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European Technical Assessment ETA 17/0318 of 17/05/2018

English translation prepared by IETcc. Original version in Spanish language

General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) Nº305/2011:	Instituto de Ciencias de la Construcción Eduardo Torroja (IETcc)
Trade name of the construction product	Silbonit HA-HC
Product family to which the construction product belongs	Kits for external wall claddings
Manufacturer	Societá Italiana Lastre, S.p.A. Via Francesco Lenzi, 26 25028 Verolanuova (Brescia) Italia website: www.sil-lastre.com
Manufacturing plant(s)	Societá Italiana Lastre, S.p.A. Via Francesco Lenzi, 26 25028 Verolanuova (Brescia) Italia
This European Technical Assessment contains	31 pages including 4 Annexes, which form an integral part of this assessment. Annex D contains confidential information and is not included in the ETA when is publicly available
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	Guideline for European Technical Approval (ETAG) nº 034 ed. April 2012, part 1 and 2 used as European Assessment Document (EAD)

SPECIFIC PART

1. Technical description of the product

The assessed kits for ventilated external wall claddings “Silbonit HA-HC” consist of an external cladding, mechanically fastened to a framework, which is fixed to the external wall of new or existing buildings (retrofit). An insulation layer is usually fixed on the external wall.

These kits for vertical exterior wall claddings are classified as family A, according to the ETA Guidance nº 034: *Kits for external wall claddings*. *Part 1: Ventilated cladding kits comprising cladding components and associated fixings and Part 2: Cladding kits comprising cladding components, associated fixings, subframe and possible insulation layer*, edition April 2012 (hereinafter ETAG 034), used as European Assessment Document (EAD), and comprises the components specified in table 1, which are factory produced by the ETA holder or a supplier.

TABLE 1 – DEFINITION OF THE KIT COMPONENTS

Components		**Material**		**Sizes** [mm]		
Cladding element	Fibre-cement flat sheets produced by SOCIETÁ ITALIANA LASTRE, S.p.A. CE marking(1) according to Annex ZA of the EN 12467: 2012(2)	Fibre-cement flat sheet		2500	1200 1250	8 10 12
				3000	1200 1250	
				3050	1200 1250	
Cladding fixings(3)	Elements(4) used to secure the cladding tiles to the subframe	To timber subframe	Stainless steel A2 self-drilling screw	TW-S-D12 Ø 4.8 L=38 TW-S-D12 Ø 4.8 L=44		
		To galvanized steel subframe	Stainless steel A2 self-drilling screw	SX3-D12 Ø 5.5 L=30 SX3-L12 S16 Ø 5.5 L=32		
			Stainless steel A4 rivets	SSO-D15 Ø 5 L=18 SSO-D15 Ø 5 L=22		
		To aluminium subframe	Aluminium AlMg5 rivets	AP 16 Ø 5 L=18 AP 16 Ø 5 L=21		
Subframe(5)	Vertical elements(6) used to fix the sheets	Wood		Between two panels	140 (2 x 70) x (≥)50	
				Intermediate support	70 x (≥)50	
		Bended galvanized steel S235 Z275		Between two panels	Ω profile –50 x 60 x 50 x 60 x 50 (t=15/10)	
				Intermediate support	L profile – 50 x 60 (t=15/10)	
		Extruded aluminium AW6060 T66		Between two panels	Asymmetrical T profile – 130 x 45 x 2.3	
				Intermediate support	L profile – 45 x 45 x 2.3	
	Metalic elements (brackets)(7) used as load trasmission between the subframe and the substrate wall.	Timber subframe	Bended Galvanized steel S220GD Z350	50 x 60 x 80 – 150 – 300 (thickness 25/10)		
		Galvanized steel subframe				
		Aluminium subframe	Extruded aluminium AW6060 T66	Supporting br.	100 x 45.3 x 80 (t= 2.5) 100 x 45.3 x 140 (t= 3.5) 100 x 45.3 x 260 (t= 4)	
				Retention br.	70 x 45.3 x 80 (t= 2.5) 70 x 45.3 x 140 (t= 3.5) 70 x 45.3 x 260 (t= 4)	
Ancillary mate7rial	Fixings (8) between - Brackets and vertical elements	Timber subframe	Carbon steel self-drilling screw	SW-T-Ø 4.8 L=35 SW-T-H15 Ø 6.5 L=50		
		Galvanized steel subframe	Stainless steel A2 and A4 self-drilling screw	SX3-S16 Ø 6.0 L=29		
			Stainless steel A4 rivets	SSO-D Ø 4.8 L=8 SSO D15 Ø 5 L=14		
		Aluminium subframe	Stainless steel A4 self-drilling screw	SLA3/6-8-S4-SR2-Ø 4.8 L=19		
	Fixed-point sleeve	Aluminium		L= 6; D=9.4; d=5.1		
Auxiliary components	Anchorage to substrate(9)	-		--		

(1) Declaration of performance nº 001/DoP/19/04/2016 REV 1
(2) EN 12467:2012 “Fibre-cement flat sheets. Product specification and test methods”
(3) Not manufactured by SOCIETÁ ITALIANA LASTRE, S.p.A.
(4) See Annex (Subframe specifications) and figures 4.1, 5.1 and 6.1
(5) Not manufactured by SOCIETÁ ITALIANA LASTRE, S.p.A.
(6) Technical specification, Geometric and mechanical features of vertical elements in Annex B and figures 5.3, 5.4, 6.2 and 6.3
(7) Geometric and mechanical features of brackets in Annex B and figures 4.3, 6.5 and 6.6
(8) Geometric and mechanical features of screws in Annex B and figures 4.2, 5.6, 5.7 and 6.4
(9) See Annex 3

2. Specification of the intended use in accordance with the applicable EAD

2.1 Intended use

"Silbonit HA-HC" is intended to be used for ventilated external wall claddings which can be fixed to the external wall of new or existing buildings.

The substrate walls are made of masonry (bricks or blocks), concrete (cast on site or as prefabricated panels), timber or metal frame. Insulation material is defined in accordance with an EN standard or an ETA and is not manufactured by SOCIETÁ ITALIANA LASTRE, S.p.A.

Kit for ventilated external wall claddings is non-load-bearing construction system. It does not contribute to the stability of the wall on which is installed, neither to ensure the air tightness of the building structure but it can contribute to durability of the works by providing enhanced protection from the effect of weathering.

2.2 Relevant general conditions for the use of the kit

The provisions made in this European Technical Assessment, according to the ETAG 034 used as EAD, are based on an assumed working life of 25 years as minimum, provided that the conditions lay down in sections 4.2, 5.1 and 5.2 for the installation, packaging, transport and storage as well as appropriate 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 product in relation to the expected economically reasonable working life of the works.

2.3 Design of the kits

The design of the external wall cladding system for ventilated façade using "Silbonit HA-HC" kits should take into account:

- The substrate material to define the suitable anchorages, assuming that the substrate meets the mechanical requirements (resistance to static and dynamic actions) and ensures airtightness, watertightness and water vapour permeability.
- The mechanical characteristic values of the kit components (e.g. panels, cladding fixings and subframe) in order to resist the actions (dead loads, wind loads, etc.) applying on the specific work. National safety factor must be used.
- The possible movements of the substrate and the position of the building expansion joints.
- The dilation of the kit components and of the plates.
- The category of corrosivity of the atmosphere of the works [(10)].
- Because joints are not watertight, materials with low water absorption must compose the first layer behind ventilated air space.
- Insulation layer, usually fixed on the external wall should be defined in accordance with a harmonized standard or an European technical assessment.
- The construction of façade specific parts (e.g. base, top, corners, windows etc.)
- If the entire building must comply with the specific building regulations, particularly concerning fire and wind-load resistances of the Member State where the work is to be built.

2.4 Installation of the kits in works

Installation should be carried out according to the ETA holder's specifications and using the specific kit components, manufactured by the ETA holder or by suppliers recognized by the ETA holder.

Installation should be carried out by appropriately qualified staff and under the supervision of the technical responsible of the site.

2.5 Use, maintenance and repair of the works

Maintenance of the assembled systems or kit components includes inspections on site, taking into account the following aspects:

- Regarding the cladding elements appearance of any damage such as cracking o detachment due to permanent and irreversible deformation.
- Regarding metallic components: presence of corrosion or water accumulation.

[(10)] (E.g. See table 1 of Standard EN ISO 12944-2: 1998. Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Part 2: Classification of environments.

Necessary repairs should be done rapidly, using the same kit components and following the repair instructions given by ETA holder.

3. Performance of the product and references to the methods used for its assessment.

The identification tests and the assessment for the intended use of these kits for ventilated external wall claddings according to the Basic Work Requirements (BWR) were carried out in compliance with the ETAG 034 used as an EAD. The characteristics of the components shall correspond to the respective values laid down in the technical documentation of this ETA, checked by IETcc.

3.1 Mechanical resistance and stability (BWR1)

Requirements with respect to the mechanical resistance and stability of non-load bearing parts of the works are not included in this Basic Requirement but are treated under the Basic Requirement Safety in use (See section 3.4)

3.2 Safety in case of fire (BWR2)

3.2.1 Reaction to fire

Euro class A2-s1, d0 according to standard EN 13501-1: 2007 + A1:2010[(11)].

This classification is valid if the insulation layer placed in the ventilated air space is made of a non-combustible material (mineral wool) or if the layer behind the cladding elements is a mineral substrate like masonry or concrete (A1 or A2-s1, d0).

In other cases, the class of reaction to fire has not been assessed.

A European reference fire scenario has not been laid down for facades. In some Member States, the classification of external wall cladding kits according to Standard EN 13501-1 might not be sufficient for the use in facades. An additional assessment of the system according to the national provision (e.g. based on a large-scale test) might be necessary to comply with Member State Regulations, until the existing European classification system has been completed.

3.2.2 Fire resistance

The fire resistance requirement is applicable to the wall itself (made of masonry, concrete, timber or metal frame) and not on the cladding kits. The cladding kit alone does not meet any fire resistance requirements. The evaluation of “fire propagation to upper levels” is not part of the European classification and thus, cannot be evaluated, i.e. to be omitted.

3.3 Hygiene, health and the environment (BWR3)

3.3.1 Watertightness of joints

Joints in “Silbonit HA-HC” kits are open, therefore they are not waterthight.

3.3.2 Water permeability and Water vapour permeability

These performances are not relevant for external wall cladding kits with ventilated air space.

3.3.3 Drainability

On the basis of the standard construction details and the installation criteria of these kits and the technical knowledge and experience, it may be said the water which penetrates into the air space or the condensation water can be drained out from the cladding without accumulation or moisture damage into the substrate.

3.3.4 Release of dangerous substances

The fibre-cement flat sheets comply with the Annex ZA of the EN 12467-1: 2013. A declaration of conformity in this respect was made by the manufacturer.

(11) EN 13501-1:2007 + A1:2010 Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

According to this declaration Silbonit HA-HC flat sheets do not contain/nor release dangerous substances according to the European and national regulations, when and where in the Member States of destination.

Also regarding the subframe a declaration of conformity in this respect was made by the manufacturer.

According to this declaration the aluminium alloys used for the subframe contain:

- hexavalent Cr, Hg, Pb which amount is always less than 0.1%;
- Cd which amount is always less than 0.1%.

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

3.4 Safety in use (BWR4)

3.4.1 Wind load resistance

3.4.1.1 Wind suction resistance

Wind suction resistance has been determined by test carried out according to ETAG 034 part 1, § 5.4.1.1.

The weakest design mechanically has been tested.

a. Silbonit HA-HC (Timber subframe[12] – family A)

Tests specimen	1920x1190 mm
Cladding elements	Silbonit HA-HC flat sheets Sheet A 1250 mm x 1190 mm x 8 mm Sheets B and C 650 mm x 590 mm x 8 mm
Cladding fixings	Stainless steel self-drilling screws TW-S-D12 Ø 4.8 L=38 Sheet A Distance between cladding fixings H=500/600 mm V=600 mm Sheets B and C Distance between cladding fixings H=500 mm V=600 mm
Vertical batten	Wood 70 mm x 50 mm and 140 (2 x 70) mm x 50 mm Distance between batten 500mm
Brackets	Bended galvanized steel 50 x 60 x 80 Distance between brackets H=500/600 mm V=620/1000 mm
Fixing Brack-Batt	Carbon steel self-drilling screws SW-T Ø 4.8 L=35

The test results and calculated values for the tested specimen are indicated in table 2

TABLE 2 – WIND SUCTION TEST RESULT-TIMBER SUBFRAME

TEST SPECIMEN	MAXIMUM LOAD Q (Pa)	TYPE OF FAILURE	DISPLACEMENT UNDER MAXIMUM LOAD (mm)
Silbonit HA-HC (Timber subframe– family A)	3800[13]	No failure	15.13

b. Silbonit HA-HC (Galvanized steel subframe[14] – family A)

Tests specimen	1920x1190 mm
Cladding elements	Silbonit HA-HC flat Sheets Sheet A 1250 mm x 1190 mm x 8 mm Sheets B and C 650 mm x 590 mm x 8 mm
Cladding fixings	Stainless steel rivets SSO-D15 Ø 5 L=18 Sheet A Distance between cladding fixings H=500/600 mm V=600 mm Sheets B and C Distance between cladding fixings H=500 mm V=600 mm
Vertical profiles	Bended galvanized steel L 40 mm x 60 mm and Ω 150 mm x 60 mm Distance between profiles 550mm

(12) Characteristics of components are indicated in Annex 1 and 2
(13) The test had to be stopped at 3800Pa because the equipment did not achieve stabilization. No failure occurs.
(14) Characteristics of components are indicated in Annex 1 and 2

Brackets Bended galvanized steel 50 x 60 x 80
Distance between brackets H=500/600 mm V=620/1000 mm

Fixing Brack-Prof Stainless steel A4 rivets SSO-D Ø 4.8 L=8

The test results and calculated values for the tested specimen are indicated in table 3

TABLE 3 – WIND SUCTION TEST RESULT-GALVANIZED STEEL SUBFRAME			
TEST SPECIMEN	**MAXIMUM LOAD Q (Pa)**	**TYPE OF FAILURE**	**DISPLACEMENT UNDER MAXIMUM LOAD (mm)**
Silbonit HA-HC (Galvanized steel subframe – family A)	3600	Sheet cracking(15)	14.89

c. Silbonit HA-HC (Aluminium subframe(16) – family A)

Tests specimen 1920x1190 mm

Cladding elements Silbonit HA-HC flat Sheets
Sheet A 1250 mm x 1190 mm x 8 mm
Sheets B and C 650 mm x 590 mm x 8 mm

Cladding fixings Aluminium rivets AP 16 Ø 5 L=18
Sheet A Distance between cladding fixings H=500/600 mm V=600 mm
Sheets B and C Distance between cladding fixings H=500 mm V=600 mm

Vertical profiles Aluminium L profile 45 mm x 45 mm and asymmetrical T profile 130 mm x 45 mm
Distance between profiles 550mm

Brackets Aluminium 100 x 45.3 x 80 (supporting br.) 70 x 45.3 x 80 (retention br.)
Distance between brackets H=500/600 mm V=620/1000 mm

Fixing Brack-Prof Stainless steel rivets SLA3/6-8-S4-SR2-Ø 4.8 L=19

The test results and calculated values for the tested specimen are indicated in table 4

TABLE 4 – WIND SUCTION TEST RESULT-ALUMINIUM SUBFRAME			
TEST SPECIMEN	**MAXIMUM LOAD Q (Pa)**	**TYPE OF FAILURE**	**DISPLACEMENT UNDER MAXIMUM LOAD (mm)**
Silbonit HA-HC (Aluminium subframe– family A)	3600	Sheet breakage(17)	20.14

3.4.1.2 Wind pressure resistance

The kit behaviour exposed to wind pressure is most favourable than when exposed to wind suction. Therefore, according to paragraph § 5.4.1.2 of ETAG 034, wind pressure test has been avoided and wind pressure resistance of kit can be considered as equal to wind suction resistance.

3.4.2 Mechanical test

3.4.2.1 Mechanical test (Family A)

3.4.2.1.1 Pull-through resistance of cladding element

Pull-through resistance of cladding element has been tested according to ETAG 034 part 1 section 5.4.2.1.1 using Stainless steel self-drilling screw TW-S-D12 Ø 4.8 L=38/44 and Aluminium rivet AP 16 Ø 5 L=18/21.

Test results are indicated in table 5 and 6.

TABLE 5 - PULL-THROUGH RESISTANCE OF CLADDING ELEMENT (SCREW)					
SHEET THICKNESS (mm)	**SUPPORT Ø (mm)**	**FIXING POSITION (Aluminum rivet)**	**FAILURE LOAD (N)**		**FAILURE MODE**
			F_m	$F_{u,5}$	
8	180	Centre	1859.8	1649.15	Bending failure
		Border	964.66	781.15	Bending failure
		Corner	523.70	367.94	Superficial Crack/ Fixing deformation
	270	Centre	1308.5	1138.32	Bending failure
		Border	522.01	470.21	Bending failure
		Corner	267.54	186.96	Bending failure
12	180	Centre	4123.77	3791	Pull-through
		Border	2333.14	1602.05	Bending failure

(15) Achieving the 3800 Pa, *"Panel A"* cracked.
(16) Characteristics of components are indicated in Annex 1 and 2
(17) Achieving the 3800 Pa, *"Panel A"* broke.

		Corner	890.16	448.16	Fixing deformation
	270	Centre	3481	3065.76	Pull-through
		Border	1204.55	1047.70	Bending failure
		Corner	463.02	303.74	Fixing deformation

TABLE 6 - PULL-THROUGH RESISTANCE OF CLADDING ELEMENT (ALUMINIUM RIVET)					
SHEET THICKNESS (mm)	SUPPORT Ø (mm)	FIXING POSITION (Aluminum rivet)	FAILURE LOAD (N)		FAILURE MODE
			F_m	$F_{u,5}$	
8	180	Centre	2061.47	1726.53	Bending failure
		Border	919.89	833.52	Bending failure
		Corner	560.82	486.66	Bending failure
	270	Centre	1425.35	1245.58	Bending failure
		Border	510.44	405.87	Bending failure
		Corner	315.09	285.26	Bending failure
12	180	Centre	4625.37	3920.27	Pull-through
		Border	2129.79	1963.14	Bending failure
		Corner	1084.94	995.69	Bending failure
	270	Centre	3557.91	3149.68	Bending failure
		Border	1016.07	662.90	Bending failure
		Corner	635.90	537.90	Bending failure

3.4.2.1.2 Pull-through resistance under shear load

Pull-through resistance under shear load has been tested according to ETAG 034 part 1 section 5.4.2.1.2.

Tests results are indicated in table 7.

TABLE 7 - PULL-THROUGH RESISTANCE UNDER SHEAR LOAD				
SHEET THICKNESS (mm)		FAILURE LOAD (N)		FAILURE MODE
		F_m	$F_{u,5}$	
WOOD BATTEN STAINLESS SCREW	8	1928.4	1400	Sheet breakage
	12	2051.6	826.4	Sheet breakage
ALUMINIUM PROF. ALUMINIUM RIVET	8	2423.6	2175.7	Sheet breakage
	12	2930.6	2804.5	Sheet breakage

3.4.2.2 Mechanical test (Subframe)

3.4.2.2.1 Load bearing capacity of the brackets

The resistance of the brackets and their fixings under tension and shear loads was determined by calculation using the specifications defined in the annex E of ETAG 034 part 2.

The calculation results are indicated in table 8 and 9.

TABLE 8: RESISTANCE TO VERTICAL LOAD OF BRACKETS – CALCULATION RESULT						
BRACKETS DIMENSIONS			F_r (N) ΔL=0.2% de L	F_{1d}(N) ΔL=1mm	F_{3d}(N) ΔL=3mm	F_s(N) failure
GALVANIZED STEEL		60 x 50 x 80	510	420	710	Purposeless
		60 x 50 x 150	235	110	260	Purposeless
		60 x 50 x 300	110	25	75	Purposeless
ALUMINIUM	RETENTION B	70 x 45 x 80	1350	1050	2000	Purposeless
		70 x 45 x 140	770	460	1000	Purposeless
		70 x 45 x 260	310	125	335	Purposeless
	SUPPORTING B	100 x 45 x 80	2700	2000	3800	Purposeless
		100 x 45 x 140	2050	1100	2350	Purposeless
		100 x 45 x 260	1100	330	770	Purposeless

TABLE 9: RESISTANCE TO HORIZONTAL LOAD OF BRACKETS – CALCULATION RESULT				
BRACKETS DIMENSIONS			**F_{1d}**(N) ΔL=1mm	**F_s**(N) failure
GALVANIZED STEEL		60 x 50 x 80	960	Purposeless
		60 x 50 x 150	885	Purposeless
		60 x 50 x 300	850	Purposeless
ALUMINIUM	RETENTION BR	70 x 45 x 80	3400	Purposeless
		70 x 45 x 140	3200	Purposeless
		70 x 45 x 260	2800	Purposeless
	SUPPORTING BR	100 x 45 x 80	5700	Purposeless
		100 x 45 x 140	5500	Purposeless
		100 x 45 x 260	5100	Purposeless

3.4.3 Resistance to horizontal point loads

Resistance to horizontal point loads has been tested according to the method indicated in section 5.4.3 of ETAG 034 part 1. After test the kit have acceptable resistance to horizontal point loads as no permanent deformation on any component was visually appreciated.

3.4.4 Impact resistance

Impact resistance has been tested and classified according to the method indicated in section 5.4.4 of ETAG 034 part 1.

According with the test results the use category of Silbonit HA-HC kits for vertical exterior wall claddings is the Category III that means this kit can be used in zones not likely to be damage by normal impacts caused by people or by thrown or kicked object.

3.4.5 Resistance to seismic actions

This performance has not been assessed.

3.4.6 Hygrothermal behaviour

The hygrothermal behaviour test has been carried out according to the method indicated in section 5.4.6 of ETAG 034 part 1 and during the test cycles, none of the following defects occurs:

- deterioration such as cracking or delamination of the cladding element that allows water penetration to the insulation
- detachment of the cladding element
- Irreversible deformation

This system is therefore assessed as resistant to hygrothermal cycles.

The joint in Silbonit HA-HC kits are not waterthight so the insulation layer shall be made of EPS to EN 13163, XPS to EN 13164, PUR to EN 13165, phenolic foam to EN 13166 or mineral wool to EN 13162 (WS or WL(P), depending on the national regulations).

3.5 Protection against noise (BWR5)

This requirement is not relevant for cladding kits designed with ventilated air space.

3.6 Energy economy and heat retention (BWR6)

This requirement is not relevant for cladding kits designed with ventilated air space.

3.7 Sustainable use of natural resources (BWR7)

This performance has not been assessed.

3.8 Aspects of durability and serviceability

3.8.1 Pulsating load

After pulsating load cycles, pull-through resistance of cladding element has been tested according to the method indicated in section 5.7.1 of ETAG 034 part 1.

The test results are indicated in table 10.

TABLE 10 - PULL-THROUGH RESISTANCE OF CLADDING ELEMENT AFTER PULSATING LOAD CYCLES					
SHEET THICKNESS (mm)	SUPPORT Ø (mm)	FIXING POSITION (Stainless steel self-drilling screw)	FAILURE LOAD (N)		FAILURE MODE
			F_m	$F_{u,5}$	
8	270	Centre	1285.43	929.61	Bending failure

3.8.2 Dimensional stability

The tabulated values of cladding and subframe are included in Annexes A and B following the standards:

- for fibre-cement flat sheet EN 12467: 2013
- for aluminium EN 1999-1
- for stainless steel EN 10088-1: 2015

3.8.3 Immersion in water

After immersion in water according to EN 12467: 2012(18), pull-through resistance of the sheet has been tested according to ETAG 034 part 1 section 5.4.2.1.1.

Tests results are indicated in table 11.

TABLE 11 - PULL-THROUGH RESISTANCE OF CLADDING ELEMENT AFTER IMMERSION IN WATER					
SHEET THICKNESS (mm)	SUPPORT Ø (mm)	FIXING POSITION (Stainless steel self-drilling screw)	FAILURE LOAD (N)		FAILURE MODE
			F_m	$F_{u,5}$	
8	270	Centre	1378.57	1278.51	Bending failure
12	270	Centre	3517.42	3217.93	Pull-through

3.8.4 Freeze / thaw behaviour

After freeze-thaw cycles according to EN 12467: 2012, pull-through resistance of the sheet has been tested according to ETAG 034 part 1 section 5.4.2.1.1.

Tests results are indicated in table 12.

TABLE 12 - PULL-THROUGH RESISTANCE OF CLADDING ELEMENT AFTER FREEZE-THAW CYCLES					
SHEET THICKNESS (mm)	SUPPORT Ø (mm)	FIXING POSITION (Stainless steel self-drilling screw)	FAILURE LOAD (N)		FAILURE MODE
			F_m	$F_{u,5}$	
8	270	Centre	1299.4	1267.4	Bending failure
12	270	Centre	3456.6	3161.7	Bending failure

3.8.5 Chemical and biological attack

This performance has not been assessed.

3.8.6 Corrosion

The material and corrosion protection of the kit components are defined in the relevant table of Annex B.

3.8.7 UV radiation

This performance has not been assessed.

(18) EN 12467:2012 “Fibre-cement flat sheets. Product specification and test methods”.

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

4.1 System of assessment and verification of constancy of performances

According to the decision 2003/640/EC of the European Commission [19] the system of assessment and verification of constancy of performances (see Annex V to Regulation (EU) Nº 305/2011) given in the following table applies:

Product(s)	Intended use(s)	Level(s) or class(es)	System(s)
Claddings kit based on fibre-cement flat sheets fastened to the subframe by visible fixings	kit for external finishes of walls	-	2+

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the quality plan deposited at the Instituto de Ciencias de la Construcción Eduardo Torroja.

Instituto de Ciencias de la Construcción Eduardo Torroja
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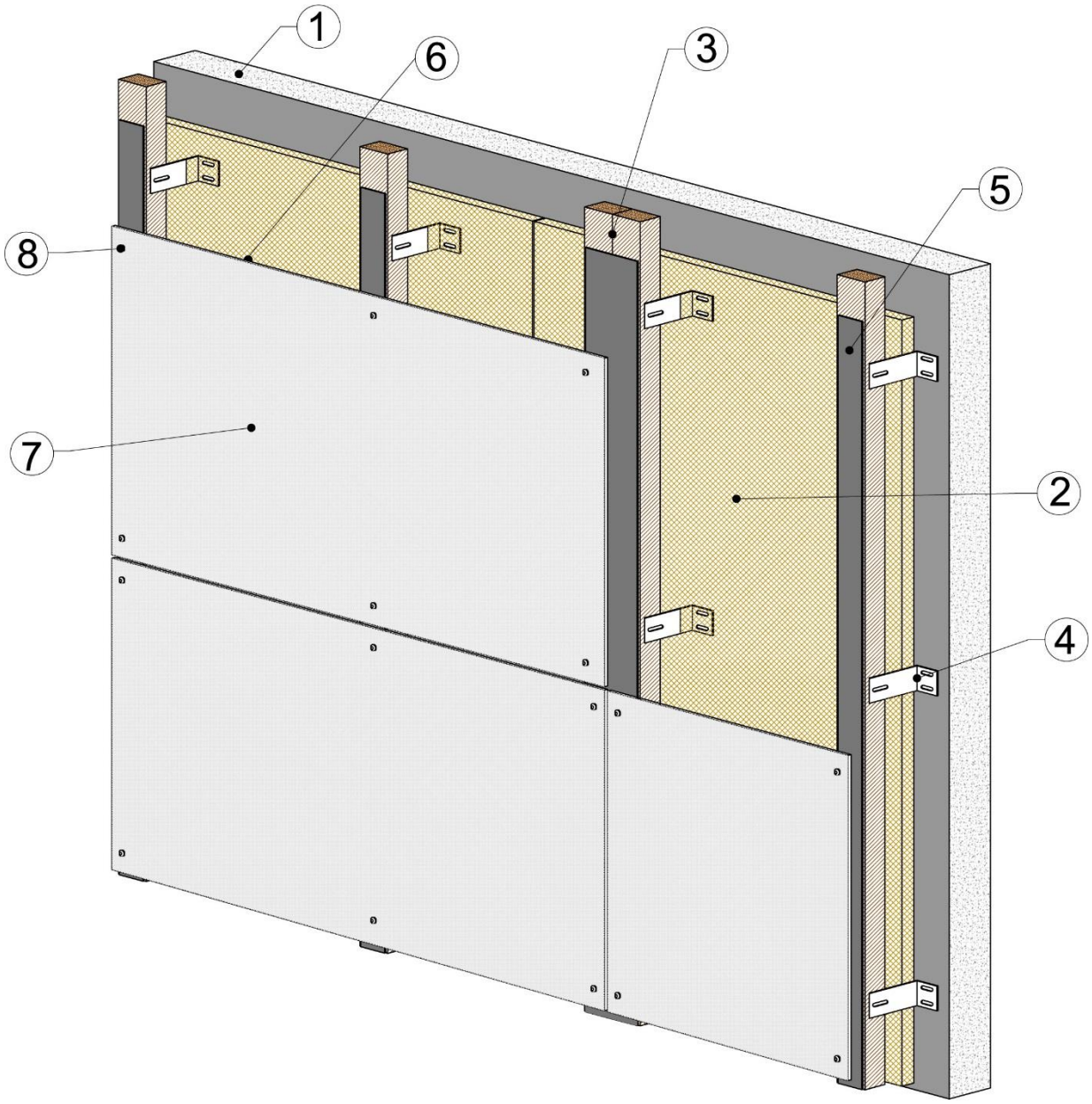
On behalf of the Instituto de Ciencias de la Construcción Eduardo Torroja
Madrid, 17th May 2017

Marta Castellote Armero
Directora

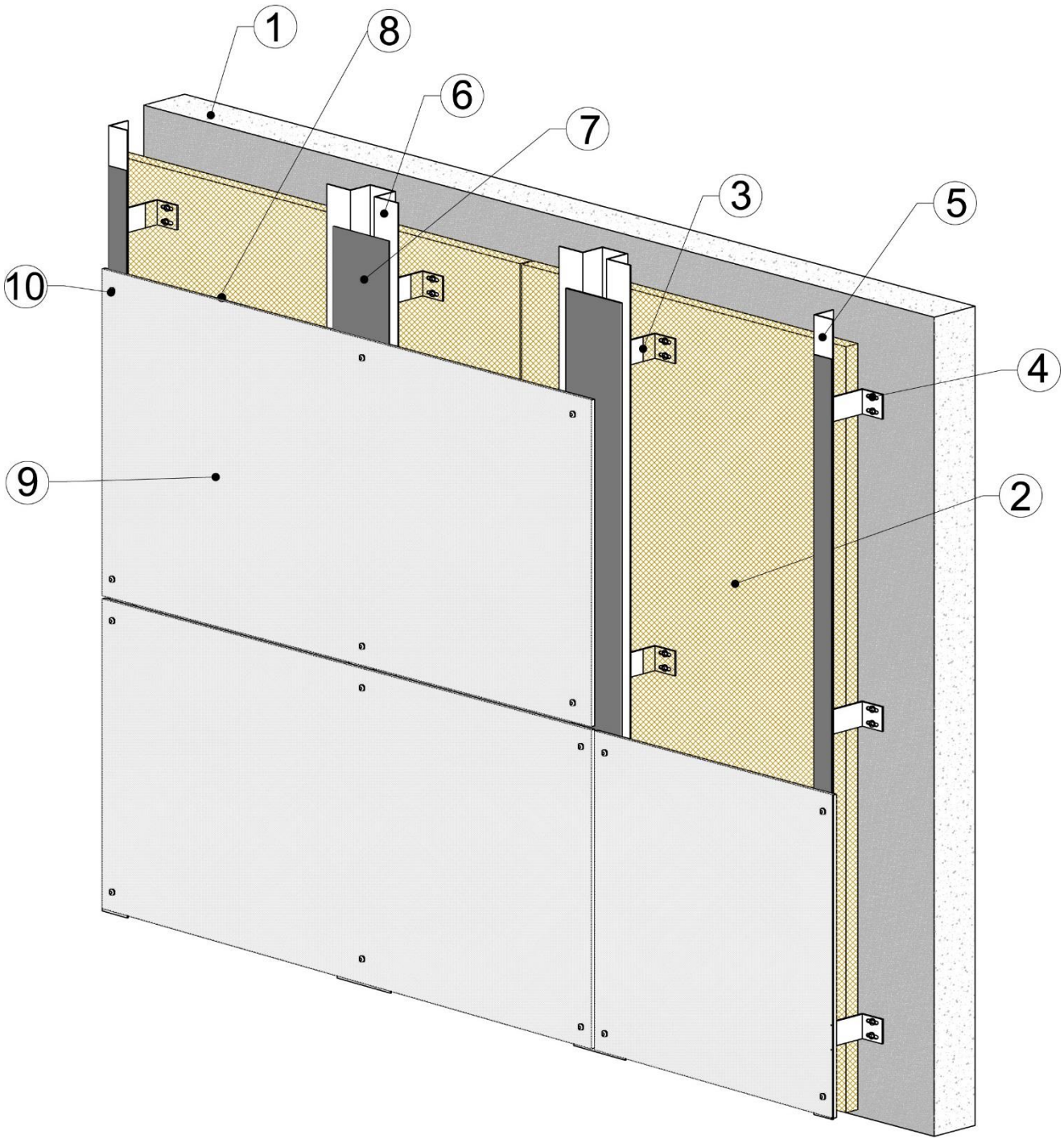
[19] Published in the Official Journal of the European Communities L226/21 of 10.09.2003. See www.new.eur-lex.europa.eu/oj/direct-access.html

FIGURE 1-A: SILBONIT HA HC– GENERAL CONFIGURATION TIMBER SUBFRAME



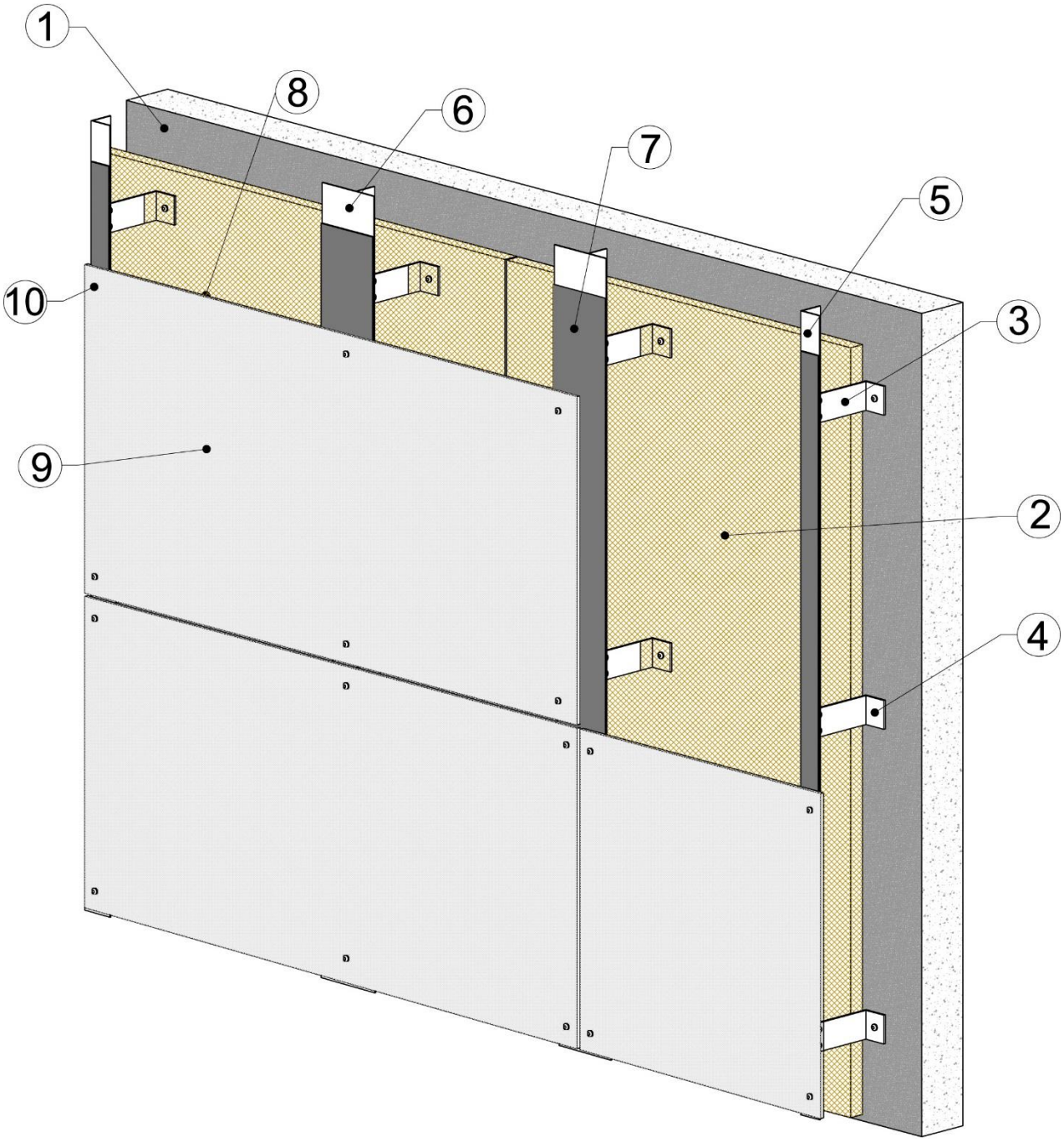
1. Load-bearing structure
2. Thermal insulation
3. Wooden sub frame – Vertical battens
4. Fixing between subframe and load-bearing structure
5. EPDM ribbon
6. Ventilation cavity
7. Fibre-cement cladding sheets
8. Fixing between cladding sheet and subframe

FIGURE 1-B: SILBONIT HA HC– GENERAL CONFIGURATION GALVANIZED STEEL SUBFRAME



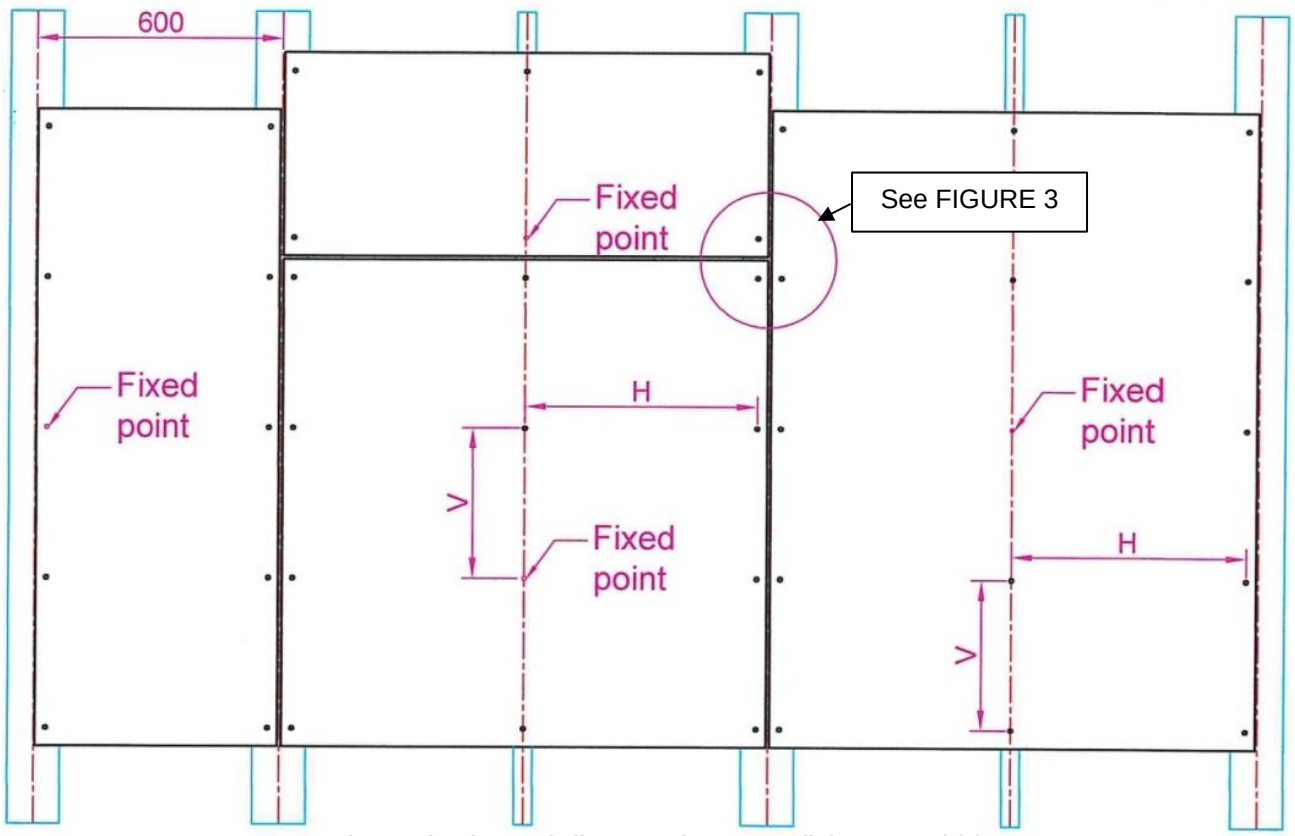
1. Load-bearing structure
2. Thermal insulation
3. Galvanized steel brackets
4. Fixing between subframe and load-bearing structure
5. L vertical profiles
6. Ω vertical profiles
7. EPDM ribbon
8. Ventilation cavity
9. Fibre-cement cladding sheets
10. Fixing between cladding sheet and steel profile

FIGURE 1-C: SILBONIT HA HC– GENERAL CONFIGURATION ALUMINIUM SUBFRAME



1. Load-bearing structure
2. Thermal insulation
3. Bracket for fixed/slipping points
4. Fixing between subframe and load-bearing structure
5. GFT L profile
6. GFT T profile with asymmetric wings
7. EPDM ribbon
8. Ventilation cavity
9. Fibre-cement cladding sheets
10. Rivet between cladding sheet and aluminium profile

FIGURE 2.1: FIXED POINT ON FIBRE-CEMENT FLAT SHEETS



H maximum horizontal distance between fixings H≤ 600 mm
V maximum horizontal distance between fixings V≤ 600 mm

FIGURE 2.2: FIXED POINT SLEEVE

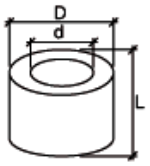
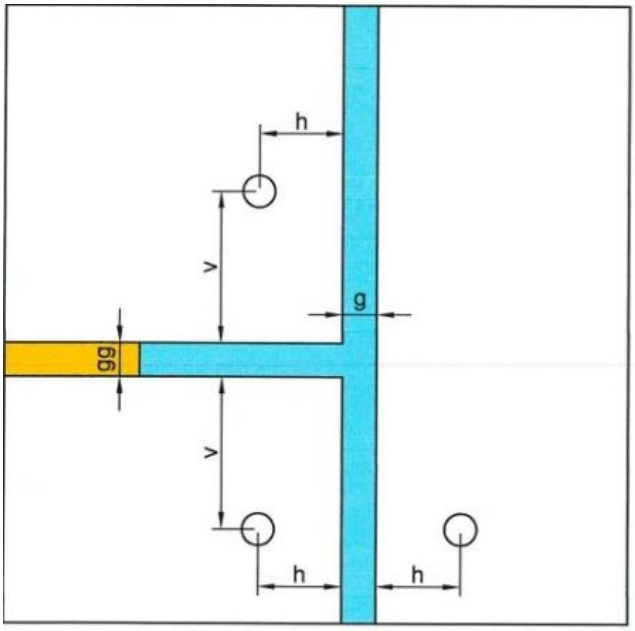


FIGURE 3: JOINTS AND HOLES DISTANCE FROM SHEET EDGES



h fixing distance to sheet edges measured following fibres direction: **h**≥45 mm

v fixing distance to sheet edges measured across fibres direction: **v**≥25 mm

g vertical sheet joint, **gg** horizontal sheet joint; **g**=**gg**= minimum width 8 mm

FIGURE 3.a: HOLES DISTANCE FROM SHEET AND BATTEN

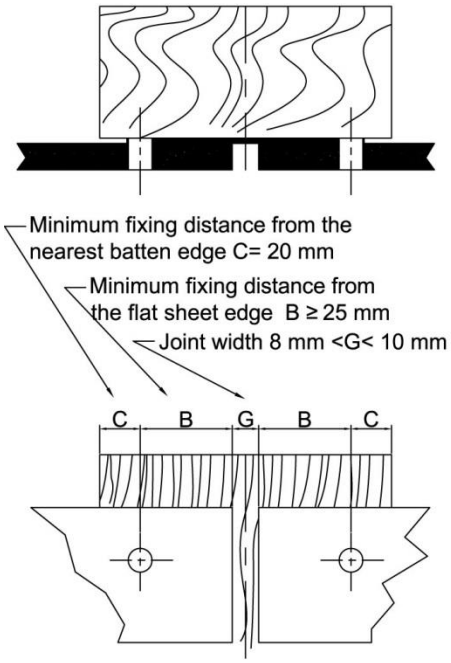
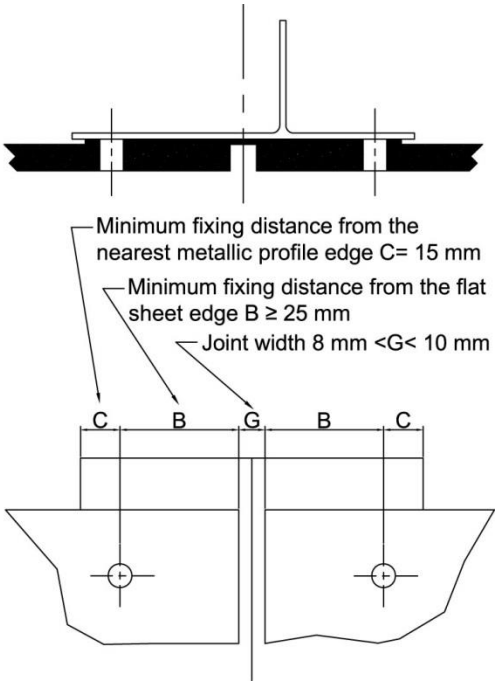


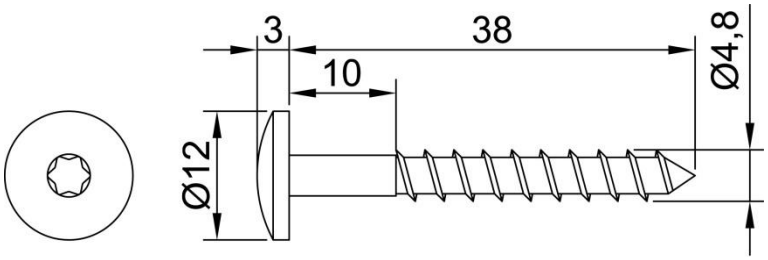
FIGURE 3.b: HOLES DISTANCE FROM SHEET AND METALLIC PROFILE



SYSTEM COMPONENTS

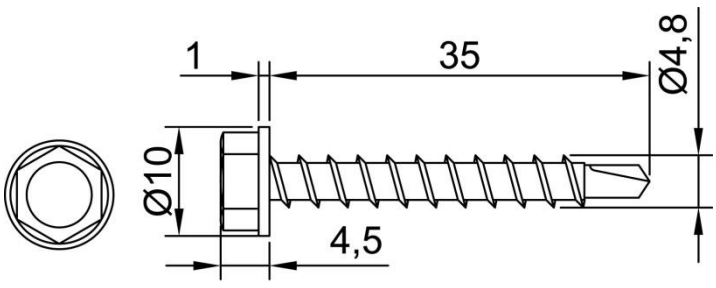
FIGURE 4: TIMBER SUBFRAME

4.1: CLADDING FIXING TO TIMBER SUBFRAME - STAINLESS STEEL SCREW



TW-S-D12 Ø 4.8 L=38

4.2: FIXING BETWEEN BRACKET AND BATTEN – STAINLESS STEEL SCREW



SW-T Ø 4.8 L=35

4.3: GALVANIZED STEEL BRACKETS

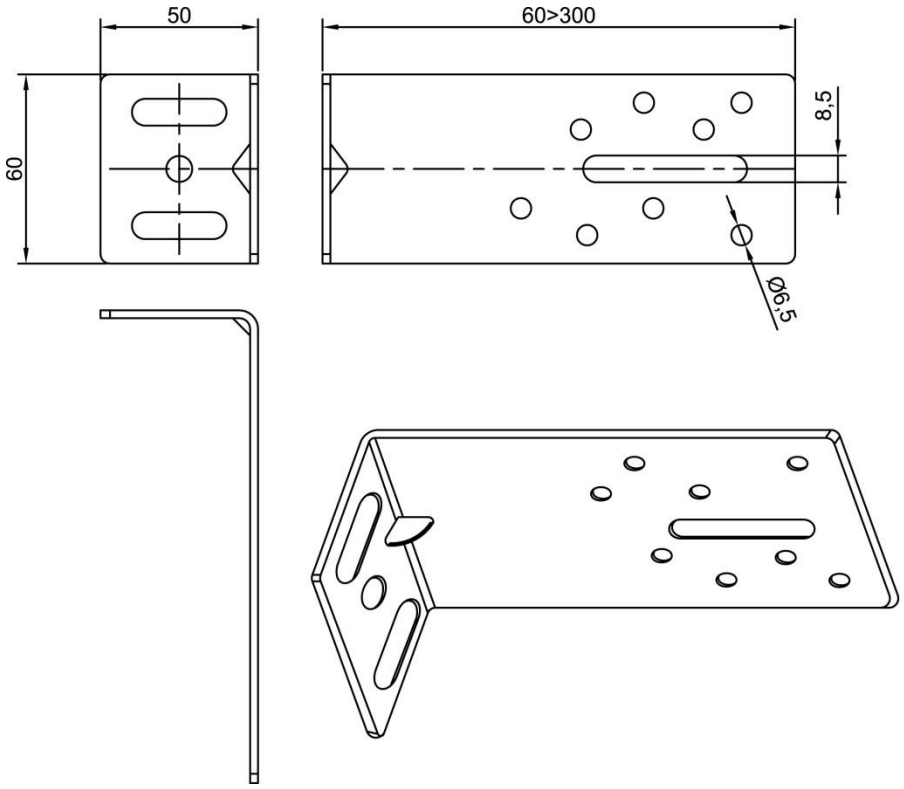
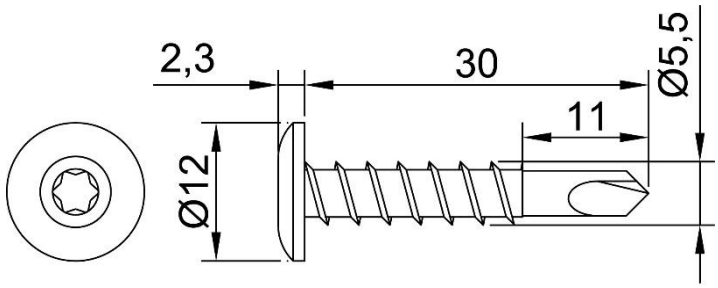


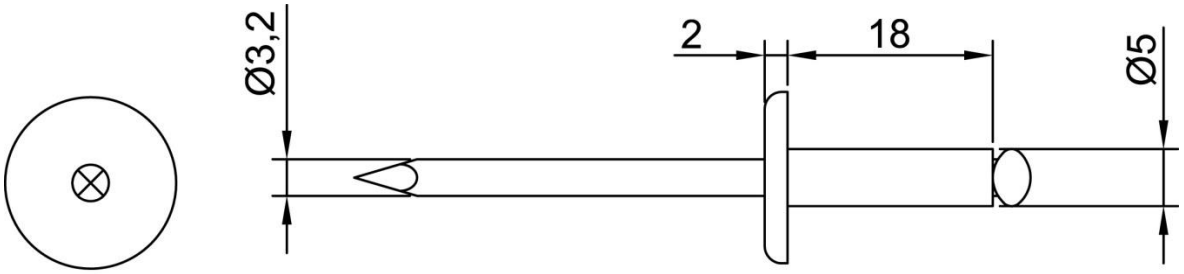
FIGURE 5: GALVANIZED STEEL SUBFRAME

5.1: CLADDING FIXING TO GALVANIZED STEEL SUBFRAME – STAINLESS STEEL SCREW



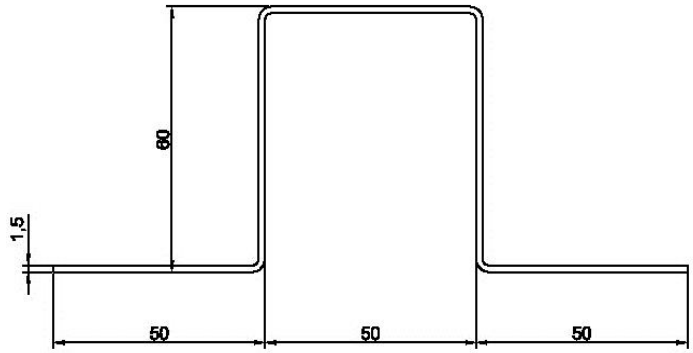
SX3-D12 Ø 5,5 L=30

5.2: CLADDING FIXING TO GALVANIZED STEEL SUBFRAME – STAINLESS STEEL RIVET

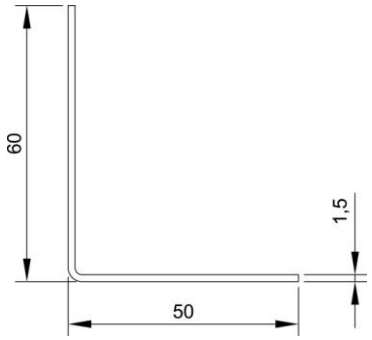


SSO-D15 Ø 5 L=18

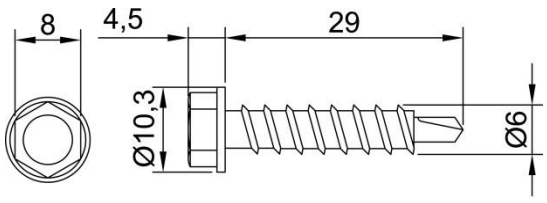
5.3: GALVANIZED STEEL Ω PROFILE



5.4: GALVANIZED STEEL L PROFILE



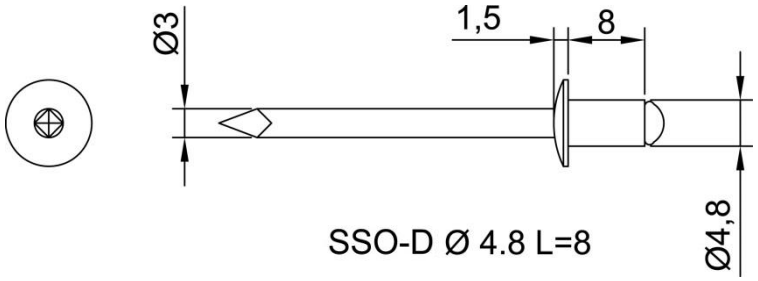
5.5: FIXING BETWEEN BRACKET AND VERTICAL PROFILE – STAINLESS STEEL SCREW



SX3-S16 Ø 6.0 L=29

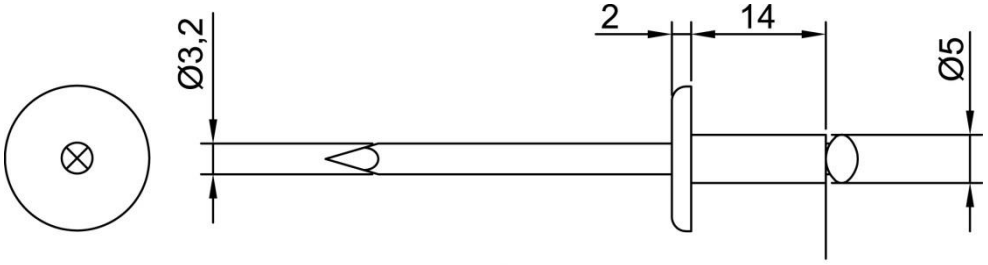
5.6: FIXING BETWEEN BRACKET AND VERTICAL PROFILE– STAINLESS STEEL RIVET

OPTION 1 – For grip range from 4 mm to 6 mm



SSO-D Ø 4.8 L=8

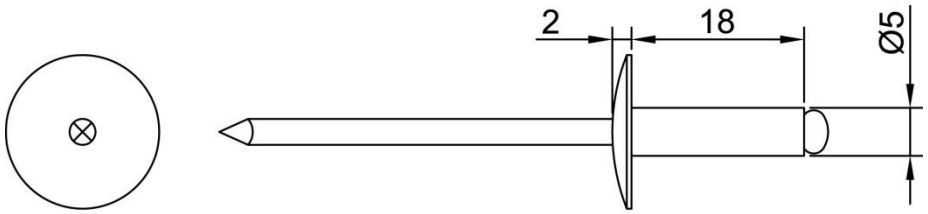
OPTION 2 – For grip range greater than 6 mm



SSO-D15 Ø 5 L=14

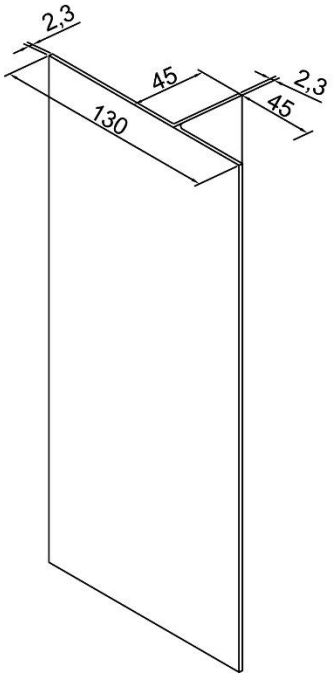
FIGURE 6: ALUMINIUM SUBFRAME

6.1: CLADDING FIXING TO ALUMINIUM SUBFRAME – ALUMINIUM RIVET

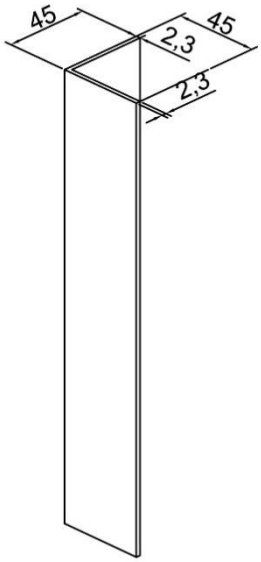


AP 16 Ø 5 L=18

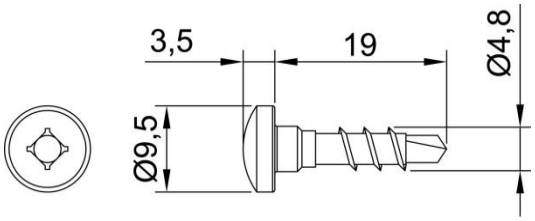
6.2: ALUMINIUM T PROFILE



6.3: ALUMINIUM L PROFILE



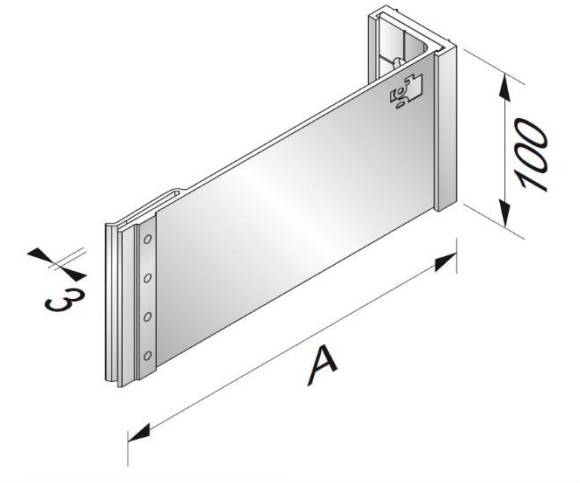
6.4: FIXING BETWEEN BRACKET AND VERTICAL PROFILE – STAINLESS STEEL SCREW



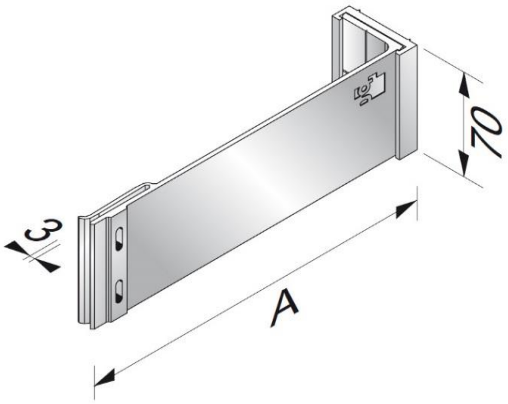
SLA3/6-8-S4-SR2 ø 4.8 L=19

6.5: ALUMINIUM BRACKETS

6.5a: SUPPORTING BRACKET

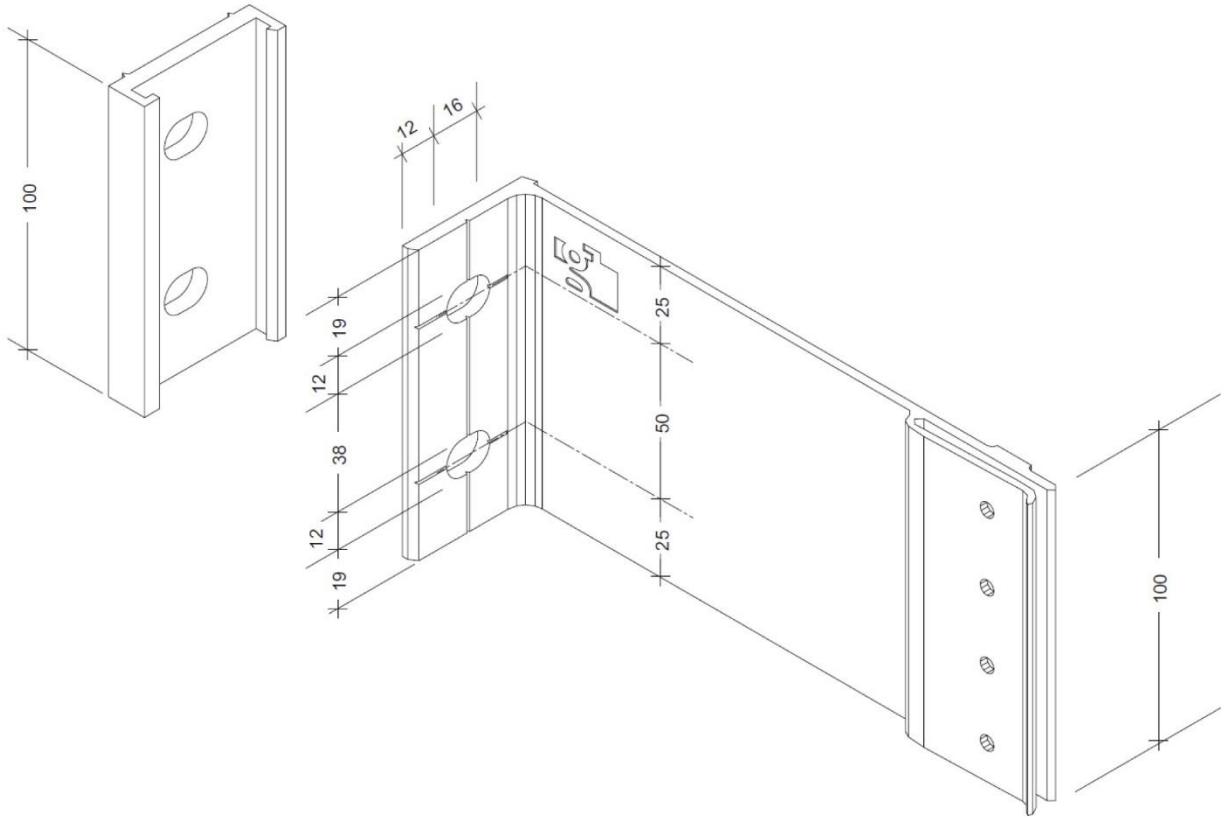


6.5b: RETENTION BRACKET

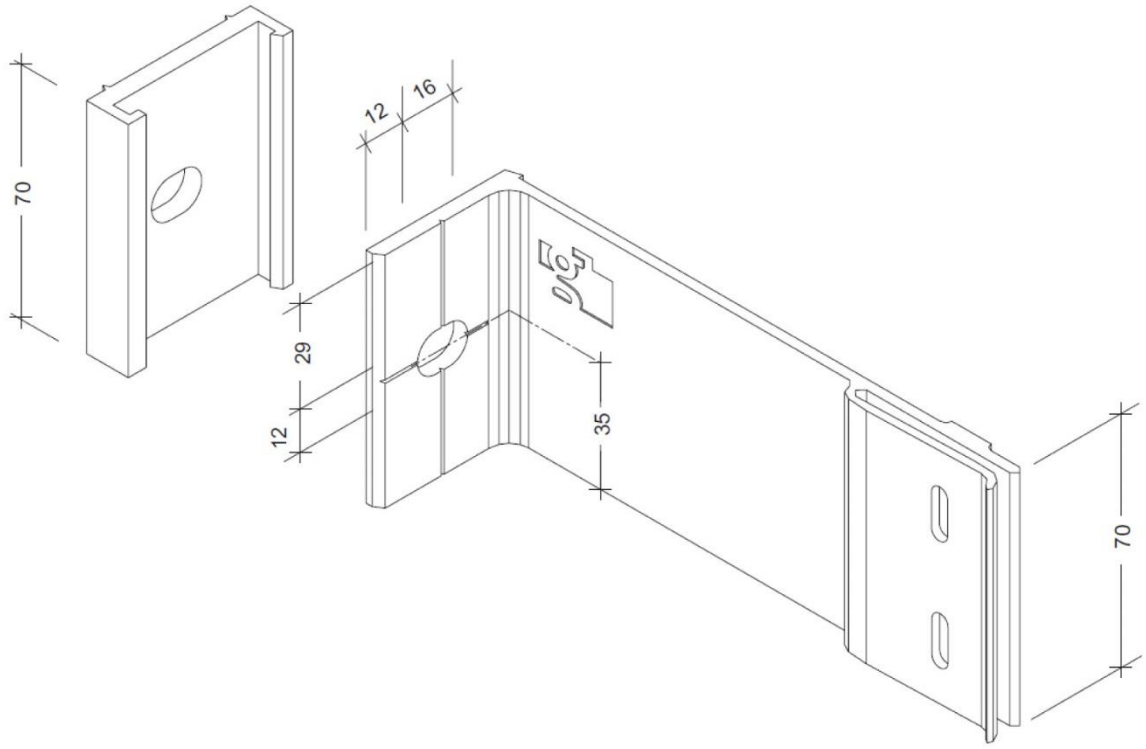


6.6: ALUMINIUM BRACKETSDETAILS

6.6a: SUPPORTING BRACKETS DETAIL
(FIXED POINT)



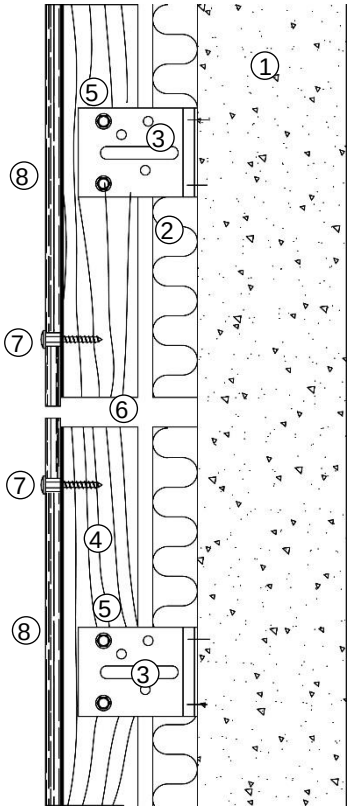
6.6b: RETENTION BRACKETS DETAIL
(GLIDING POINT)



Note: The details shown in figures above are approximate and must be defined for each project.
These details concern the kit for ventilated external wall claddings and may not be used as justification for compliance with the National requirements.

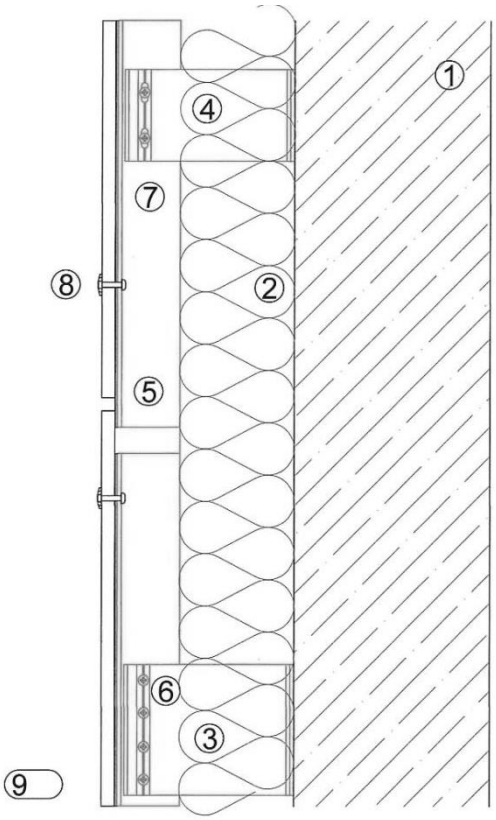
FIGURE 7. VERTICAL SECTION

FIGURE 7.a: TIMBER SUBFRAME



1. Load-bearing structure
2. Thermal insulation
3. Galvanized steel bracket
4. Batten
5. Screw between brackets and batten
6. Ventilation cavity
7. Screw between cladding sheet and batten
8. Fiber-cement cladding sheets

FIGURE 7.b: ALUMINIUM SUBFRAME



1. Load-bearing structure
2. Thermal insulation
3. GFT AVANTI bracket for fixed points
4. GFT AVANTI bracket for slipping points
5. GFT T profile with asymmetric wings
6. GFT Avanti screw
7. Ventilation cavity
8. Rivet between cladding sheet and aluminium profile
9. Fiber-cement cladding sheets

FIGURE 8. HORIZONTAL SECTION

FIGURE 8.a: TIMBER SUBFRAME

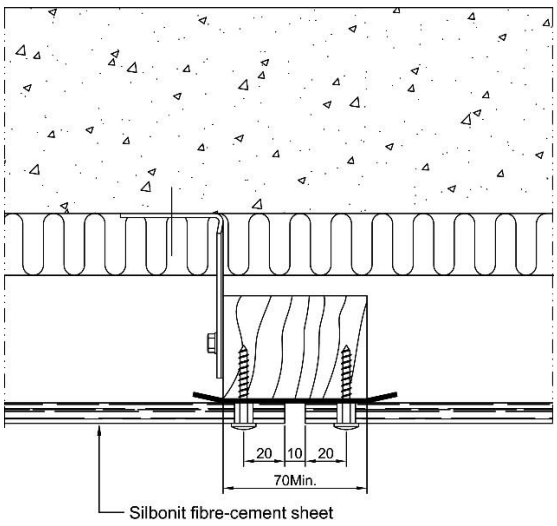


FIGURE 8.b: ALUMINIUM SUBFRAME

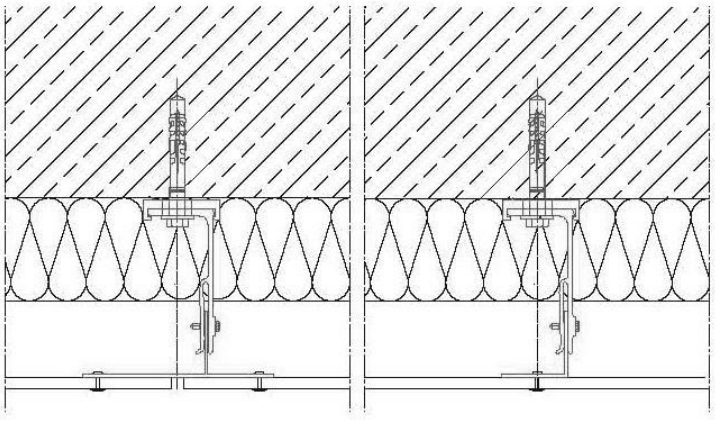


FIGURE 9: DETAIL OF CROWN AND BASE

FIGURE 9.a: TIMBER SUBFRAME

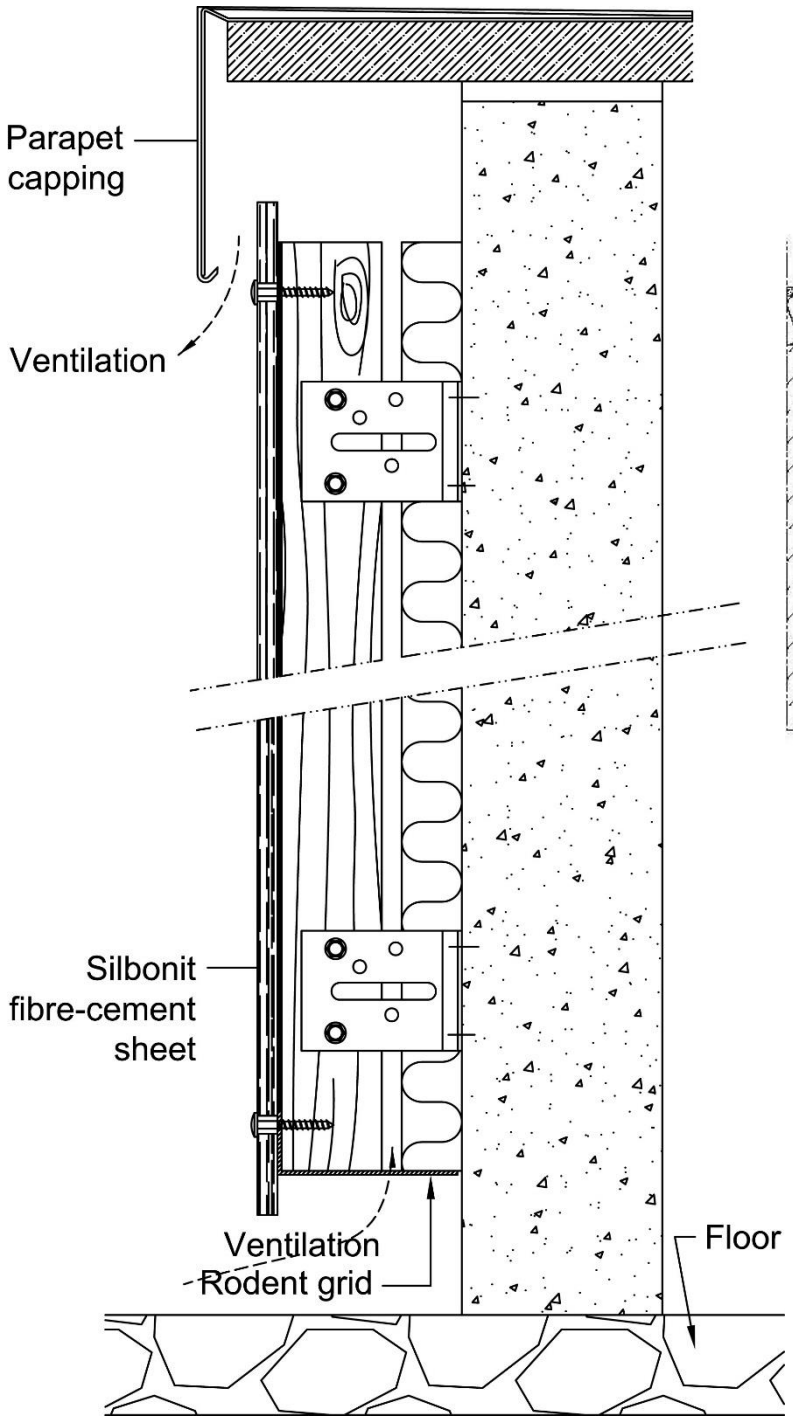


FIGURE 9.b: ALUMINIUM SUBFRAME

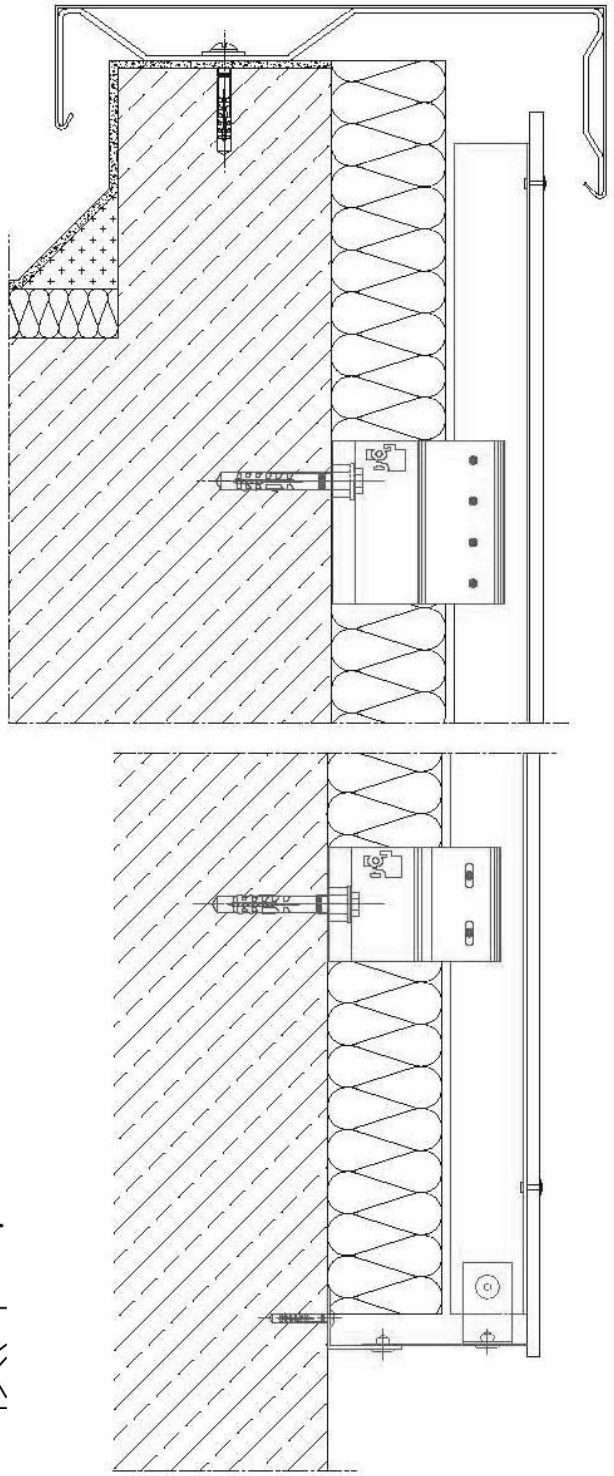


FIGURE 10. EXTERNAL CORNER

FIGURE 10.a: TIMBER SUBFRAME

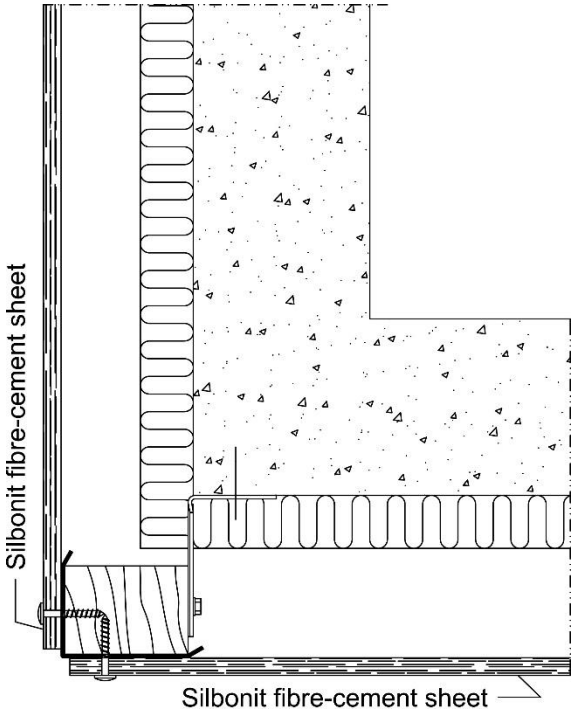


FIGURE 10.b: ALUMINIUM SUBFRAME

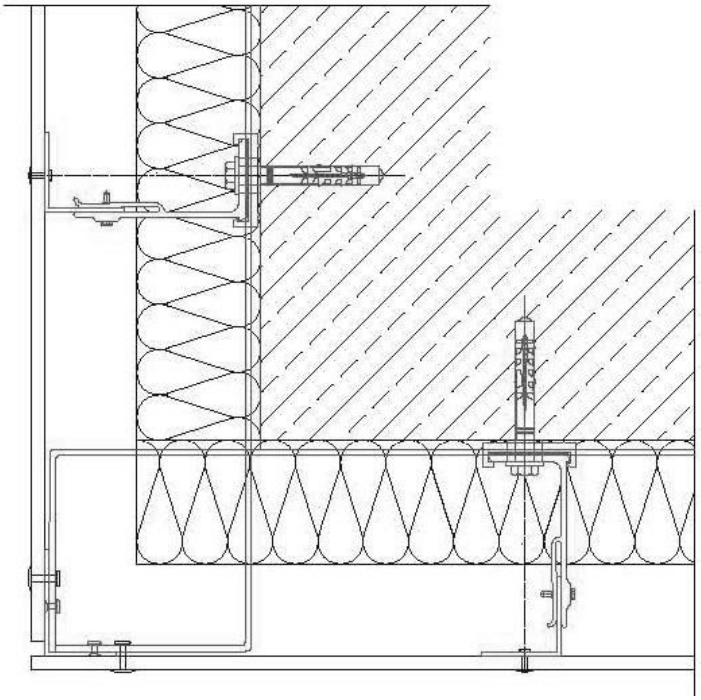


FIGURE11. INTERNAL CORNER

FIGURE 11.a: TIMBER SUBFRAME

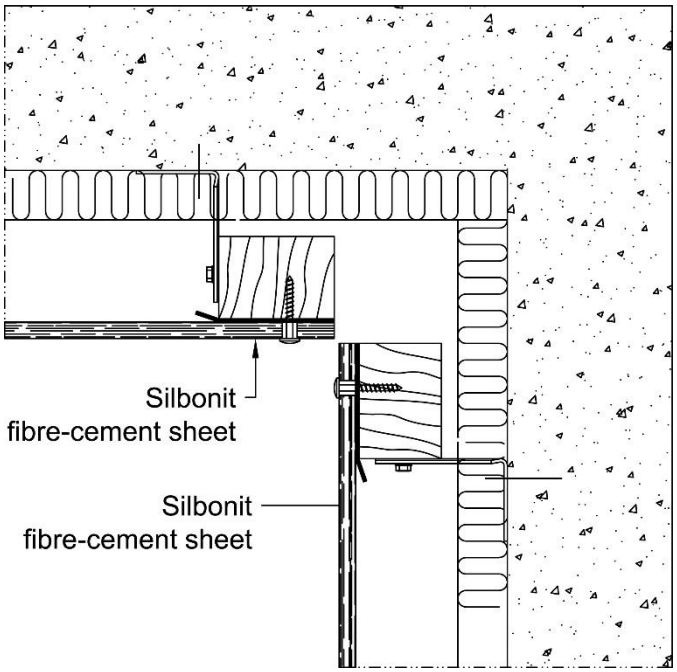


FIGURE 11.b: ALUMINIUM SUBFRAME

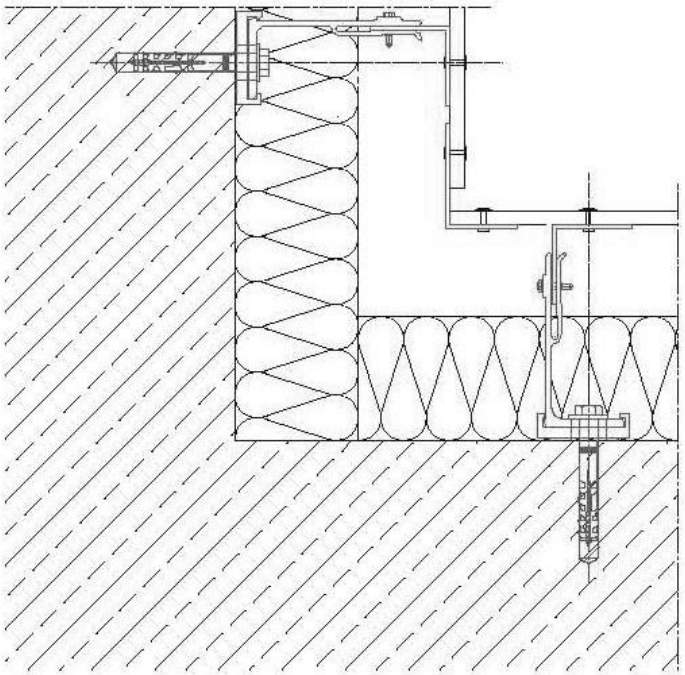


FIGURE12. WIDOW VERTICAL SECTION

FIGURE 12.a: TIMBER SUBFRAME

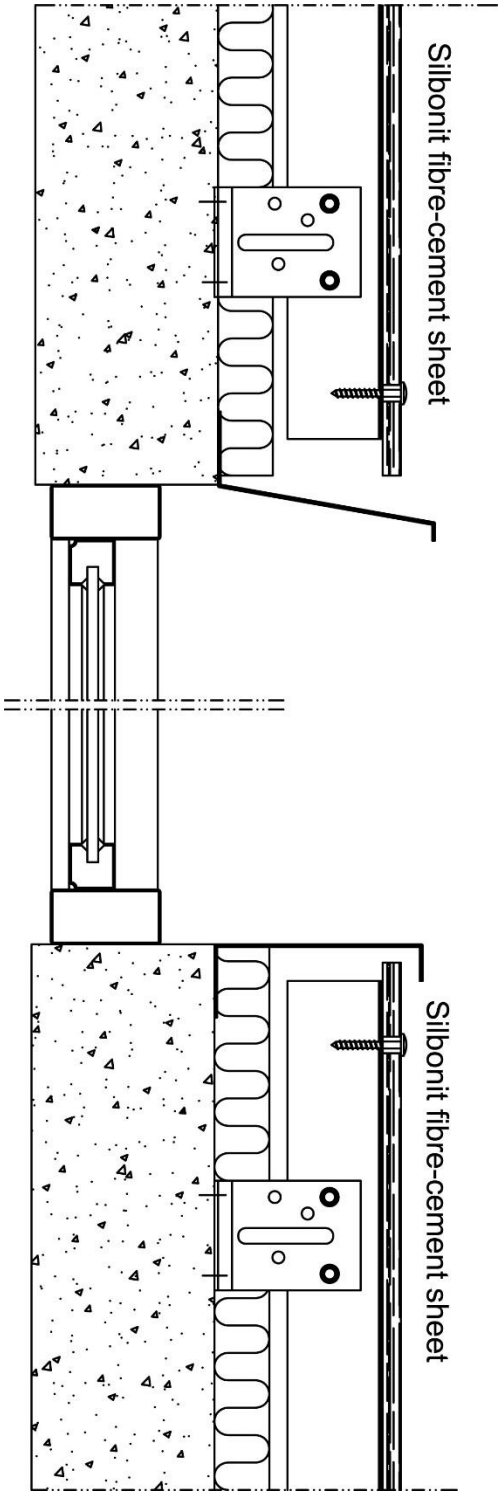


FIGURE 12.b: ALUMINIUM SUBFRAME

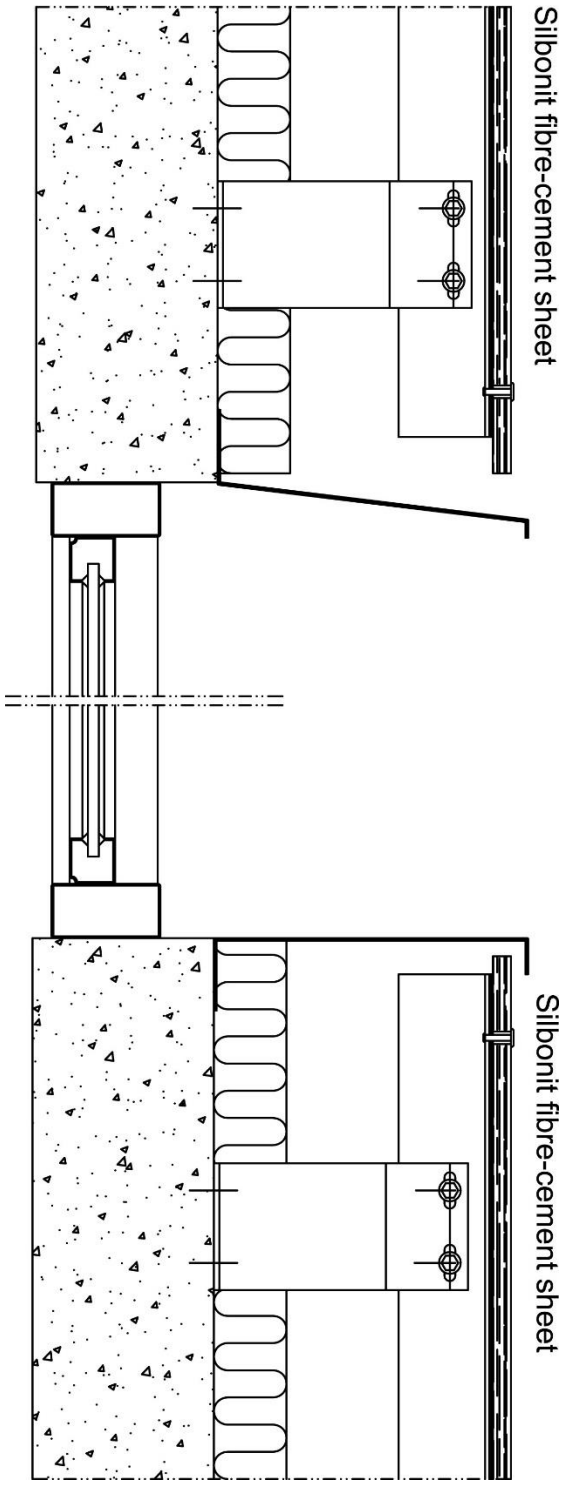


FIGURE13. VENTILATION CAVITY PARTITION

FIGURE 13.a: TIMBER SUBFRAME

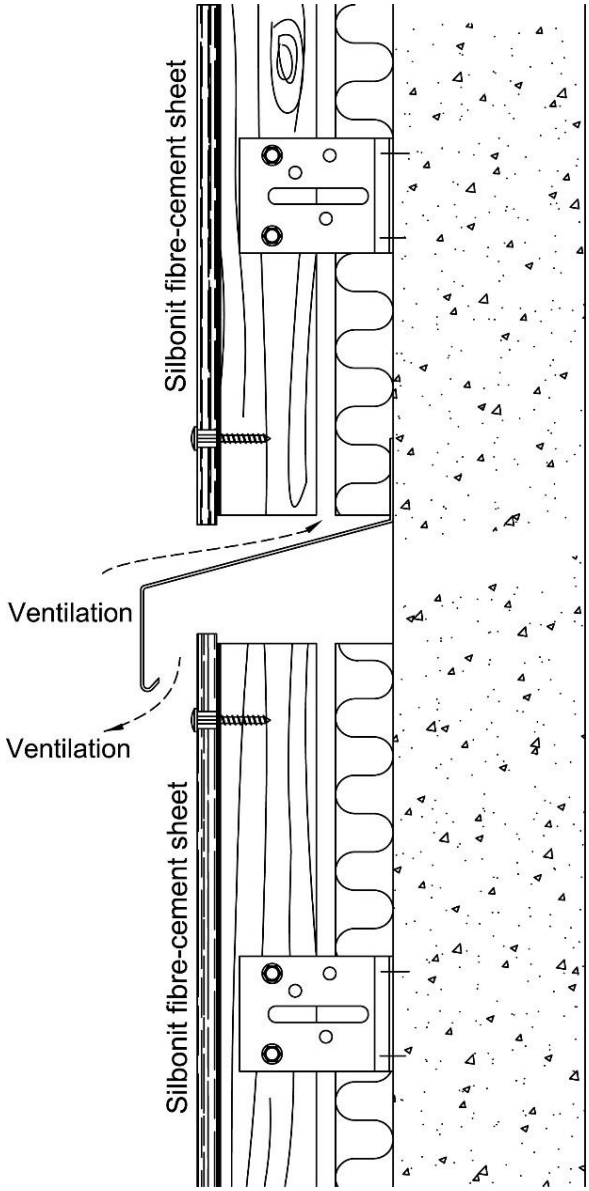
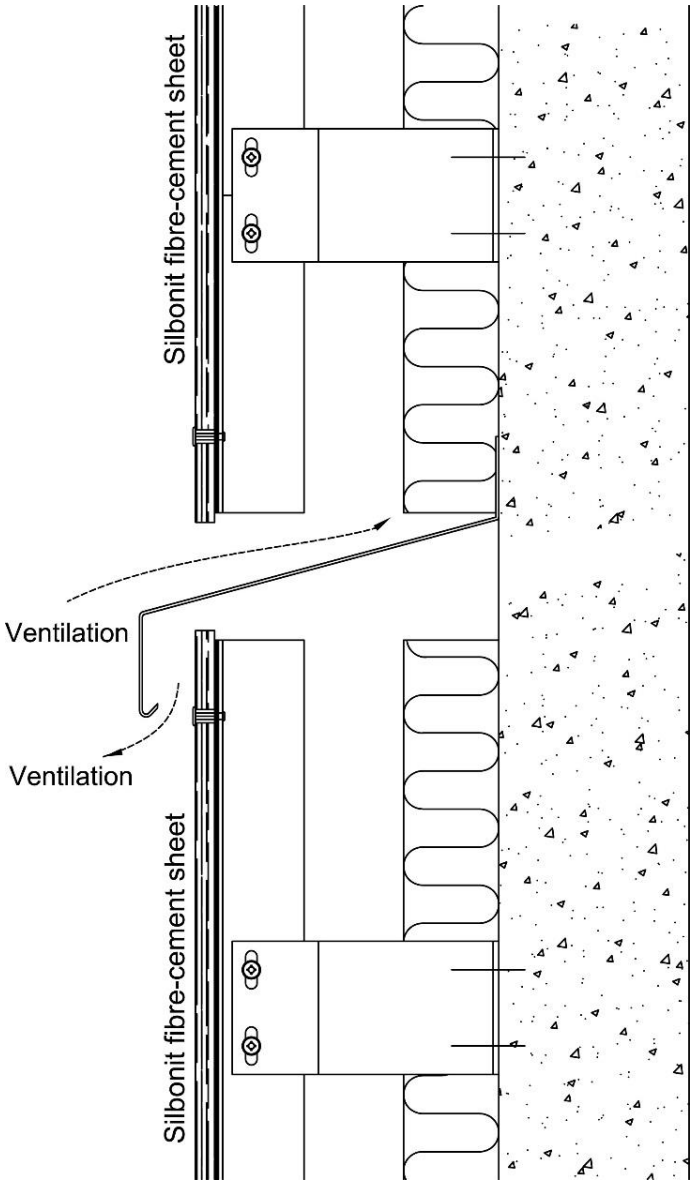


FIGURE 13.b: ALUMINIUM SUBFRAME



Annex A: Cladding element specifications

STANDARD DIMENSIONS[20] AND GEOMETRY[21]		
Characteristics	Nominal value	Tollerance (Level 1, classifications according to EN 12467:2016)
Length	2500 – 3000 - 3050	±2 mm
Width	1200 - 1250	±1 mm
Thickness for smooth sheets	8 – 10 - 12	±0.2 mm
Squareness of edges		2 mm/m
Straightness of edges		0.1 %
Nominal weight (Kg/m^2)		14.4 (8 mm) 18 (10 mm) 21,6 (12 mm)

PHYSICAL PROPERTIES		
Density		1600 ± 50 Kg/m^3
MECHANICAL PROPERTIES		
E modulus of elasticity (dry)	longitudinal	14 GPa
	transversal	12 GPa
E modulus of elasticity (wet)	longitudinal	11 GPa
	transversal	9 GPa
Bending strength (wet) – untreated sheet		≥ 18 MPa
Bending strength (wet) – hydrophobic treated sheet and acrylic coated (treated sheets)		≥ 24 MPa
Bending strength (dry)	longitudinal	32 MPa
	transversal	22 MPa
Compressive strength		40 MPa
Resilience (Charpy test) – According to EN 179-1:2010	longitudinal	4,3 kJ/m^2
	transversal	3,1 kJ/m^2
HYGROMETRICAL PROPERTIES		
Natural humidity		10 ÷ 15 %
Max water absorption*– untreated sheets		25 ± 2 %
Max water absorption* – hydrophobic treated sheets (treated sheets)		9 ± 3 %
Max water absorption* – acrylic coated sheets (treated sheets)		3 ± 2 %
Moisture movement – Relative humidity change from 30% to 90%	longitudinal	0,7 mm/m
	transversal	0,8 mm/m
THERMAL AND WATER VAPOUR PROPERTIES		
Vapour resistance factor, μ – According to EN 12572:2016		320
Thermal conductivity – According to EN 12664:2002		0,42 W/mK
Thermal expansion coefficient - According to EN 10545-8:2014	longitudinal	1,71*10^{-6}/ºC
	transversal	0,58*10^{-6}/ºC
OTHER CHARACTERISTICS		
Superior calorific power (untreated sheets)		0,14 MJ/kg
Fire rating class – According to EN 13501-1		A2 s1 d0
Durability classification – According to EN 12467:2016		category A
Strength classification – untreated sheets – According to EN 12467:2016		class 4
Strength classification – treated sheets – According to EN 12467:2016		class 5
CE marked product according to EN 12467: 2016		

(20) Available smaller dimensions with the same thickness
(21) Properties according to EN 12467-1:2013

Annex B: Subframe specifications

Wood requirements

Resistance class	≥ C 18[22]
Durability	Class 3[23]
Processing	Autoclave level 5
Damp control	≤ 18%

Galvanized steel physical and mechanical properties

Type of steel	S235 (profiles)	S220GD (brackets)
Treatment	Z 275 (profiles)	Z350 (brackets)
PHYSICAL PROPERTIES		
Density	7850 g/cm^3	7850 g/cm^3
Coefficient of linear thermal expansion	1,2 x 10^{-5} ºC^{-1}	1,2 x 10^{-5} ºC^{-1}
Poisson coefficient	0.39	0.3
MECHANICAL PROPERTIES		
Tensile strength (R_m)	360-510 MPa	300 MPa
Elastic limit (R_{eH})	235 MPa	220 MPa
Elongation (A_{80mm})	20 mm	20 mm
According to EN 10025-5: 2007[24] and EN 10346:2015[25]		

Aluminium physical and mechanical properties

Symbolic designation	EN AW-Al MgSi
Numeric designation	AW 6060[26]
Treatment	T66
PHYSICAL PROPERTIES	
Density	2,7 kg/dm^3
Coefficient of linear thermal expansion (20º-100ºC)	23,2 x 10^{-6} ºC
Elastic modulus	69 000 N/mm^2
MECHANICAL PROPERTIES	
Tensile strength (R_m)	≥215 N/mm2
Elastic limit ($R_{p0,2}$)	≥160 N/mm^2
Elongation (A)	8 %
Webster hardness	14
Brinell hardness	75
According to EN 755-2: 2016[27] and EN 12020-1: 2008[28]	

(22) EN 338: 2011 Structural timber - Strength classes
(23) EN 335-2: 2007 Durability of wood and wood-based products - Definition of use classes - Part 2: Application to solid Wood
(24) EN 10025:2007.Hot rolled products of structural steels - Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance
(25) EN 10346:2015. Continuously hot-dip coated steel flat products for cold forming - Technical delivery conditions.
(26) Aluminium alloy 6060 T66 is classified as class B (Normally no protection necessary in rural and Industrial/Urban moderate atmospheric exposure) according to (Eurocode 9) EN 1999-1-1:2007+A1:2009 Design of aluminium structures – Part 1 – 1: General structural rules. Table 3.1a and Table.D.1 in Annex D.
(27) EN 755-2: 2016 Aluminium and aluminium alloys. Extruded rod/bar, tube and profiles. Part 2: Mechanical properties.
(28) EN 12020-1: 2008 Aluminium and aluminium alloys. Extruded precision profiles in alloys EN AW-6060 and EN AW-6063. Part 1: technical conditions for inspection and delivery.

TIMBER SUBFRAME ELEMENTS

Stainless steel screw between cladding elements and vertical batten

Designation	TW-S-D12	
Diameter	4.8 mm	
Length	38 mm	44 mm
Material	Stainless steel A2 (1.4301)	
Standard	EN ISO 3506-4:2009[29]	
Tensile breaking load	7100 N	
Shear breaking load	5400 N	

Vertical batten geometrical features

Reference	**AT LOCATION OF JOINT**	**INTERMEDIATE SUPPORT**
Minimun width –W (mm)	2 x ≥ 70	≥ 70
hickness – T (mm)	≥ 50	≥ 50
E=T/W	0.5 < E < 2	

Galvanized steel brackets geometrical properties

Reference	**50 x 60 x 80**	**50 x 60 x 150**	**50 x 60 x 260**
Thickness (mm)	25/10	25/10	25/10
Material	D220GD + Z350		

Stainless steel screw between brackets and vertical batten

Designation	SW-T-4.8 x 35	SW3-T-H15 – 6.5 x 50
Standard	ETA-10/0198 Fastening screws for metal members and sheeting	
	Annex 57	Annex 59
Diameter	4.8 mm	6.5 mm
Length	35 mm	50 mm
Material	Carbon steel	

[29] EN ISO 3506-4: 2009 Mechanical properties of corrosion-resistant stainless steel fasteners - Part 4: Tapping screws (ISO 3506-4:2009)

GALVANIZED STEEL SUBFRAME ELEMENTS

Stainless steel screw between cladding elements and vertical profile

Designation	SX3-D12 5.5 x 30	SX3-L12 5.5 x 32
Diameter	5.5 mm	
Length	30 mm	32 mm
Material	Austenitic stainless steel A2 (1.4301)	
Standard	EN ISO 3506-4:2010(30)	
Tensile breaking load	10351 N	
Shear breaking load	8966 N	

Stainless steel rivet between cladding elements and vertical profile

Designation	SSO-D15 5 x 18	SSO-D15 5 x 22
Diameter	5.0 mm	
Length	18 mm	22 mm
Material	Austenitic stainless steel A4	
Tensile breaking load	≥ 6500 N	
Shear breaking load	≥ 5300 N	

Vertical profiles geometrical features

Reference	**Ω 50x60x50x60x50**	**L 50x60**
Thickness (mm)	15/10	15/10
Material	Bended galvanized steel S235 + Z275	

Stainless steel screw between bracket and vertical profile

Designation	SX3-S16 6.0 x 29
Diameter	6.0 mm
Length	29 mm
Material	Austenitic stainless steel (1.4301 or 1.4567) and A4 (1.4578)
Standard	ETA-10/0198 Fastening screws for metal members and sheeting - Annex 8
Tensile breaking load	11282 N
Shear breaking load	8293 N

Stainless steel rivet between bracket and vertical profile

Designation	SSO-D 4.8 x 8mm	SSO-D15 5 x 14mm
Diameter	4.8 mm	5
Length	10 mm	14 mm
Material	Austenitic stainless steel A4 (1.4578)	
Tensile breaking load	≥ 5000 N	≥ 6500 N
Shear breaking load	≥ 4000 N	≥ 5300 N

(30) EN ISO 3506-4:2010 Mechanical properties of corrosion-resistant stainless steel fasteners - Part 4: Tapping screws (ISO 3506-4:2009)

ALUMINIUM SUBFRAME ELEMENTS

Aluminium rivet between cladding elements and vertical profile

Designation	AP16 5 x 18 (mandrel A3)	AP16 5 x 21 (mandrel A3)
Diameter	5.0 mm	
Length	18 mm	21 mm
Material		
- **Sleeve**	Aluminium AlMg5	
- **Mandrel**	Stainless steel A3 (1.4541)	
Tensile breaking load	3720 N	
Shear breaking load	2414 N	

Vertical profiles geometrical and mechanical features

Reference	T 130 x 45 x 2.3	L 45 x 45 x 2.3
Thickness (mm)	2.3	2.3
Section (mm^2)	3.99	2.02
$\mathbf{I_x}$ (cm^4)	5.25	4.05
$\mathbf{W_x}$ (cm^3)	1.37	1,23
$\mathbf{I_y}$ (cm^4)	44.77	4,05
$\mathbf{W_y}$ (cm^3)	6.42	1,23

Stainless steel screw between bracket and vertical profile

Designation	SLA3/6-8-S4-SR2
Diameter	4.8 mm
Length	19 mm
Material	Austenitic stainless steel A4 (1.4401)
Standard	EN ISO 3506-4:2010(31)
Tensile breaking load	7 850 N
Shear breaking load	5 235 N

Brackets geometrical and mechanical features

Reference	**Supporting bracket**			**Retention bracket**		
	100x45.3x80	**100x45.3x140**	**100x45.3x260**	**70x45.3x80**	**70x45.3x140**	**70x45.3x260**
Thichness (mm)	2.5	3.5	4	2.5	3.5	4
Section (cm^2)	4.94	8.02	13.50	4.94	8.02	13.50
$\mathbf{x_c}$ (mm)	9.4	6.9	5	9.4	6.9	5
$\mathbf{Ix_c}$ (cm^4)	36.50	186.92	1016.32	36.50	186.92	1016.32
$\mathbf{y_c}$ (mm)	49.5	76.2	134.6	49.5	76.2	134.6
$\mathbf{Iy_c}$ (cm^4)	6.91	7.90	8.72	6.91	7.90	8.72

Annex C: Anchorage to substrate

The fixings between the subframe and the substrate are not part of the kit, therefore have not been assessed, even so it is important define type, position and number of the anchorage according to the substrate material and the resistance required due to the envisaged actions and when possible, CE marking according to the ETA via ETAG 001, ETAG 020 or ETAG 029 is recommended.

(31) EN ISO 3506-4: 2010 Mechanical properties of corrosion-resistant stainless steel fasteners - Part 4: Tapping screws (ISO 3506-4:2009)