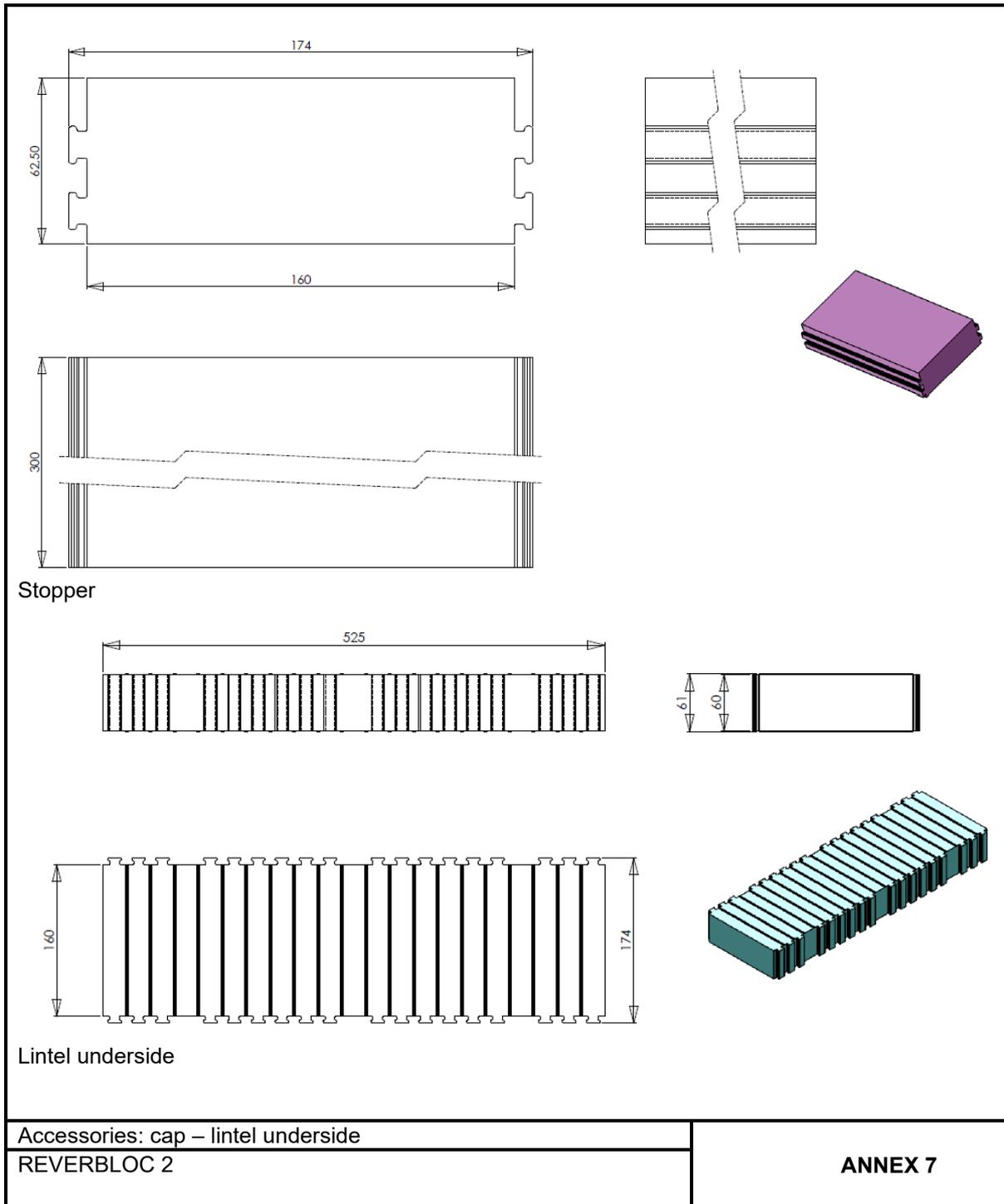
REVERBLOC 2

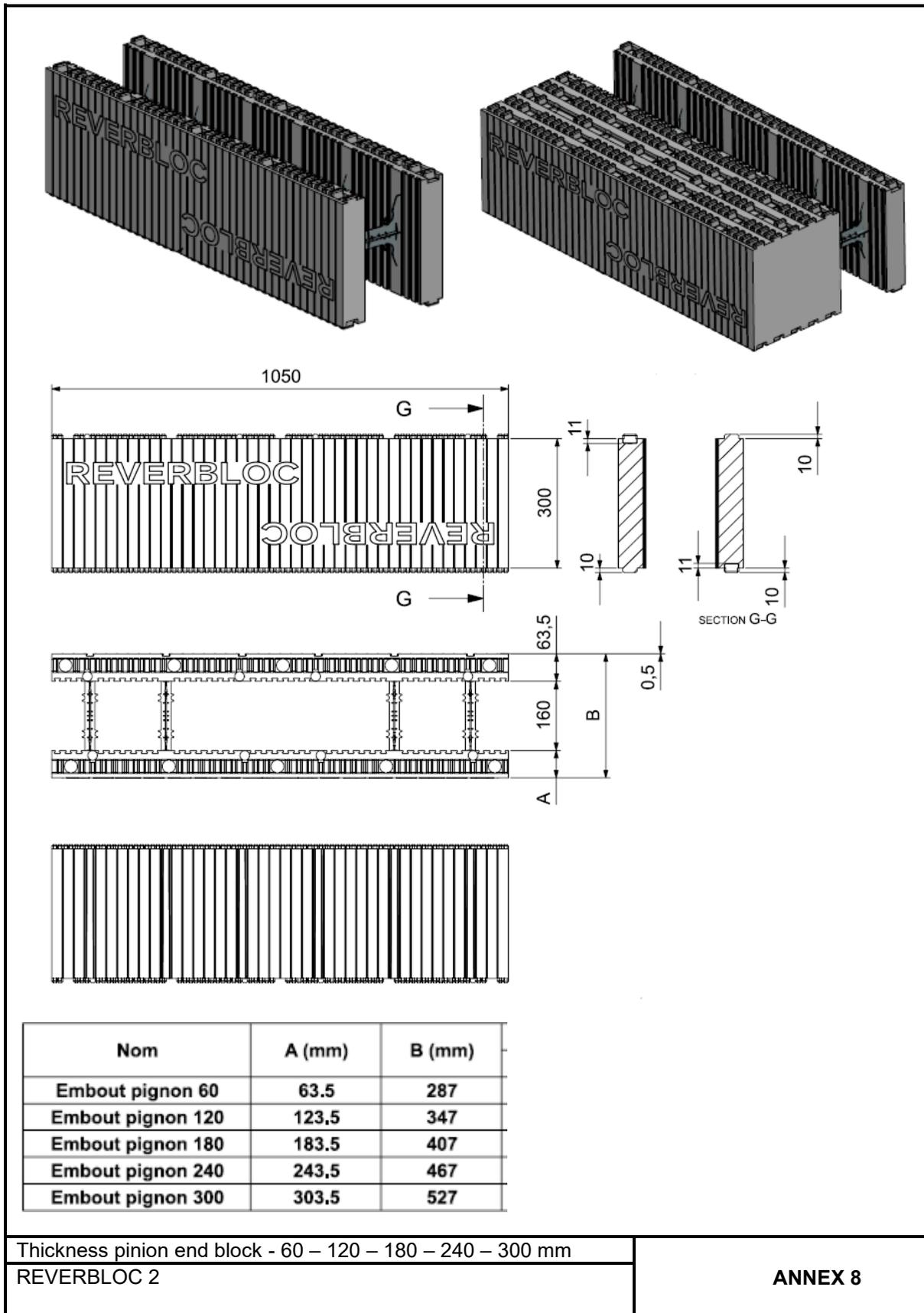
APPENDIX 4

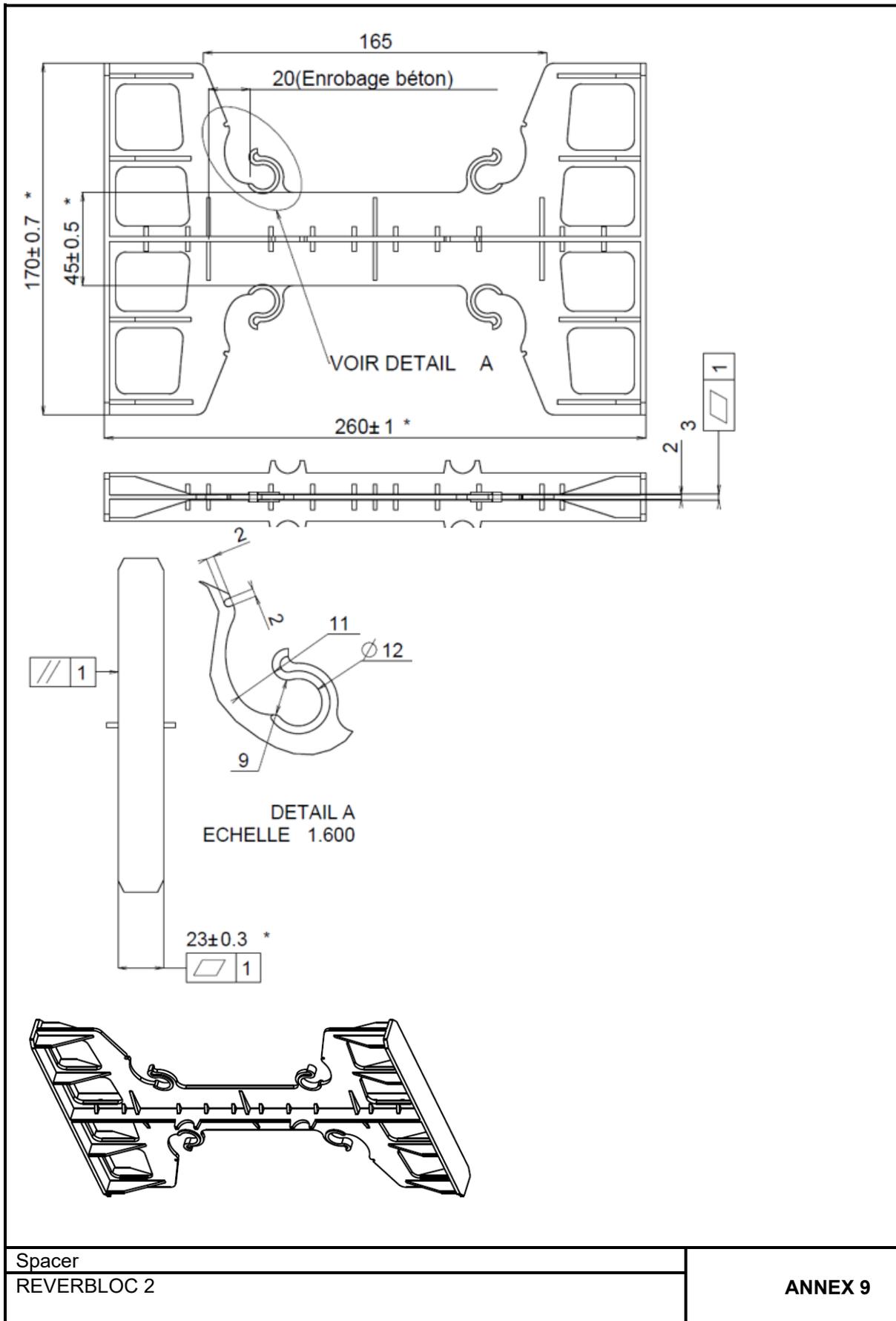


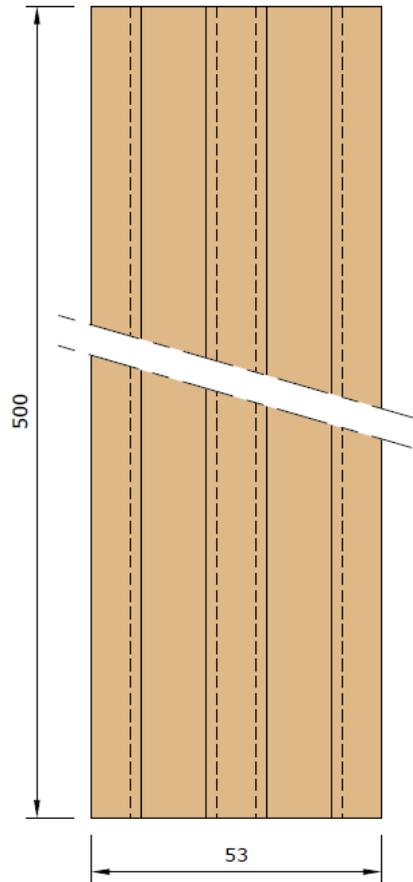
Height risers 50 mm for thickness - 60 – 120 – 180 – 240 – 300 mm
 REVERBLOC 2

ANNEX 6

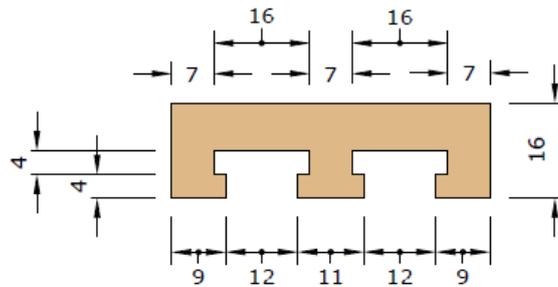








Front view



Bottom view

Planelle fixed
REVERBLOC 2

ANNEX 10