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European Technical Assessment

ETA 13/0166
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General part

Technical Assessment Body issuing the ETA: ITeC

ITeC has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment)

Trade name of the construction product

Tempio® FK and Tempio® FS kits

Product family to which the construction product belongs

Kits for external wall claddings mechanically fixed

Manufacturer

CERÁMICA MAYOR SA

Partida Planet s/n
ES-03510 Callosa d'en Sarrià (Alicante)
Spain

Manufacturing plant(s)

Partida Planet s/n
ES-03510 Callosa d'en Sarrià (Alicante)
Spain

This European Technical Assessment contains

31 pages including 3 annexes which form an integral part of this assessment.

This European Technical Assessment is issued in accordance with Regulation (EU) 305/2011, on the basis of

EAD 090062-00-0404 *Kits for external wall claddings mechanically fixed.*

This ETA replaces

ETA 13/0166, issued on 06/05/2013.

General comments

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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Specific parts of the European Technical Assessment

1 Technical description of the product

This ETA refers to Tempio® FK and Tempio® FS kits¹ for external wall cladding in ventilated façades.

Tempio® FK and Tempio® FS kits components are given in table 1.1.

Detailed information and data of all the components are given in the annexes of this ETA.

Table 1.1: Kits components.

N.	Generic component		Type A - Tempio® FK kit (family C)	Type B - Tempio® FK kit (family C)	Type C - Tempio® FS kit (family C)	Technical description in Annex 1
1	Cladding element (*)		Tempio® FK-16 & Tempio® FK-20		Tempio® FS-20; Tempio® FS-24 & Tempio® FS-30	§A1.1
2	Cladding fixing	Fixing device	Aluminium alloy continuous horizontal profiles	Aluminium alloy discontinuous rails	Aluminium alloy clips	§A1.2
		Screw	Stainless steel screws			
		Ancillary components	Stainless steel spring or MS adhesive spot		NBR-PVC pieces	
3	Subframe	Vertical profile	Aluminium alloy T profiles			§A1.3
		Bracket	Aluminium alloy brackets			
		Subframe fixing	Stainless steel screws			

(*) Extruded ceramic tiles according to EN 14411.

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

Tempio® FK and Tempio® FS kits are intended to be used as external wall claddings in ventilated façades (rainscreens). The walls are made of masonry (clay, concrete or stone), concrete (cast on site or as prefabricated panels), timber or metal frame in new or existing buildings (retrofit).

The characteristics of the walls shall be verified prior to use of Tempio® FK and Tempio® FS kits, especially regarding conditions for reaction to fire classification and for mechanical fixing of Tempio® FK and Tempio® FS kits.

The provisions made in this European Technical Assessment are based on an assumed working life of at least 25 years for Tempio® FK and Tempio® FS kits. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

Tempio® FK and Tempio® FS kits are made of non-load bearing construction components. They do not contribute directly to the stability of the wall on which they are installed, but they can contribute to its durability by providing enhanced protection from the effect of weathering.

Tempio® FK and Tempio® FS kits are not intended to ensure the airtightness of the building envelope.

Detailed information and data regarding design, installation, maintenance and repair criteria are given in Annexes 2 and 3.

¹ "Kit" means a construction product placed on the market by a single manufacturer as a set of at least two separate components that need to be put together to be incorporated in the construction works (Art. 2 n° 2 CPR).

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

The assessment of Tempio® FK and Tempio® FS kits for the intended use was performed following the EAD 090062-00-0404 *Kits for external wall claddings mechanically fixed* (ETAG 034 conversion).

Table 3.1: Summary of Tempio® FK and Tempio® FS kits performance (see also detailed performance in relevant sections).

Product:		Intended use:				
Tempio® FK kit Tempio® FS kit		External wall claddings in ventilated façades (rainscreens).				
Basic Works Requirement	ETA section	Essential characteristic	Performance			
			Type A - Tempio® FK kit	Type B - Tempio® FK kit	Type C - Tempio® FS kit	
BWR 2 Safety in case of fire	3.1	Reaction to fire	A1		B-s1,d0	
	---	Façade fire performance	Not assessed			
	---	Propensity to undergo continuous smouldering	Not relevant (the thermal insulation is not a kit component)			
BWR 3 Hygiene, health and the environment	3.2	Watertightness of joints (protection against driving rain)	Not watertight (open joints)			
	---	Water absorption	Not relevant (use in ventilated façades)			
	---	Water vapour permeability	Not relevant (use in ventilated façades)			
	3.3	Drainability	See figures in Annex 2			
	---	Content and/or release of dangerous substances	Not assessed			
BWR 4 Safety and accessibility in use	3.4	Wind load resistance	≥ 2000 Pa (for tiles width ≤ 450 mm)	≥ 2600 Pa (for tiles width ≤ 450 mm)	≥ 2200 Pa	
	---	Resistance to horizontal point loads	Not assessed			
	3.5	Impact resistance	See table 3.3			
	3.6	Bending strength of cladding element	≥ 13,8 MPa		≥ 18,2 MPa	
	3.7	Resistance of grooved cladding elements	≥ 0,3 kN		≥ 0,5 kN	
	---	Resistance to vertical load	Not assessed			
	3.8	Pull-through resistance of fixings from profile	≥ 2,3 kN	---	---	
	3.9	Resistance on metal clip	---	See table 3.7		
	3.10	Resistance of profiles	See table A1.3.1			
	3.11	Tension/pull-out resistance of subframe fixings	≥ 0,85 kN			
	3.12	Shear load resistance of subframe fixings	≥ 3,75 kN			
	3.13	Bracket resistance (horizontal and vertical load)	See tables 3.10			
	BWR 5 Protection against noise	---	Airborne sound insulation	Not assessed		
BWR 6 Energy economy and heat retention	---	Thermal resistance of the kit	Not relevant (use in ventilated façades and the thermal insulation is not a kit component)			
	---	Thermal resistance of thermal insulation product				

Table 3.1: Summary of Tempio® FK and Tempio® FS kits performance (see also detailed performance in relevant sections).

Product:		Intended use:					
Tempio® FK kit Tempio® FS kit		External wall claddings in ventilated façades (rainscreens).					
Basic Works Requirement	ETA section	Essential characteristic		Performance			
				Type A - Tempio® FK kit	Type B - Tempio® FK kit	Type C - Tempio® FS kit	
Durability aspects	---	Hygrothermal behaviour		Not relevant			
	---	Behaviour after pulsating load		Not assessed			
	---	Freeze-thaw resistance		Not assessed			
	---		Dimensional stability of the cladding elements	by temperature	Not assessed		
				by humidity	Not assessed		
	---		Chemical and biological resistance of the cladding elements		Not relevant		
	---		UV radiation resistance of the cladding elements		Not relevant		
3.14		Corrosion of metal components		See §3.14			

Complementary information:

Requirements with respect to the mechanical resistance and stability of non-load bearing parts of the works are not included in the Basic Works Requirement *Mechanical resistance and stability* (BWR 1) but are treated under the Basic Works Requirement *Safety and accessibility in use* (BWR 4).

The fire resistance requirement is applicable to the wall (made of masonry, concrete, timber or metal frame) and not to Tempio® FK and Tempio® FS kits themselves.

3.1 Reaction to fire

Reaction to fire of Tempio® FK and Tempio® FS kits according to Commission Delegated Regulation (EU) 2016/364 and EN 13501-1 is:

- For Tempio® FK kits type A (with horizontal profiles) and type B (with discontinuous rails) which do not contain the NBR-PVC pieces:
 - class A1 without need of testing according to Decision 96/603/EC as amended.
- For Tempio® FS kit type C with clips which contains the NBR-PVC pieces:
 - class B-s1,d0. It is based on the relevant tests according to EN 13501-1.

These classes are valid provided that the insulation layer placed behind the cladding elements is made of non-combustible materials (e.g. mineral wool) or that the layer behind the cladding elements is a mineral substrate like masonry or concrete (class A1 or A2-s1, d0). For other end use conditions (for example: with insulation layer made of EPS, XPS, PUR or PF), the reaction to fire of the external wall claddings for ventilated façades will be the reaction to fire of the insulation material.

Note: A European reference fire scenario has not been laid down for façades. In some Member States, the classification of external wall claddings according to EN 13501-1 might not be sufficient for the use in façades. An additional assessment of external wall claddings according to national provisions (e.g. on the basis of a large-scale test) might be necessary to comply with Member State regulations, until the existing European classification system has been completed.

3.2 Watertightness of joints (protection against driving rain)

Joints between the cladding elements in the external wall claddings for ventilated façades are open, therefore Tempio® FK and Tempio® FS kits are not watertight.

3.3 Drainability

On the basis of the construction details (see Annex 2), the available technical knowledge, experience and the installation criteria, it is considered that the water which penetrates into the air space or the condensation water can be drained out from the cladding without accumulation or moisture damage or leakage into the substrate.

3.4 Wind load resistance

Wind load resistance has been determined taking into account the wind resistance tests and the mechanical resistance of components (see sections 3.6 to 3.13). Different cases have been tested depending on the type of kit considered.

The worst cases have been tested: minimum thickness, maximum width and maximum separation between cladding fixings and subframe components.

Test results are given in table 3.2.

For other assembled systems, wind load resistance obtained by calculation on the basis of the mechanical resistance of the kit components should not be higher than the maximum load obtained in the tests.

Table 3.2: Wind load test results.

Test	Kit	Maximum load Q (Pa)	Displacement under maximum load (mm) [deflection after 1 min recovery]
Suction (1)		2000 (i)	15,6 mm [4,5 mm]
Pressure (1)	Type A - Tempio® FK with horizontal profiles	2200 (ii)	7,4 mm [2,1 mm]
Suction (2)		2400 (i)	14,5 mm [5,2 mm]
Pressure (2)		2200 (ii)	5,0 mm [0,6 mm]
Suction (3)	Type B - Tempio® FK with discontinuous rails	2600 (i)	9,3 mm [1,1 mm]
Suction (4)		1600 (i)	5,3 mm [0,8 mm]
Suction (5)	Type C - Tempio® FS with clips	2200 (iii)	9,2 mm [1,0 mm]

(1) Tests specimen: ceramic tiles Tempio® FK maximum size 1200 mm x 450 mm and minimum thickness 16 mm with horizontal profiles between the tiles and with metallic springs, three vertical profiles at distances 900 mm, 9 brackets 60 mm x 3 mm (span 1000 mm) and subframe fixings.

(2) Tests specimen: ceramic tiles Tempio® FK maximum size 1200 mm x 450 mm and minimum thickness 16 mm with horizontal profiles between the tiles and with points of MS adhesive, three vertical profiles at distances 900 mm, 9 brackets 60 mm x 3 mm (span 1000 mm) and subframe fixings.

(3) Tests specimen: ceramic tiles Tempio® FK maximum size 1200 mm x 450 mm and minimum thickness 16 mm with four discontinuous rails for each the tile and with metallic springs, four vertical profiles maximum distance 1200 mm, 12 brackets 60 mm x 4 mm (span 750 mm) and subframe fixings.

(4) Tests specimen: ceramic tiles Tempio® FK maximum size 1200 mm x 510 mm and minimum thickness 16 mm with four discontinuous rails for each the tile and with metallic springs, four vertical profiles maximum distance 1200 mm, 12 brackets 60 mm x 4 mm (span 750 mm) and subframe fixings.

(5) Tests specimen: ceramic tiles Tempio® FS maximum size 1500 mm x 500 mm and minimum thickness 20 mm with four clips for each the tile and with NBR-PVC pieces, four vertical profiles maximum distance 1500 mm, 12 brackets 60 mm x 4 mm (span 750 mm) and subframe fixings.

(i) Failure due to ceramic tile breaks.

(ii) Test stopped without kit failure.

(iii) Maximum load reached without kit failure (at test equipment limit due to lack of airtightness).

3.5 Impact resistance

Impact resistance has been tested in the assembled systems given in table 3.3. For other assembled systems, the impact resistance has not been assessed.

Table 3.3: Impact resistance.

Cladding element			Cladding fixing for cladding element	Impact resistance passed	Degree of exposure in use (*)
Trade name	Length, L (mm)	Width, H (mm)			
Tempio® FK-16	≥ 600	≤ 400	2 horizontal profiles	Hard body (0,5 kg), 3 impacts of 1 J Soft body (3,0 kg), 3 impacts of 10 J	Category IV
Tempio® FK-20	≥ 400	200	2 horizontal profiles		
Tempio® FK-20	1500	≤ 545	≥ 4 discontinuous rails	Hard body (0,5 kg) 3 impacts of 1 J	---
Tempio® FS-20; FS-24 & FS-30	1500	≤ 500	≥ 4 clips	Hard body (0,5 kg), 3 impacts of 1 J Soft body (3,0 kg), 3 impacts of 10 J	Category IV
Tempio® FS-30	≥ 400	200	≥ 4 clips		

(*) Category I: This category means that the degree of exposure in use should be a zone readily accessible to the public at ground level and vulnerable to hard body impacts but not subjected to abnormally rough use.

Category II: This category means that the degree of exposure in use should be a zone liable to impacts from thrown or kicked objects, but in public locations where the height of the kit will limit the size of the impact; or at lower levels where access to the building is primarily to those with some incentive to exercise care.

Category III: This category means that the degree of exposure in use should be a zone not likely to be damaged by normal impacts caused by people or by thrown or kicked objects.

Category IV: This category means that the degree of exposure in use should be a zone out of reach from ground level.

3.6 Bending strength of the cladding element

Bending strength of the cladding element has been tested according to EN 10545-4. The supports of the test specimens have been positioned parallel to the extrusion of the cladding element. Mean values of the breaking load, breaking strength and bending strength are given in table 3.4.

Table 3.4: Bending strength of the cladding element.

Trade name	Load direction	Breaking load (N)	Breaking strength (N)	Bending strength (MPa)
Tempio® FK-16-510	Suction	939	4411	26,6
	Pressure	963	4439	26,7
Tempio FK-16-450	Suction	1181	3154	18,4
Tempio® FK-20-200	Suction	3497	5595	21,3
	Pressure	2346	3590	13,8
Tempio® FK-20-545	Suction	1204	6103	24,2
	Pressure	1071	5334	21,5
Tempio® FS-20-200	Suction	3842	5724	22,4
	Pressure	3676	5477	21,4
Tempio® FS-20-500	Suction	1147	5126	18,7
	Pressure	1110	4962	18,2

Table 3.4: Bending strength of the cladding element.

Trade name	Load direction	Breaking load (N)	Breaking strength (N)	Bending strength (MPa)
Tempio® FS-24-500	Suction	2396	10565	30,0
	Pressure	1513	6719	19,2
Tempio® FS-30-400	Suction	4300	14577	25,9
	Pressure	3442	11598	20,7

3.7 Resistance of grooved cladding elements

Mean and characteristic values of the grooved cladding elements are given in table 3.5.

The worst cases have been tested.

Table 3.5: Resistance of grooved cladding elements.

Test specimen	Resistance (N)				
	under suction action		under pressure action		
	F _m	F _c	F _m	F _c	
Tempio® FK-16	Top groove	1134	353	(*)	(*)
	Lower groove	1452	1073	1090	805
Tempio® FK-20	Top groove	904	588	(*)	(*)
	Lower groove	1110	612	2034	1528
Tempio® FS-20	Top groove	1432	831	(*)	(*)
	Lower groove	1572	1213	628	514
Tempio® FS-24	Top groove	1994	1409	(*)	(*)
	Lower groove	2950	1525	1642	1337
Tempio® FS-30	Top groove	1568	1334	(*)	(*)
	Lower groove	2170	1576	1068	845

(*) Test not relevant by geometry.

Where: F_m = mean values; F_c = characteristic values giving 75% confidence that 95% of results will be higher than this value.

3.8 Pull-through resistance of fixing from horizontal profiles

Pull-through resistance of fixings on cladding fixing horizontal profile has been tested. Mean and characteristic values of the pull-through resistance are given in table 3.6.

Table 3.6: Pull-through resistance of fixing from horizontal profile.

Test specimen	Failure load (N)		Failure mode
	F _m	F _c	
Intermediate profile: Thickness 1,4 mm, AW-6063 aluminium alloy. Self-drilling screw: Ø5,5 mm, A2-70 stainless steel.	2593	2375	Screw came out

Where: F_m = mean values; F_c = characteristic values giving 75% confidence that 95% of results will be higher than this value.

3.9 Resistance of metal clips

Mean and characteristic values of the mechanical resistance of discontinuous rails and clips are given in table 3.7.

The worst cases have been tested.

Table 3.7: Resistance of discontinuous rails and clips.

Test specimen	Resistance (N) at 1 mm of permanent deflection		Ultimate resistance (N)		Failure	
	F _m	F _c	F _m	F _c		
Horizontal load	Discontinuous rail double PSOA start-end for spring	1195	1043	2185	935	Predrilling hole breaks
	Discontinuous rail double PSOI intermediate upper support	329	254	463	343	Excessive deflection
	Discontinuous rail double PSOI intermediate lower support (*)	829	657	1725	468	Predrilling hole breaks
	Discontinuous rail double PSOA start-end					
	Clip 20-24 simple intermediate	1070	882	1086	915	
	Clip 20-24 simple start-end	1069	895	1981	1375	Excessive deflection
	Clip 30 simple intermediate	852	795	1084	698	
	Clip 30 simple start-end	524	366	1584	1217	
Vertical load	Discontinuous rail double PSOA start-end for spring (*)					
	Discontinuous rail double PSOI intermediate lower support (*)	1087	782	3036	1408	Excessive deflection
	Discontinuous rail double PSOA start-end					
	Clip 20-24 simple intermediate (**)	676	450	782	519	
	Clip 20-24 simple start-end (**)	279	145	381	264	Excessive deflection
	Clip 30 simple intermediate	676	450	782	519	
	Clip 30 simple start-end	279	145	381	264	

(*) Not tested. Discontinuous rail double PSOA start-end values are applicable.

(**) Not tested. Clip 30 values are applicable.

Where: F_m = mean values; F_c = characteristic values giving 75% confidence that 95% of results will be higher than this value.

3.10 Resistance of profiles

The following characteristics of the vertical profiles are given in Annex 1:

- Form and dimensions of profiles sections.
- Inertia of profiles sections.
- Minimum elastic limit of profiles material.

3.11 Tension / Pull-out resistance of subframe fixings

Mean and characteristic values of the pull-out resistance of subframe fixing on profile minimum thickness 3 mm are given in table 3.8. For lower thicknesses this performance has not been assessed.

Table 3.8: Pull out resistance.

Test specimen	Ultimate resistance (N)	
	F _m	F _c
Profile: Thickness 3,0 mm, AW-6063 aluminium alloy. Self-drilling screw: Ø5,5 mm, A2-70 stainless steel.	1927	1715
Where: F _m = mean values; F _c = characteristic values giving 75% confidence that 95% of results will be higher than this value.		

3.12 Shear load resistance of subframe fixings

Mean and characteristic values of the shear resistance of subframe fixing on profile minimum thickness 3 mm are given in table 3.9. For lower thicknesses this performance has not been assessed.

Table 3.9: Shear resistance.

Test specimen	Ultimate resistance (N)	
	F _m	F _c
Profile: Thickness 3,0 mm, AW-6063 aluminium alloy. Self-drilling screw: Ø4,8 mm, A2-70 stainless steel.	8100	7500
Where: F _m = mean values; F _c = characteristic values giving 75% confidence that 95% of results will be higher than this value.		

3.13 Bracket resistance (vertical and horizontal load)

Bracket resistance to horizontal load has been tested (see table 3.10a). Bracket resistance to vertical load has been tested (see table 3.10b).

The worst cases have been tested.

Table 3.10a: Bracket resistance to horizontal load.

Bracket L x H x B x t (mm)	Resistance (N) at 1 mm of permanent deflection		Ultimate resistance (N)	
	F _m	F _c	F _m	F _c
MR-140x60x50x4 (*)	3507	2555	5495	4721
MR-120x60x50x4	3776	2830	5879	5561
MR-100x60x50x4	3903	2994	5819	5129
MR-80x60x50x4	3507	2555	5495	4721

(*) Bracket not tested. Minimum values are applicable.

Where:

L = length; H = height; B = base; t = thickness

F_m = mean values; F_c = characteristic values giving 75% confidence that 95% of results will be higher than this value.

Table 3.10b: Bracket resistance to vertical load.

Bracket L x H x B x t (mm)	Resistance (N) at 1 mm of displacement		Resistance (N) at 3 mm of displacement		Resistance at $\Delta L = 0,2\% \cdot L$ mm of permanent deflection (N)		Ultimate resistance (N)	
	F _m	F _c	F _m	F _c	F _m	F _c	F _m	F _c
MS-140x90x50x4	835	696	1767	1402	943	714	3760	3481
MS-120x90x50x4	1179	971	2339	2083	1460	1125	4316	3900
MS-100x90x50x4	1813	1160	3215	2456	1752	1349	4614	4021
MS-80x90x50x4	2342	1914	3868	2920	2481	2309	5218	4346

Where:

L = length; H = height; B = base; t = thickness

F_m = mean values; F_c = characteristic values giving 75% confidence that 95% of results will be higher than this value.

3.14 Corrosion of metal components

The cladding fixings, the vertical profiles and the brackets are made of aluminium alloy AW-6063 and AW-6005A according to EN 573, EN 1999 and EN 755. The durability is class B and the minimum thickness is 1,4 mm. Therefore, these components may be used in the following external atmospheric exposure: rural environment, moderate industrial/urban environment, but excluding industrial marine environment. These components may be used in other external atmospheric conditions exposure if the components are protected as indicated in EN 1999-1-1.

The subframe fixings are made of A2-70 stainless steel according to EN ISO 3506-1. Therefore, these components may be used in dry internal conditions or exposure in permanent damp internal conditions and also in external atmospheric exposure with high category of corrosivity of the atmosphere (included industrial and marine environment, C4 as defined in ISO 9223), provided that no particular aggressive conditions exist. Such particular aggressive conditions are e.g. permanent or alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with extreme chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used).

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

According to the decision 2003/640/EC, as amended of the European Commission², the systems of AVCP (see EC delegated regulation (EU) No 568/2014 amending Annex V to Regulation (EU) 305/2011) given in the following table apply.

Table 4.1: Applicable AVPC system.

Product	Intended use	Level or class	System
Exterior wall claddings	External finishes of walls	Any	2+
	For uses subject to regulations on reaction to fire	A1	4
		B-s1,d0	3

(*) Class A1 according to Commission Decision 96/603/EC, as amended, for Tempio[®] FK kits type A and type B which do not contain the NBR-PVC pieces.

(**) Class B,s1-d0 for Tempio[®] FS kit type C which contains the NBR-PVC pieces.

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

All the necessary technical details for the implementation of the AVCP system are laid down in the *Control Plan* deposited with the ITeC³, with which the factory production control shall be in accordance.

Issued in Barcelona on 29 March 2019

by the Catalonia Institute of Construction Technology.



Ferran Bermejo Nualart
 Technical Director, ITeC

² 2003/640/EC – Commission Decision of date 4 September 2003, published in the Official Journal of the European Union (OJEU) L226/21 of 10/09/2003.

³ The *Control Plan* is a confidential part of the ETA and is only handed over to the notified certification body involved in the assessment and verification of constancy of performance.

ANNEX 1: Description of Tempio® FK & Tempio® FS kits

Tempio® FK and Tempio® FS kits for external wall claddings in ventilated façades are composed by:

1. Cladding elements: five types of extruded ceramic tiles (see table A1.1) according to harmonized standard EN 14411:
 - Tempio® FK-16 (see figure A1.1a).
 - Tempio® FK-20 (see figure A1.1b).
 - Tempio® FS-20 (see figure A1.1c).
 - Tempio® FS-24 (see figure A1.1d).
 - Tempio® FS-30 (see figure A1.1e).
2. Cladding fixings: three types of cladding fixings according to family C given in EAD 090062-00-0404:
 - Aluminium alloy continuous horizontal profiles (see table A1.2.1 and figures A1.2.1), stainless steel screws for fixing to subframe and stainless-steel springs or MS adhesive spots as ancillary components.
 - Aluminium alloy discontinuous rails (see table A1.2.1 and figures A1.2.1), stainless steel screws for fixing to subframe and stainless-steel springs or MS adhesive spots as ancillary components.
 - Aluminium alloy clips (see table A1.2.2 and figures A1.2.2), stainless steel screws for fixing to subframe and NBR-PVC pieces as ancillary components.
3. Subframe components:
 - Vertical profile: Aluminium alloy T profiles
 - Bracket: Aluminium alloy supporting and retaining brackets.
 - Stainless steel screws between the vertical profile and the bracket.

A1.1 Cladding elements

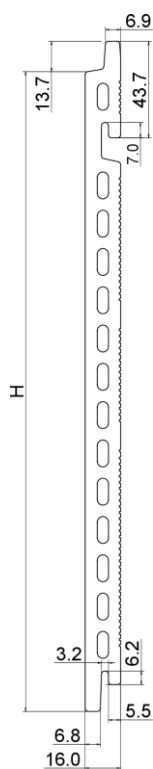


Figure A1.1a:
Tempio® FK-16 tile.

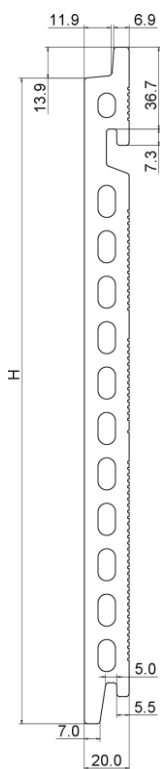


Figure A1.1b:
Tempio® FK-20 tile.

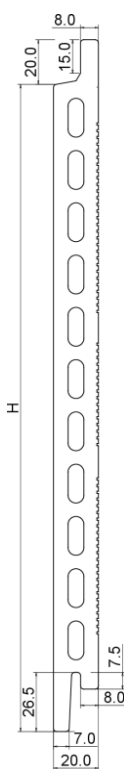


Figure A1.1c:
Tempio® FS-20 tile.

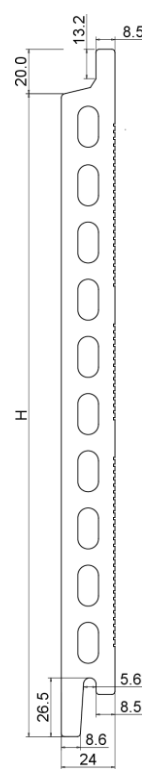


Figure A1.1d:
Tempio® FS-24 tile.

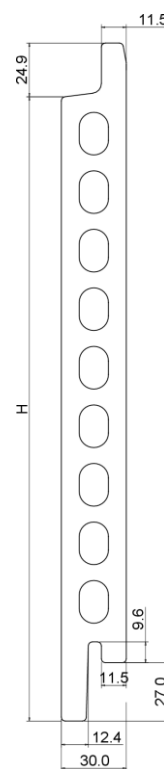


Figure A1.1e:
Tempio® FS-30 tile.

Table A1.1: Tempio® FK & Tempio® FS cladding elements.

Characteristic	Value					Reference	
	FK-16	FK-20	FS-20	FS-24	FS-30		
Form	Tile	Figure A1.1a	Figure A1.1b	Figure A1.1c	Figure A1.1d	Figure A1.1e	---
	Grooves						
Nominal length (mm)	(variable) ± 1,0 L _{max} ≤ 1200	(variable) ± 1,0 L _{max} ≤ 1500	(variable) ± 1,0 L _{max} ≤ 1500	(variable) ± 1,0 L _{max} ≤ 1500	(variable) ± 1,0 L _{max} ≤ 1500	(variable) ± 1,0 L _{max} ≤ 1500	
Nominal width (mm), H	200 ± 2,0	200 ± 2,0	200 ± 2,0	225 ± 2,0	200 ± 2,0		
	250 ± 2,5	250 ± 2,5	250 ± 2,5	250 ± 2,5	250 ± 2,5	200 ± 2,0	
	280 ± 3,0	280 ± 3,0	280 ± 3,0	280 ± 3,0	280 ± 3,0	250 ± 2,5	
	300 ± 3,0	300 ± 3,0	300 ± 3,0	300 ± 3,0	300 ± 3,0	300 ± 3,0	
	400 ± 4,0	400 ± 4,0	374 ± 3,0	400 ± 4,0	400 ± 4,0	400 ± 4,0	
	450 ± 4,0 510 ± 4,0	450 ± 4,0 545 ± 4,0	450 ± 4,0 500 ± 4,0	450 ± 4,0 500 ± 4,0	500 ± 4,0		
Thickness (mm), L	16 ± 1,6	20 ± 2,0	20 ± 2,0	24 ± 2,4	30 ± 3,0		EN ISO 10545-2
Rectangularity			± 1,0 %				
Straightness of sides			± 0,5 %				
Central curvature							
Lateral curvature			± 0,5 %				
Warping							
Surface appearance			> 95 %				
Water absorption (% weight)			2,33 % ± 0,3				
Apparent relative density (kg/m ³)			2440 ± 20				EN ISO 10545-3
Bulk density (kg/m ³)			1950 ± 19				
Apparent porosity (%)			14 ± 1				
Weight (kg/m ²)	28,5	33	31 ± 1	42	48		---
Breaking strength (N)			4117				EN ISO 10545-4
Modulus of rupture (MPa)	> 3000	> 3000	> 3000	> 3000	> 3000		EN ISO 10545-9
Resistance to thermal shock							EN ISO 10545-11
Crazing resistance for glazed tiles			No defects				EN ISO 10545-11
Frost resistance							EN ISO 10545-12

A1.2 Cladding fixings

Table A1.2.1: Horizontal profiles and discontinuous rails geometric and material properties.

Characteristic	Value						Reference
Geometric properties							
Type of profile	PSOA start-end for spring		PSOI intermediate		PSOA start-end		
	Horizont. profiles	Disconti-nuous rails	Horizont. profiles	Disconti-nuous rails	Horizont. profiles	Disconti-nuous rails	
Form and dimensions	Figure A1.2.1a		Figure A1.2.1b		Figure A1.2.1c		
Standard length	4,0 m	101 mm	4,0 m	101 mm	4,0 m	101 mm	
Weight per linear metre (g/m)	459		564		337		---
Cross section (mm ²)	170,07		208,73		124,80		
Inertia of profile section	I_{xx} (cm ⁴)	5,18	8,16		1,67		
	I_{yy} (cm ⁴)	0,51	0,97		0,23		
Material properties							
Material (*)	Aluminium alloy AW 6063 T5			Aluminium alloy AW 6005 T6			
Durability class	B						
Specific weight (kg/m ³)	2700						
Elastic limit $R_{p0,2}$ (MPa)	≥ 130			≥ 225			
Elongation (%)	≥ 6			≥ 8			
Tensile strength R_m (MPa)	≥ 175			≥ 270			EN 1999-1-1 EN 755-2
Modulus of elasticity at 20 °C (MPa)	70000						
Poisson coefficient	0,3						
Coefficient of thermal expansion between 50 °C and 100 °C (µm/(m·°C))	23,0						
(*) Other aluminium alloys according to EN 755-2 with better material mechanical properties than AW 6063 T5 may be used.							

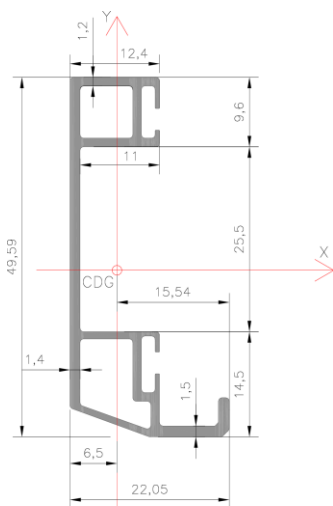


Figure A1.2.1a: PSOA with spring.

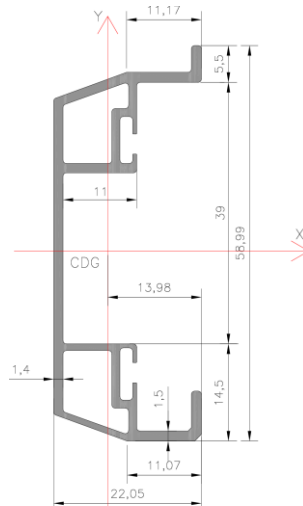


Figure A1.2.1b: PSOI.

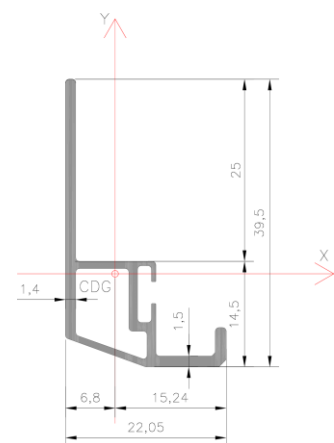


Figure A1.2.1c: PSOA small.

Table A1.2.2: Clips geometric and material properties.

Characteristic	Value				Reference
Geometric properties					
Type of profile	Start-end clip FS 20-24	Start-end clip FS 30	Intermediate clip FS 20-24	Intermediate clip FS 30	
Form and dimensions	Figure A1.2.2a	Figure A1.2.2b	Figure A1.2.2c	Figure A1.2.2d	---
Weight per linear metre (g/m)	389	492	602	997	
Standard length (mm)	20,0				
Cross section (mm ²)	144	182	223	369	
Material properties					
Material (*)	Aluminium alloy AW 6005 T6				
Durability class	B				
Specific weight (kg/m ³)	2700				
Elastic limit R _{p0,2} (MPa)	≥ 190				
Elongation (%)	≥ 5				
Tensile strength R _m (MPa)	≥ 230				EN 1999-1-1
Modulus of elasticity at 20 °C (MPa)	70000				EN 755-2
Poisson coefficient	0,3				
Coefficient of thermal expansion between 50 °C and 100 °C (µm/(m·°C))	23,0				

(*) Other aluminium alloys according to EN 755-2 with better material mechanical properties than AW 6005 T6 may be used.

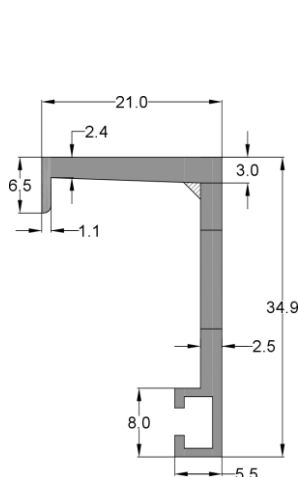


Figure A1.2.2a: Start-end clip FS 20-24.

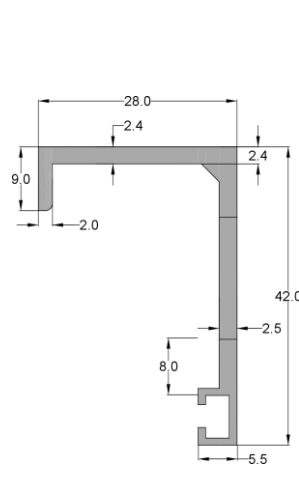


Figure A1.2.2b: Start-end clip FS 30.

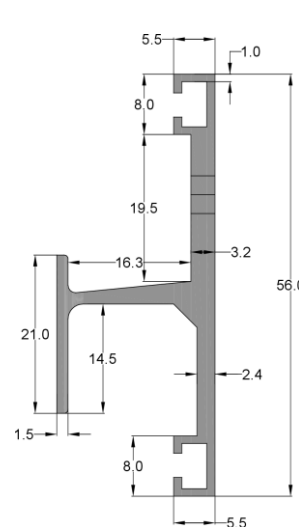


Figure A1.2.2c: Intermediate clip FS 20-24.

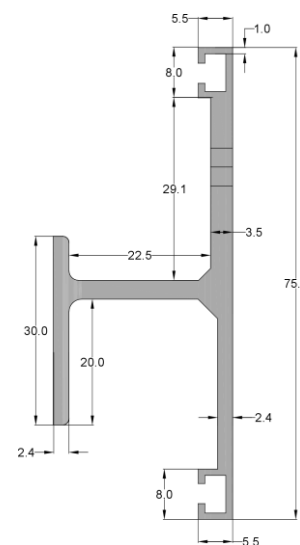


Figure A1.2.2d: Intermediate clip FS 30.

Table A1.2.3: Ancillary components.

Component	Characteristic	Value	Reference
Clip joint	Trade name	NBR-PVC piece	---
	Material	NBR-PVC	---
	Density (kg/m ³)	1,32 ± 0,03	ISO 1183 A
	Hardness, 15 sec (ShA)	65 ± 3	ISO 868
	Tensile strength (MPa)	≥ 12	ASTM D 412
	Elongation at break (%)	≥ 300	
	Tear strength (N/mm)	≥ 30	ASTM D 624
	Melt mass-flow rate (MFR) (2,16 kg/190°C), 10 min (g)	≥ 12	ISO 1133
Metallic spring	Trade name	Spring for discontinuous rail and horizontal profile	---
	Material	1.4310 (X10CrNi18-8)	EN 10088-X

A1.3 Subframe

Table A1.3.1.: Tempio® FK and Tempio® FS vertical profiles geometric and material properties.

Geometric properties						
Type of profile	Form and dimensions	Weight per linear metre (kg/m)	Cross section (mm ²)	Inertia of profile section (cm ⁴)		
				I _{xx}	I _{yy}	
T 40x50	40 x 50 x 3,0	Figure A1.3.1a	0,715	265	1,61	6,70
T 105x60	105 x 63 x 2,0	Figure A1.3.1b	1,212	449	21,15	16,24
T 120x50	120 x 50 x 3,0	Figure A1.3.1c	1,364	505	43,21	8,96
Material properties						
Characteristic	Value			Reference		
Material (*)	EN AW-6063					
Treatment	T5					
Durability class	B					
Specific weight (kg/m ³)	2700					
Elastic limit (MPa)	130					
Elongation (%)	≥ 6			EN 755		
Tensile strength (MPa)	175			EN 1999-1		
Modulus of elasticity (MPa)	70000					
Poisson coefficient	0,3					
Coefficient of thermal expansion between 50 °C and 100 °C (µm/(m·°C))	23,0					
(*) Other aluminium alloys according to EN 755-2 with better material mechanical properties than AW 6063 T5 may be used.						

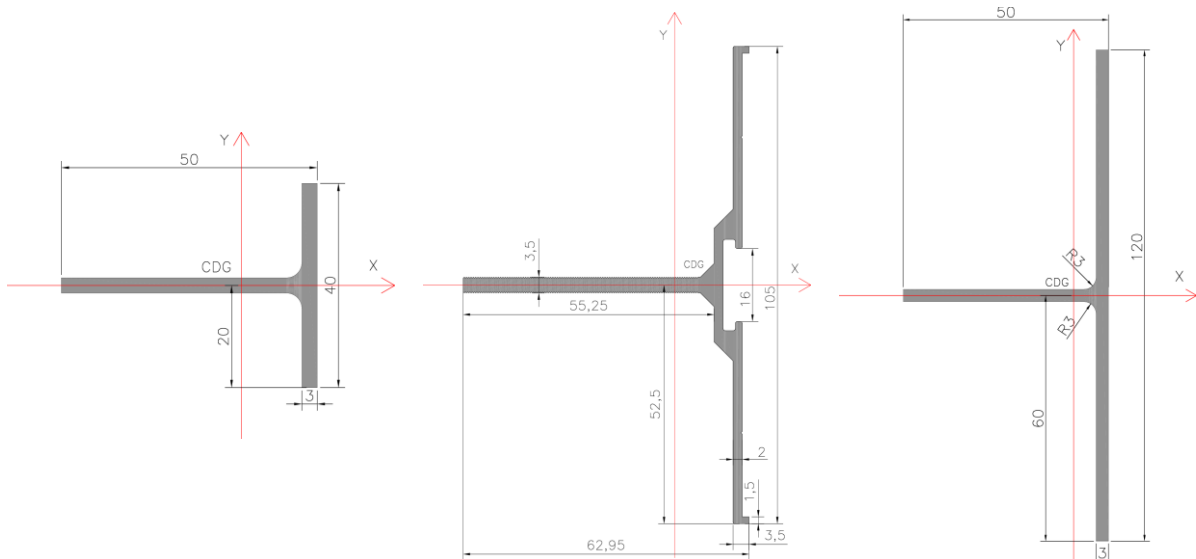


Figure A1.3.1a: T40x50x3.

Figure A1.3.1b: T105x63x2.

Figure A1.3.1c: T120x50x3.

Table A1.3.2: Tempio® FK and Tempio® FS brackets geometric and material properties.

Geometric properties		
Type of bracket	Form and dimensions	Mass per unit (kg)
Supporting brackets	MS-80x90x50x4	0,12
	MS-100x90x50x4	0,14
	MS-120x90x50x4	0,16
	MS-140x90x50x4	0,17
Retaining brackets	MR-80x60x50x4	0,08
	MR-100x60x50x4	0,10
	MR-120x60x50x4	0,11
	MR-140x60x50x4	0,12
Material properties		
Characteristic	Value	Reference
Material (*)	EN AW-6063	
Treatment	T5	
Durability class	B	
Specific weight (kg/m ³)	2700	
Elastic limit (MPa)	130	
Elongation (%)	6	EN 755
Tensile strength (MPa)	175	EN 1999-1
Modulus of elasticity (MPa)	70000	
Poisson coefficient	0,3	
Coefficient of thermal expansion between 50 °C and 100 °C (µm/(m·°C))	23,0	
(*) Other aluminium alloys according to EN 755-2 with better material mechanical properties than AW 6063 T5 may be used.		

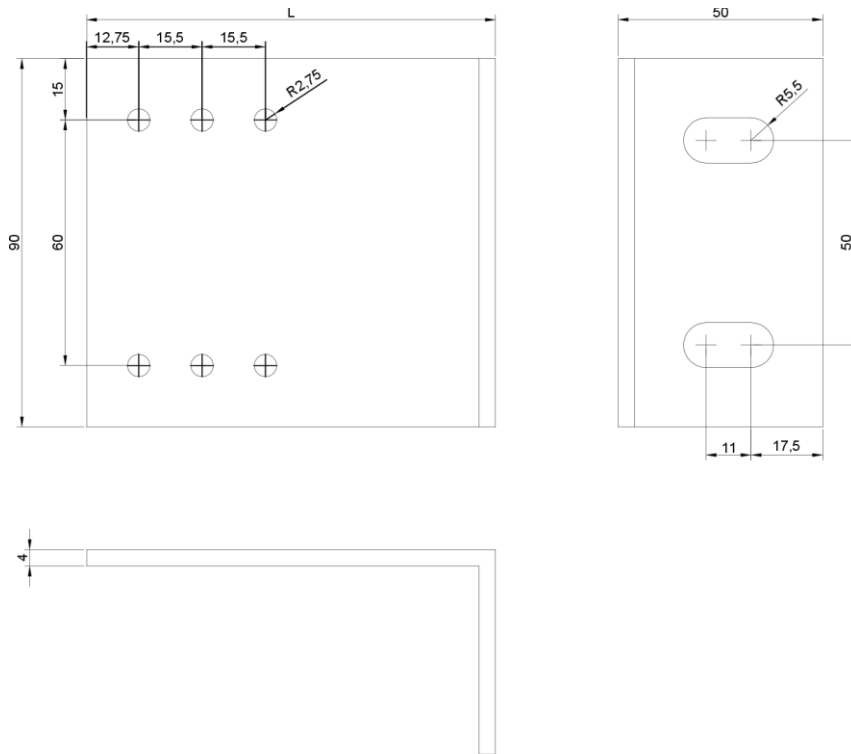


Figure A1.3.2a: Supporting bracket MS-Lx90x50x4.

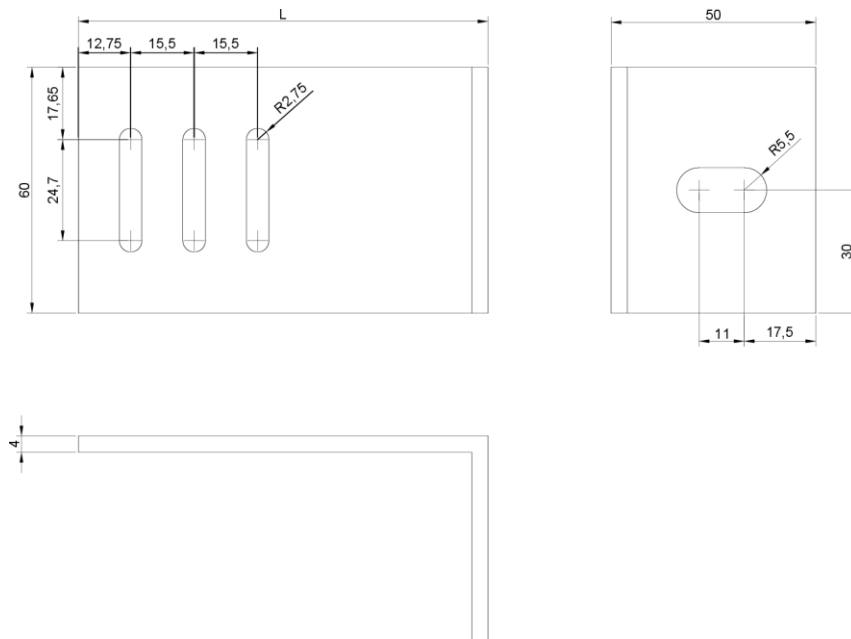


Figure A1.3.2b: Retaining brackets MR-Lx60x50x4.

Table A1.3.3: Tempio® FK and Tempio® FS subframe fixing.

Fixing elements	Geometry		Material		Reference
Position	Type	Description	Type	Class	---
Between the cladding fixing (clip, discontinuous rail or horizontal profile) and the vertical profiles	Self-drilling screws	5,5 x L	Stainless steel	A2-70	EN ISO 3506-4 EN ISO 15480 EN ISO 10666
Between the vertical profile and the bracket					

ANNEX 2: Essential construction details

A2.1 Tempio® FK kit

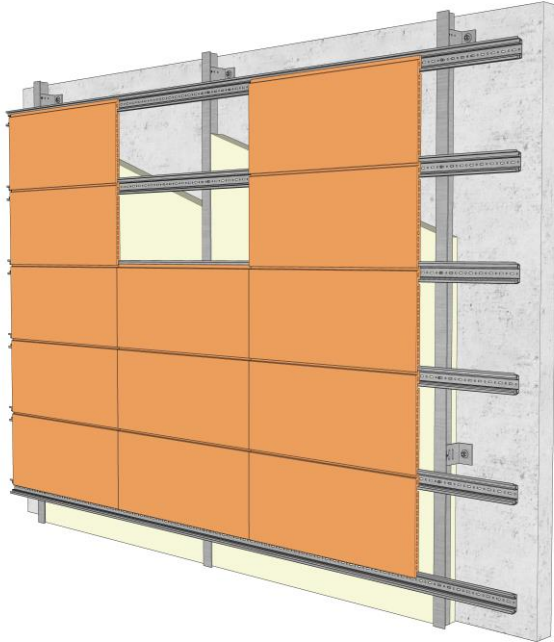


Figure A2.1.1a: Tempio® FK kit with horizontal profiles. General view.

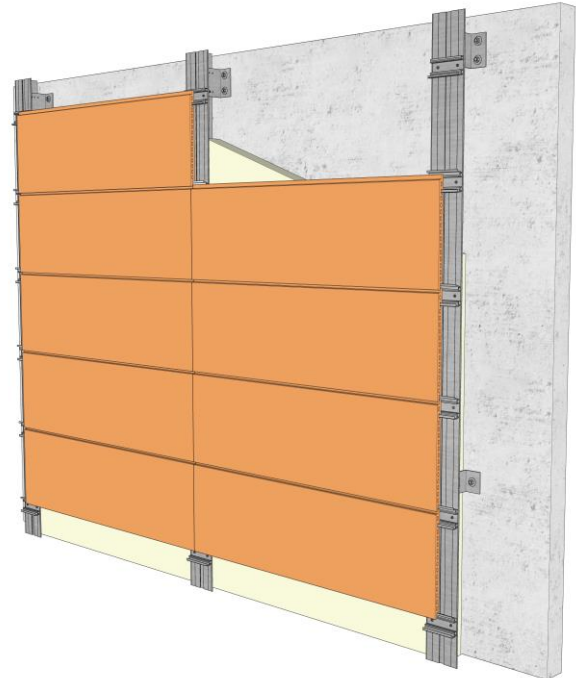


Figure A2.1.1b: Tempio® FK kit with discontinuous rails. General view.

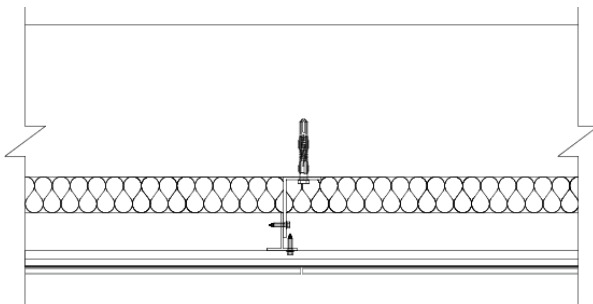


Figure A2.1.2a: Tempio® FK kit with horizontal profiles. Horizontal section.

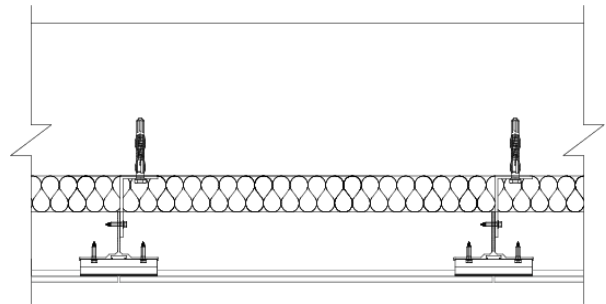


Figure A2.1.2b: Tempio® FK kit with discontinuous rails. Horizontal section.

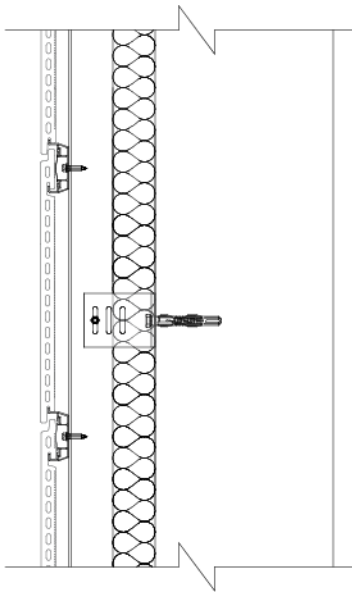


Figure A2.1.3: Tempio® FK kit. Vertical section.

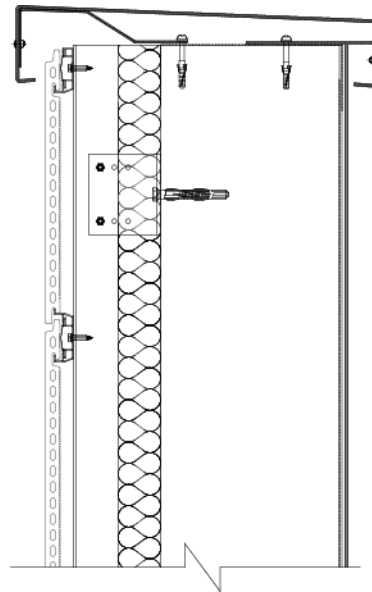


Figure A2.1.4: Tempio® FK kit. Vertical section. Roof edge.

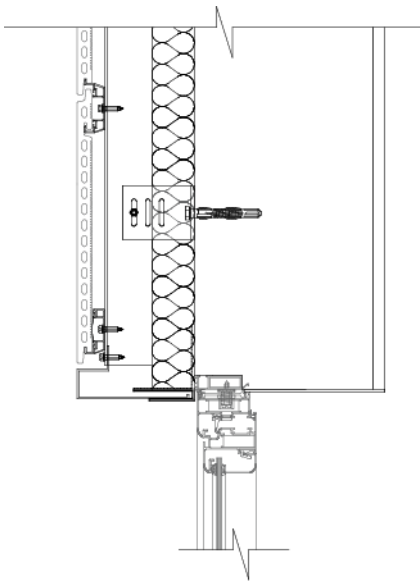


Figure A2.1.5a: Tempio® FK kit. Aluminium lintel.

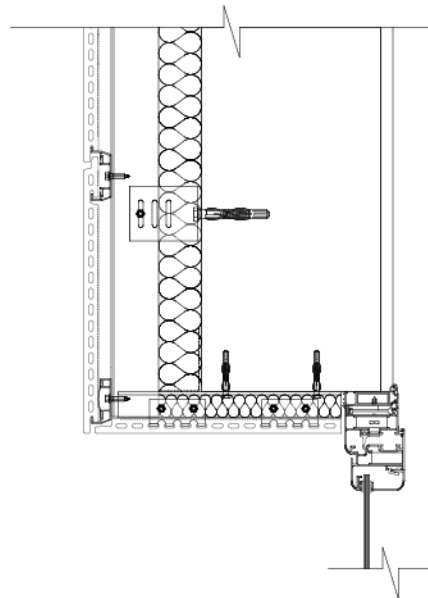


Figure A2.1.5b: Tempio® FK kit. Ceramic lintel.

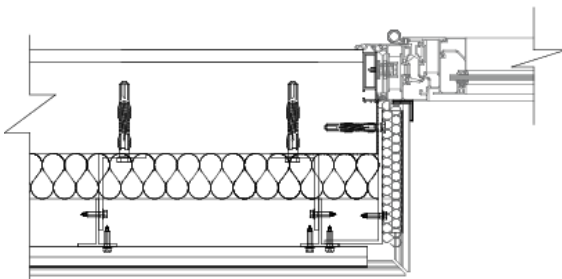


Figure A2.1.6a: Tempio® FK kit with horizontal profiles. Jamb (Option 1).

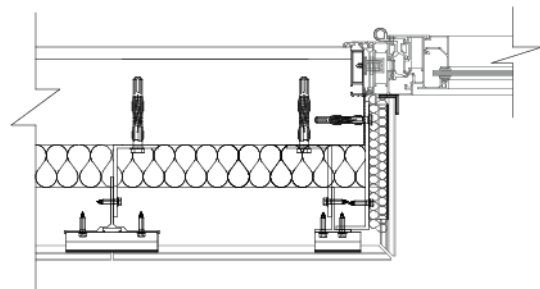


Figure A2.1.6b: Tempio® FK kit with discontinuous rail. Jamb (Option 1).

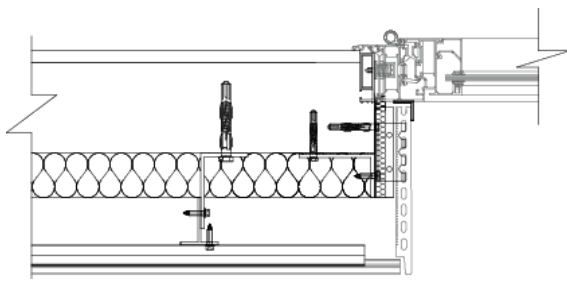


Figure A2.1.6c: Tempio® FK kit with horizontal profiles. Jamb (Option 2).

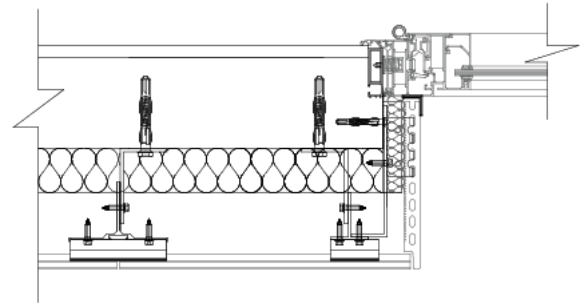


Figure A2.1.6d: Tempio® FK kit with horizontal profiles. Jamb (Option 3).

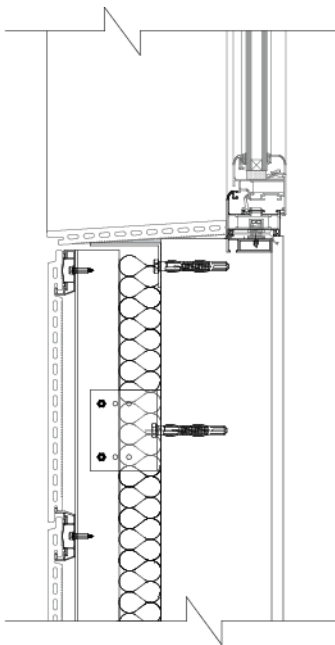


Figure A2.1.7a: Tempio® FK kit. Ceramic Sill.

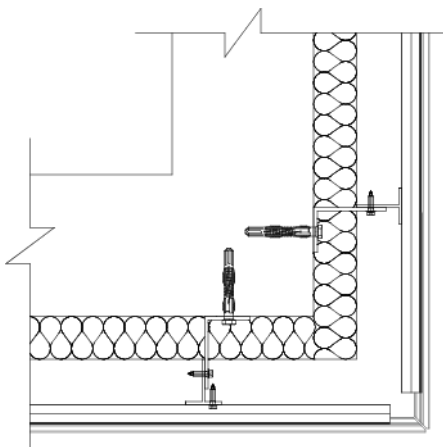


Figure A2.1.8a: Tempio® FK kit with horizontal profile. Convex corner.

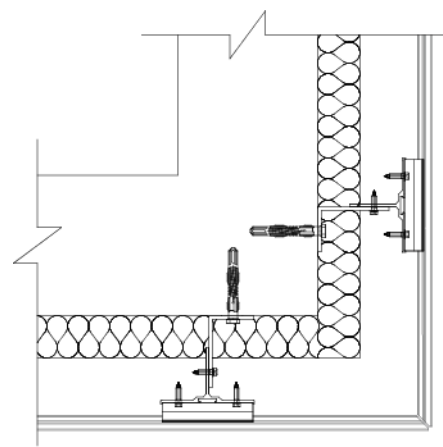


Figure A2.1.8b: Tempio® FK kit with discontinuous rail profile. Convex corner.

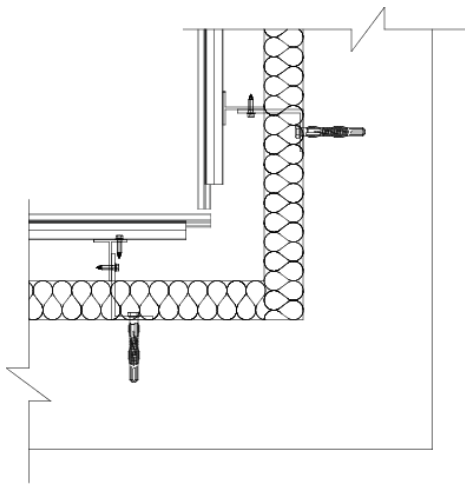


Figure A2.1.9a: Tempio® FK kit with horizontal profile. Concave corner.

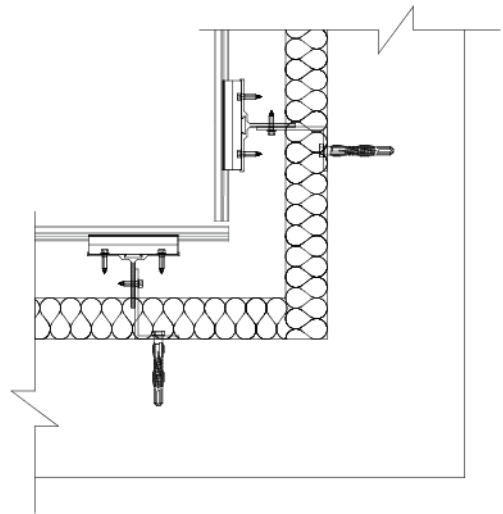


Figure A2.1.9b: Tempio® FK kit with discontinuous rail profile. Concave corner.

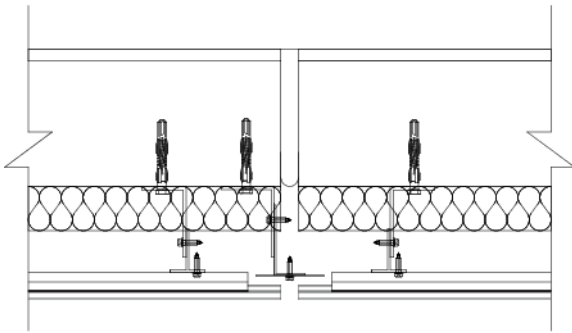


Figure A2.1.10a: Tempio® FK kit with horizontal profile. Movement joint.

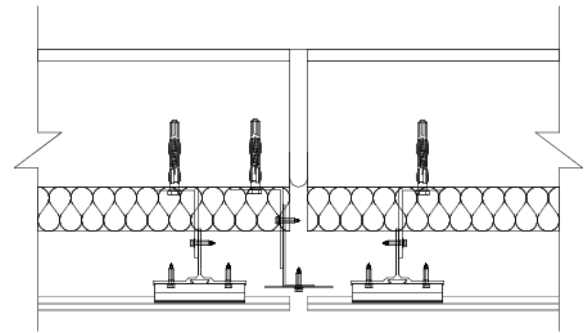


Figure A2.1.10b: Tempio® FK kit with discontinuous rail profile. Movement joint.

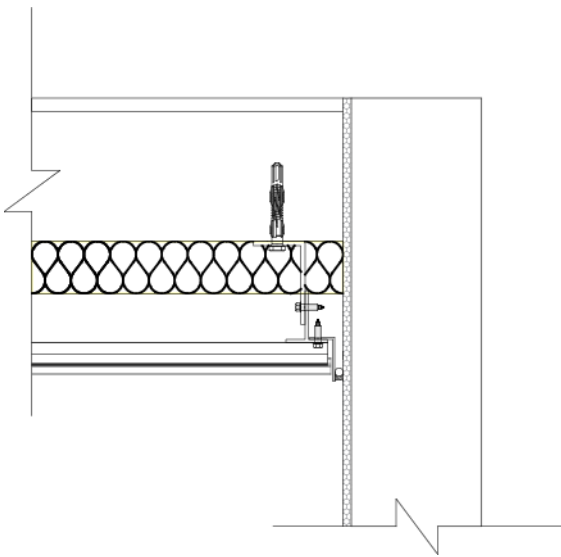


Figure A2.1.11a: Tempio® FK kit with horizontal profile. Side termination.

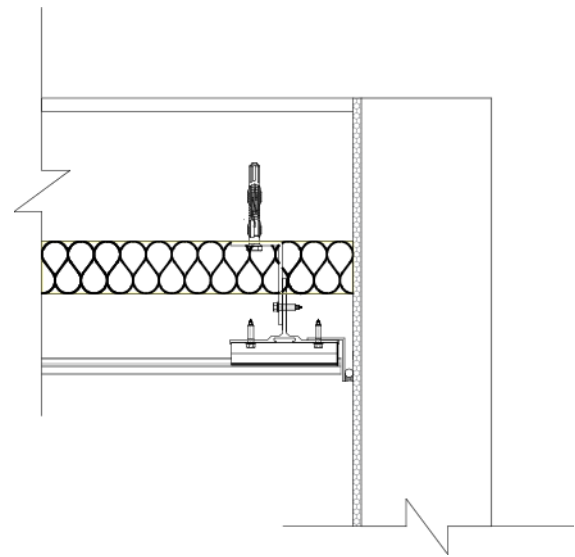


Figure A2.1.11b: Tempio® FK kit with discontinuous rail profile. Side termination.

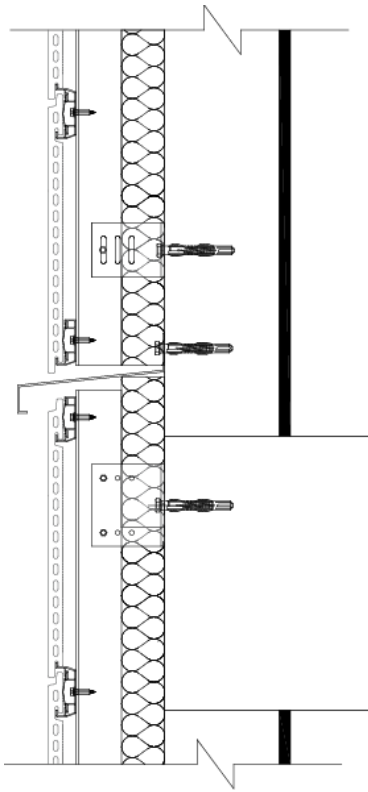


Figure A2.1.12: Tempio® FK kit. Compartmentation of air space.

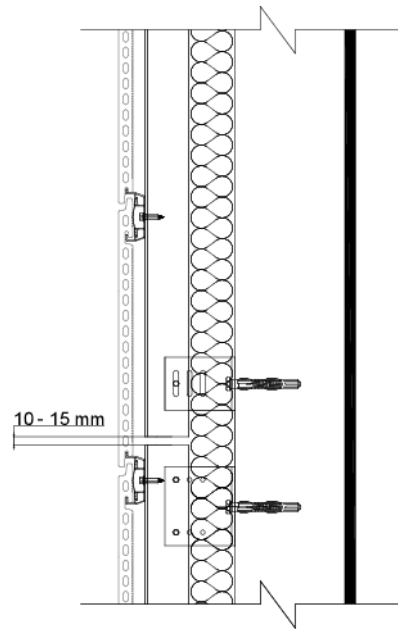


Figure A2.1.13: Tempio® FK kit. Joint between two vertical profiles.

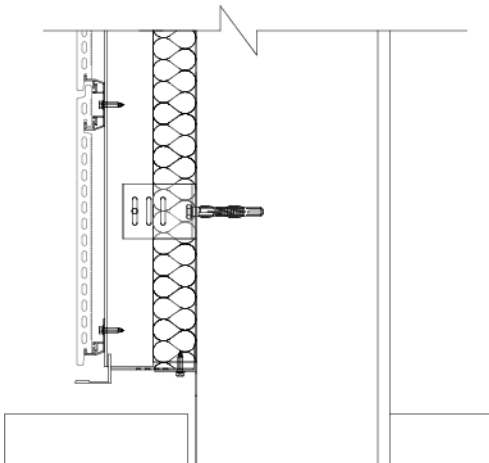


Figure A2.1.14: Tempio® FK kit. Base edge.

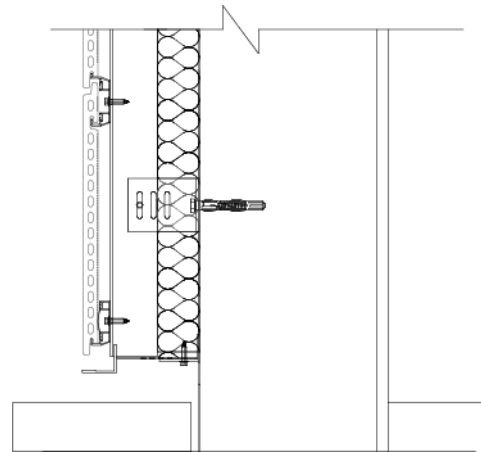


Figure A2.1.15: Tempio® FK kit. Base edge.

A2.2 Tempio® FS kit

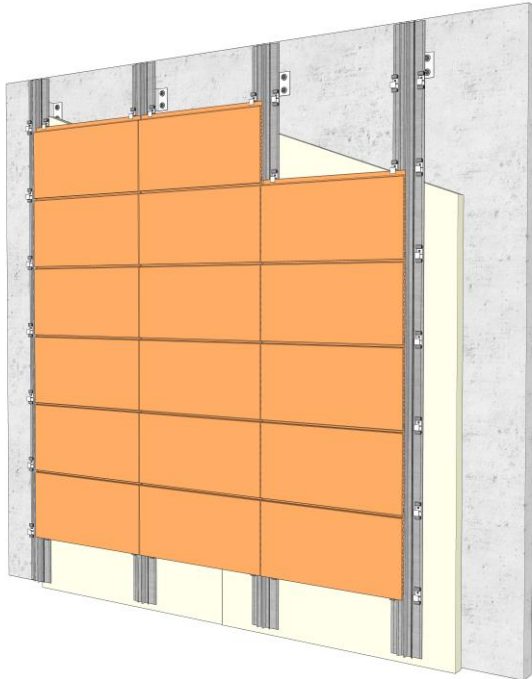


Figure A2.2.1: Tempio® FS kit. General view.

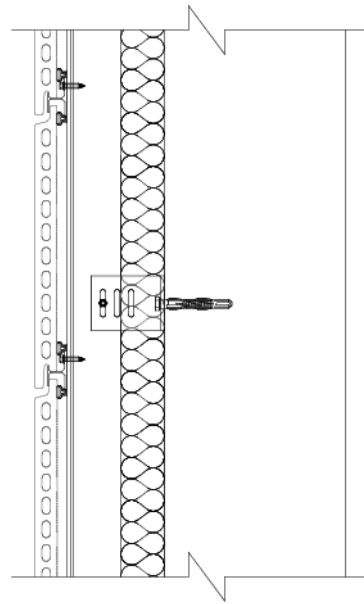


Figure A2.2.2: Tempio® FS kit. Vertical section.

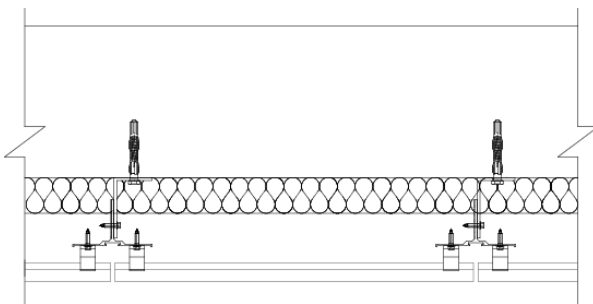


Figure A2.2.3a: Tempio® FS with T105x60. Horizontal section.

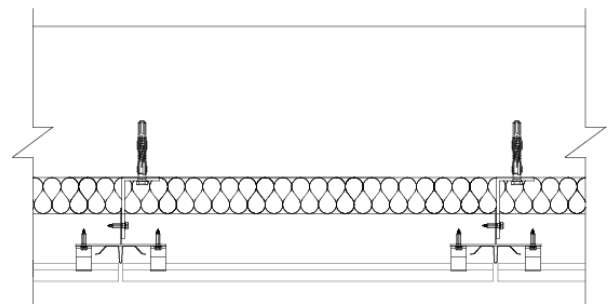


Figure A2.2.3b: Tempio® FS with T120x50. Horizontal section.

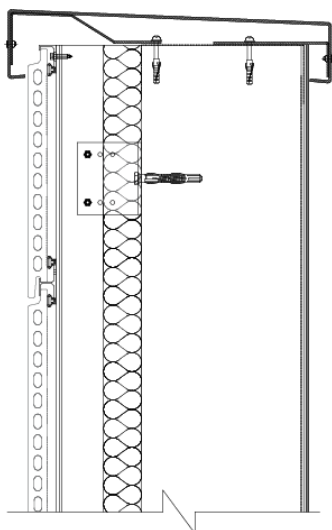


Figure A2.2.4: Tempio® FS kit. Roof edge.

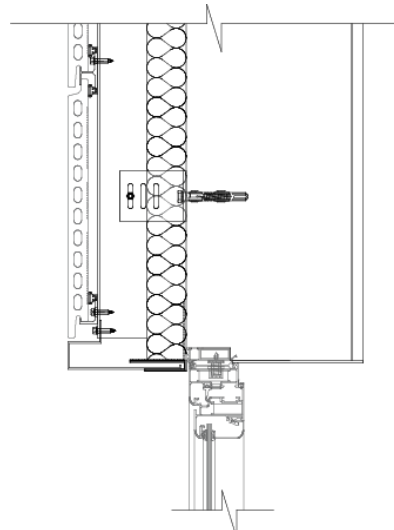


Figure A2.2.5: Tempio® FS kit. Lintel.

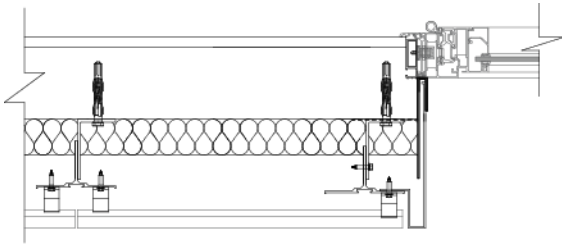


Figure A2.2.6a: Tempio® FS kit with T105x60. Aluminium Jamb.

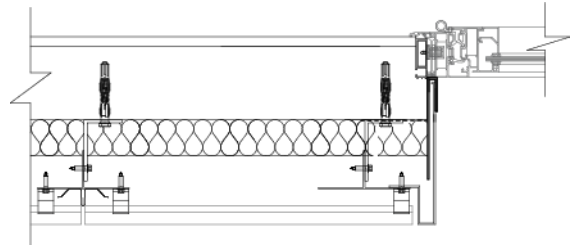


Figure A2.2.6b: Tempio® FS kit with T120x50. Aluminium Jamb.

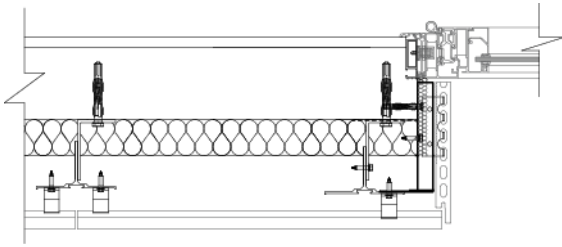


Figure A2.2.6c: Tempio® FS kit with T105x60. Ceramic Jamb (Option 1).

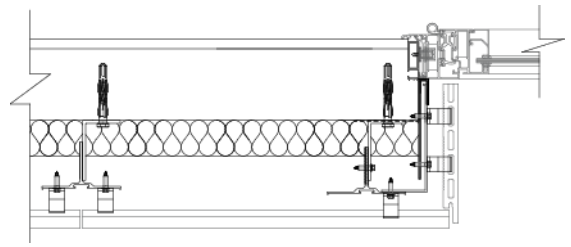


Figure A2.2.6d: Tempio® FS kit with T105x60. Ceramic Jamb (Option 2).

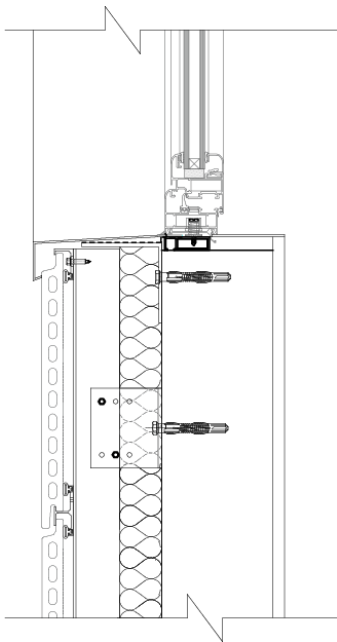


Figure A2.2.7: Tempio® FS kit. Sill.

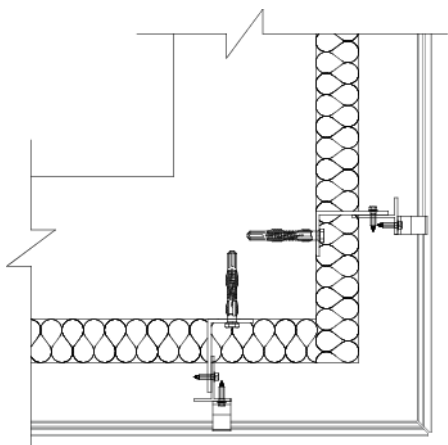


Figure A2.2.8a: Tempio® FS kit with T105x60. Convex corner.

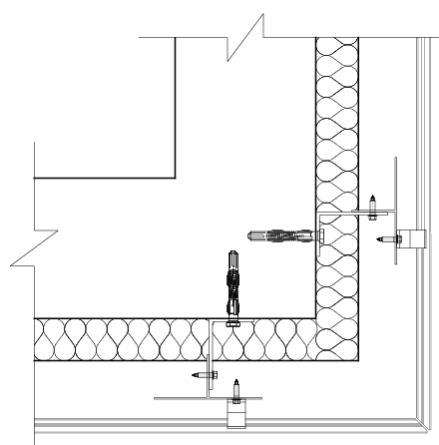


Figure A2.2.8b: Tempio® FS kit with T120x50. Convex corner.

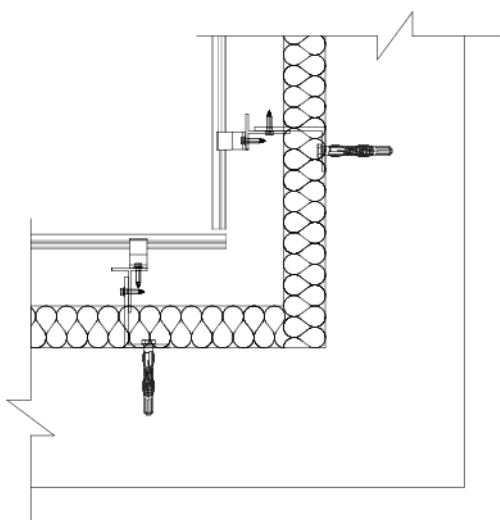


Figure A2.2.9a: Tempio® FS kit with T105x60. Concave corner.

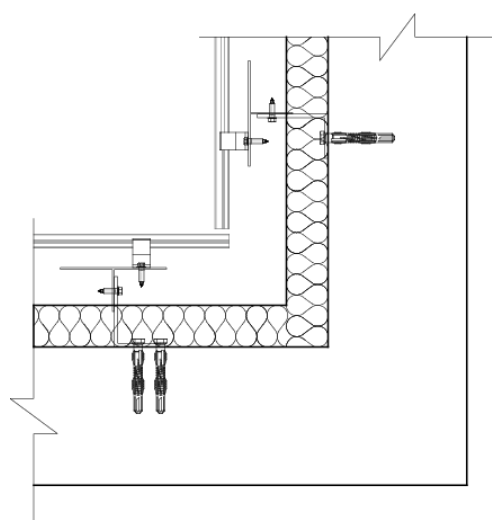


Figure A2.2.9b: Tempio® FS kit with T120x50. Concave corner.

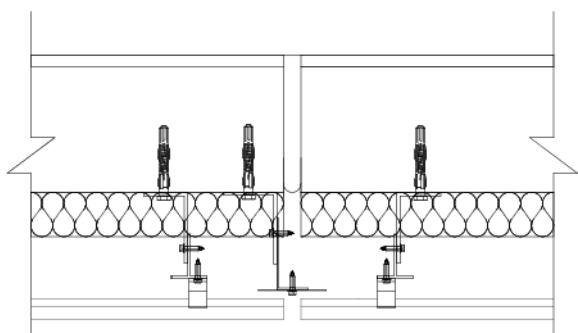


Figure A2.2.10a: Tempio® FS kit with T105x60. Movement joint.

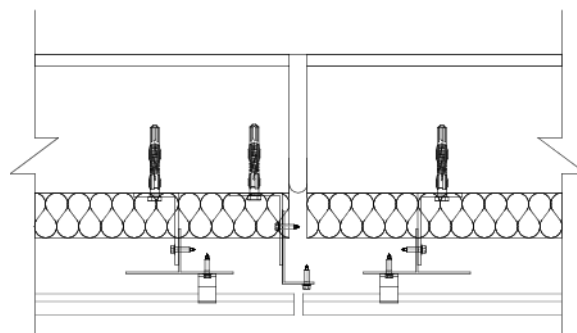


Figure A2.2.10b: Tempio® FS kit with T120x50. Movement joint.

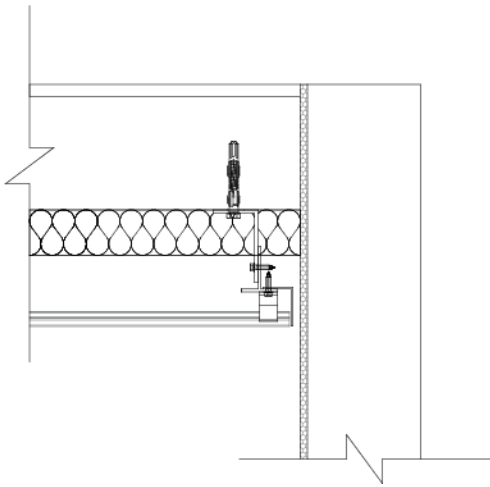


Figure A2.2.11a: Tempio® FS kit with T105x60. Side termination.

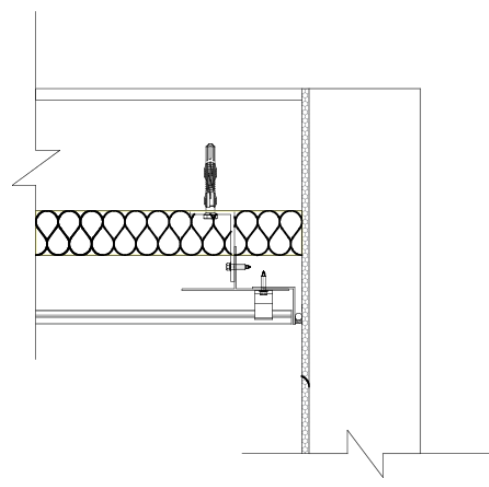


Figure A2.2.11b: Tempio® FS kit with T120x50. Side termination.

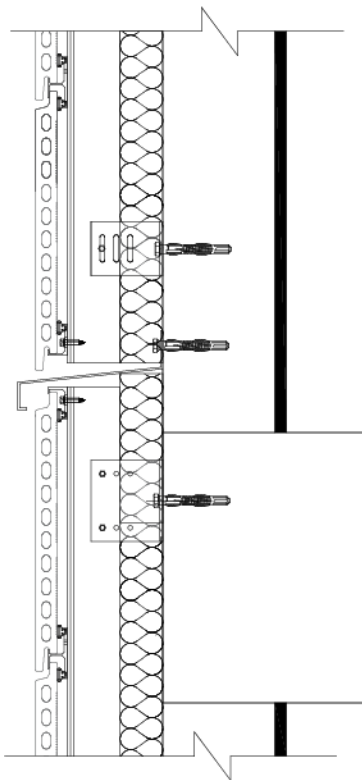


Figure A2.2.12: Tempio® FS kit. Compartmentation of air space.

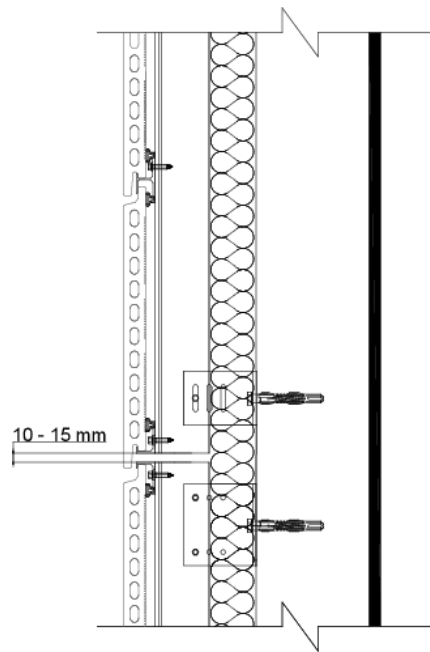


Figure A2.2.13: Tempio® FS kit. Joint between two vertical profiles.

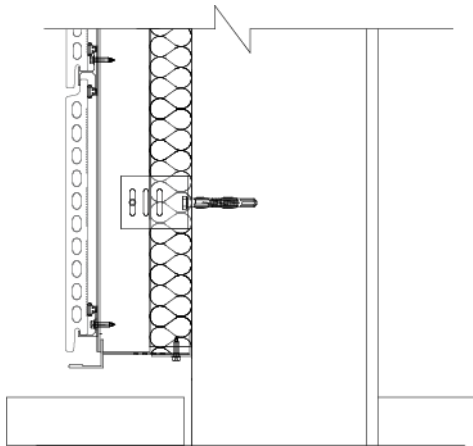


Figure A2.2.14: Tempio® FS kit. Base edge.

ANNEX 3: Design, installation, maintenance and repair criteria

A3.1 Design

The design of the external wall claddings for ventilated façades using Tempio® FK and Tempio® FS kits should consider:

- It is assumed that the substrate wall meets the necessary requirements regarding the mechanical strength (resistance to static and dynamic loads) and the airtightness, as well as the relevant resistance regarding watertightness and water vapour.
- The verification of the designed system by means of calculation, taking into account the mechanical characteristic values of the kit components in order to resist the actions (dead loads, wind loads, etc.) applying on the specific works. National safety factors and other national provisions must be followed.
- The selection and verification of the brackets which support the subframe vertical profiles considering compatible materials (e.g. aluminium alloy) and the mechanical resistance (vertical and horizontal resistance) according to the envisaged actions obtained from the mechanical calculation of the designed system.
- The selection and verification of the anchors between the brackets and the external walls (substrate), taking into account the substrate material and the minimum resistance required (pull-out and shear resistance) according to the envisaged actions obtained from the mechanical calculation of the designed system.
- The accommodation of the designed system movements to the substrate or structural movements.
- The execution of singular parts of the façade; some examples of construction details are indicated in Annex 2.
- The corrosion protection of the designed system metallic components taking into account the category of corrosivity of the atmosphere of works (e.g. acc. ISO 9223).
- The drainability of the ventilated air space between the cladding elements and the insulation layer or the external wall accordingly.
- An insulation layer is usually fixed on the external wall and should be defined in accordance with a harmonized standard or a European technical assessment and taking into account the section 3.1 of this ETA.
- Because the joints are not watertight, the first layer behind ventilated air space (e.g. insulation layer) should be composed by materials with low water absorption.

A3.2 Installation

Installation of the external wall claddings for ventilated façades using Tempio® FK and Tempio® FS kits should be carried out:

- According to the specifications of the manufacturer and using the components specified in this ETA.
- In accordance with the design and drawings prepared for the specific works. The manufacturer should ensure that the information on these provisions is given to those concerned.
- By appropriately qualified staff and under the supervision of the technical responsible of the specific works.

A3.3 Maintenance and repair

Maintenance of the external wall claddings for ventilated façades using Tempio® FK and Tempio® FS kits includes inspections on site, taking into account the following aspects:

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

When necessary, any repair to localized damaged areas must be carried out with the same components and following the repair instructions given by the manufacturer.