

RAICO

THERM⁺ FS-I

MERGING GLASS INTO STEEL!



ARCHITECTS' DARLING
AWARDS 2017

GOLD



Heinze

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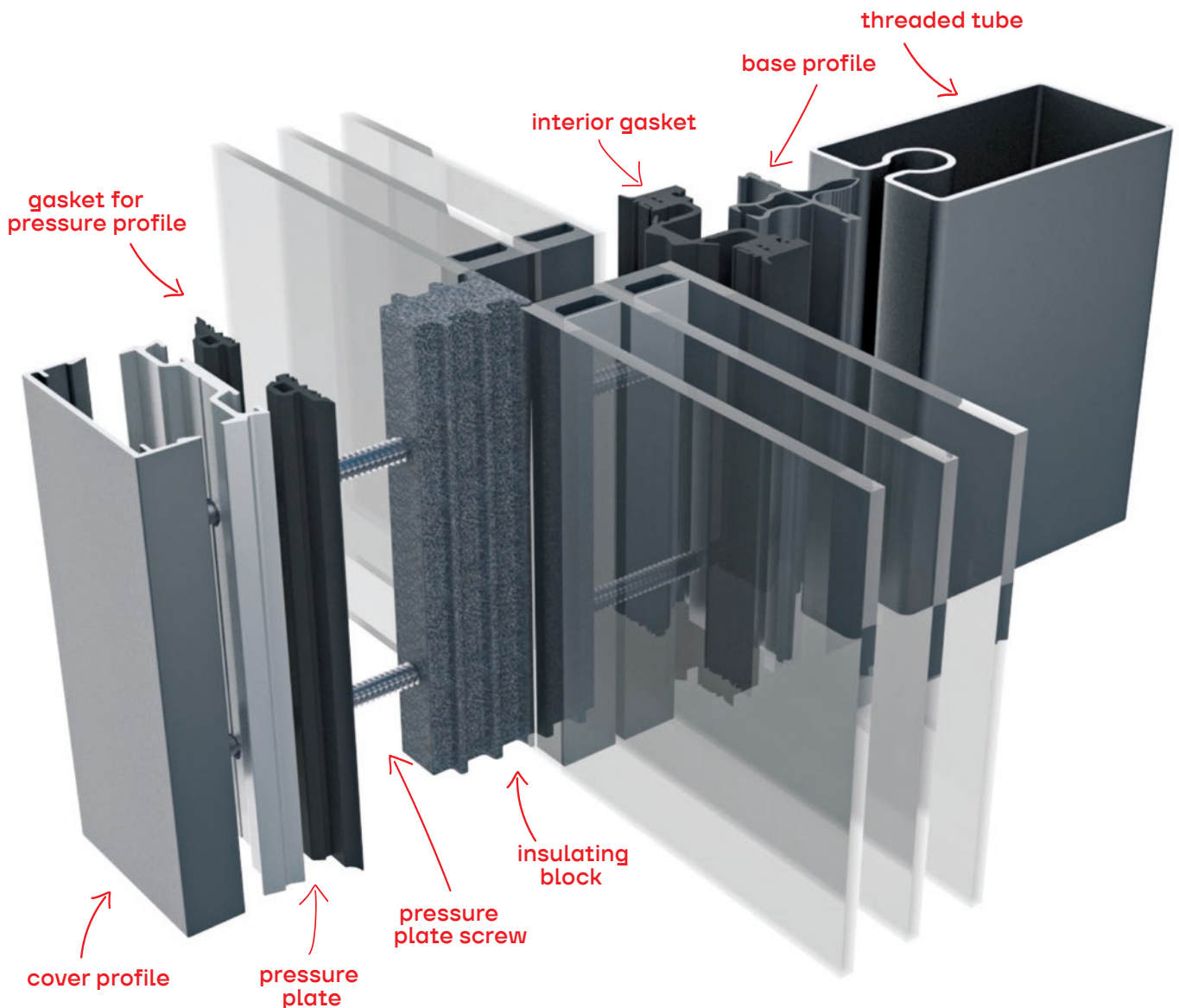


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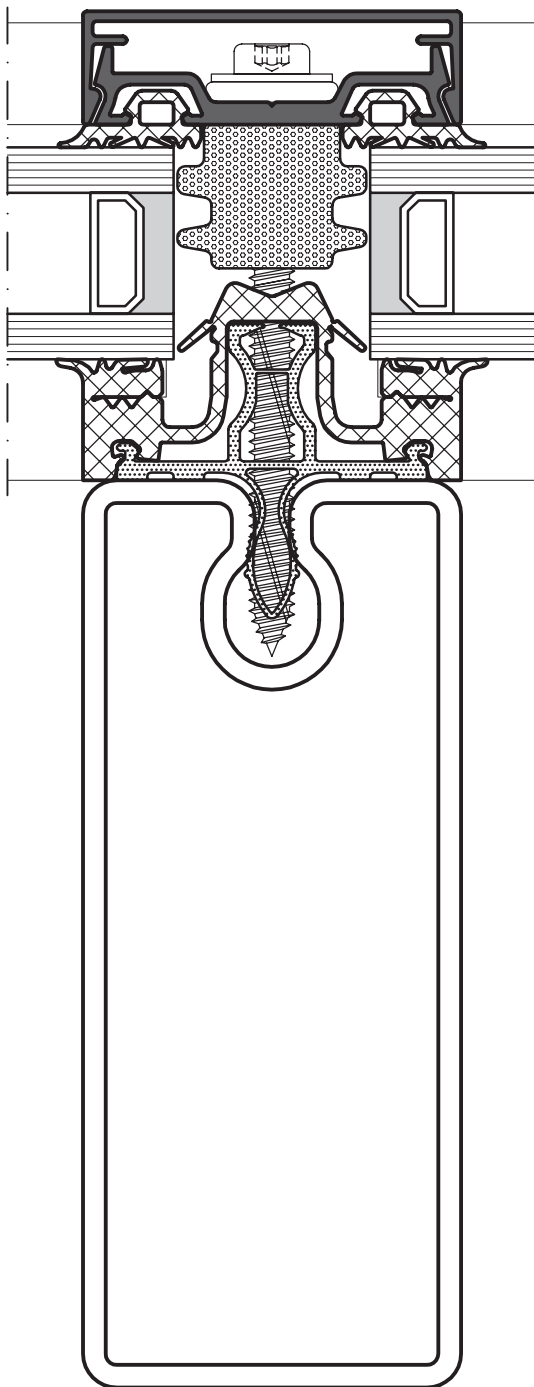
MERGING GLASS into STEEL!

This curtain wall system with integrated screw channel is compatible with all other THERM+ systems. Architects can employ it freely with a massive range of dimensions and wall thicknesses, and use its sharp-edged look to create elegant, seamlessly merged glass and curtain wall profiles. Installers no longer need to worry about welding or riveting, as the FS-I system lets them screw the pressure profile and structural system directly to each other. The system also includes two different T-connectors for single-bar and ladder installation.



THERM⁺ FS-I

Overview of the latest member of the façade system



- Excellent product properties**
 - Sharp edged profiles due to small radii.
 - System widths 50 and 56 mm.
 - Add-on construction for RAICO threaded tubes (width 50 or 60 mm).
 - Infill thickness from 4 to 64 mm.
 - Maximum energy saving by variable thermal insulation with insulating block options up to $U_{m,t} = 0.75 \text{ W}/(\text{m}^2\text{K})$ including the screw influence.
 - Passive house certified in all system widths.
 - All profiles can be used as well for mullions as for transoms.

- Optimum planning**
 - Threaded tubes available in many varying dimensions and wall thicknesses for a wide range of static requirements.
 - Vertical curtain wall and glass roof up to 2° roof inclination.
 - Different steel connectors for single bar or ladder assembly available.
 - Special steel connector even for heavy loads.
 - Extensive system accessories, e.g. sun protection fixations.

- Efficient installation**
 - Integrated screw channel in tube reduces planning, manufacturing and installation costs.
 - No welding needed for the curtain wall construction.
 - Direct mounting of the pressure profile into the steel substructure.
 - Sendzimir galvanised profiles ensure a broad corrosion protection.
 - Special technology for invisible screwed transom connection of the steel tubes.
 - Two options for interior gaskets.
 - Guidance of gasket with one-part synthetic profile.
 - Integrated drainage at the continuous gasket in three levels.
 - Separation of screw penetration and water-bearing level by hat gaskets.
 - Design variants: burglar-resistance up to RC3, Structural Glazing SG2, fire protection EI 30 and EI60

Test type/Standard	Classification/Result
Wind resistance (EN 12179)	Permissible load 2.5 kN/m ² · Increased load 3.75 kN/m ²
Air permeability (EN 12153)	AE (>600)
Water penetration (EN 12155)	RE 1950
Airborne sound insulation (if requested) (EN ISO 140-3)	RW(C;Ctr) = 34 (-1;-4) dB until RW(C;Ctr) = 47 (-1;-3) dB
Thermal transmittance (UCW value) (DIN EN ISO 12631)	Calculation with data from RAICO $U_{m,t}$ -value tables

In dialogue with the development team

With THERM⁺ FS-I, the RAICO development team for curtain walls has created a valuable addition to the RAICO curtain wall system family. The Head of the Team Curtain Wall, Daniel Filser, and Michael Kaufmann, now the Head of Project Engineering, provide insights into the development process from the basic idea to the European Technical Assessment. Marcel Englert and Beate Schmid, responsible for the implementation of the planning and the processing, are also happy about the result of the joint team performance.



It's a question of getting the size of the gap in the functional groove just right.

What were the basic considerations as the team planned the THERM⁺ FS-I?

Michael Kaufmann: We wanted to create a steel curtain wall system with integrated screw channel, for combining with our THERM⁺ range. This gives architects greater freedom to design. THERM⁺ FS-I offers significantly more processing comfort, since the pressure profile can be screwed directly to the structural construction. Welding is no longer necessary.

The heart of the THERM⁺ FS-I is the functional groove with correspondingly matched screw and clip-on profile. What was important here?

Michael Kaufmann: The key question was how to design the groove into which the screw is anchored in order to fix the pressure profile and structural construction directly. Spaltmaßes, welches die Schraube leicht in der Klips-

into each other. The decisive factor here was to determine the exact dimension of the gap that would allow easy insertion of the screw into the clip opening, while eliminating any play between the elements concerned.

Why did the RAICO team develop a new screw for this purpose?

Beate Schmid: We wanted a screw that has two important properties: It should be hard enough to cut its thread into the steel profile. At the same time it has to be highly resistant to corrosion, as its head may be exposed to the weather.

What is the key point of the innovative T-connection?

Marcel Englert: The standard SC connector for mullion and transom profiles has a variably adjustable fixing element designed to match internal tube-diameter tolerances.

It can be transported easily. Since it can be screwed with threaded tubes and standard press-on steel profiles, and also as a screw-on expansion transom, it is also suitable for subsequent transom installation. The SCL ladder connector can also be screwed in to provide contact pressure. Another great advantage is the high glass weight of over 1,000 kg that we can be borne with it. Due to this innovative technology, a solid steel façade can be installed similar to the familiar aluminium façade.

How does the ideal solution for sealing and insulation of FS-I look like?

Michael Kaufmann: A cover seal stops surrounding water penetrating the screw. It is also impervious to temperature changes, as its one-piece synthetic profile conducts considerably less heat than one made of metal. Various insulating blocks based on the existing THERM⁺ system can be used, depending on the required heat insulation and desired heat transfer coefficients. The FS-I is passive house certified in all systems widths – with maximum thermal insulation of up to $U_{m,t}=0.77$ W/(m²K), with screw factor included.

THERM⁺ FS-I is also a visual highlight...

Beate Schmid: The reduced radii of the profile tubes give the FS-I its sharp edged appearance. Architects appreciate this characteristic, because it allows them to create seamlessly merged glass façades and curtain wall profiles. In addition, it is especially the high spans that can be realised that make the architects' hearts leap.



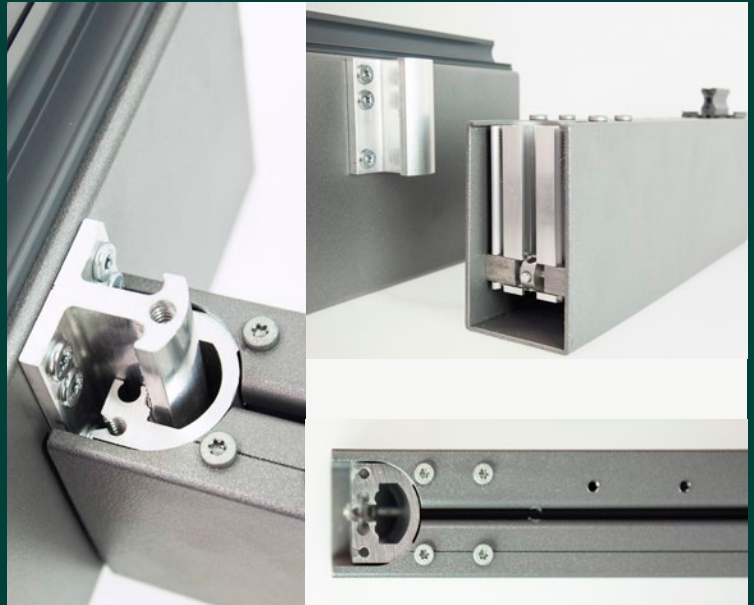
Function testing with the first prototypes from the 3D printer.



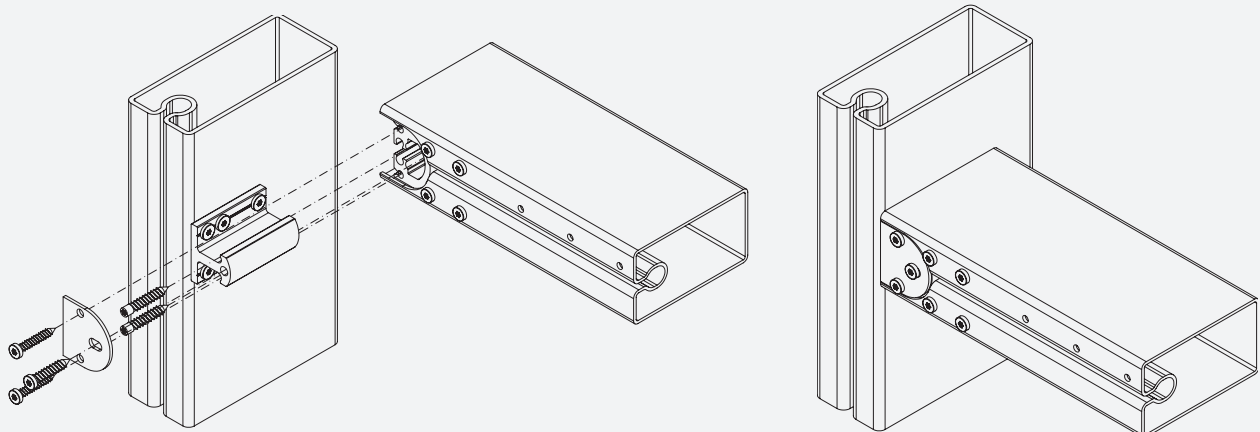
The RAICO development team curtain wall: Marcel Englert, Michael Kaufmann, Beate Schmid (f.l.t.r.)

MORE FREEDOM WITH THE ... Standard connector SC

- Transom to mullion connector
- Adjuster to compensate for internal profile dimension tolerances
- Smart Connector concept provides tolerance for the facade grid alignment
- Threaded tube and custom steel profiles have twist lock fixings → to provide joint stability for transportation
- Transoms fitted internally between mullions
- Available in vertical facade and sloped glass roof formats

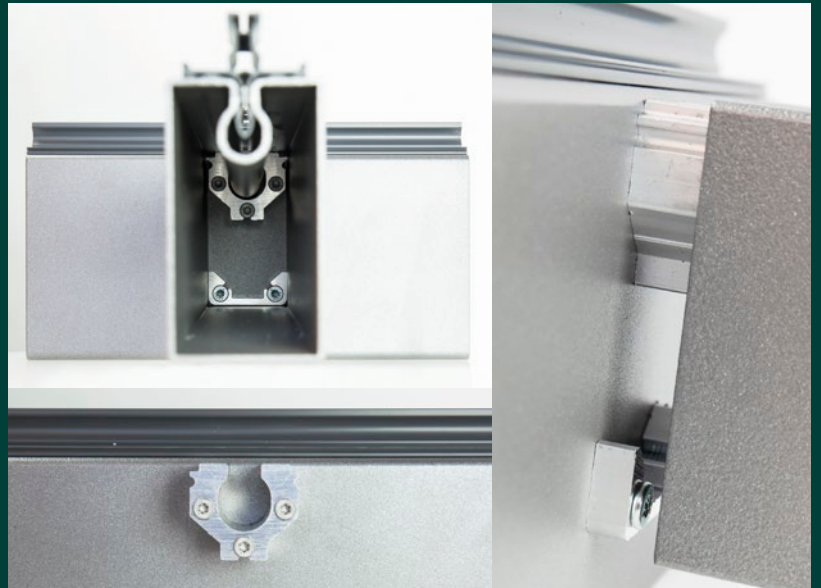


Connector SC

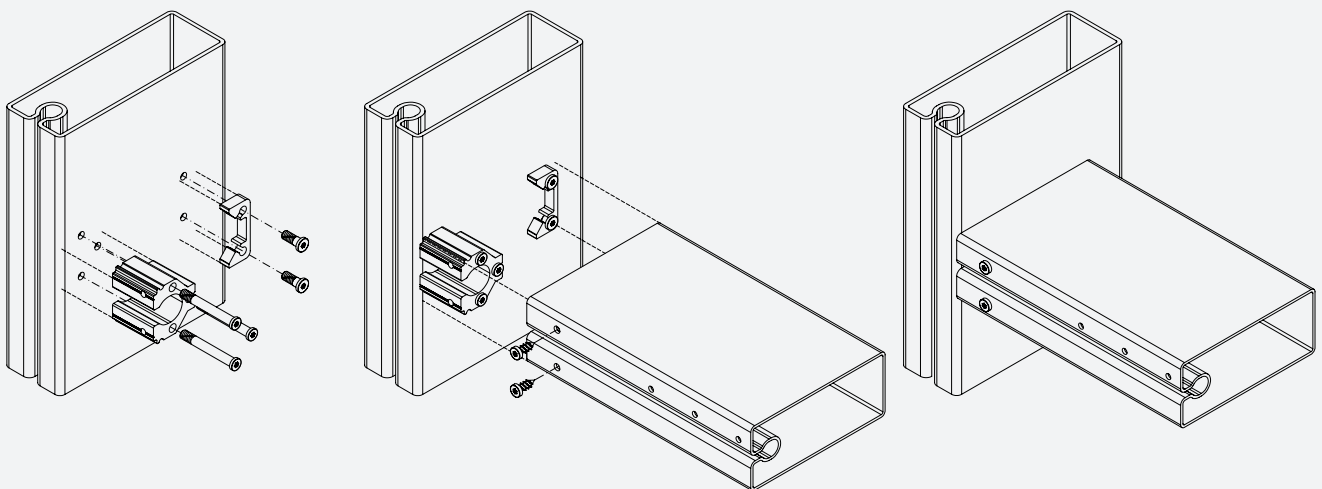


... T-CONNECTORS SC & SCL Ladder connector SCL

- Connectors available for both threaded tube and custom steel profiles
- On contact pressure screw fixing
- Available in vertical facade and sloped glass roof formats
- Also available as angled or polygon connection



Connector SCL

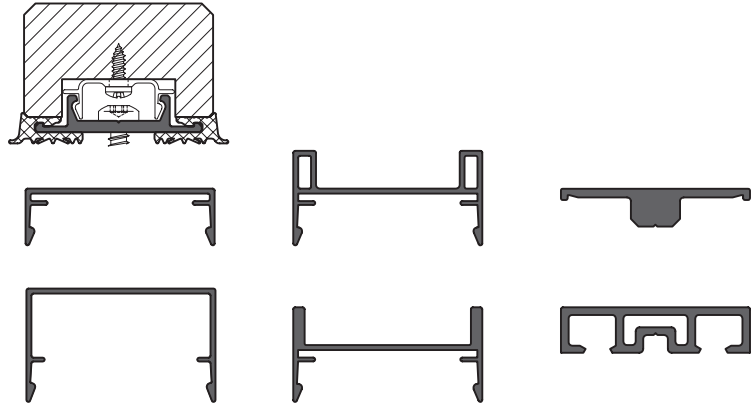


TECHNOLOGY IN DETAIL

THERM⁺ FS-I under examination

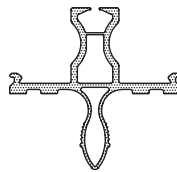
- Pressure profiles and cover caps for curtain wall and roof light applications**

- Wide choice of profiles for all system widths
- Project specific solutions available with short lead-in times
- Aesthetically pleasing flat pressure profiles with only 4 mm offset from glass surface
- Optimum cross point sealing system



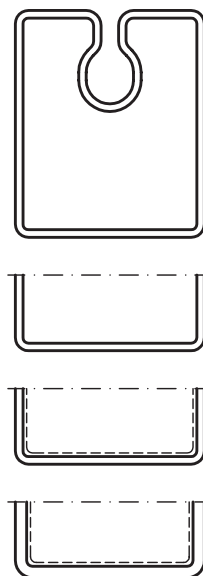
- Gasket alignment with one-part synthetic base profile**

- No gasket slippage
- Secure pressure plate screw fixing into the steel grid
- Slim sight-line glazing without expensive on-site welding
- Long term quality assured by established RAICO technology

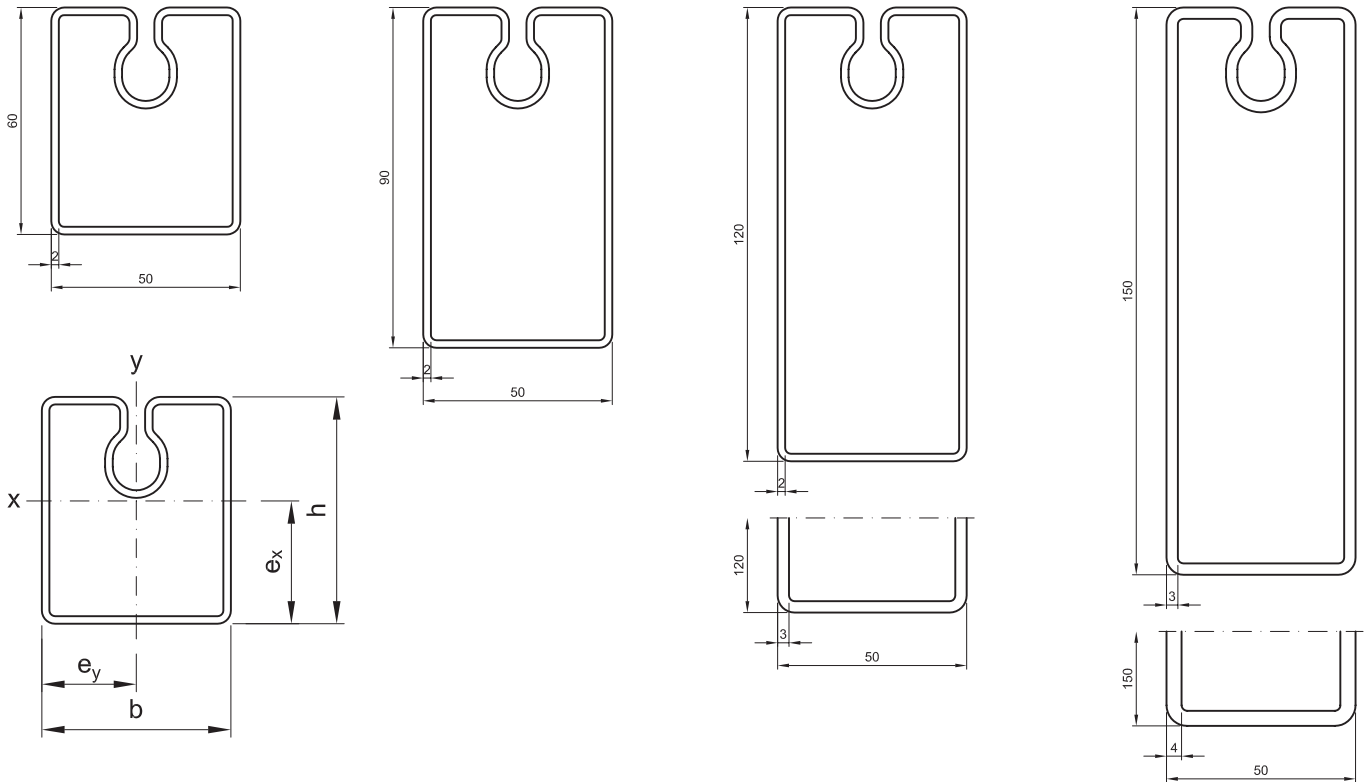


- A range of threaded tubes to meet project requirements**

- System widths of 50 and 56 mm (internally 50 or 60 mm)
- Threaded tubes available in a variety of sizes and wall thicknesses
- Covers a wide range of static requirements
- Integrated screw channel within profile
- Small radii corners provide almost sharp edges



System width 50/56 mm
Structural steel profiles
 I-Series



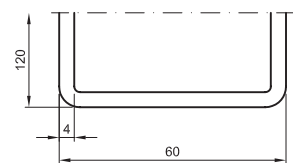
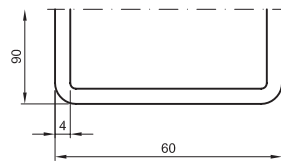
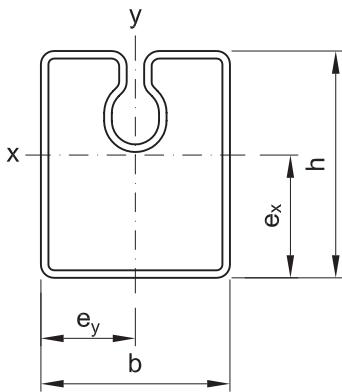
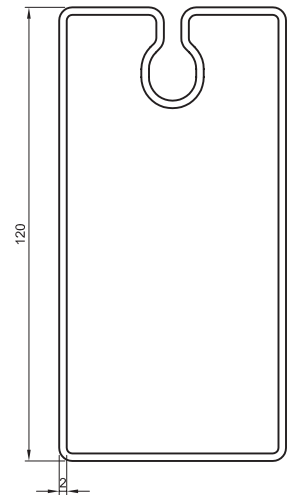
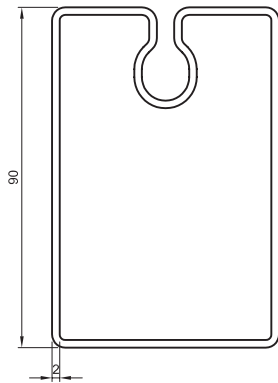
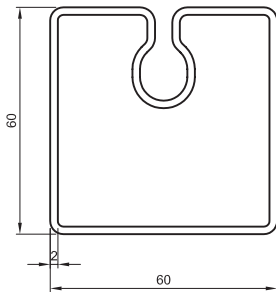
• **Technical information**

- Possible for assembly as mullion or transom profile
- Profile width: 50 mm
- Material:
Steel S280GD + Z275MAO
- Surface: sendzimir galvanised
- Execution class EXC2
- PU: 7 m

Article	Width mm	Height mm	Weight kg/m	Wall thickness mm	Surface area m	No.	I_x cm ⁴	I_y cm ⁴	e_x cm	e_y cm	W_x cm ³	W_y cm ³
Threaded tube 50/60/2	50	60	4,07	2	0,265	445010*	23,51	16,87	3,25	2,50	7,24	6,75
Threaded tube 50/90/2	50	90	5,01	2	0,325	445015*	65,03	23,79	4,94	2,50	13,16	9,52
Threaded tube 50/120/2	50	120	5,95	2	0,385	445020*	134,90	30,70	6,57	2,50	20,52	12,28
Threaded tube 50/120/3	50	120	8,79	3	0,382	445025*	194,11	43,73	6,56	2,50	29,60	17,94
Threaded tube 50/150/3	50	150	10,21	3	0,442	445030*	345,64	53,68	8,15	2,50	42,39	21,47
Threaded tube 50/150/4	50	150	13,43	4	0,440	445035*	444,75	68,09	8,14	2,50	54,66	27,24

*by request only

System width 50/56 mm
Structural steel profiles
 I-Series

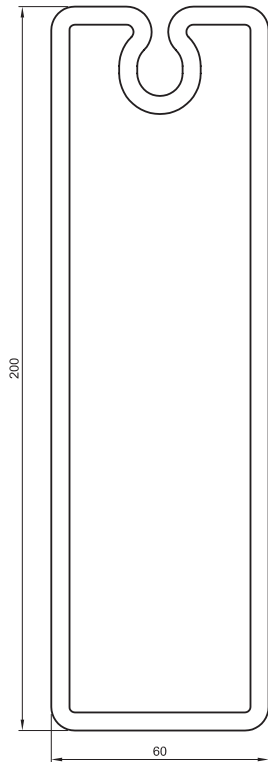
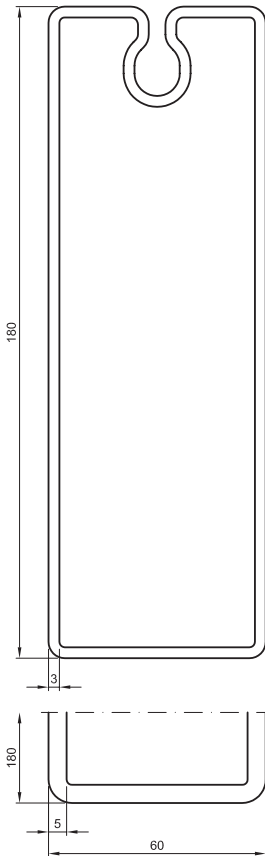
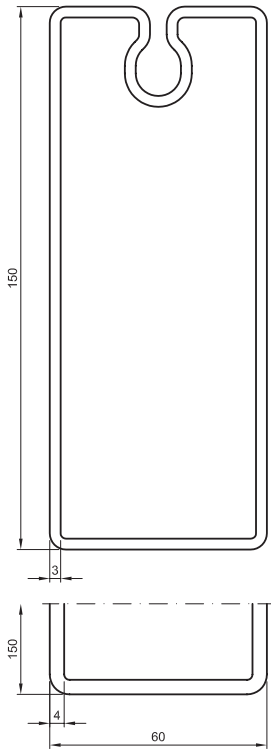


• **Technical information**

- Possible for assembly as mullion or transom profile
- Profile width: 60 mm
- Material:
Steel S280GD + Z275MAO
- Surface: sendzimir galvanised
- Execution class EXC2
- PU: 7 m

Article	Width mm	Height mm	Weight kg/m	Wall thickness mm	Surface area m	No.	$I_x \text{ cm}^4$	$I_y \text{ cm}^4$	$e_x \text{ cm}$	$e_y \text{ cm}$	$W_x \text{ cm}^3$	$W_y \text{ cm}^3$
Threaded tube 60/60/2	60	60	4,38	2	0,285	445060	26,90	25,61	3,23	3,00	8,33	8,54
Threaded tube 60/90/2	60	90	5,32	2	0,345	445065	72,85	35,70	4,91	3,00	14,82	11,90
Threaded tube 60/90/4	60	90	10,28	4	0,340	445070	132,08	64,79	4,88	3,00	27,05	21,60
Threaded tube 60/120/2	60	120	6,27	2	0,405	445075	148,95	45,80	6,54	3,00	22,76	15,27
Threaded tube 60/120/4	60	120	12,17	4	0,400	445080	275,26	83,64	6,51	3,00	42,26	27,88

System width 50/56 mm
Structural steel profiles
 I-Series



■ **Technical information**

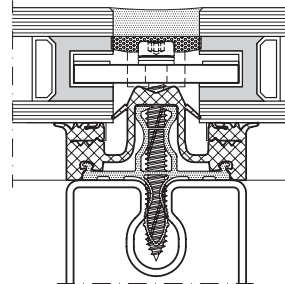
- Possible for assembly as mullion or transom profile
- Profile width: 60 mm
- Material:
Steel S280GD + Z275MAO
- Surface: sendzimir galvanised
- Execution class EXC2
- PU: 7 m
- PU: 10 m for no. 445100.F10000 and 445105.F10000

Article	Width mm	Height mm	Weight kg/m	Wall thickness mm	Surface area m	No.	I_x cm ⁴	I_y cm ⁴	e_x cm	e_y cm	W_x cm ³	W_y cm ³
Threaded tube 60/150/3	60	150	10,68	3	0,462	445085	378,31	80,28	8,12	3,00	46,57	26,76
Threaded tube 60/150/4	60	150	14,05	4	0,460	445090	487,71	102,48	8,11	3,00	60,14	34,16
Threaded tube 60/180/3	60	180	12,10	3	0,522	445095	602,72	94,92	9,70	3,00	62,15	31,64
Threaded tube 60/180/5	60	180	19,70	5	0,517	445100	946,86	145,38	9,67	3,00	97,96	48,46
Threaded tube 60/180/5	60	180	19,70	5	0,517	445100.F10000	946,86	145,38	9,67	3,00	97,96	48,46
Threaded tube 60/200/5	60	200	21,27	5	0,557	445105	1247,02	160,55	10,71	3,00	116,48	53,52
Threaded tube 60/200/5	60	200	21,27	5	0,557	445105.F10000	1247,02	160,55	10,71	3,00	116,48	53,52

Steel curtain wall 50/56 mm
Curtain wall options/drainage system

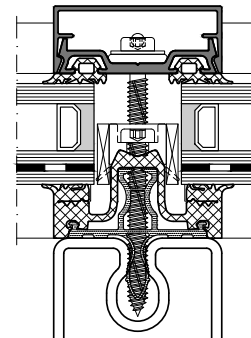
• **SG2 Structural Glazing**

- System widths of 50 and 56 mm
- Glazing system provides all glass appearance
- High thermal performance using SG insulation blocks
- Simple and economic fabrication
- Relevant building regulations must be complied with



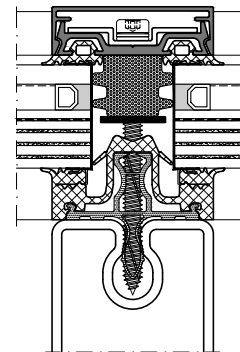
• **Burglar proof curtain wall RC2/RC3**

- System widths 50 and 56 mm
- Resistance class RC2 and RC3 permitted
- Simple processing
- Identical technology to the basic system
- Optimized design variant



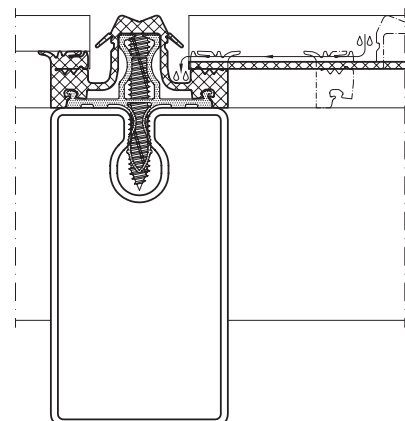
• **Fire protection**

- Tested up to E30/EW30/EI30
- Mullion-transom connection with steel connector SCL
- Only a few additional components required
- Tested up to EI60



• **Drainage system**

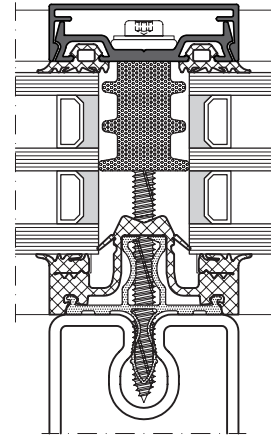
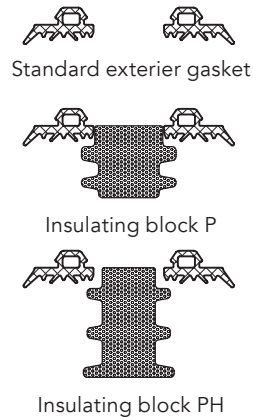
- The drainage groove of the mullion and transom gasket is arranged on various levels
- In all THERM⁺ systems the ventilation and drainage principle is so designed that a controlled condensate removal from transom to the mullion rebate is secured via interior gaskets
- Separation of screw penetration and water-bearing level



Steel curtain wall 50/56 mm Gasket options

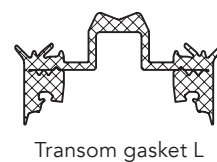
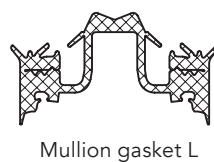
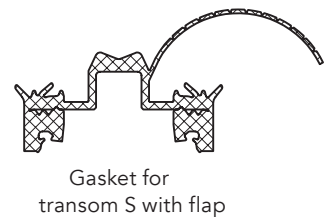
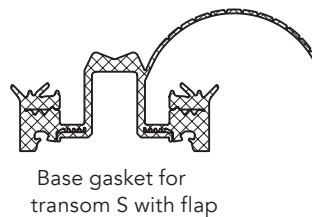
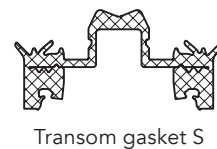
Exterior gasket

- Various exterior gaskets and insulating block options available
- Gradual adaptation of the insulation value
- Maximum thermal insulation up to $U_{m,t} = 0.75 \text{ W/(m}^2\text{K)}$ including screw influence
- Certified passive house curtain wall
- Economic solution



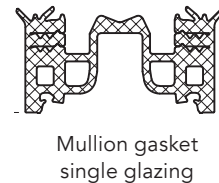
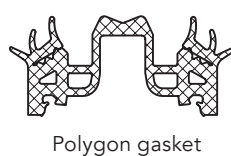
Transom and mullion gaskets

- Optimised shape for maximum thermal insulation and efficient fabrication
- Complete covering and sealing of the base profile
- Available in two materials: EPDM or silicone
- Perfect and easy fitting on the structural profile (without silicone)
- Two options of gaskets with flaps for transom and base drainage as well as draining within the continuous gasket at the structural connections
- Reliable drainage in two or three levels by simply notching
- Tested with a roof inclination of up to 2°
- Special accessories for all applications, e. g. transom and mullion sealing elements



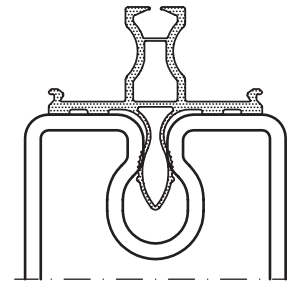
Interior gasket options

- **Type „S“** for assembly with lateral guidance and fixation by a synthetic base profile
- **Type „L“** with lateral lips for visual optimization using big radiuses of structural profiles lateral guidance like type „S“

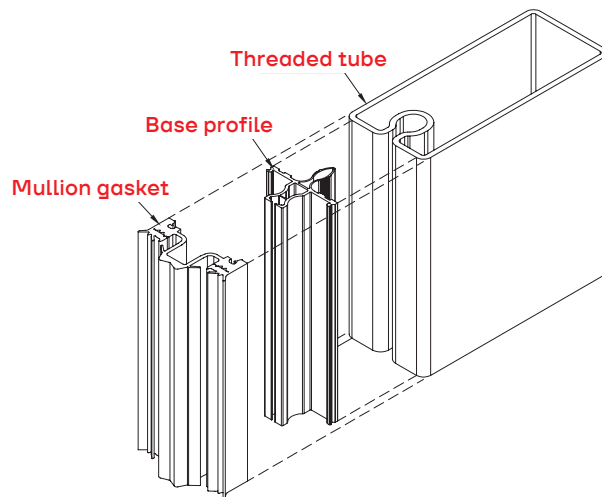


Steel curtain wall 50/56 mm
Protection against corrosion

- **Optimal corrosion protection**
 - Proven THERM⁺ sealing technology ensures controlled drainage of condensate and prevents ingress of humidity
 - Access to all surfaces enables easy and efficient treatment against corrosion
 - Further corrosion protection with Sendzimir process pre-galvanised coated finish (See also RAICO coating guidelines for top coat finishes)

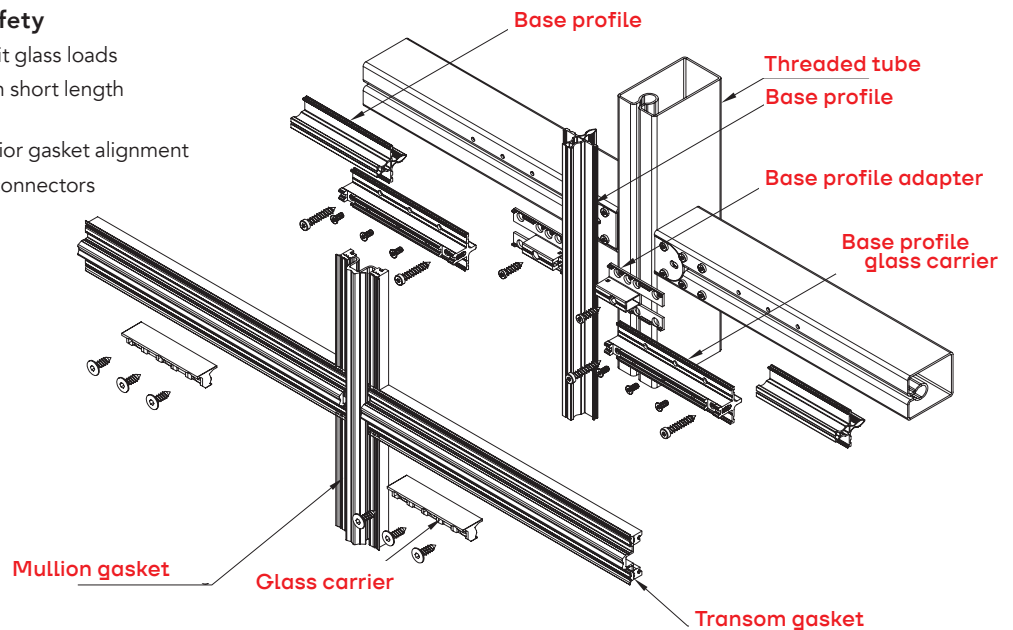


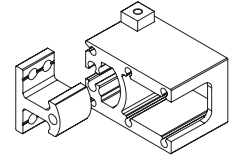
- **Synthetic base profile**
 - Push fit or lightly tap in with a mallet
 - Roll on the internal gaskets in the correct orientation
 - Plug in technology allows for quick and simple processing with just a few additional components



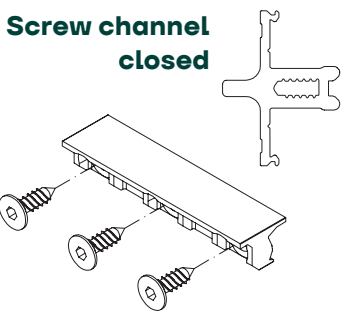
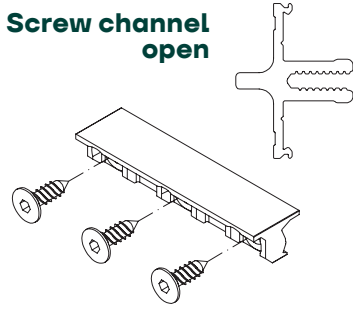
Steel curtain wall 50/56 mm
Assembly cross point area

- **Maximum cross point safety**
 - Choice of glass carriers to suit glass loads
 - Safe glass load retention with short length aluminium base profile
 - Base profile adapter for interior gasket alignment
 - Choice of SC and SCL steel connectors



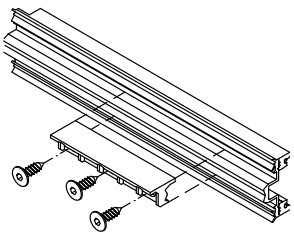


Steel curtain wall 50/56 mm
Admissible glass loads for steel connector SC – variant L (light)
 Open & closed screw channel (1 glass carrier per side)



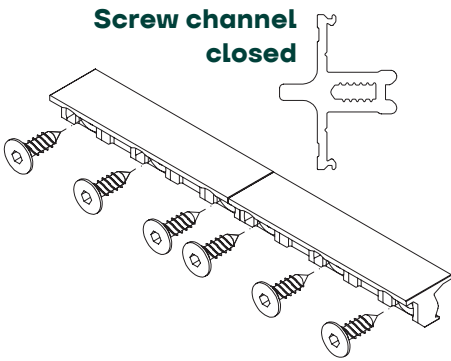
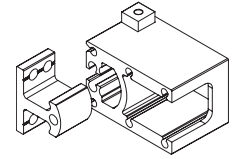
• **Technical information**

- The tests and evaluations for determining the glass loads were carried out according to EN 16758. A max. tipping over of 1 mm is recommended
- The safety coefficients on the point of application side are extracted from the National Annexes (Germany) of the EUROCODES
- A combination of glass load and horizontal load is calculated by linear interaction
- The indicated wind loads refer to the maximum glass weight of 500 kg or 300 kg
- Deviating constructions available on request
- For the use of interior gaskets 26 mm please consult the RAICO customer service
- The glass weights of all variants can be applied similarly to commercial steel tubes for the various fixing options of the base profiles (except the welded screw channel). They refer to one field
- Intermediate figures can be interpolated
- *Minimum face width 50 mm
- ** $\gamma_q = 1.5$ considered



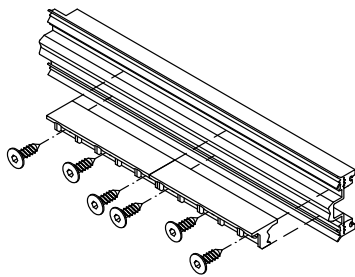
Mullion Wall thickness (mm)	*Transom Depth x wall thickness (mm)	Base profile Glass carrier (open)	Eccentricity [mm]				Base profile Glass carrier (closed)	Glass weight [kg]		
			≤ 36	≤ 40	≤ 48	≤ 56	≤ 40	≤ 44	≤ 48	≤ 56
≥ 2	≥ 60 x 2	306	306	246	177	306	306	284	205	
	≥ 90 x 2	510	446	300	216	510	420	348	251	
	≥ 90 x 4						483	400	288	
	≥ 120 x 2						434	360	259	
	≥ 120 x 3						483	400	288	
	≥ 120 x 4									

Steel curtain wall 50/56 mm
Admissible glass loads for steel connector SC – variant H (heavy)
 Schraubkanal offen & geschlossen (2 glass carriers per side)



Technical information

- The tests and evaluations for determining the glass loads were carried out according to EN 16758. A max. tipping over of 1 mm is recommended
- The safety coefficients on the point of application side are extracted from the National Annexes (Germany) of the EUROCODES
- A combination of glass load and horizontal load is calculated by linear interaction
- The indicated wind loads refer to the maximum glass weight of 700 kg
- Deviating constructions available on request
- The glass weights of all variants can be applied similarly to commercial steel tubes for the various fixing options of the base profiles (except the welded screw channel). They refer to one field
- Intermediate figures can be interpolated
- *Minimum face width 50 mm
- ** $V_q = 1.5$ considered

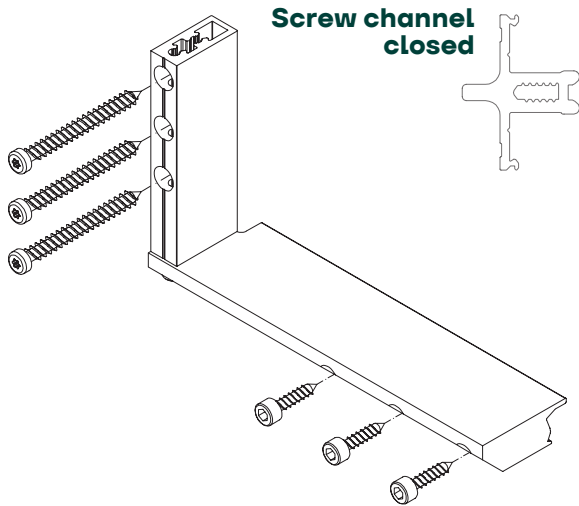
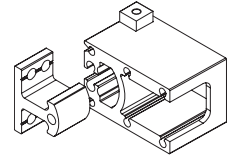


Wall thickness mullion (mm)	*Transom Depth x wall thickness (mm)	Base profile Glass carrier (closed)		
		Eccentricity [mm]		
		≤ 44	≤ 48	≤ 56
		Glass weight [kg]		
≥ 2	≥ 90 x 4	714	610	459
	≥ 120 x 3		696	523
	≥ 120 x 4			

Steel curtain wall 50/56 mm

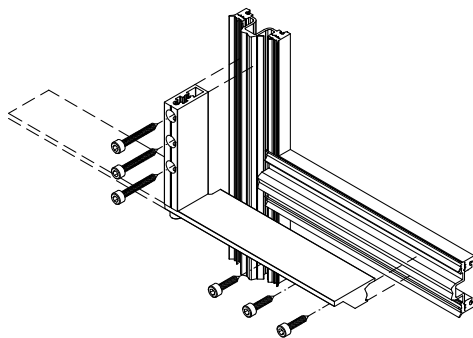
Admissible glass loads for steel connector SC – variant cross point glass carrier

Closed screw channel (1 glass carrier per side)



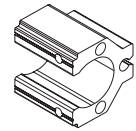
• **Technical information**

- The tests and evaluations for determining the glass loads were carried out according to EN 16758. A max. tipping over of 1 mm is recommended.
- The safety coefficients on the point of application side are extracted from the National Annexes (Germany) of the EUROCODES.
- A combination of glass load and horizontal load is calculated by linear interaction
- The indicated wind loads refer to the maximum glass weight of 750 kg or 1000 kg
- Deviating constructions available on request
- In case of an additional load please consult the RAICO customer service
- The glass weights refer to one field. All variants can be applied similarly to commercial steel tubes for the various fixing options of the base profiles (except the welded screw channel). In case of the demand for a cross glass carrier with two fields, please consult the RAICO customer service
- Intermediate figures can be interpolated
- *Minimum face width 50 mm
- ** $V_q = 1.5$ considered

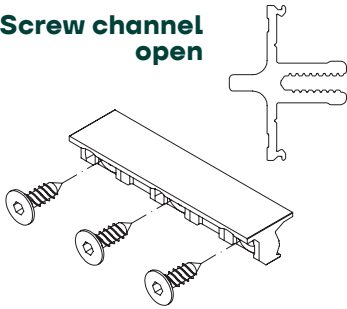


Wall thickness mullion (mm)	*Transom Depth x wall thickness (mm)	Base profile Glass carrier (closed)
		Eccentricity [mm]
		≤ 56
		Glass weight [kg]
≥ 2	≥ 90 x 2	765
	≥ 90 x 4	1019
	≥ 120 x 2	765
	≥ 120 x 3	1019
	≥ 120 x 4	

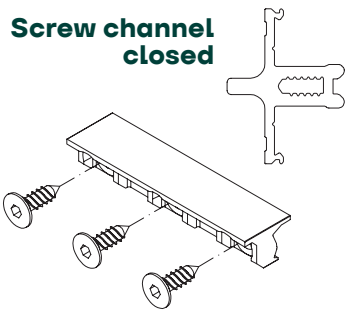
Steel curtain wall 50/56 mm
Admissible glass loads for steel connector SCL – variant L (light)
 Screw channel open & closed (1 glass carrier pers side)



Screw channel open

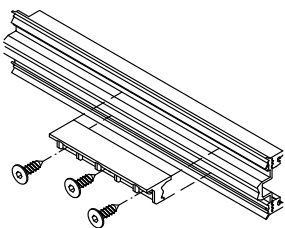


Screw channel closed



• **Technical information**

- The tests and evaluations for determining the glass loads were carried out according to EN 16758. A max. tipping over of 1 mm is recommended
- The safety coefficients on the point of application side are extracted from the National Annexes (Germany) of the EUROCODES
- A combination of glass load and horizontal load is calculated by linear interaction
- The indicated wind loads refer to the maximum glass weight of 500 kg or 300 kg
- Deviating constructions available on request.
- For the use of interior gaskets 26 mm please consult the RAICO customer service
- The glass weights of all variants can be applied similarly to commercial steel tubes for the various fixing options of the base profiles (except the welded screw channel). They refer to one field
- Intermediate figures can be interpolated
- *Minimum face width 50 mm
- ** $\gamma_q = 1.5$ considered

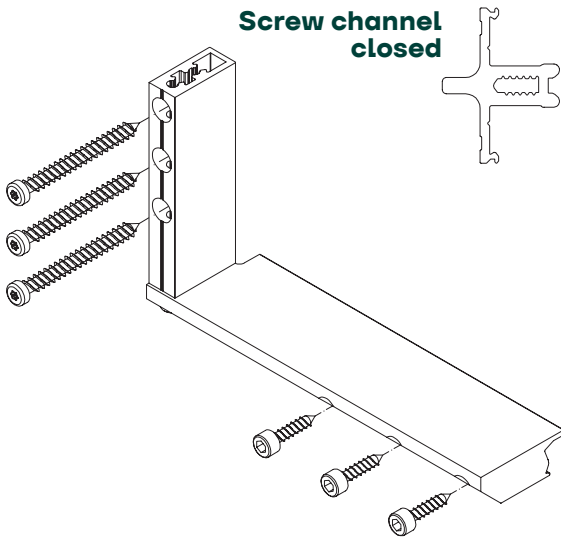
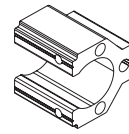


Wall thickness mullion (mm)	*Transom Depth x wall thickness (mm)	Base profile Glass carrier (open)				Base profile Glass carrier (closed)			
		Eccentricity [mm]							
		≤ 36	≤ 40	≤ 48	≤ 56	≤ 40	≤ 44	≤ 48	≤ 56
Glass weight [kg]									
≥ 2	≥ 60 x 2	306	306	246	177	306	306	284	205
	≥ 90 x 2	510	446	300	216	510	420	348	251
	≥ 90 x 4						483	400	288
	≥ 120 x 2						434	360	259
	≥ 120 x 3						483	400	288
	≥ 120 x 4								

Steel curtain wall 50/56 mm

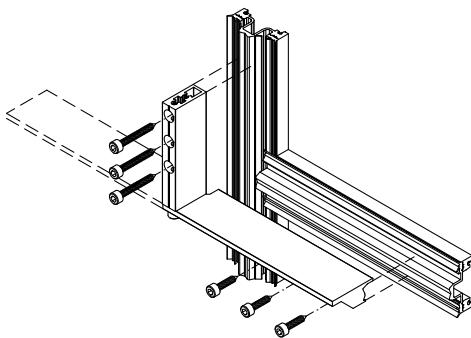
Admissible glass loads for steel connector SCL – variant cross glass carrier

Screw channel closed (1 glass carrier per side)



■ **Technical information**

- The tests and evaluations for determining the glass loads were carried out according to EN 16758. A max. tipping over of 1 mm is recommended
- The safety coefficients on the point of application side are extracted from the National Annexes (Germany) of the EUROCODES
- A combination of glass load and horizontal load is calculated by linear interaction
- The indicated wind loads refer to the maximum glass weight of 750 kg or 1000 kg.
- Deviating constructions available on request
- In case of an additional load please consult the RAICO customer service
- The glass weights refer to one field. All variants can be applied similarly to commercial steel tubes for the various fixing options of the base profiles (except the welded screw channel). In case of the demand for a cross glass carrier with two fields, please consult the RAICO customer service
- Intermediate figures can be interpolated
- *Minimum face width 50 mm
- ** $\gamma_q = 1.5$ considered



Wall thickness mullion (mm)	*Transom Depth x wall thickness (mm)	Base profile Glass carrier (closed)
		Eccentricity [mm]
		≤ 56
		Glass weight [kg]
≥ 2	≥ 90 x 2	765
	≥ 90 x 4	1019
	≥ 120 x 2	765
	≥ 120 x 3	1019
	≥ 120 x 4	

THERM⁺ FS-I IN USE

EXPLORiT in Yverdon-les-Bains!



The Swiss canton of Waadt is famed for its art of watchmaking. It perhaps therefore comes as no surprise that the EXPLORiT Edutainment centre in Yverdon-les-Bains will play host to an award-winning RAICO product: The THERM⁺ FS-I unites glass and steel in an innovative manner with precision, finesse and uncompromising reliability ...



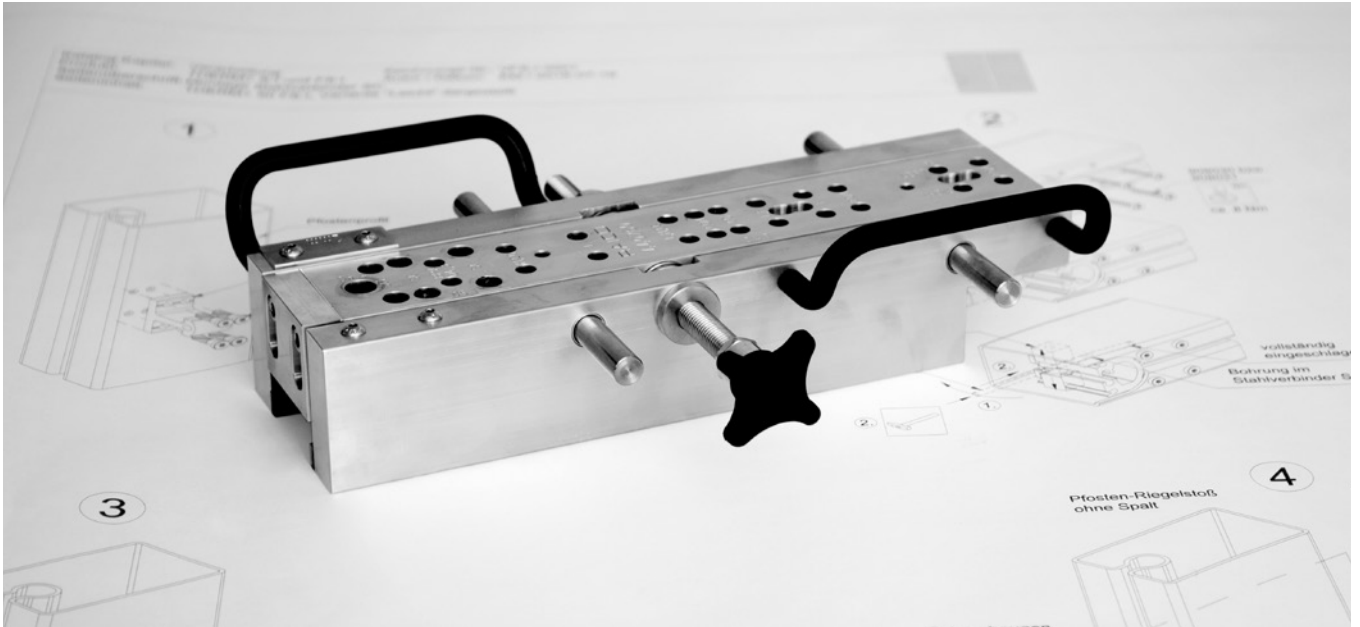
Please ask your
RAICO contact
person for
OBJEKT INSIDE

or read this and further
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THE NEXT STEPS?

Further information...



Now also on YouTube:

Videos which show the step-by-step processing of the steel connectors SC and SCL.



ANY QUESTIONS LEFT? Please feel free to contact us!

We are happy to assist you with further information, personalised advice and the provision of relevant planning and installation documents:

TELEPHONE +49 (0)8265 911

The RAICO team is always happy to help with any questions you may have about your building project!

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