Integration substructure samples with integrated PV modules for laboratory testing

Integration substructure

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Adaptable and adaptive RES envelope solutions to maximise energy harvesting and optimize EU building and district load matching

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1. Description of all necessary functional samples for laboratory testing at system level (structure + PV-laminates from Onyx) for roof and façade configurations.

1.1 Integration substructure

The technical work to be performed by TULIPPS will be focused on the optimization of several aspects like rear side assembly, mounting design and manufacturability for pre-fab pitched roofs and façade building skins. Size and shape flexibility must be guaranteed in order to comply with one of the main requirements from the BIPV market, which is the flexibility of design. In the same sense, a range of solutions have to be worked out in terms of combination (gluing) with different PV module materials (glass or composite, in cooperation with ONYX and TECNALIA), as well as integration within the building (in collaboration with BOUYGUES). The main output of this task will be the manufacturing of all the necessary functional samples for laboratory testing at system level (structure + PV modules) for roof and façade configurations, which will be performed in task 3.8. These samples will be manufactured by TULIPPS including the PV modules from other tasks.

Following table shows an overview of samples and materials for Indoor testing to be delivered by TULiPPS and Plastica

TEST	Structures / Rear frames from **TULIPPS**					mounting rails from Plastica			FIRE Hazard	
TEST	number of Tulipps frames	code number rear frame	pv-laminate dimensions (glass+glass)	Type	Comments	project numbers	mounting rails	railtype	mechanical support	retention
EAN13823	3	14913xx	500x1500(3+3)	Façade	1 frame for 1 laminate	1916	5 verticale rails 1500	A	yes	yes
EAN13823	3	14913xx	205x 500 (3+3)	Façade	1 frame for 1 laminate	1916			yes	yes
EAN13823	3	14913xx	800x500x(3+3)	Façade	1 frame for 1 laminate	1916			yes	yes
EAN13823	3	14913xx	800 x 1000(3+3)	Façade	1 frame for 1 laminate	1916			yes	yes
EAN13823	3	14913xx	205x1000(3+3)	Façade	1 frame for 1 laminate	1916			yes	yes
CEN TS 1187	4	14913xx	400x900x(3+3)	Roof without overlapping	1 frame for 1 laminate	1912	3 vertical rails 1800	B + TF27	yes	yes
CEN TS 1187	3	1492301	900x350 (3+3)	Roof without overlapping	1 frame for 1 laminate	1912	2 vertical rails 1800	B + TF27	yes	no
impact	3	1492301	900x350 (3+3)	Façade	1 frame for 1 laminate	1914-1	2 vertical rails 350	A	no	yes
CEN TS 1187	3	1492401	900x1420 (3+3)	Roof without overlapping	1 frame for 1 laminate	1912			yes	no
suction + impact	5	1492401	900x1420 (3+3)	Roof system	1 frame for 1 laminate	1913-3 + 1914-3	2 vertical rails 1420	B + TF27	yes	no
suction	1	1492201	900x1070(3+3)	Façade	1 frame **for 3 laminates**	1913-1	2 vertical rails 1070		yes	yes
suction + impact	6	1492100	1508x1325 (4+4)	Window block	1 frame for 1 laminate	1913-2 + 1914-2	2 vertical rails 1325	B	yes	yes
	5	1492002	900x890	Roof - composite	1 frame for 1 laminate	1915	2 vertical rails 890	B + TF27	no	no
	45									

Following drawings show all variants of test samples that will be produced by TULiPPS.

Test set up for EN 13823 (Project number 1916)

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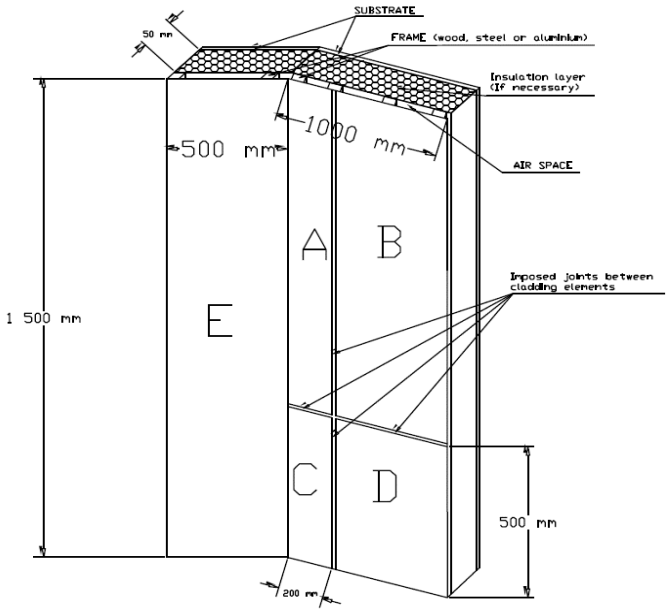
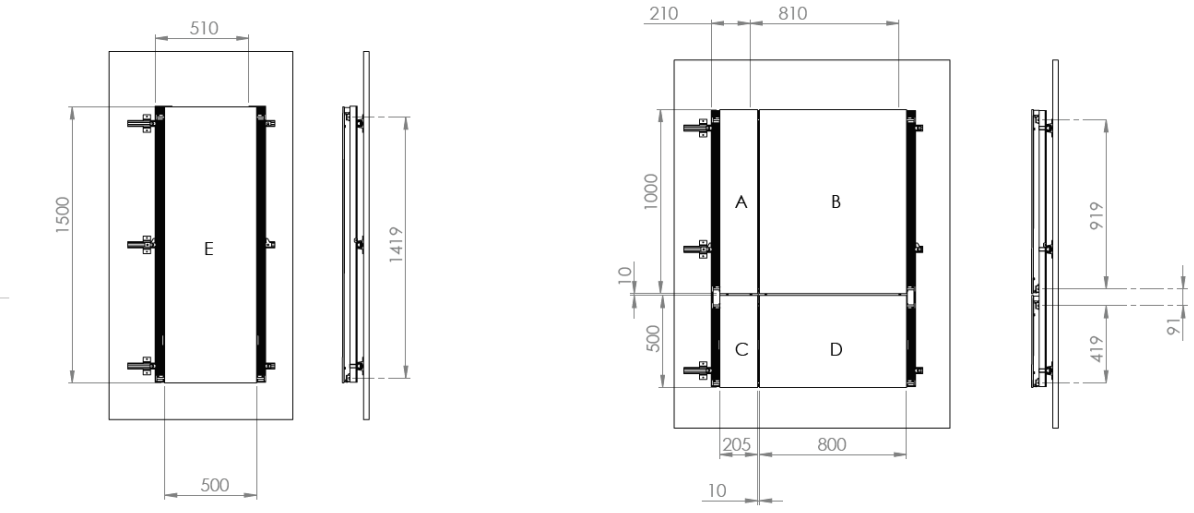


The drawing shows the dimensioned test set-up

1916 EN 13825 Fire test setups



1 set of mounting rails
3 sets of PV panels (A-E)

CEN TS 1187 Fire test on pitched roofs (project number 1912)

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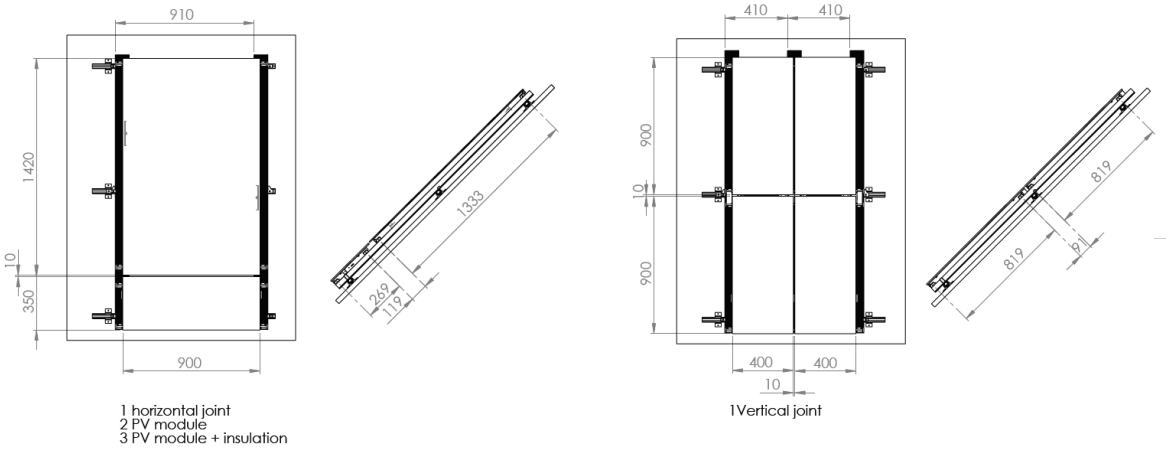
1912 CEN TS 1187 Fire test setups

Roof, Non overlapping



1 horizontal joint
2 PV module
3 PV module + insulation

1Vertical joint

1 set of mounting rails, to be adjusted for the needed setup

EAD 090062-00-0404 (previously ETAG 034)

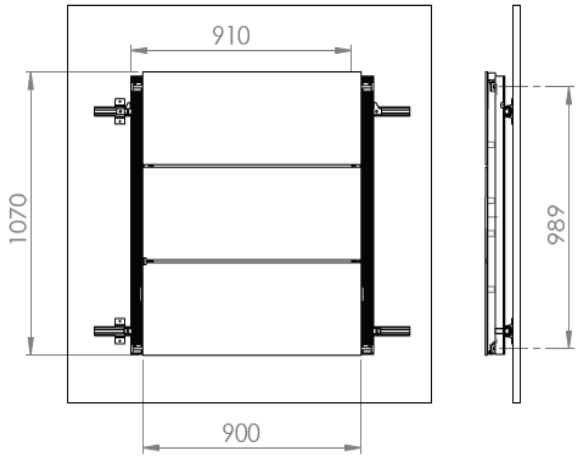
Wind load resistance

Impact on façade

Hail impact

1913 Wind suction & 1914 Impact tests setups

1913-1 Wind suction: 1 pv module - 3x 900x350x3/3 or



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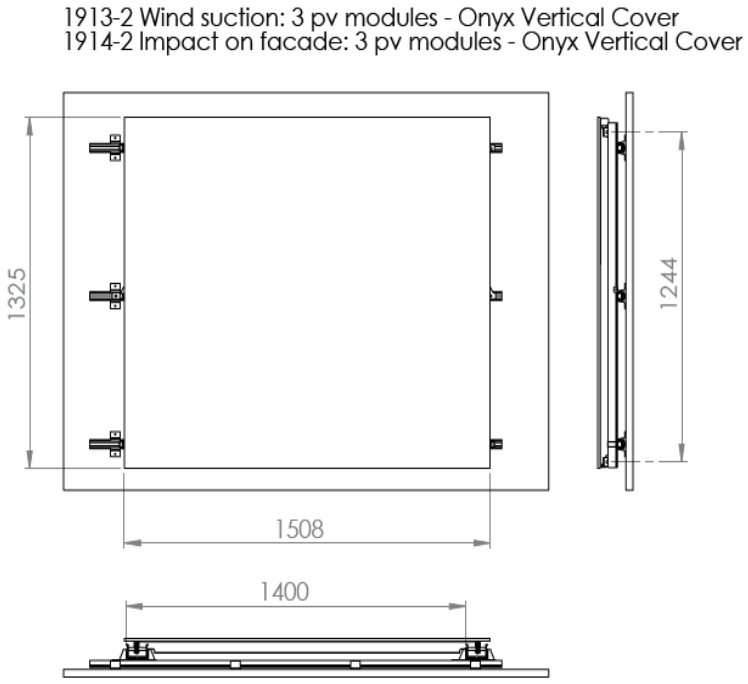
For the parapet and roof of Casa Spa (Italy) and for the facades of The French and Swedish demo cases PV laminates of 900 x 350mm are designed. Tulipps has designed one frame on which three modules are glued, as shown in the drawing above.



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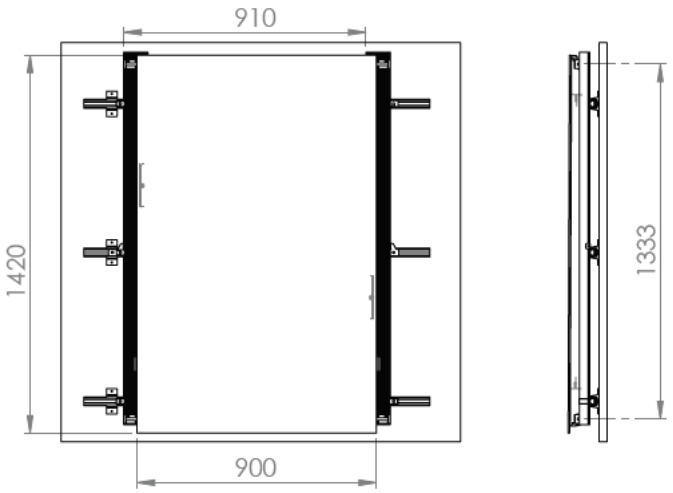
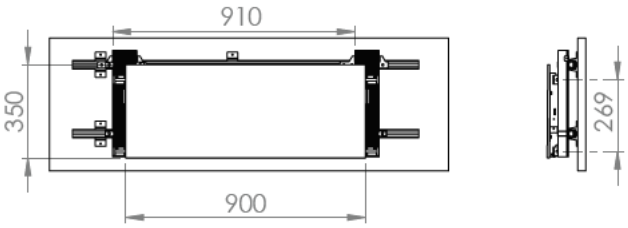
1913-3 Wind suction: 3 pv modules - 900x1420x3/3
1914-3 Impact on facade: 2 pv modules - 900x1420x3/3



1914-1 Impact on facade: 3 pv modules - 900x350x3/3



Impact and suction on composite modules (project number 1915)

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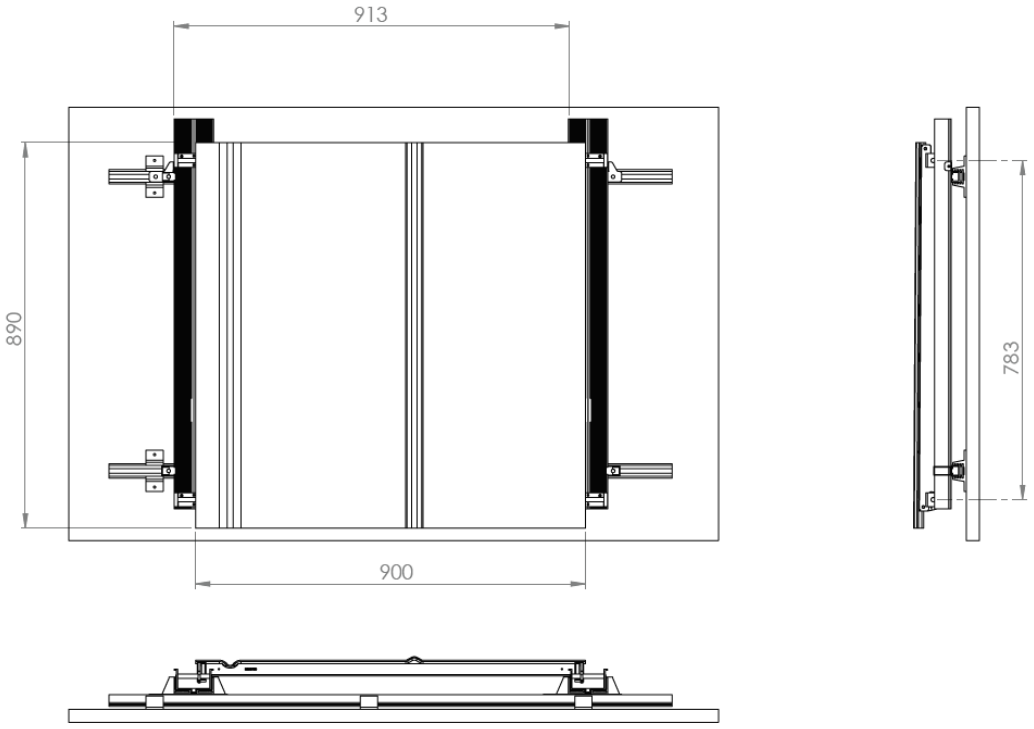

1.2 Prototype parts for manufacturing of the frames

1.2.1 Frame profiles

Following picture shows the aluminum profiles in several strengths and lengths ready to be assembled for manufacturing of the samples to be tested.

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1.2.2 Locking plates, sliding plates and locking connectors

Following pictures show boxes with exchangeable plates that are fixed at the ends of the rear frame profiles. They are made of polymer or stainless steel.

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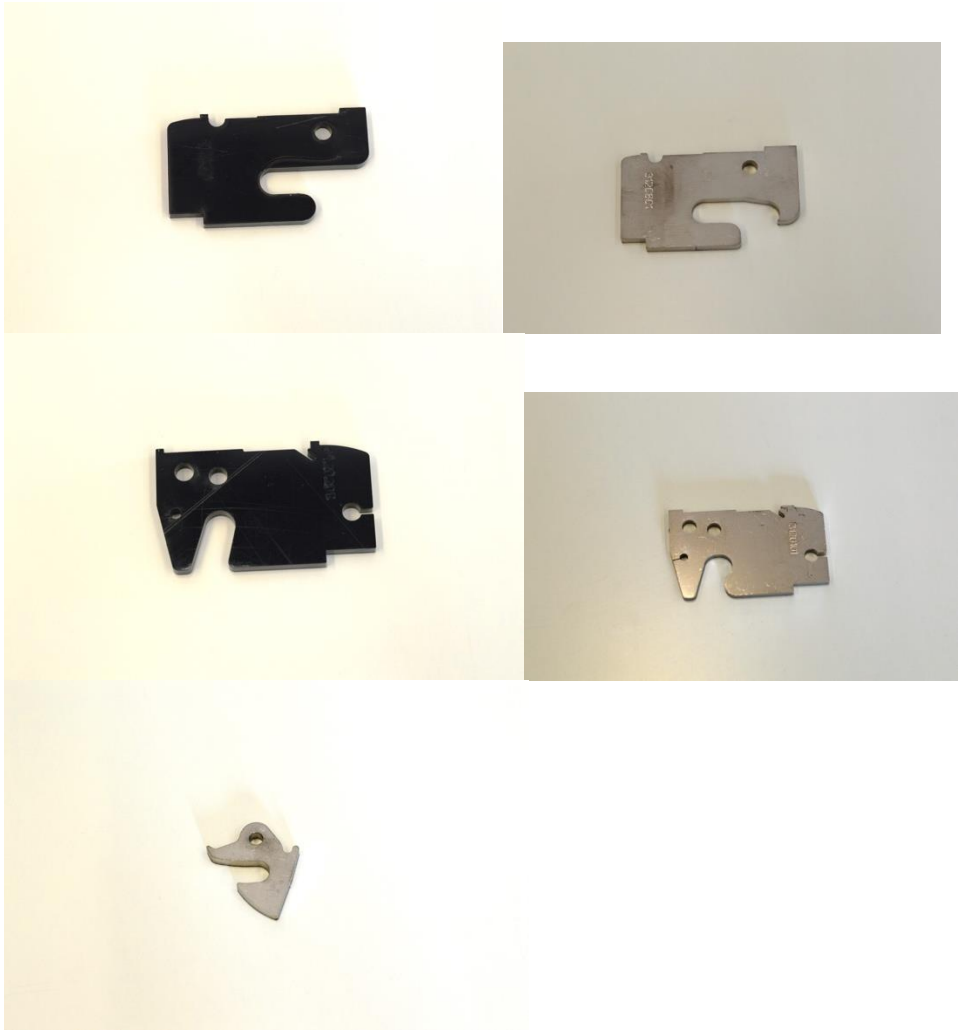
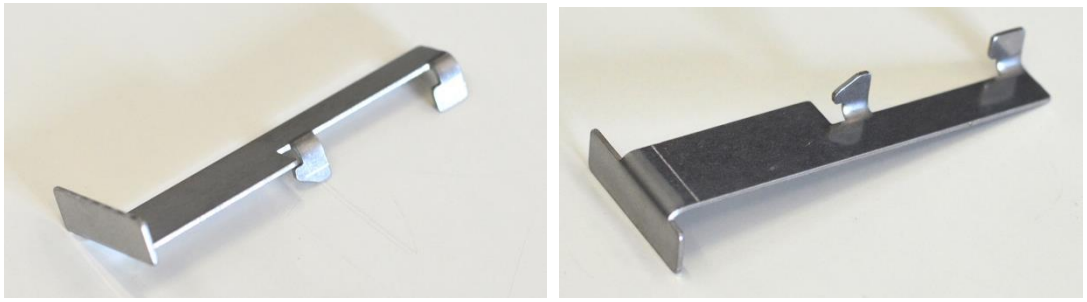


1.2.3 SUPPORT clip

The Tulipps rear frame is glued to the rear side of the glass/glass laminates. In comparison with curtain wall application, the glass is not supported on the bottom edge. So in comparison with curtain wall application support of the weight of the glass requires special attention. During normal circumstances, the adhesive is more than strong enough to hold the weight during the lifetime. But in case of fire, when the adhesive might weaken, mechanical support is foreseen. The glass is supported by the support clip, which is fixed at the bottom of the vertical profiles of the rear frame, see following pictures.



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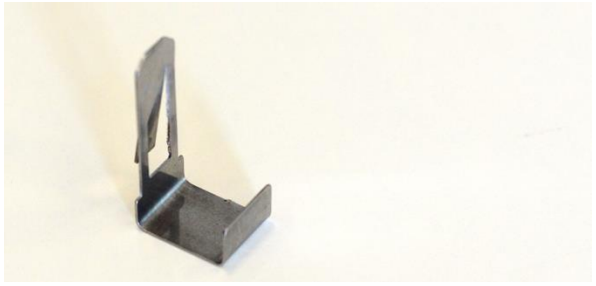
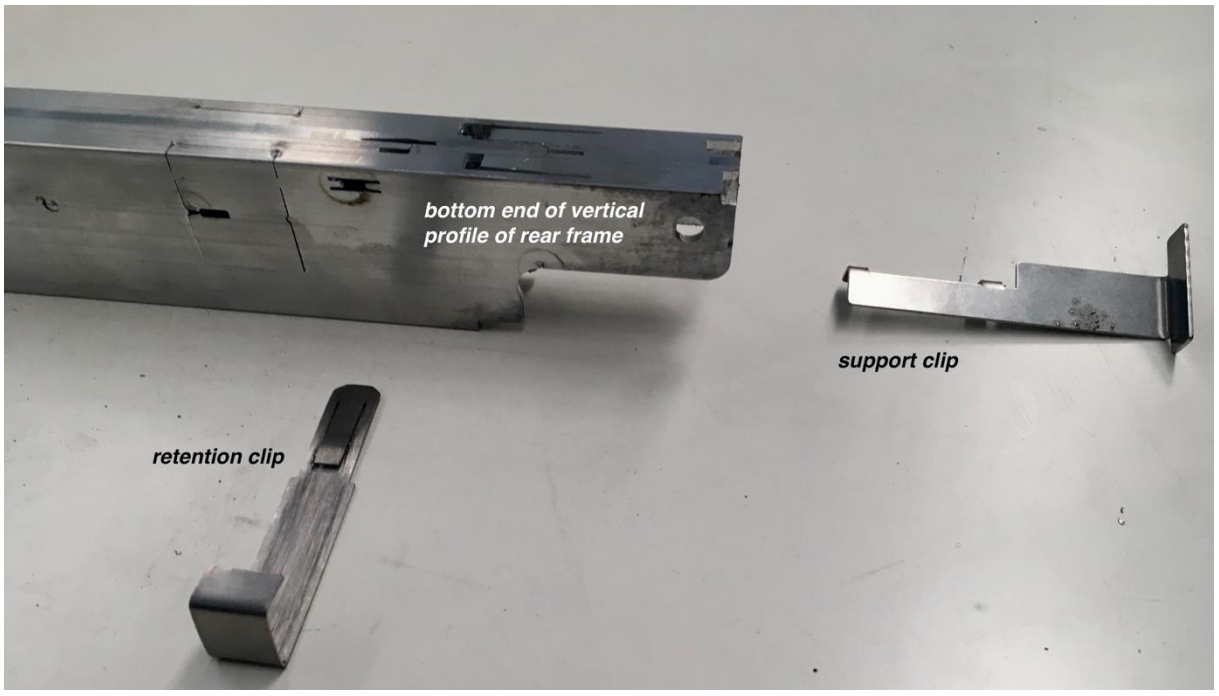
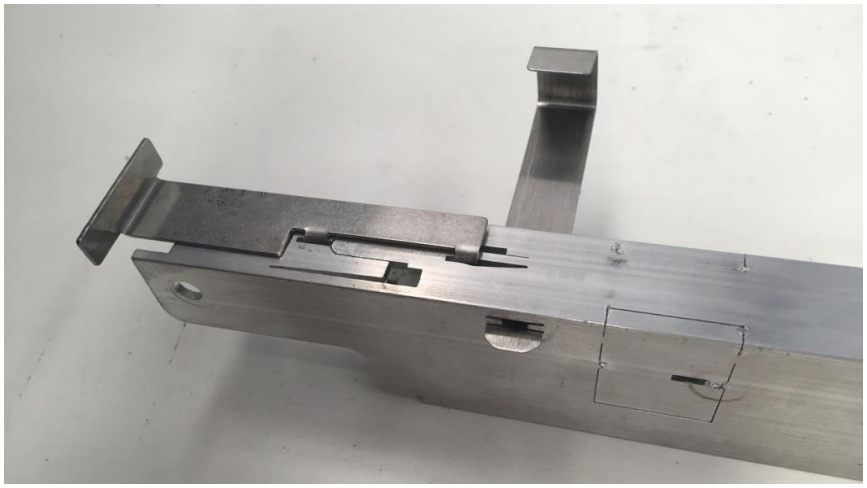
Tulipps had designed a retention clip, to prevent the glass from falling forward in case of failure of the adhesive. The clips can be clicked in the frame at the four corners of a laminate.





Picture showing bottom end of vertical profile, retention clip and the support clip.

In the following pictures the parts are assembled in the profile of the rear frame.



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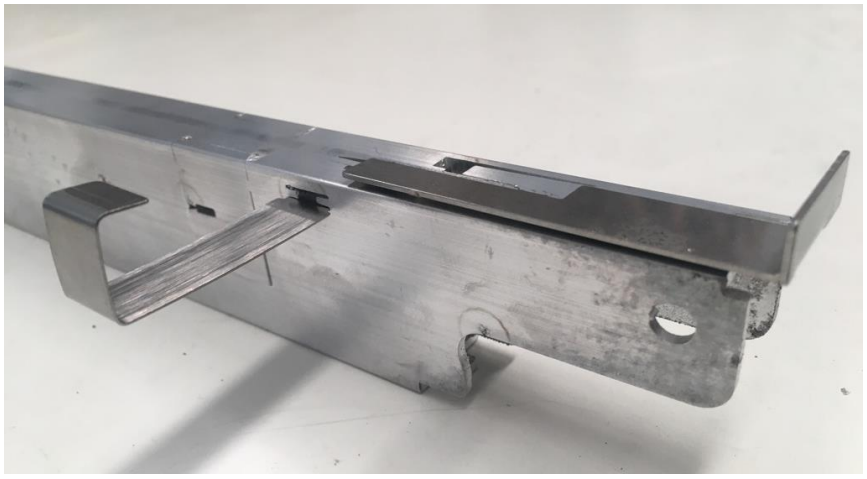

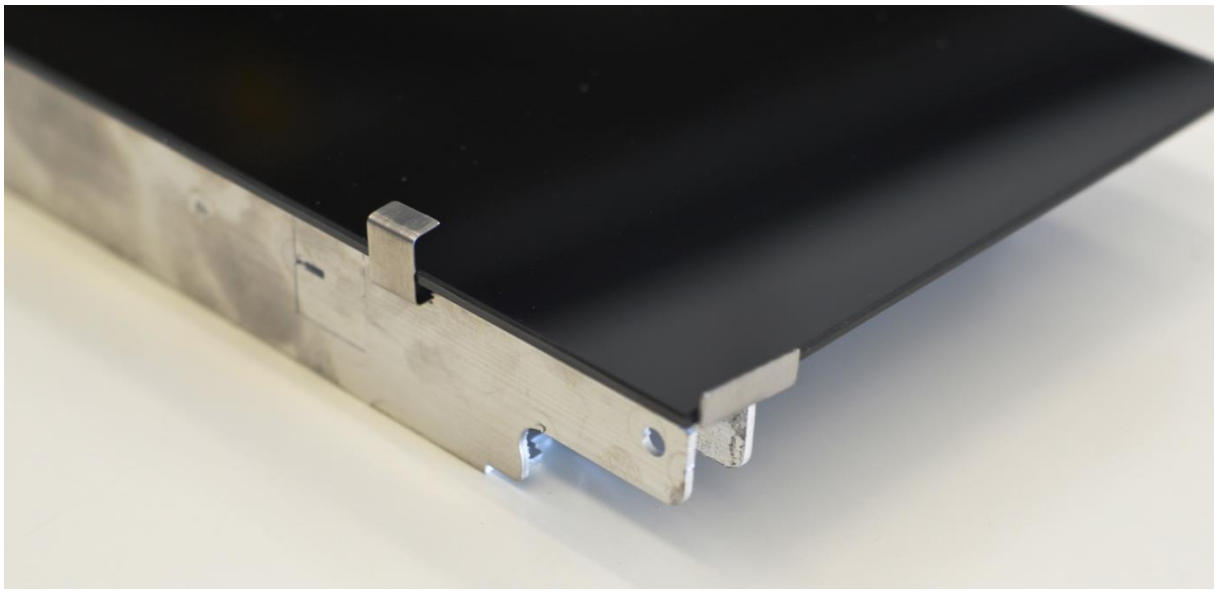

Picture of support clip and retention clip and laminate on rear frame.

1.2.4 Retention clip for more laminates on one frame

These Retention clips are applied for mechanical fixture of the laminates in case the adhesive fails (e.g. in case of fire). The following pictures show the retention clips especially designed for three laminates on one frame when applied on facades.

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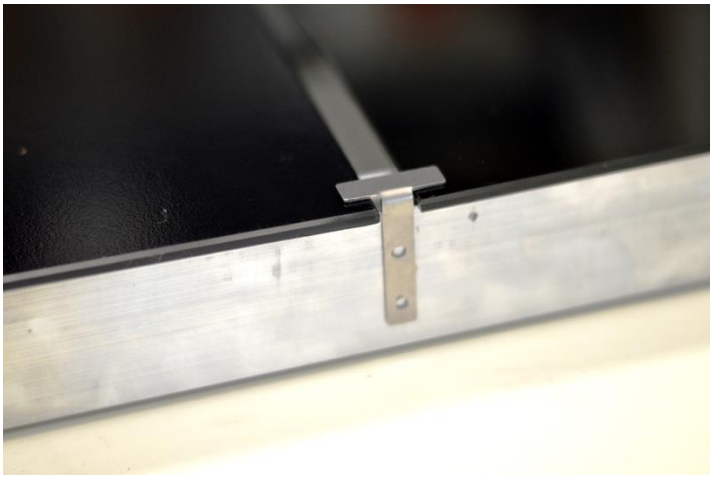
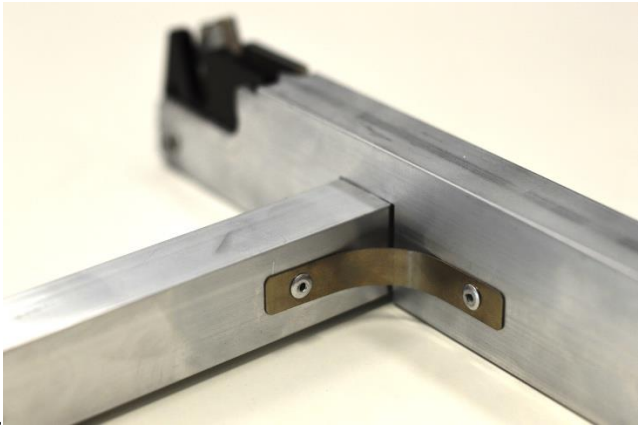


1.2.5 Junction strip

The connection between the profiles of the rear frame requires electrical continuity on hand while leaving each profile freedom to expand/shrimp during temperature changes without pushing the perpendicular connected profile. For this purpose, TULiPPS designed the junction strip. The following pictures show the junction strip and the junction strip assembled in the connection position of the profiles of the frame.



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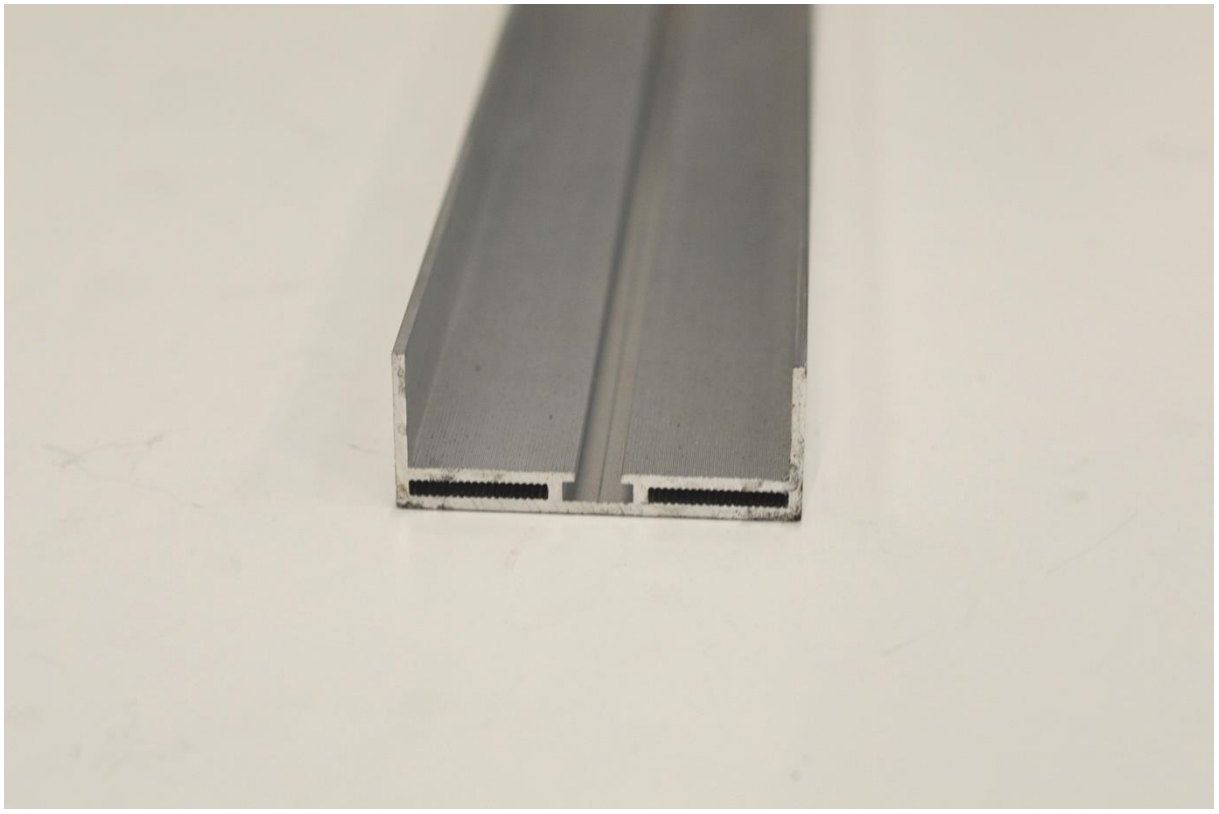
1.2.6 Rear frame assembly

Following photo shows an assembled rear frame and a glass plate glued on the rear frame.

Photos of parts of mounting rail system by Plastica.



Extrusion rail.

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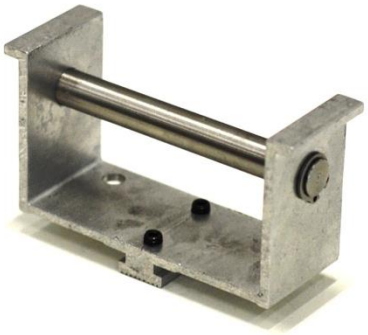
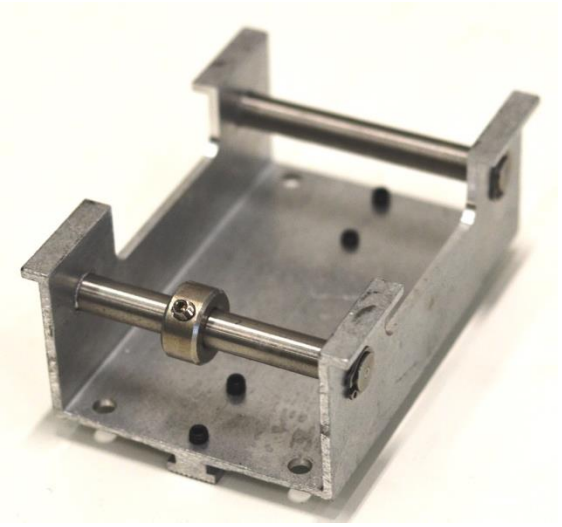
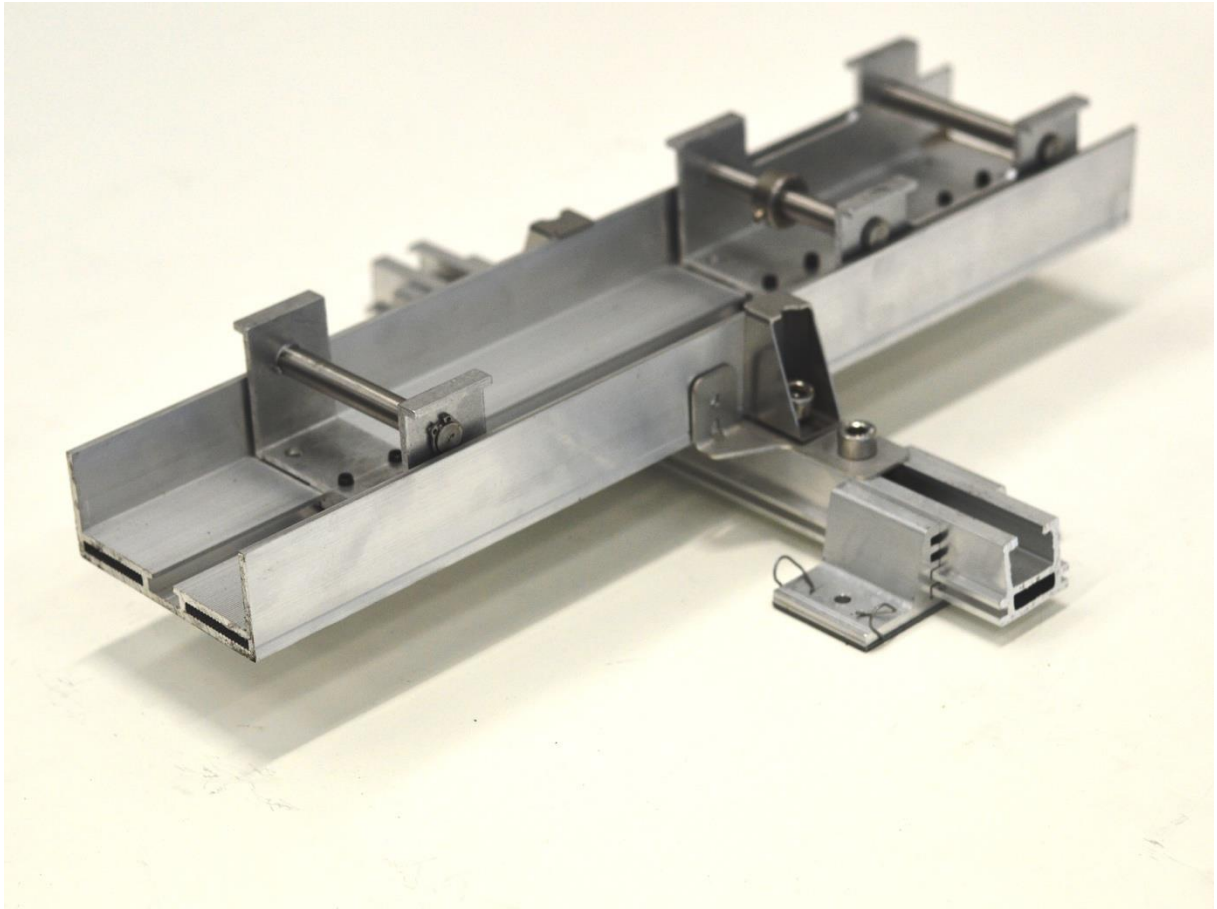


Single axle holder



double axle holder



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Technical references

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