Deutsches Institut für Bautechnik

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European Technical Assessment Body for construction products

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European Technical Assessment ETA-17/0768 of 23 September 2024

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General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	'Twinloc' connector
Product family to which the construction product belongs	Three-dimensional nailing plates
Manufacturer	GUTMANN Bausysteme GmbH Nürnberger Straße 57 91781 Weißenburg DEUTSCHLAND
Manufacturing plant	Betrieb 1, Betrieb 2
This European Technical Assessment contains	57 pages including 4 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 130186-00-0603
This version replaces	ETA-17/0768 issued on 2 February 2018

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Specific part

1 Technical description of the product

The 'Twinloc' connector is a timber fastener consisting of two aluminium connector elements to be fastened respectively to the main and secondary support beams and which are fastened to the main or secondary beam by self-tapping screws with an outer thread diameter of 5 mm. Main support beams can be mullions for facade constructions or purlins for roof constructions. Secondary support beams are transoms for facade constructions and rafters for roof constructions.

In the version V0 glass supports made from aluminium are fastened to the base profiles (see Annexes 4.15 and 4.16).

In the version glass support dowel 02, glass supports are fastened to the transom with dowel (see Annexes 4.19 and 4.20). Glass supports made from plastic as shown in Annexes 4.19 and 4.20 are not covered by this ETA. The provisions at the location of use shall apply to the glass supports made from plastic.

'LARA heavy duty' aluminium L- or T-shaped glass supports may be installed (reinforcement variants V2 and V3) for increasing the load-carrying capacity of the connection.

The components of the product are given in Annex 3.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The ETA covers 'Twinloc' connectors

- for which the maximum eccentricity of the load applied to the mullion-to-transom connection parallel to the mullion axis and at a right angle to the rafter axis does not exceed the values given in the Annexes 4.17, 4.21, 4.25 and 4.32.
- for which the load is introduced centrically for rafter-to-purlin connections.
- which are arranged as described in Annexes 4.19 and 4.20 for the version glass support dowel 02.
- which are arranged as described in Annexes 4.15 and 4.16 for variant V0.
- which are arranged as described in Annexes 4.23 to 4.35 for the version with integrated 'LARA heavy duty' glass support.
- for which the 'Twinloc' connectors TL 41 and TL 59 are only used for coupling connectors in accordance with Annex 4.9 for the version with integrated 'LARA heavy duty' glass support.
- which are installed in such a manner that constraint forces are avoided unless separate verifications are carried out.
- which are installed with the number and type of fasteners indicated in Tables A.1.1 to A.1.6.
- which for connection to coniferous timber are installed with a minimum spacing between full-thread screws in accordance with EN 1995-1-1 following the specifications for nails with non-pre-drilled nail holes. This does not apply for screw spacings defined in Annex 4.
- which for connection to glued laminated timber made of hardwood are installed with a minimum spacing between full-thread screws in accordance with EN 1995-1-1 following the specifications for nails with non-pre-drilled nail holes. This does not apply for screw spacings defined in Annex 4.
- which are installed in timber components with a wood moisture content of max. 18 % when the parts are being connected.

The performance data given in Section 3 are only valid if the 'Twinloc' connector is used in compliance with the specifications and the conditions given in Annexes 1 to 4.

The verification and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the 'Twinloc' connectors of at least 50 years. 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.

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

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Joint strength	See Annex 2
Joint stiffness	See Annex 2
Resistance to seismic actions	No performance assessed
Resistance to corrosion and deterioration	No performance assessed

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Euroclass A1
Resistance to fire	No performance assessed

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

In accordance with EAD No. 130186-00-0603, the applicable European legal act is: 97/638/EC.

The system to be applied is: 2+

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

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 23 September 2024 by Deutsches Institut für Bautechnik.

Anja Dewitt
Head of Section

beglaubigt:
Vössing

Deutsches Institut für Bautechnik DIBt

Annex 1 Specifications of intended use

Use of the 'Twinloc' connectors only for:

- non-fatigue-relevant static and quasi-static actions.

Materials, which can be fastened

The 'Twinloc' connectors are used as timber fasteners for load-bearing timber structures. The 'Twinloc' connectors may be used for fastening or connecting the following timber materials:

- at least core-separated sawn solid timber made from coniferous wood at least of strength class C24 in accordance with EN 14081-1[1],
- glued solid timber made from coniferous wood in accordance with EN 14080[2]. The glued lamellae (planks or squared timber) shall be made from solid timber (coniferous wood) of at least strength class C24 in accordance with DIN EN 14081-1.
- glued laminated timber made from coniferous wood in accordance with EN 14080 of at least strength class GL 24h,
- glued laminated timber made from hardwood in accordance with a European Technical Assessment,
- laminated veneer lumber (LVL) in accordance with EN 14374[3],
- plywood in accordance with EN 636[4] and EN 13986[5] with a characteristic density of at least 400 kg/m³.

Use conditions (environmental conditions)

The corrosion protection of the 'Twinloc' connectors is specified in Annex 3.

Execution

General

EN 1995-1-1[6] shall apply for design and execution.

The dimensions of the main and secondary support beams shall be determined in consideration of the lengths of the 'Twinloc' connector elements in accordance with Annex 4.13. The secondary beam height (face width) H_N and the main beam width (face width) B_H shall be at least 50 mm net.

In general, installation of connector type TL 131 or TL 221 is necessary for coupling connector types. In addition to type TL 131, types TL 41 to TL 131 can be used. In addition to type TL 221, types TL 41 to TL 221 can be used. The possible coupling options for the different connector types and the corresponding permissible transom depths are specified in Annex 4.9. The gap between the two connectors shall not exceed 1 mm.

Screws 4 mm x 45 mm or 4,5 mm x 40 mm according to Table A.3.1 are used to connect the base profiles to the mullions and transoms.

The number of fasteners for the connection of the 'Twinloc' connectors shall for mullion-transom connections correspond to the information given in Table A.1.1 and for rafter-purlin connections correspond to the information given in Table A.1.2.

1	EN 14081-1:2005+A1:2011	Timber structures – Strength-graded structural timber with rectangular cross section – Part 1: General requirements
2	EN 14080:2013	Timber structures – Glued laminated timber and glued solid timber – Requirements
3	EN 14374:2004	Timber structures – Structural laminated veneer lumber – Requirements
4	EN 636:2012+A1:2015	Plywood – Specifications
5	EN 13986:2004+A1:2015	Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking
6	EN 1995-1-1:2004+A1:2008+A2:2014	Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings

'Twinloc' connector	Annex 1
Specification of the intended use	

Table A.1.1 Required number of screws for connection of the 'Twinloc' connectors
Mullion-transom connections

Connector type	TL 41	TL 59	TL 77	TL 95	TL 131	TL 221
Full-thread screws 5,0 x 50 according to Table A.3.1 in mullion						
Minimum number for "standard screw connection"	4	6	6	6	8	10
Number for "complete screw connection"	-	-	8	10	14	24
Full-thread screws 5,0 x 80 according to Table A.3.1 in transom						
Minimum number for "standard screw connection"	4	6	6	6	8	10
Number for "complete screw connection"	-	-	8	10	14	24
Tapping screws ST 5,5 in accordance with Annex 4.37 for all screw connection variants						
Number	1	1	1	1	1	1
Connecting pin VTL 135 in accordance with Annex 4.14						
Number	-	-	-	-	-	1

Table A.1.2 Required number of screws for connection of the 'Twinloc' connectors
Rafter-purlin connections

Connector type	TL 41	TL 59	TL 77	TL 95	TL 131	TL 221
Full-thread screws 5,0 x 50 according to Table A.3.1 in purlin						
Minimum number for "standard screw connection"	4	6	6	6	8	10
Full-thread screws 5,0 x 80 according to Table A.3.1 in rafter						
Minimum number for "standard screw connection"	4	6	6	6	8	10
Full-thread screws 5,0 x 50 according to Table A.3.1 in the purlin support 38/12/12						
Number	2	2	2	2	2	2
Tapping screws ST 5,5 in accordance with Annex 4.37						
Number	1	1	1	1	1	1
Connecting pin VTL 135 in accordance with Annex 4.14						
Number	-	-	-	-	-	1

'Twinloc' connector	Annex 1
Specification of the intended use	

Provisions for 'Twinloc' connectors- variant V0

The 'Twinloc' connectors shall be installed in accordance with Annexes 4.15 and 4.17 as well as 4.1 to 4.8 for variant V0. The required number of screws for connection of the 'Twinloc' connectors shall be in accordance with the information given in Table A.1.1.

The glass supports GA26 and GA34 shall be connected with two tapping screws according to Annex 4.37. The number of fasteners for the connection of the 'Twinloc' connectors variant V0 shall correspond to the information given in Table A.1.3.

Table A.1.3 Required number of screws for variant V0

Connection	**Glass support to base profile**
Tapping screw ST 5,5 x 22 according to Annex 4.37	
Number per glass support	2
Connection	**Base profile to mullion and transom**
Self-tapping full thread screws 4,0 x 45 according to Table A.3.1	
In the area of the glass supports	5
Over the length	on alternating sides every approx. 150 mm, at least 2 screws

Provisions for the version glass support dowel 02

The 'Twinloc' connectors shall be installed in accordance with Annexes 4.19 to 4.21 as well as 4.1 to 4.8 for the version glass support dowel 02. The required number of screws for connection of the 'Twinloc' connectors shall be in accordance with the information given in Table A.1.1.

The glass supports shall be connected with two dowels 8 x L according to Annex 4.22. The glass supports are not covered by this ETA. The number of fasteners for the connection of the 'Twinloc' connectors variant V0 shall correspond to the information given in Table A.1.4.

Table A.1.4 Required number of screws for variant glass support dowel 02

Connection	**Glass support to base profile**
Tapping screw ST 5,5 x 22 according to Annex 4.37	
Number per glass support	1
Connection	**Glass support to transom**
Dowel SD according to Annex 4.22	
Number per glass support	2
Connection	**Base profile to mullion and transom**
Self-tapping full thread screws 4,0 x 45 according to Table A.3.1	
In the area of the glass supports	5
Over the length	on alternating sides every approx. 150 mm, at least 2 screws

'Twinloc' connector	Annex 1
Specification of the intended use	

Provisions for 'Twinloc' connectors – variant V2

For the 'Twinloc' connectors with integrated 'LARA heavy duty' glass supports, L- or T-shaped glass supports GA 63 and KA 43 made from aluminium in accordance with Annexes 4.23 to 4.29 shall additionally be installed. For reinforcement variant V2 the lengthened base profile positioned on the transom bridges the gap between the transom and the mullion (see Annexes 4.23 and 4.24). The 'Twinloc' connectors shall be connected with standard screw connections to the mullion and transom for reinforcement variant V2. The required number of screws for connection of the 'Twinloc' connectors shall be in accordance with the information given in Table A.1.1. The number of fasteners for the connection of the 'Twinloc' connectors variant V2 shall correspond to the information given in Table A.1.5.

Glass supports GA 63 shall be installed with a superelevation of 1 mm (see Annex 4.29).

Table A.1.5 Required number of screws for variant V2

Connection	**Glass support GA 63 L and R and M to cross profile KA 43**	
Tapping screw ST 5,5 x 38 according to Annex 4.37		
Number per glass support	2	
Connection	**Cross profile KA 43 to base profile**	
Tapping screw ST 5,5 x 55 according to Annex 4.37		
Number per glass support	2	
Countersunk tapping screw ST 4,8 x 11 according to Annex 4.38		
Number per glass support	2	
Connection	**Glass support GA 63 L and R to P GF 50 V**	**Glass support GA 63 M to P GF 50 V**
Tapping screw ST 5,5 x 45 according to Annex 4.37		
Number per glass support	4	8
Connection	**P GF 50 V to transom**	
Self-tapping screws 5,0 x 80 according to Table A.3.1		
Number per component	9	
Connection	**Base profile to mullion and transom**	
Self-tapping screws 4,0 x 45 according to Table A.3.1		
In the area of the glass supports	5	
Over the length	on alternating sides every approx. 150 mm, at least 2 screws	

'Twinloc' connector	Annex 1
Specification of the intended use	

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Provisions for 'Twinloc' connectors – variant V3

For the 'Twinloc' connectors with integrated 'LARA heavy duty' glass supports, L- or T-shaped glass supports GA 63 HL and KA 43 HL made from aluminium in accordance with Annexes 4.30 to 4.36 shall additionally be installed. The 'Twinloc' connectors shall be connected with heavy-duty screw connections to the mullion and transom for reinforcement variant V3. The required number of screws for connection of the 'Twinloc' connectors shall be in accordance with the information given in Table A.1.1. The number of fasteners for the connection of the 'Twinloc' connectors variant V3 shall correspond to the information given in Table A.1.6.

Glass supports GA 63 HL shall be installed with a superelevation of 2 mm (see Annex 4.36).

Table A.1.6 Required number of screws for variant V3

Connection	**Glass support GA 63 HL L and R and M to cross profile KA HL 43**	
Tapping screw ST 5,5 x 38 according to Annex 4.37		
Number per glass support	2	
Connection	**Cross profile KA 43 HL to mullion**	
Panhead screw 5,0 x 100 according to Table A.3.1		
Number per glass support	4	
Connection	**Glass support GA 63 HL L and R to base profile**	**Glass support GA 63 HL M to base profile**
Tapping screw ST 5,5 x 38 according to Annex 4.37		
Number per glass support	4	8
Connection	**Base profile to mullion and transom**	
Self-tapping screw 4,0 x 45 according to Table A.3.1		
In the area of the glass supports	5	
Over the length	on alternating sides every approx. 150 mm, at least 2 screws	

'Twinloc' connector	Annex 1
Specification of the intended use	

Assembly

General

Special attention shall be paid to precise marking of screw hole positions and drilling of screw holes; usually a drilling template needs to be used.
Screw holes with a diameter of 3.0 mm shall be pre-drilled in the transom or rafter for components consisting of glued laminated timber made from hardwood.

'Twinloc' connectors'

Assembly in the workshop involves the following work steps:

- milling a recess with dimensions 12 mm x 38 mm x (l + 6 mm) in the heartwood surface of the transom using a milling template, where l is the length of the transom-side connector element in mm,
- pre-drilling screw holes with a diameter of 3.0 mm in the mullion,
- fastening the connector element to the mullion with full-thread screws 5 mm x 50 mm; see Annex 4.3 to 4.8 for connection design for standard and complete screw connections.
- inserting the connector element into the recess in the transom and fastening with full-thread screws 5 mm x 80 mm; see Annex 4.3 to 4.8 for connection design for standard and complete screw connections.

Assembly at the construction site involves the following work steps:

- inserting the connector element at the transom from the inside to the outside or hinging it from the side,
- screwing the tapping screw ST 5,5 into the screw channel formed by the two connector elements.

  For coupling of connector types and when using connector type TL 221, the connecting pin VTL 135 (see Annex 4.14 for length L) shall be hammered in to a depth of 20 mm before the tapping screw is screwed in. The connecting pin is moved to its final position through the subsequent screwing in of the tapping screw.

Base profiles GF 50, GF 60, GF 80

- The base profiles are screwed to the transom-mullion construction with timber screws 4 mm x 45 mm or 4.5 mm x 40 mm on alternating sides every approx. 150 mm. The base profiles shall be at least 200 mm long. The base profiles may be divided in three parts at maximum between the glass supports.
  Die Basisprofile dürfen zwischen den Glasauflagern in maximal 3 Teilstücke aufgeteilt werden.
- In the area of the glass supports, the base profile shall additionally be fastened with five timber screws 4 mm x 45 mm or 4.5 mm x 40 mm per glass support point. For this three are positioned correctly above and two below the screw channel; see, e.g., Annex 4.19 and 4.20.

'Twinloc' connectors variant 'V0'

'Twinloc' connectors

- Assembly of the connector as described above for 'Twinloc' connectors standard screw connection

Glass support 'V0'

- For variant V0, the glass supports GA 26 or GA 34 are placed on the base profile at a distance of 90 mm to 100 mm to the outer edge of the mullion and screwed to the screw channel of the base profile with two tapping screws 5.5 mm x 22 mm each; see Annexes 4.15 and 4.16.

'Twinloc' connector	Annex 1
Assembly of the 'Twinloc' connectors	

'Twinloc' connectors variant dowel 'SD02'

'Twinloc' connectors

- Assembly of the connector as described above for 'Twinloc' connectors standard screw connection

Glass support dowel 'SD02'

- Two holes with d = 8 mm are drilled with a spacing of 72 mm through the base profile through the middle of the screw channel into the transom. The distance from the first hole to the outer edge of the mullion is 104 to 114 mm. The distance of the bore hole from the end of the base profile in direction of the mullion shall be at least 80 mm. The hole depth depends on the dowel pin length; see Annexes 4.22.
- The glass support is fixed on top of the holes and the two dowel pins are then driven in; see Annexes 4.19 to 4.20.
- The tapping screw 5.5 mm x 22 mm is then screwed through the middle of the glass support into the screw channel of the base profile.

'Twinloc' connectors with integrated 'LARA heavy duty' glass supports – variant V2

Assembly in the workshop involves the following work steps:

'Twinloc' connectors

Assembly of the connector as described above for 'Twinloc' connectors standard or complete screw connection

Glass support variant V2

- milling a recess with dimensions 38 mm x 5 mm x 240 mm in the front surface on both ends of the transom; see, e.g., Annex 4.25,
- pre-drilling screw holes with a diameter of 3.0 mm in the transom,
- milling a recess with dimensions 38 mm x 5 mm on the front surface of the mullion over the entire mullion width on the axis of the transom profile,
- pre-drilling screw holes with a diameter of 3.0 mm in the mullion (1x for one-sided connection; 2x for two-sided connection); see Annex 4.23.

Assembly at the construction site involves the following work steps:

'Twinloc' connector

Assembly of the connector as described above for 'Twinloc' connectors standard or complete screw connection

Glass support variant V2

- The assembly provisions regarding the base profiles GF 50, GF 60 and GF 80 are valid for the base profiles fastened between the reinforced base profiles P GF 50 V.
- screwing the reinforced base profile P GF 50 V into the transom supporting structure with eight self-drilling full-thread screws 5.0 mm x 80 mm; see Annexes 4.23 and 4.24,
- screwing the reinforced base profile P GF 50 V into the mullion supporting structure with one self-drilling full-thread screw 5.0 mm x 80 mm; see Annexes 4.23 and 4.24,
- mounting and hooking in the horizontal glass support GA 63 on the transom base profile with facade seal,
- screwing the glass support GA 63-M to the reinforced transom base profile P GF 50 V with eight tapping screws 5.5 mm x 45 mm; see Annexes 4.23 and 4.24 and screwing the glass supports GA 63-L and GA 63-R with four tapping screws 5.5 mm x 45 mm
- fastening the vertical additional profile KA 43 in the screw channel of the mullion base profile
- screwing the additional profile KA 43 to the mullion base profile with two tapping screws 5.5 mm x 55 mm; see Annexes 4.23 and 4.24
- screwing the additional profile KA 43 to the mullion base profile with two countersunk screws 4.8 mm x 11 mm; see Annexes 4.23 and 4.24
- screwing the glass support GA 63-M or L or R to the additional profile KA 43 with two tapping screws 5.5 mm x 38 mm; see Annexes 4.23 and 4.24.

'Twinloc' connector	Annex 1
Assembly of the 'Twinloc' connectors	

'Twinloc' connectors with integrated 'LARA heavy duty' glass supports – variant V3

Assembly in the workshop involves the following work steps:

'Twinloc' connectors

Assembly of the connector as described above for 'Twinloc' connectors complete screw connection

Glass support variant V3

- pre-drilling screw holes with a diameter of 3.0 mm in the mullion; see, e.g., Annex 4.30 for hole positions.

Assembly at the construction site involves the following work steps:

'Twinloc' connector

Assembly of the connector as described above for 'Twinloc' connectors complete screw connection

Glass support variant V3

- placing the pre-assembled integrated glass support (comprising of glass support GA 63 HL-M or L or R and additional profile KA 43 HL connected by two tapping screws 5.5 mm x 38 mm) on the base profile with facade seal; see Annex 4.30
- screwing the integrated glass support GA 63 HL-M to the transom base profile with eight tapping screws 5.5 mm x 38 mm; see Annex 4.30 and the integrated glass support GA 63 HL-M or L or R with four tapping screws 5.5 mm x 38 mm
- screwing the integrated glass support GA 63 HL-M or L or R to the mullion with four pan head screws 5.0 mm x 100 mm; see Annex 4.30.

Assembly of the 'Twinloc' connectors for use as rafter-to-purlin connection

Assembly in the workshop involves the following work steps:

- milling a recess with dimensions 12 mm x 38 mm x H in the purlin using a milling template, where H is the height of the recess in mm in accordance with the information given in Table A.1.7,

  Table A.1.7 Height H of recess in purlin

Roof slope	Height H of recess in purlin in mm
0° - 10°	6 + l + 12
11° - 20°	20 + l + 12
21° - 30°	35 + l + 12
31° - 40°	55 + l + 12

  where:

  l = length of connector element in mm in accordance with Annex 4.13.
- pre-drilling screw holes with a diameter of 3.0 mm in the purlin,
- inserting the connector element into the recess in the purlin and fastening with full-thread screws 5 mm x 50 mm (standard screw connection in accordance with Table A.1.1) and fastening the support with two full-thread screws 5 mm x 50 mm in the purlin recess; for the execution of the connection see Annexes 4.10 to 4.12,
- fastening the connector element to the rafter with full-thread screws 5 mm x 80 mm (standard screw connection in accordance with Table A.1.1); see Annexes 4.10 to 4.12 for execution of the connection.

Assembly at the construction site involves the following work steps:

- inserting the connector element at the rafter downwards from above or hinging from the side,
- screwing the tapping screw into the screw channel formed by the two connector elements.
- For coupling of connector types, the connecting pin VTL 135 (see Annex 4.14 for length L) shall be hammered in to a depth of 20 mm before the tapping screw is screwed in. The connecting pin is moved to its final position through the subsequent screwing in of the tapping screw.

'Twinloc' connector	Annex 1
Assembly of the 'Twinloc' connectors	

Annex 2 Characteristic load-bearing capacity values for 'Twinloc' connectors

A.2.1 General

Coupling of connector types is permissible. In addition to connector type TL 131 or TL 221, types TL 41 to TL 131 or types TL 41 to TL 221 can be installed (see overview in Annex 4.9). The load-bearing capacity for the additional connector types TL 41 to TL 131 shall not be taken into account.

In the case of loading in the connector element plane at a right angle to the mullion axis F_{23}, sheer tensile stress verification for the mullion and transom shall additionally be provided, where required, for two-sided connections to mullions of width $B_H < 100$ mm. Verification shall be provided in accordance with the provisions applicable at the location of installation, e.g. in accordance with DIN EN 1995-1-1/NA:2013-08 Sections NCI to 8.1.4 and NCI NA.6.8.2.

Unless otherwise specified below the modification factor k_{mod} and the partial safety factor γ_M according to EN 1995-1-1 shall be used to determine the design resistances.

For combined loading, equation (8.28) in accordance with EN 1995-1-1:2004 shall apply analogously.

A.2.2 Loading at a right angle to the connector element plane

A.2.2.1 Centric loading at a right angle to the connector element plane

The characteristic load-bearing capacity value $F_{1,Rk}$ for the 'Twinloc' connectors for centric loading at a right angle to the connector element plane is:

$$F_{1,Rk} = 93 \cdot l \quad [N] \qquad (1)$$

where:

l = length of connector element in mm in accordance with Annex 4.13, with a length of 131 mm to be applied for connector TL 221.

For determination of the design value, the partial safety factor γ_M in accordance with EN 1999-1-1[7] shall be applied.

A.2.2.1 Eccentric loading at a right angle to the connector element plane

The characteristic load-bearing capacity value $F_{1,Rk}$ for the 'Twinloc' connectors for eccentric loading at a right angle to the connector element plane is:

$$F_{1,Rk} = \frac{F_{ax,Rk}}{\frac{1}{n_J} + \frac{e_{vk} + e_{vb}}{e_{ax}}} \quad [N] \qquad (2)$$

where:

$F_{ax,Rk}$ Characteristic load-bearing capacity value for an axially loaded screw in accordance with ETA-12/0114 [N]

$$F_{ax,Rk} = 11.8 \cdot \rho_k^{0,8} \quad [N] \qquad (3)$$

n_J Number of screws in the transom connection

e_{vk} Distance of line of action $F_{1,Ed}$ to edge of transom

e_{vb} Distance between front edge of transom and centre of gravity of screw connection; see Table A.2.1

e_{ax} Value in accordance with Table A.2.1.

ρ_k characteristic density of main or secondary support beam [kg/m³], with the smaller value taking precedence. The maximum bulk density ρ_k which may be applied is 500 kg/m³ for coniferous timber materials and 590 kg/m³ for glued laminated timber made from hardwood.

[7] EN 1999-1-1:2007 + A1:2009 + A2:2013 Eurocode 9: Design of aluminium structures – Part 1-1: General structural rules

'Twinloc' connector	Annex 2
Characteristic load-bearing capacity and stiffness values	

Table A.2.1 Values for determining load-bearing capacity $F_{1,Rk}$ of 'Twinloc' connectors for standard and complete screw connections

'Twinloc' connector type	41	59	77	95	131	221
e_{ax} [mm]	30	63	110	166	276	600
e_{vb} [mm]	19.5	28.5	34.5	40.5	60	89.7

A.2.3 Loading in the connector element plane at a right angle to the main beam axis

The characteristic load-bearing capacity value $F_{23,Rk}$ for the 'Twinloc' connectors for loading in the connector element plane at a right angle to the mullion axis is:

$$F_{23,Rk} = k\rho \cdot n_{standard} \cdot 1070 \quad [N] \qquad (4)$$

where:

$$k\rho = (\rho_k/430)^{0.5} \qquad (5)$$

$n_{standard}$ number of screws per connector element for a standard screw connection, with $n_{standard}$ = 8 to be applied for connector TL 221

ρ_k characteristic density of main or secondary support beam [kg/m³], with the smaller value taking precedence. The maximum density ρ_k which may be applied is 500 kg/m³ for coniferous timber materials and 590 kg/m³ for glued laminated timber made from hardwood.

A.2.4 Loading in the connector element plane parallel to the main beam axis

A.2.4.1 'Twinloc' connector – Variant V0

For the characteristic load-bearing capacity value for 'Twinloc' connector variant V0 with loading in the connector element plane parallel to the mullion axis by eccentrically acting loads such as glass loads, Table A.2.2 shall apply. The load-bearing capacity $F_{45,Rk}$ may only be applied for variant V0 if single- and double-glazed glass units with quasi-rigid sealing strips and glued joints are used.

Table A.2.2 Characteristic load-bearing capacity value $F_{45,Rk}$ for 'Twinloc' connectors variant V0 for loading in the connector element plane parallel to the mullion axis in N

Variant	V0 Standard screw connection
Distance of the glass support to the mullion $l_ü$ [mm] (see Annex 4.16)	$l_ü \leq 100$
Glass pane thickness d [mm]	$d \leq 30$
Connector type	TL 77 to TL 221
$F^*_{45,Rk}$ [N]	1230
* For mullions or transoms made from coniferous wood solid timber, $F_{45,Rk}$ shall be reduced by $k\rho = (\rho_k/430)^{0.5}$.	

'Twinloc' connector	Annex 2
Characteristic load-bearing capacity and stiffness values	

A.2.4.2 'Twinloc' connector – Variant glass support dowel 02

The characteristic load-bearing capacity value for the 'Twinloc' connectors in the variant glass support dowel 02 for loading in the connector element plane parallel to the mullion axis by eccentrically acting loads such as glass loads is:

$$F_{45,Rk} = \frac{k_s \cdot F_{v,Rk}}{\sqrt{\left(\frac{1}{n_J} + \frac{e_{vk} + e_{vb}}{e_{vx}}\right)^2 + \left(\frac{e_{vk} + e_{vb}}{e_{vy}}\right)^2}} \quad (6)$$

where:

$F_{v,Rk}$ Characteristic load-bearing capacity value for a screw in single shear for thick metal sheets according to equation (8.10) in EN 1995-1-1:2004

$$F_{v,Rk} = 45.5 \cdot \sqrt{\rho_k} + 2.95 \cdot \rho_k^{0,8} \quad (7)$$

ρ_k Characteristic value of density of transom or mullion, with the smaller value taking precedence [kg/m³] The maximum density ρ_k which may be applied is 500 kg/m³ for coniferous timber materials and 590 kg/m³ for glued laminated timber made from hardwood.

ks Factor taking the splitting behaviour into account; see Table A.2.3

n_J Number of screws in transom connection; see Table A.2.3

e_{vk} Distance of line of action $F_{45,Ed}$ to edge of transom

e_{vb} Distance between front edge of transom and centre of gravity of screw connection; see Table A.2.3

e_{vx}, e_{vy} Values in accordance with Table A.2.3.

Table A.2.3 Values for determining load-bearing capacity $F_{45,Rk}$ of 'Twinloc' connectors – variant glass support dowel 02 –

'Twinloc' connector type – variant glass support dowel 02 –	41	59	77	95	131	221
Glass pane thickness [mm]	d ≤ 64					
k_s	1.0	1.0	1.0	1.0	0.75	0.75
n_J* standard screw connection	4	6	6	6	8	10
e_{vb} [mm]	19.5	28.5	34.5	40.5	60	89.7
e_{vx} [mm]	46.7	78	122	176	284	607
e_{vy} [mm]	84	234	464	810	2047	6772
* The number of screws of the connector elements for complete screw connection shall be taken as for standard screw connection.						

'Twinloc' connector	Annex 2
Characteristic load-bearing capacity and stiffness values	

A.2.4.3 'Twinloc' connector with integrated glass support 'LARA heavy duty' – Variants V2 and V3

For the characteristic load-bearing capacity value for the 'Twinloc' connectors with integrated glass supports 'LARA heavy duty' with loading in the connector element plane parallel to the mullion axis by eccentrically acting loads such as glass loads, Table A.2.4 shall apply.

Table A.2.4 Characteristic load-bearing capacity value $F_{45,Rk}$ for 'Twinloc' connectors for loading in the connector element plane parallel to the mullion axis in N

Variant	V2 Standard screw connection		V3 Heavy-duty screw connection	
Distance of the glass support from the mullion $l_ü$ [mm] (see Annexes 4.24 and 4.31)	$l_ü \leq 50$	$l_ü \leq 100$	$l_ü \leq 50$	$l_ü \leq 100$
Glass pane thickness d [mm]	$d \leq 64$			
Connector type	TL 77 to TL 221			
$F^*_{45,Rk}$ [N]	10400	8600	8600	7300
* For mullions or transoms made from coniferous wood solid timber, $F_{45,Rk}$ shall be reduced by $k\rho = (\rho_k/430)^{0.5}$.				

A.2.4.4 'Twinloc' connector for rafter-to-purlin connections

For the characteristic load-bearing capacity value for the 'Twinloc' connectors used for rafter-to-purlin connections with loading in the connector element plane parallel to the purlin axis by centrically acting loads, Table A.2.5 shall apply.

Table A.2.5 Characteristic load-bearing capacity value $F_{45,Rk}$ for 'Twinloc' connectors used for rafter-to-purlin connections with loading in the connector element plane parallel to the main beam axis in N
- standard screw connection -

Connector type purlin-to-rafter connection	TL 41	TL 59	TL 77	TL 95	TL 131	TL 221
Number of screws per connector element n	4	6	6	6	8	10
$F_{45,Rk}$ in N	$k\rho \cdot 2100$	$k\rho \cdot 2800$	$k\rho \cdot 2890$	$k\rho \cdot 3090$	$k\rho \cdot 3900$	$k_\rho \cdot 5000$
$k\rho$ according to equation (5)						

'Twinloc' connector	Annex 2
Characteristic load-bearing capacity and stiffness values	

A.2.5 Stiffness values

A.2.5.1 Stiffness $K_{ser,45}$ for loading in the connector element plane parallel to the mullion axis

For the calculated value of the slip modulus $K_{ser,45}$ for the serviceability limit state for 'Twinloc' connectors TL 41 to TL 221 with eccentric loading with loads F_{45} such as glass loads at a right angle to the transom axis, Table A.2.6 shall apply – in relation to the glass pane.

Table A.2.6 Calculated values of slip modulus $K_{ser,45}$ in N/mm for 'Twinloc' connectors for loading in the connector element plane parallel to the mullion axis

'Twinloc' connector						
Variant	Variant glass support dowel 02	non-reinforced	With integrated 'LARA heavy duty' glass support			For rafter-to-purlin connections
		V0 Standard screw connection	V2 Standard screw connection		V3 Complete screw connection	
Distance of the glass support from the mullion $l_ü$ [mm] (see Annexes 4.16, 4.24 and 4.31)	-	$l_ü \leq 100$	$l_ü \leq 50$	$l_ü \leq 100$	$l_ü \leq 100$	F_{45} acting centrically
Glass pane thickness d [mm]	d ≤ 64	d ≤ 30	d ≤ 64			-
Connector type	TL 41 to TL 221	TL 77 to TL 221				TL 41 to TL 221
Slip modulus $K_{ser,45}$ per mullion-to-transom connection [N/mm]	$\frac{F_{45,Rk}}{3\,mm}$	1000	2000	1300	750	$190 \cdot \sqrt{\ell}$
$F_{45,Rk}$ Characteristic load-bearing capacity value for 'Twinloc' connectors in the variant glass support dowel 02 with loading in the connector element plane parallel to the mullion axis in accordance with Annex A.2.4.2						
$\sqrt{\ell}$ Length of connector element [mm] in accordance with Annex 4.13						

A.2.5.2 Stiffness $K_{ser,23}$ for loading in the connector element plane at a right angle to the mullion axis

For the calculated value of the slip modulus $K_{ser,23}$ for the serviceability limit state for 'Twinloc' connectors loaded with loads F_{23}, the following simplifications may be made:

$$K_{ser,23} = 0.07 \cdot n_{standard} \cdot \rho_k^{1.5} \quad \text{in N/mm.} \qquad (8)$$

where:

$n_{standard}$ number of screws per connector element for a standard screw connection, with $n_{standard}$ = 8 to be applied for connector TL 221.

ρ_k characteristic density of mullion or transom [kg/m³], with the smaller value taking precedence and the maximum ρ_k to be applied being 500 kg/m³ for coniferous timber materials and 590 kg/m³ for glued laminated timber made from hardwood.

'Twinloc' connector	Annex 2
Characteristic load-bearing capacity and stiffness values	

Annex 3 Product details

Table A.3.1 Material specifications for 'Twinloc' connectors

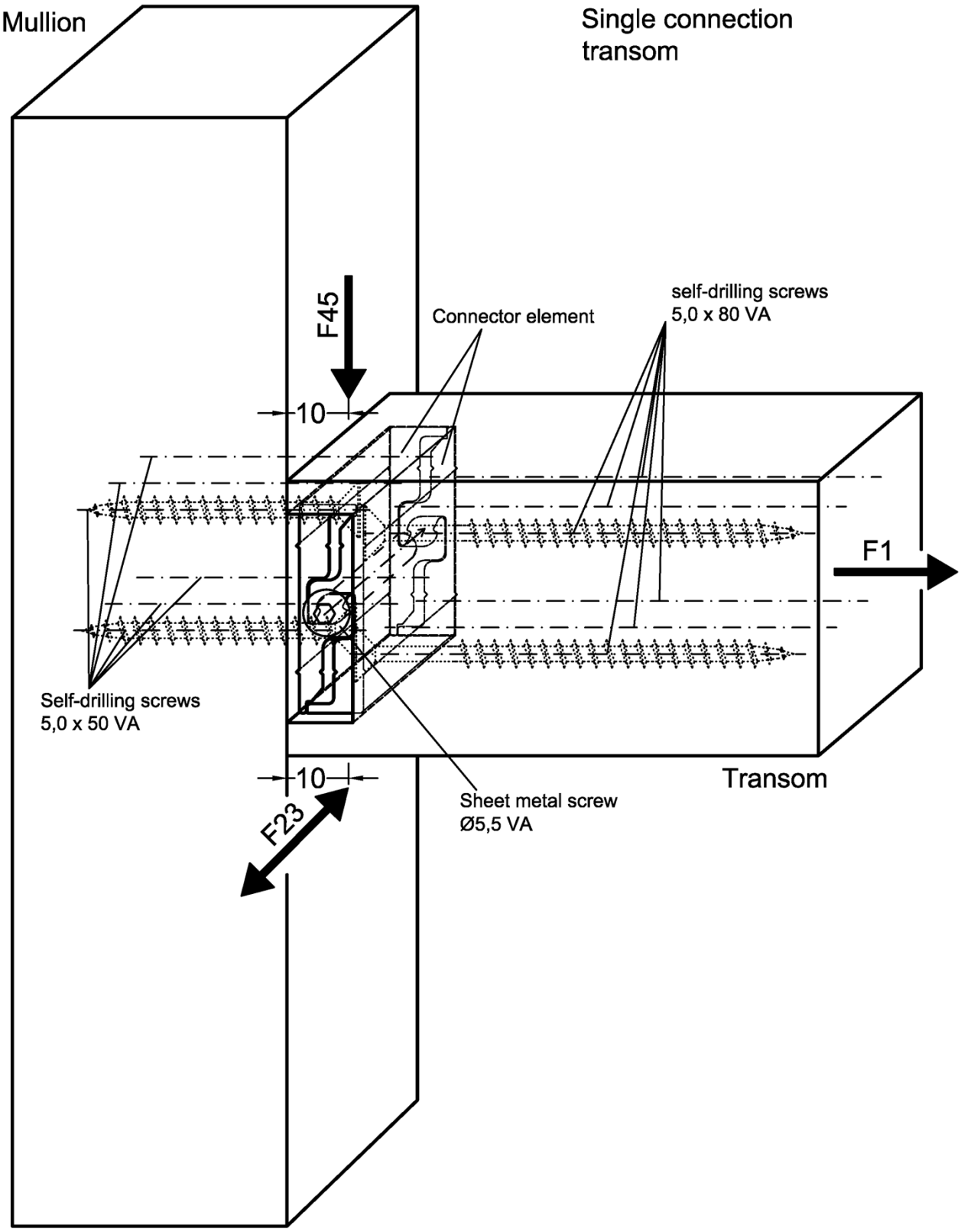
Component	Material designation		Material specification	Minimum requirements	Corrosion protection
'Twinloc' connector elements see Annex 4.13	EN AW-6060		EN 573-3[8], state T 66 in accordance with EN 755-2[9]	-	-
Self-drilling full-thread screws 5 mm x 80 mm and 5 mm x 50 mm as per ETA-12/0114 for fastening the connector elements	Stainless steel		ETA-12/0114	-	At least corrosion resistance class II[10]
Tapping screws ST 5.5 and ST 4.8 see Annex 4.37	Stainless steel	1.4301	EN 10263-5[11]	Strength class 70 in accordance with EN ISO 3506-1[12]	Corrosion resistance class II
		1.4401			Corrosion resistance class III
Connecting pin VTL 135 for coupling of connectors see Annex 4.14	EN-AW 5019		EN 573-3, state H 18 in accordance with EN 1301-2 [13]	-	-
Dowels 8 mm x 140 mm as per EN 14592 see Annex 4.22	Stainless steel		EN 10263-5	$M_y \geq 50$ Nm Bending angle $\alpha \geq 30°$	Corrosion resistance class II
Supports for rafter-to-purlin connection see Annex 4.11	EN AW-6060		EN 573-3, state T 66 in accordance with EN 755-2	-	-
Base profiles GF 50, GF 60, GF 80	EN AW-6060		EN 573-3, state T 66 in accordance with EN 755-2	-	-

[8] EN 573-3:2013 Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition and form of products
[9] EN 755-2:2016 Aluminium and aluminium alloys – Extruded rod/bar, tube and profiles – Part 2: Mechanical properties
[10] Corrosion resistance class in accordance with EN 1993-1-4
[11] EN 10263-5:2001 Steel rod, bars and wire for cold heading and cold extrusion – Part 5: Technical delivery conditions for stainless steels
[12] EN ISO 3506-1:2009 Mechanical properties of corrosion-resistant stainless steel fasteners – Part 1: Bolts, screws and studs
[13] EN 1301-2:2008-12 Aluminium und Aluminiumlegierungen - Gezogene Drähte - Teil 2: Mechanische Eigenschaften

'Twinloc' connector	Annex 3
Product details	

Component		Material designation	Material specification	Minimum requirements	Corrosion protection
Reinforced base profiles P GF 50 V see Annex 4.28		EN AW-6060	EN 573-3, state T 66 in accordance with EN 755-2	-	-
Self-drilling full-thread screws for fastening the base profiles	4.5 mm x 40 mm	Stainless steel	ETA-12/0114 or ETA-11/0190	-	At least corrosion resistance class II
	4.0 mm x 45 mm see Annex 4.38		EN 10263-5		
Pan head screw 5,0 mmx 100 mm to connect the cross profiles KA 43 HL see Annex 4.38		Stainless steel 1.4301	EN 10263-5 or according to ETA-11/0283 or ETA-12/0114	Strength class 70 in accordance with EN ISO 3506-1	Corrosion resistance class II
Additional profiles KA 43, KA 43 HL and glass support GA 63 see Annexes 4.27, 4.33 and 4.34		EN AW-6060	EN 573-3, state T 66 in accordance with EN 755-2	-	-
Glass support GA 63 HL see Annexes 4.33 and 4.34		EN AW-6063	EN 573-3, state T 66 in accordance with EN 755-2	-	-
Glass support GA 26 and GA 34 see Annex 4.18		EN AW-6060	EN 573-3, state T 66 in accordance with EN 755-2	-	-

'Twinloc' connector	Annex 3
Product details	



'Twinloc' connector	Annex 4.1
Basic configuration of the mullion-transom connection	

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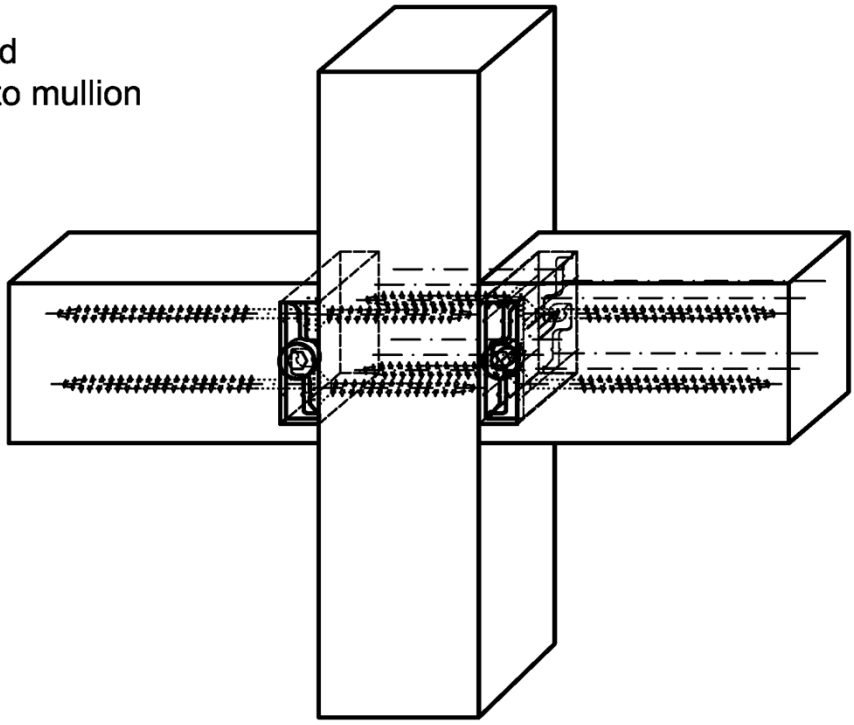
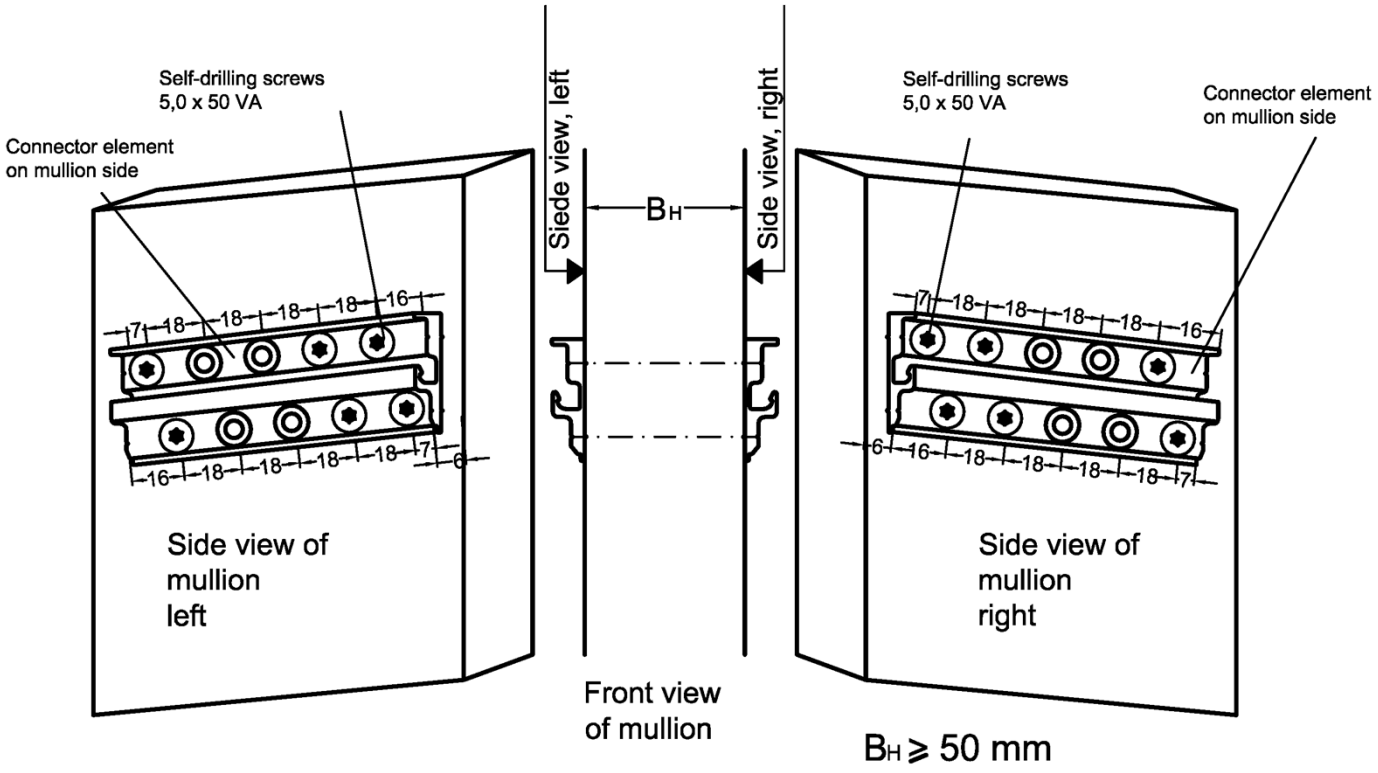
Double-sided connection to mullion



Screw connection on mullion for double-sided connection with predefined offset of screw positions



'Twinloc' connector	Annex 4.2
Double-sided connection to mullion	

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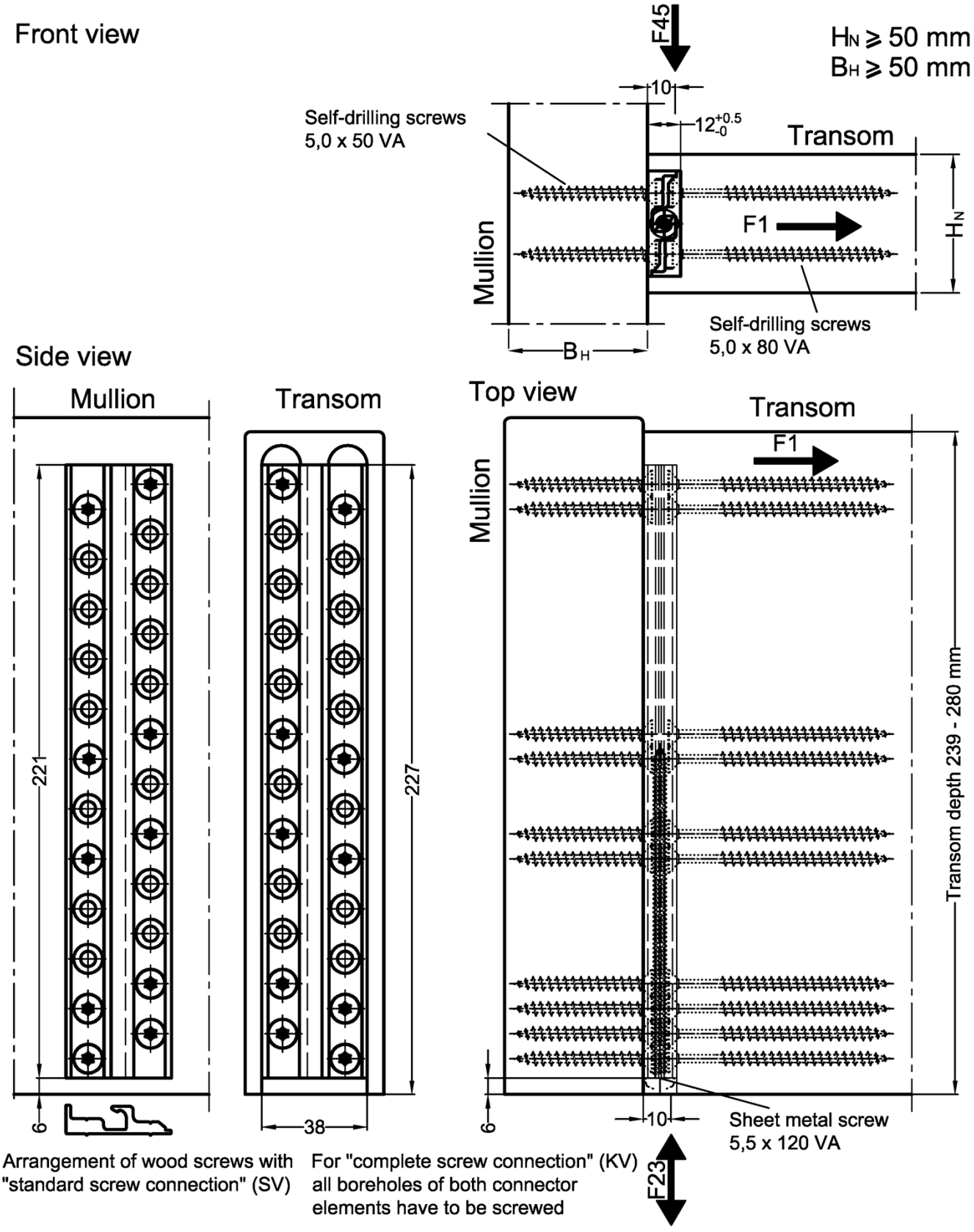

Arrangement of wood screws with "standard screw connection" (SV)

For "complete screw connection" (KV) all boreholes of both connector elements have to be screwed

'Twinloc' connector	Annex 4.3
Mullion-Transom connection with connector Twinloc TL 221	

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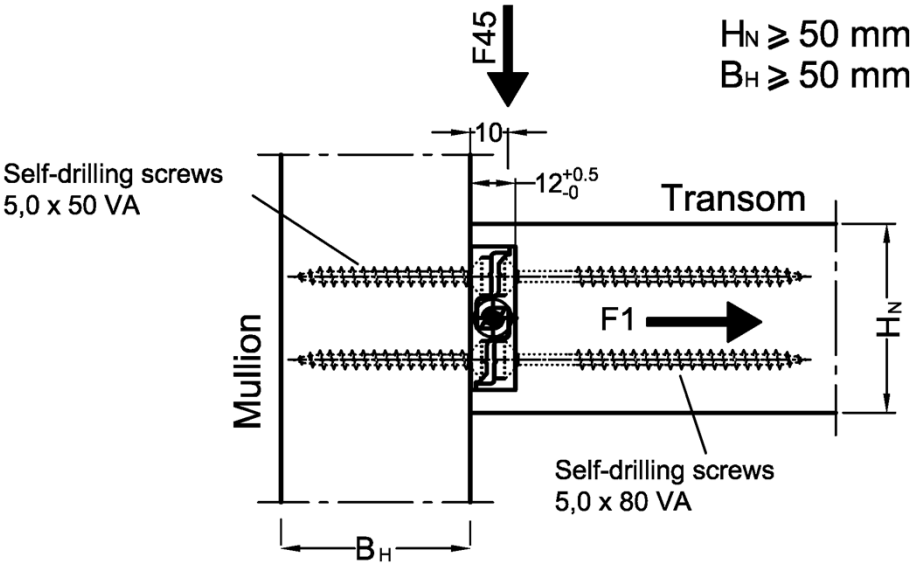
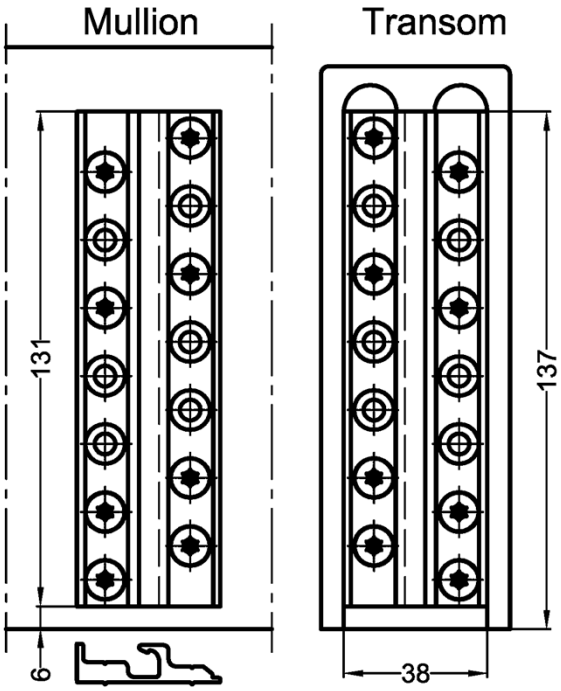
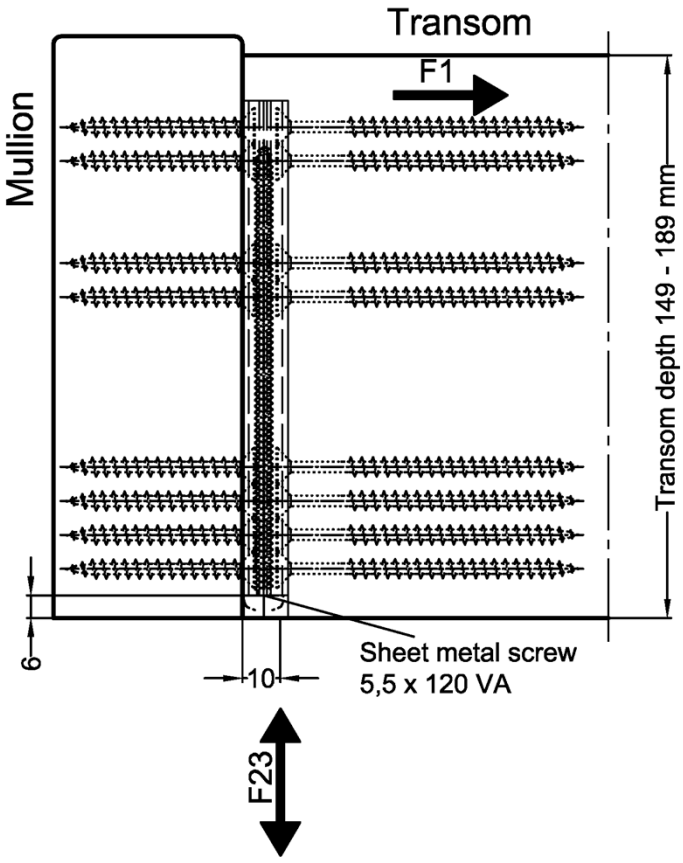
Front view



Side view



Top view



Arrangement of wood screws with "standard screw connection" (SV)

For "complete screw connection" (KV) all boreholes of both connector elements have to be screwed

'Twinloc' connector	Annex 4.4
Mullion-Transom connection with connector Twinloc TL 131	

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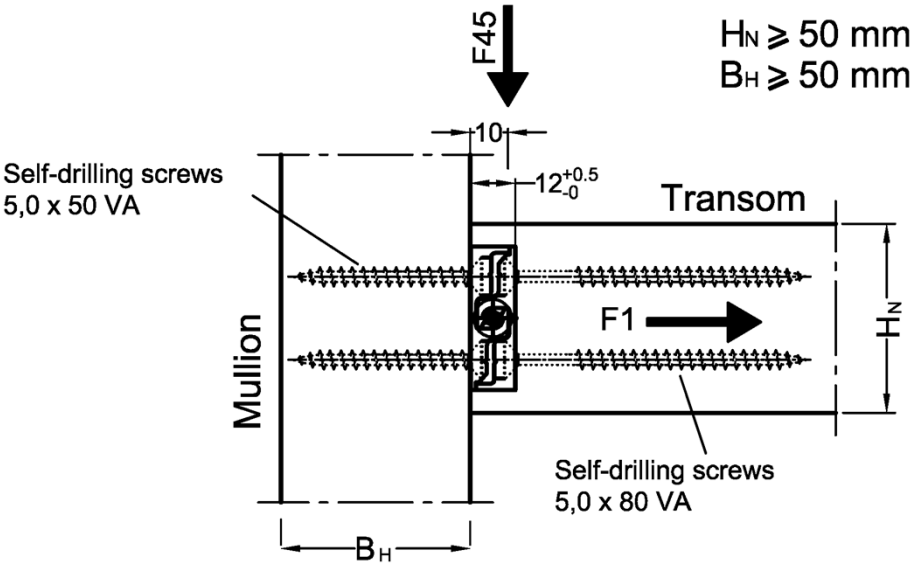
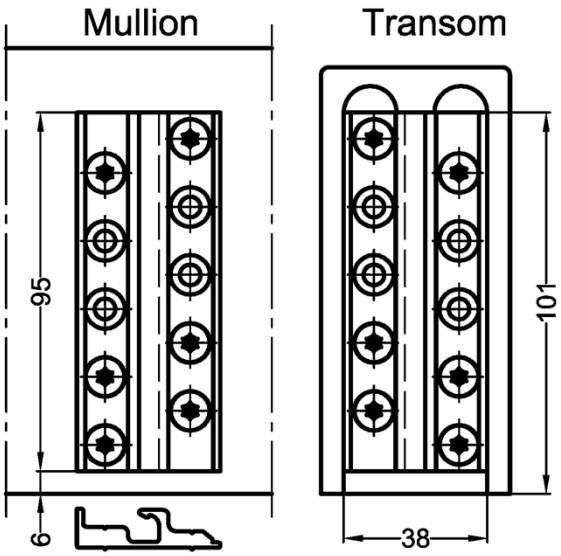
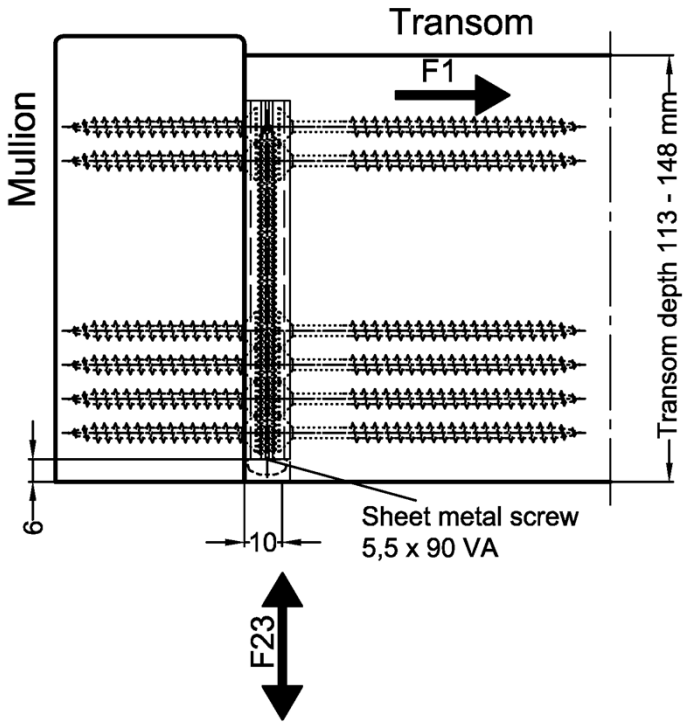
Front view



Side view



Top view



Arrangement of wood screws with "standard screw connection" (SV)

For "complete screw connection" (KV) all boreholes of both connector elements have to be screwed

'Twinloc' connector	Annex 4.5
Mullion-Transom connection with connector Twinloc TL 95	

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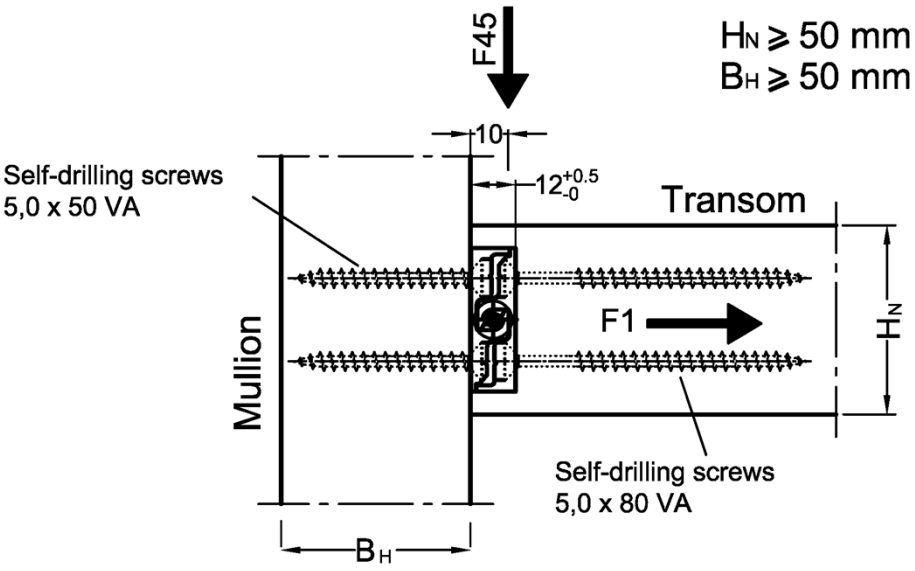
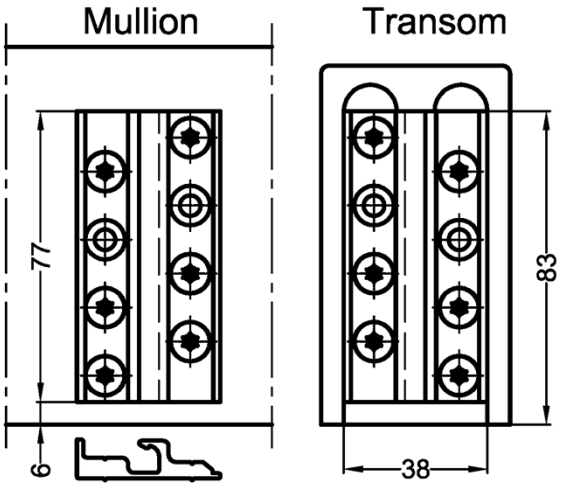
Front view



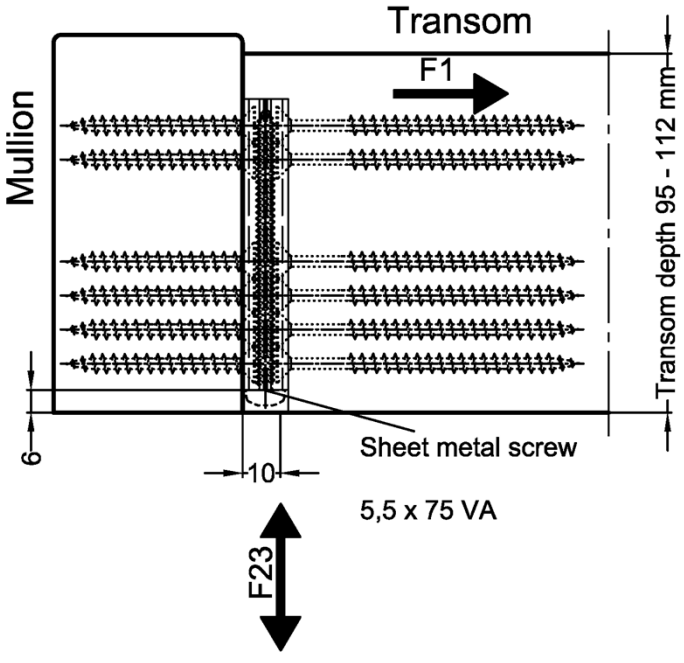
Side view



Arrangement of wood screws with "standard screw connection" (SV)

For "complete screw connection" (KV) all boreholes of both connector elements have to be screwed

Top view



'Twinloc' connector	Annex 4.6
Mullion-Transom connection with connector Twinloc TL 77	

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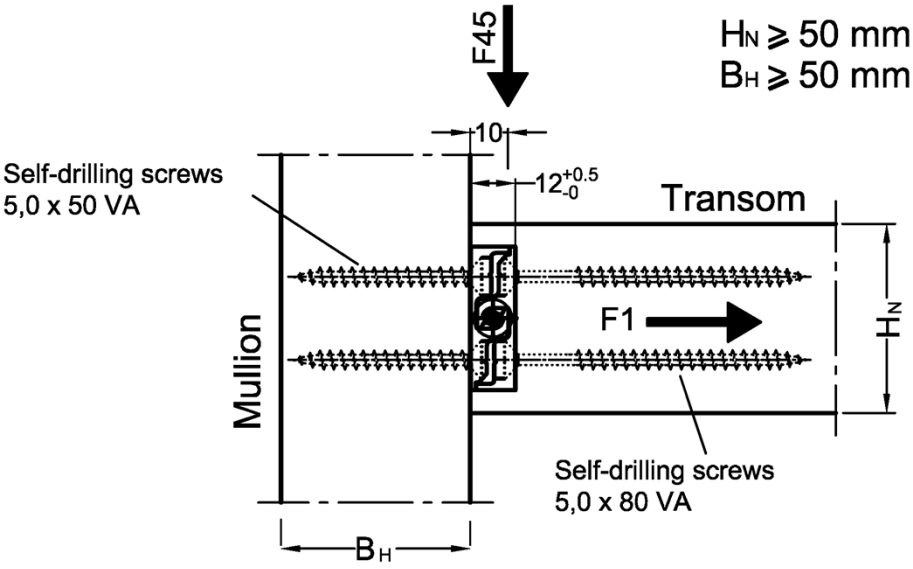
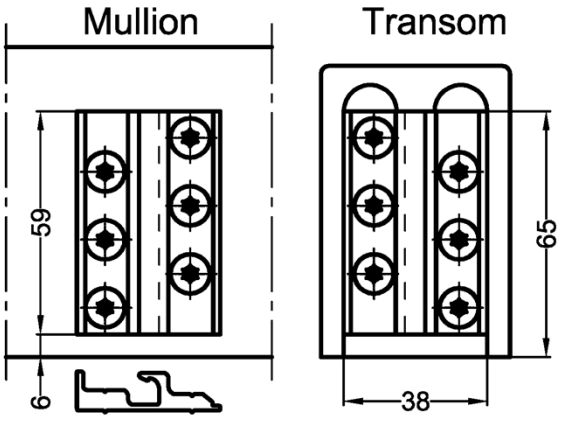
Front view

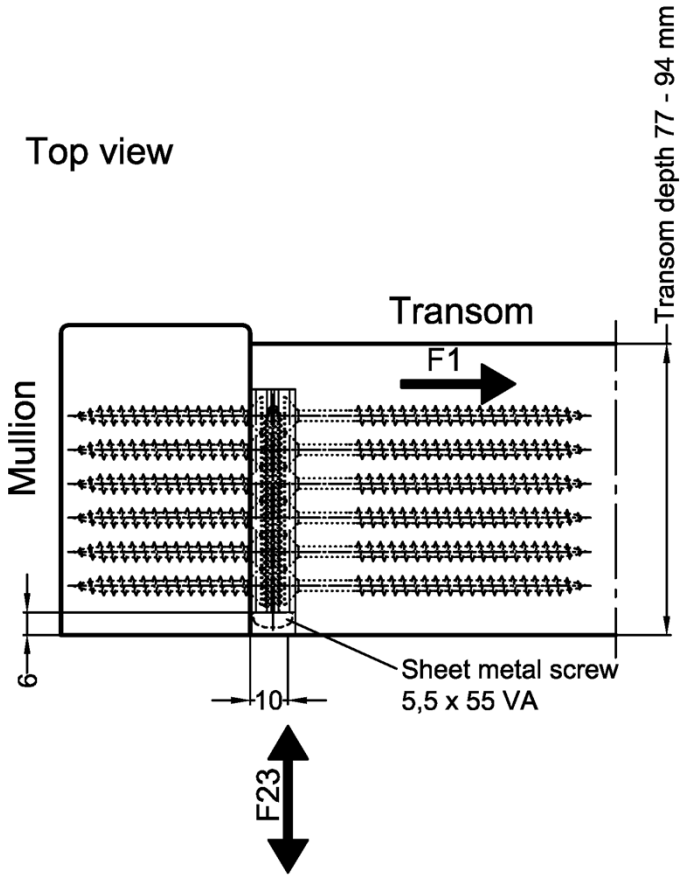


Side view



Arrangement of wood screws with
"standard screw connection" (SV)

Top view



'Twinloc' connector	Annex 4.7
Mullion-Transom connection with connector Twinloc TL 59	

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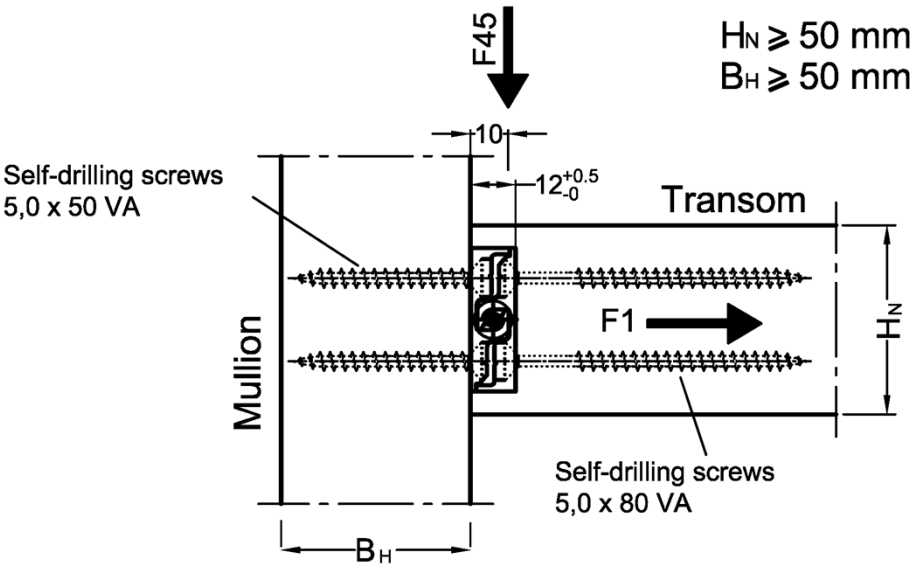
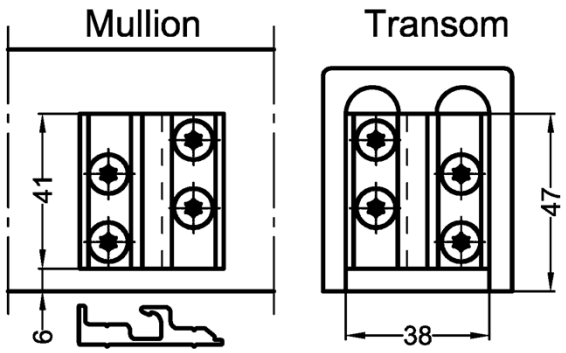
Front view

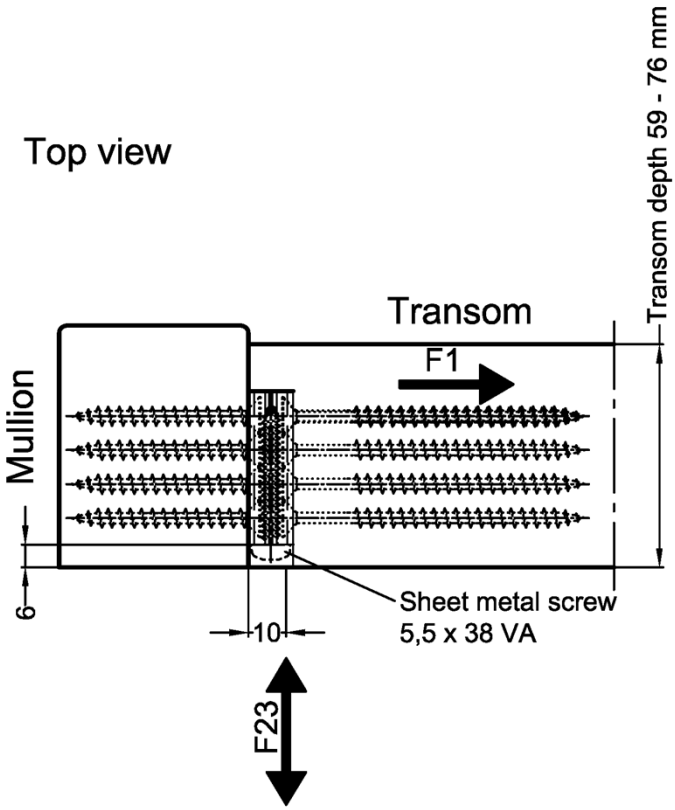


Side view



Arrangement of wood screws with
"standard screw connection" (SV)

Top view



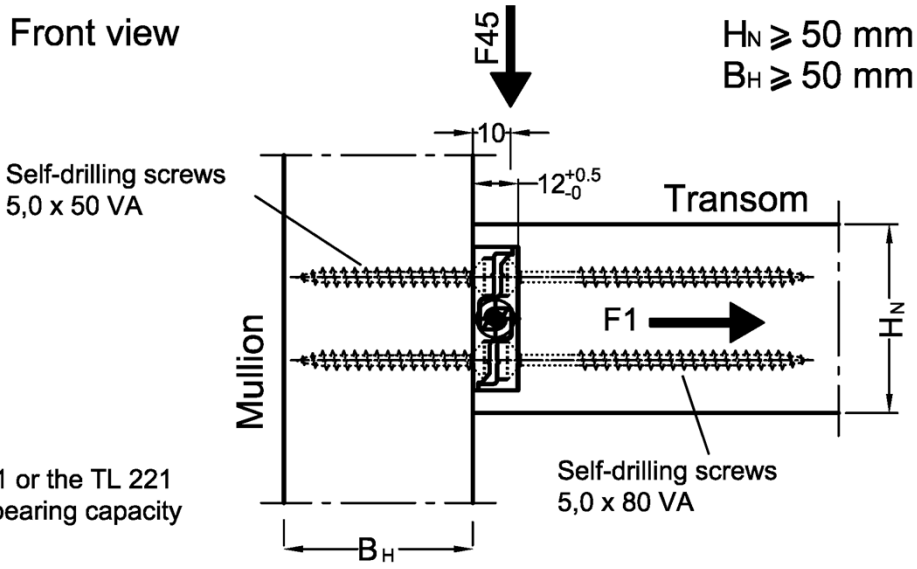
'Twinloc' connector	Annex 4.8
Mullion-Transom connection with connector Twinloc TL 41	

Coupling	Transom depth
TL 131 + TL 41:	190 - 207 mm
TL 131 + TL 59:	208 - 225 mm
TL 131 + TL 77:	226 - 243 mm
TL 131 + TL 95:	244 - 279 mm
TL 131 + TL 131:	280 - 300 mm

Coupling	Transom depth
TL 221 + TL 41:	280 - 297 mm
TL 221 + TL 59:	298 - 315 mm
TL 221 + TL 77:	316 - 333 mm
TL 221 + TL 95:	334 - 369 mm
TL 221 + TL 131:	370 - 390 mm
TL 221 + TL 221:	460 - 500 mm

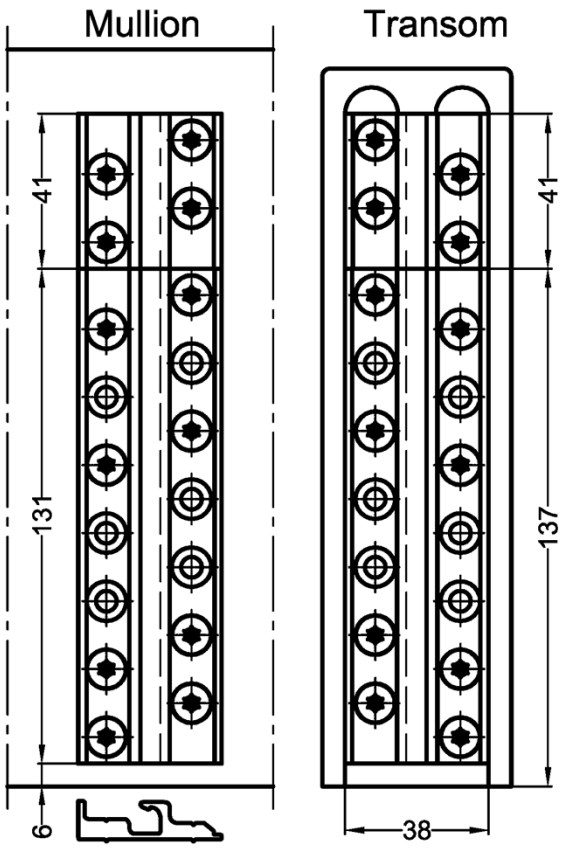
The connector adjoined to the TL 131 or the TL 221 is not taken into account in the load bearing capacity of the connection.

Front view

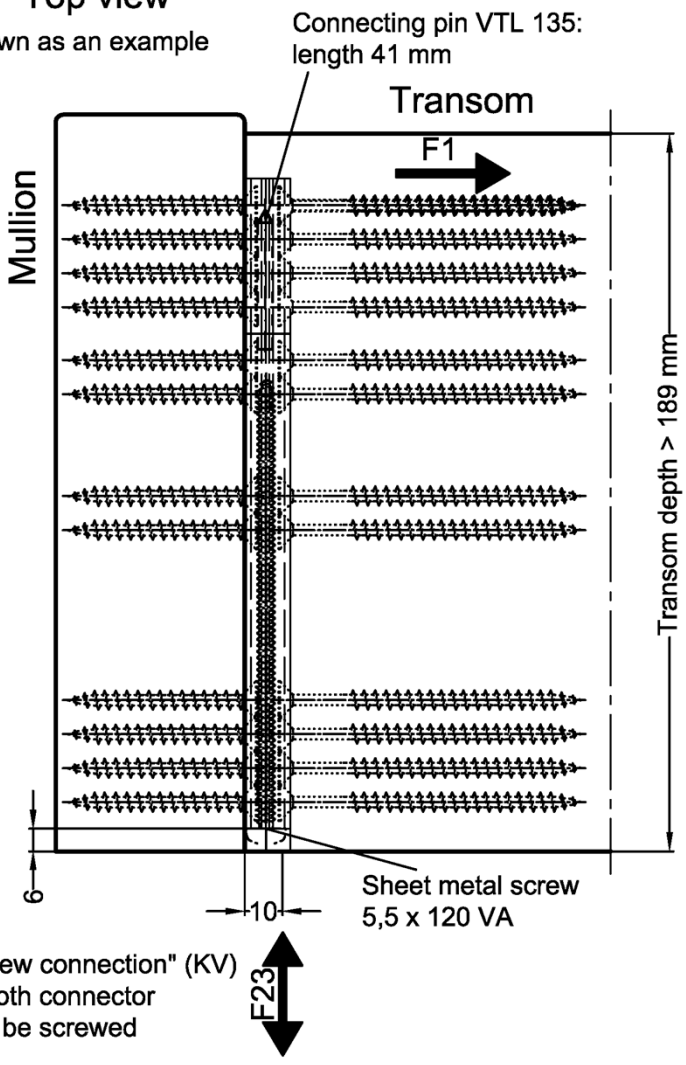


Side view

The coupling of connectors TL 131 and TL 41 is shown as an example



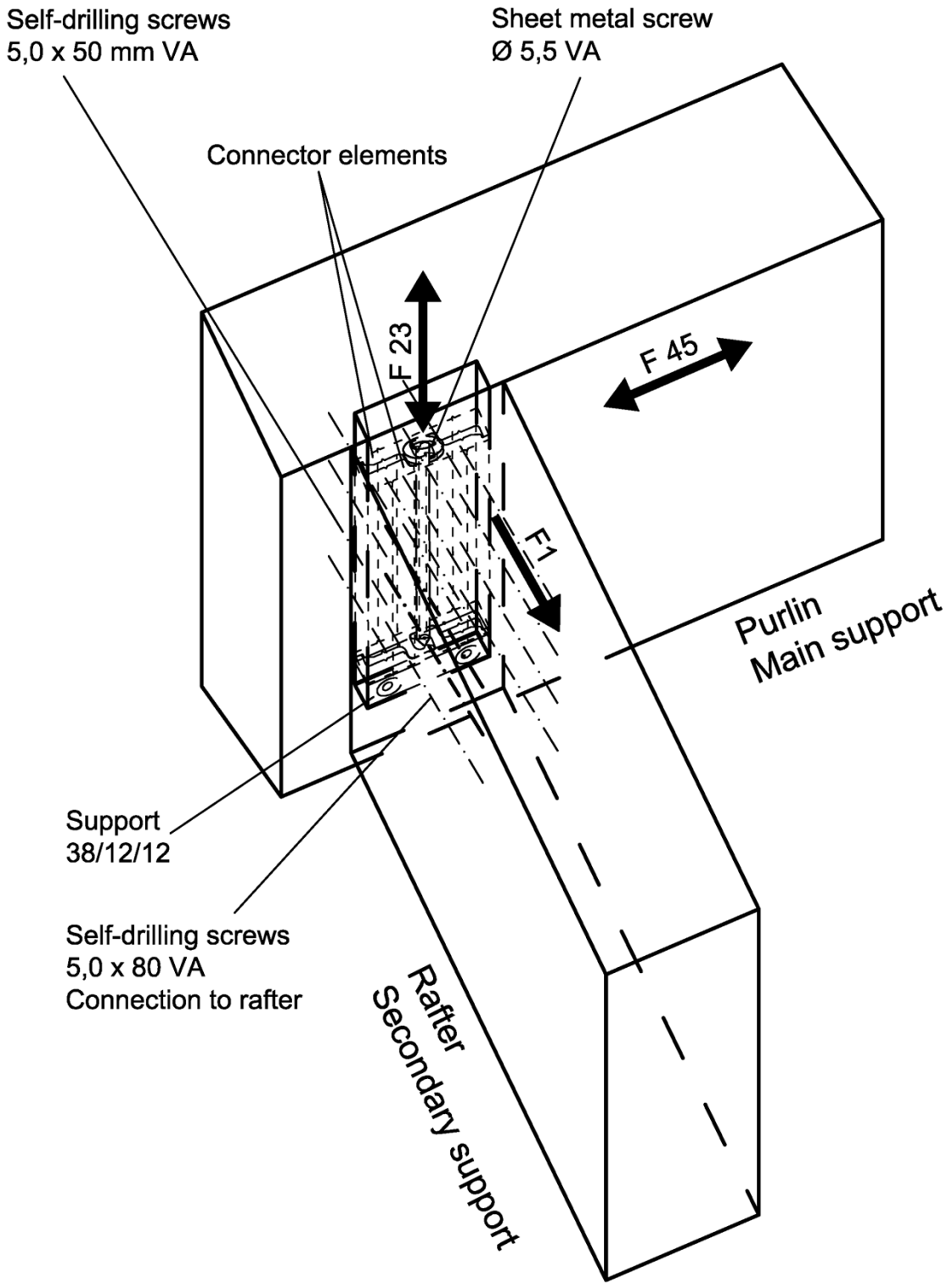
Top view



Arrangement of wood screws with "standard screw connection" (SV)

For "complete screw connection" (KV) all boreholes of both connector elements have to be screwed

'Twinloc' connector	Annex 4.9
Coupling of connectors	



'Twinloc' connector	Annex 4.10
Basic configuration of the purlin-rafter connection	

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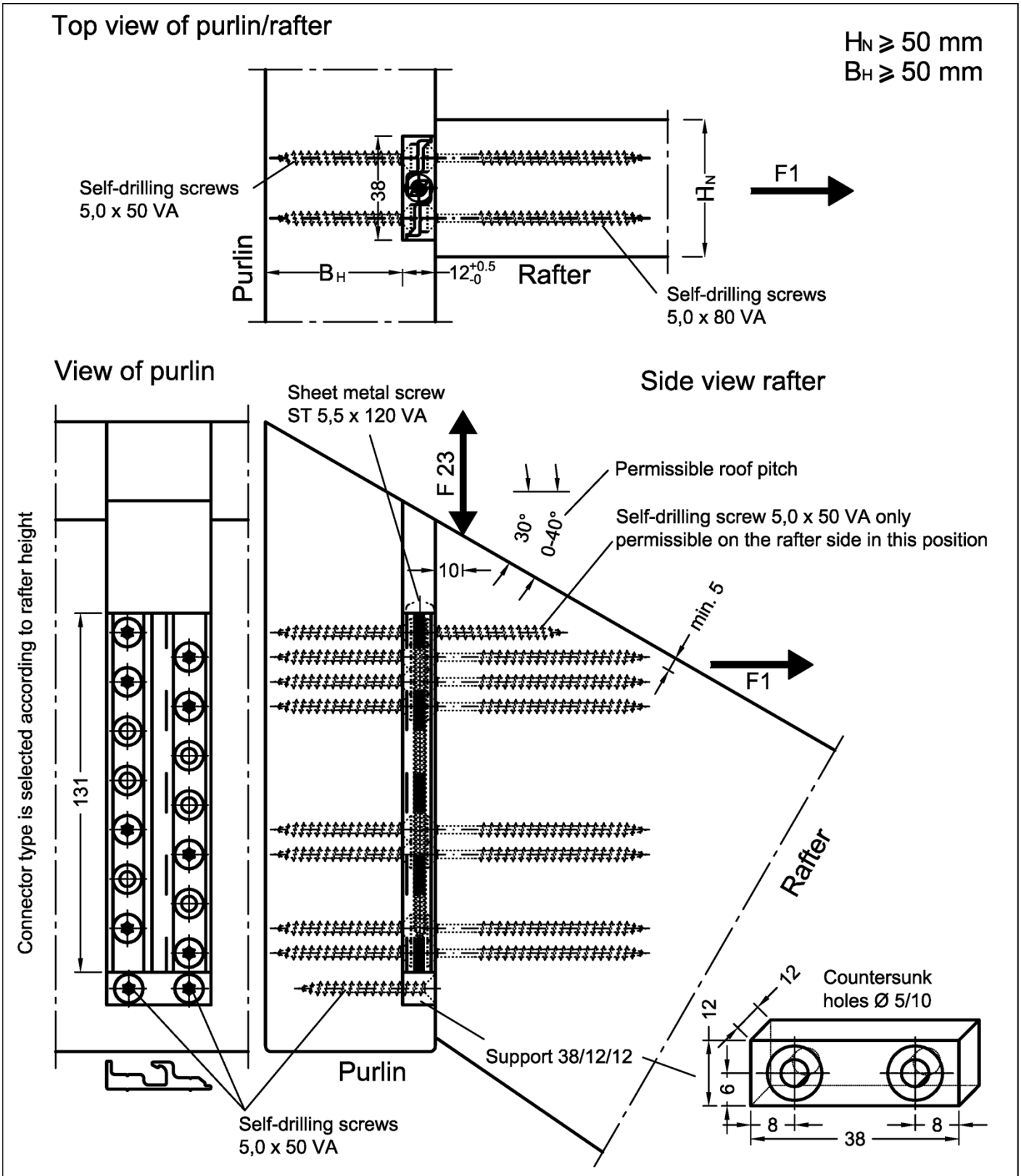

The connector TL 131 with a roof pitch of 30° is shown as an example

'Twinloc' connector	Annex 4.11
Purlin-rafter connection with the connector Twinloc TL 131	

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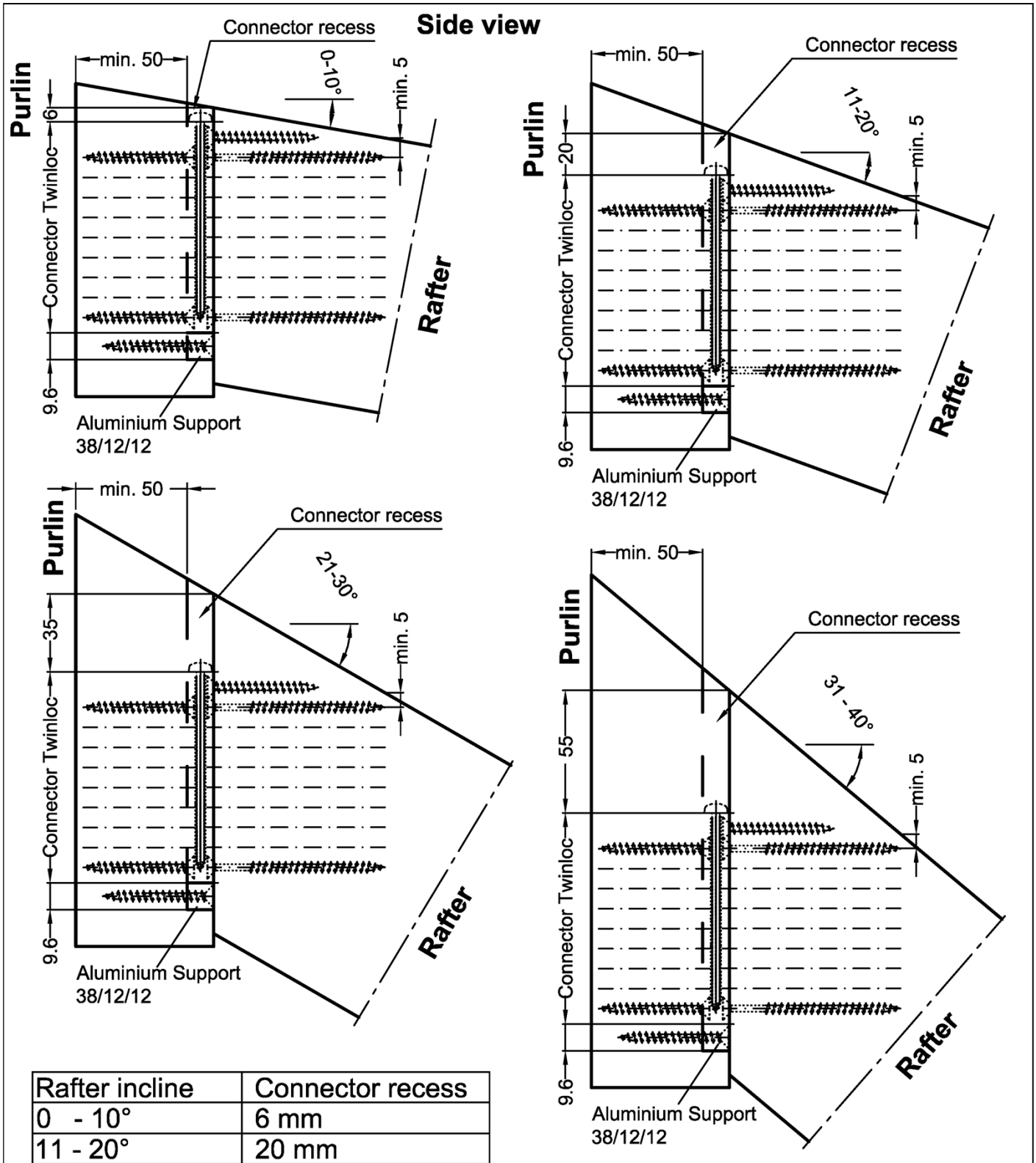

Rafter incline	Connector recess
0 - 10°	6 mm
11 - 20°	20 mm
21 - 30°	35 mm
31 - 40°	55 mm

'Twinloc' connector

Rafter-purlin connection
Assembly situation with different rafter inclines

Annex 4.12

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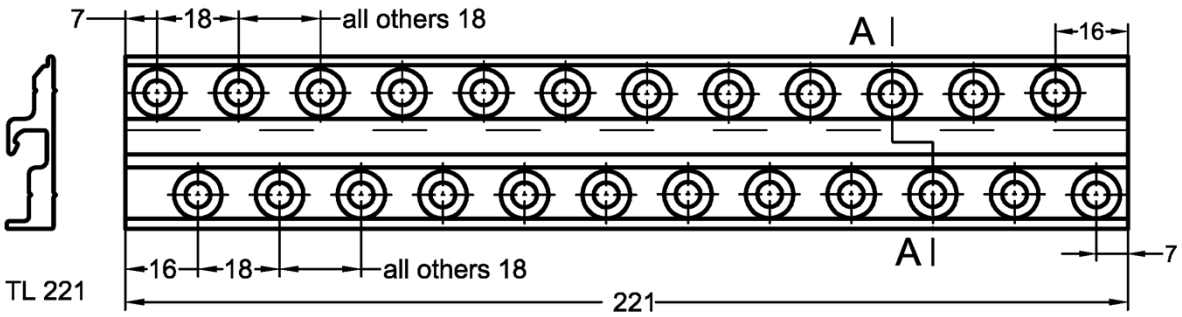
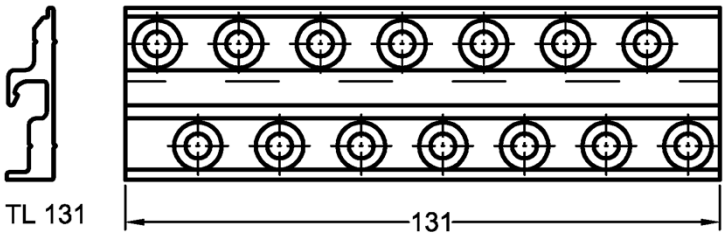
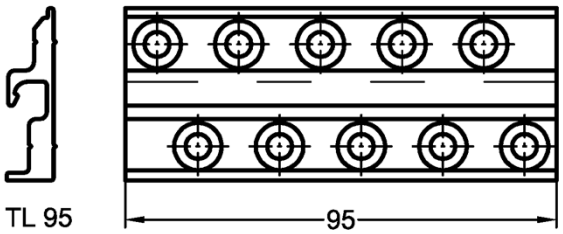
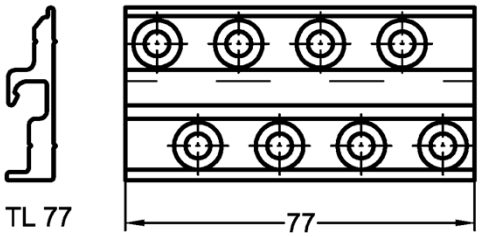
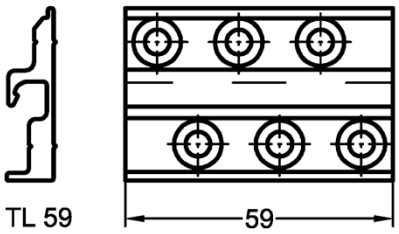
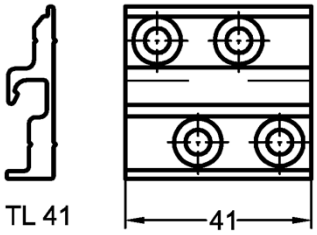








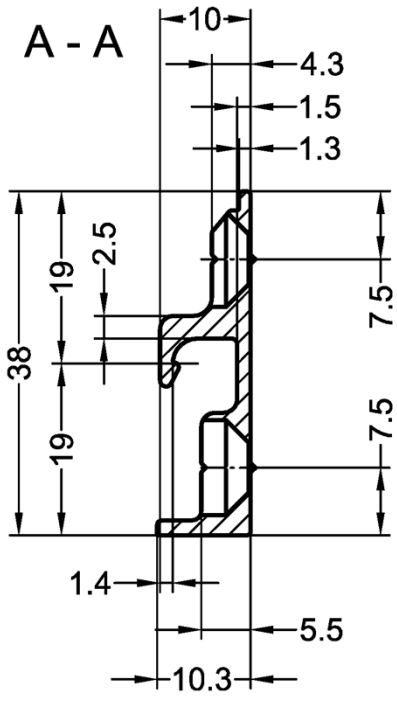




Hole distances are the same for all connectors

Drawings apply to mullion and transom connecting element: The parts are identical.

All holes:
countersunk hole
Ø5,5 / Ø10,5 mm



'Twinloc' connector

Single components
Connector elements

Annex 4.13

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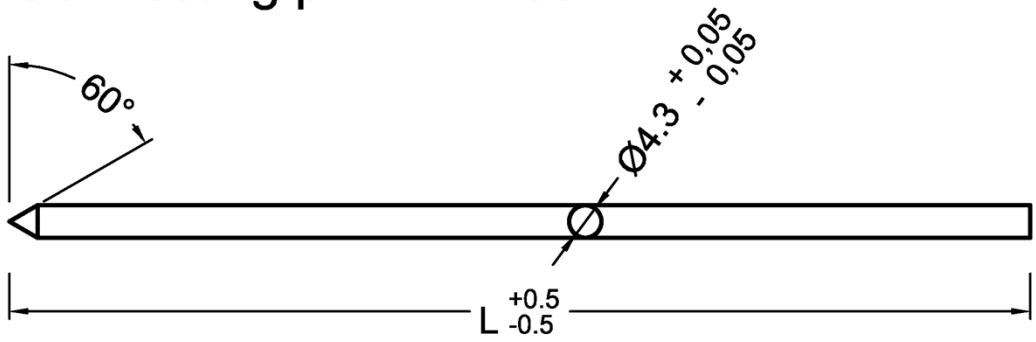
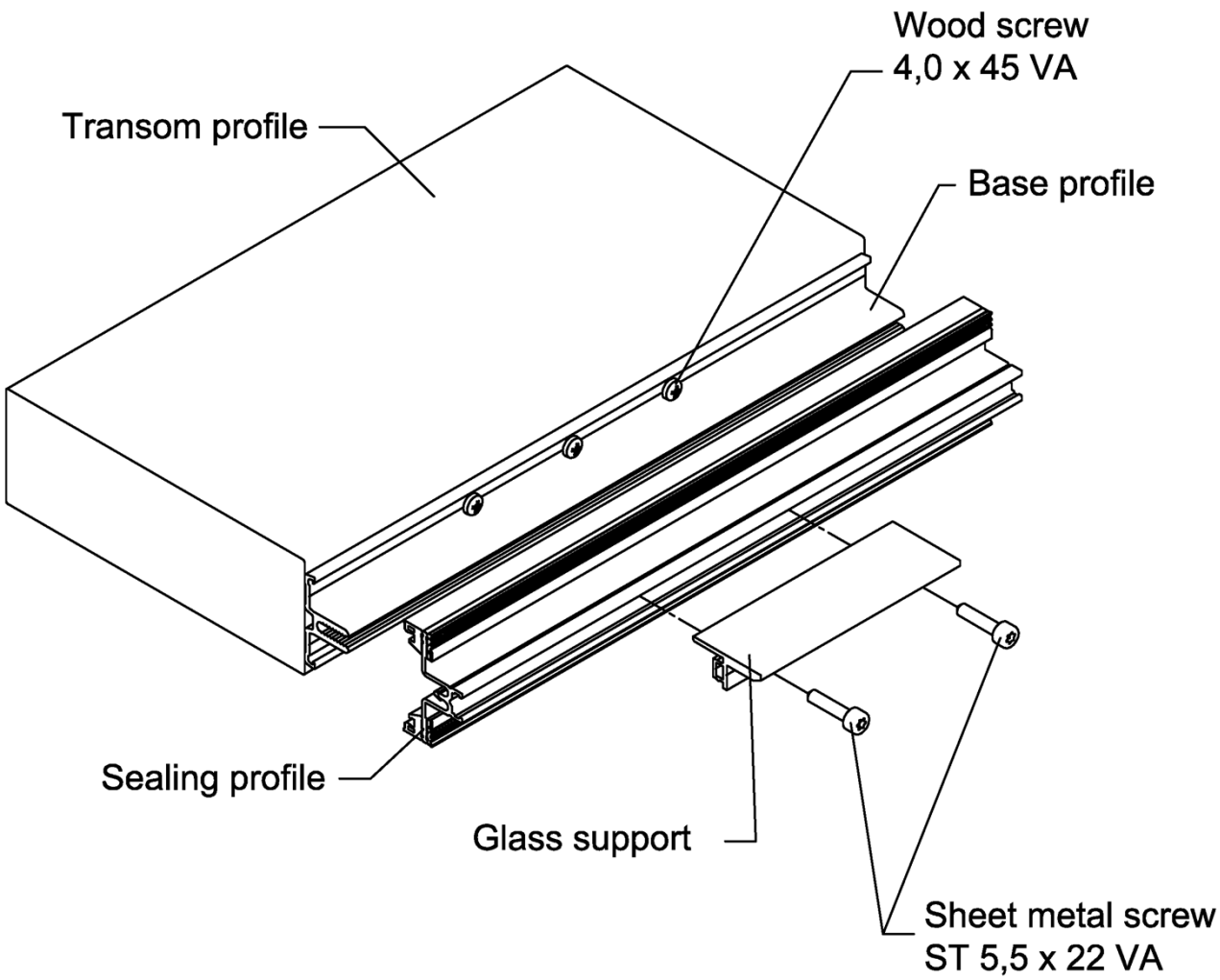
Connecting pin VTL 135



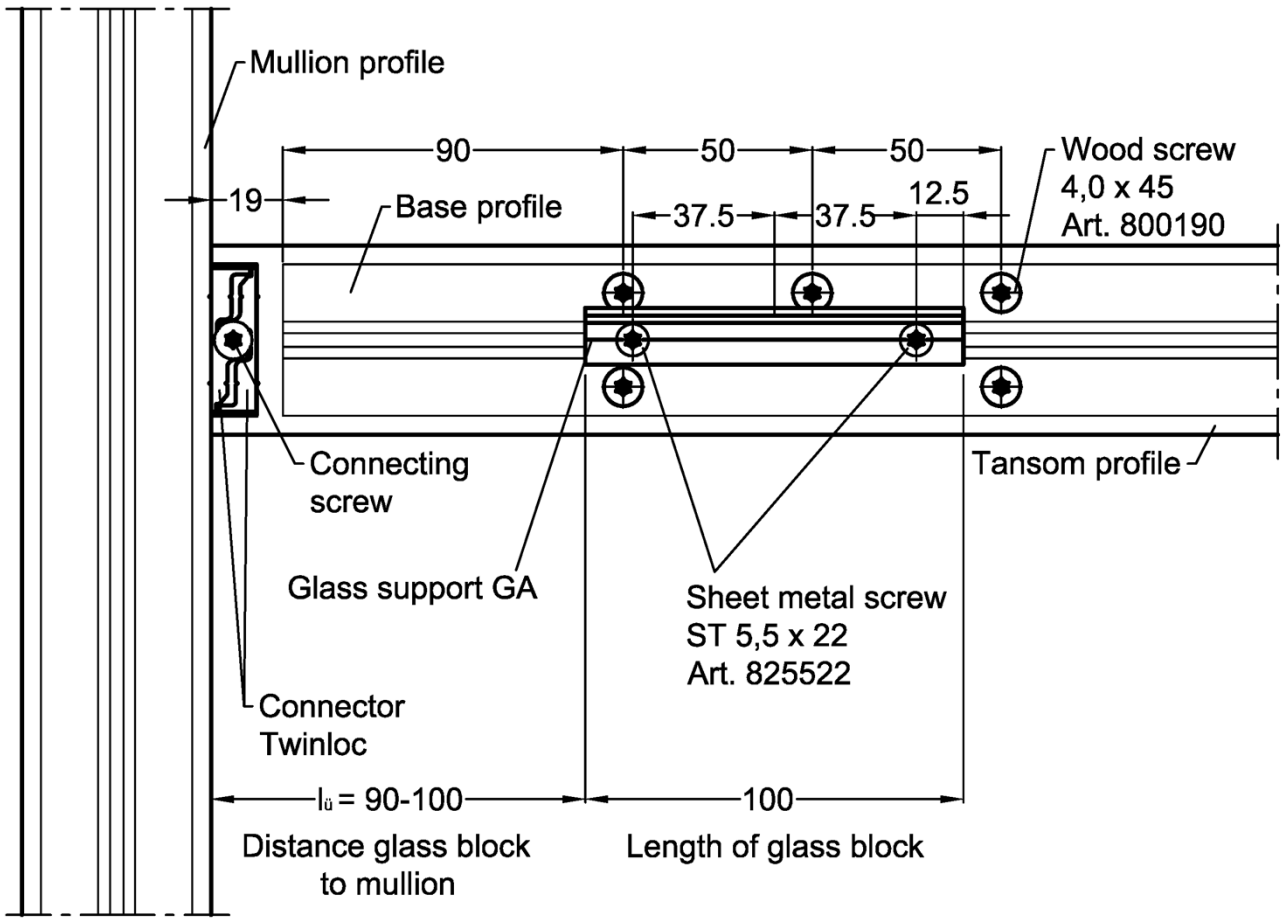
The minimum length L can be achieved by cutting or connecting the connecting pin

Minimum length of connecting pin	
Connector	L in mm
TL 221	100
TL 131 + TL 41	41
TL 131 + TL 59	59
TL 131 + TL 77	77
TL 131 + TL 95	95
TL 131 + TL 131	131
TL 221 + TL 41	141
TL 221 + TL 59	159
TL 221 + TL 77	177
TL 221 + TL 95	195
TL 221 + TL 131	231
TL 221 + TL 221	321

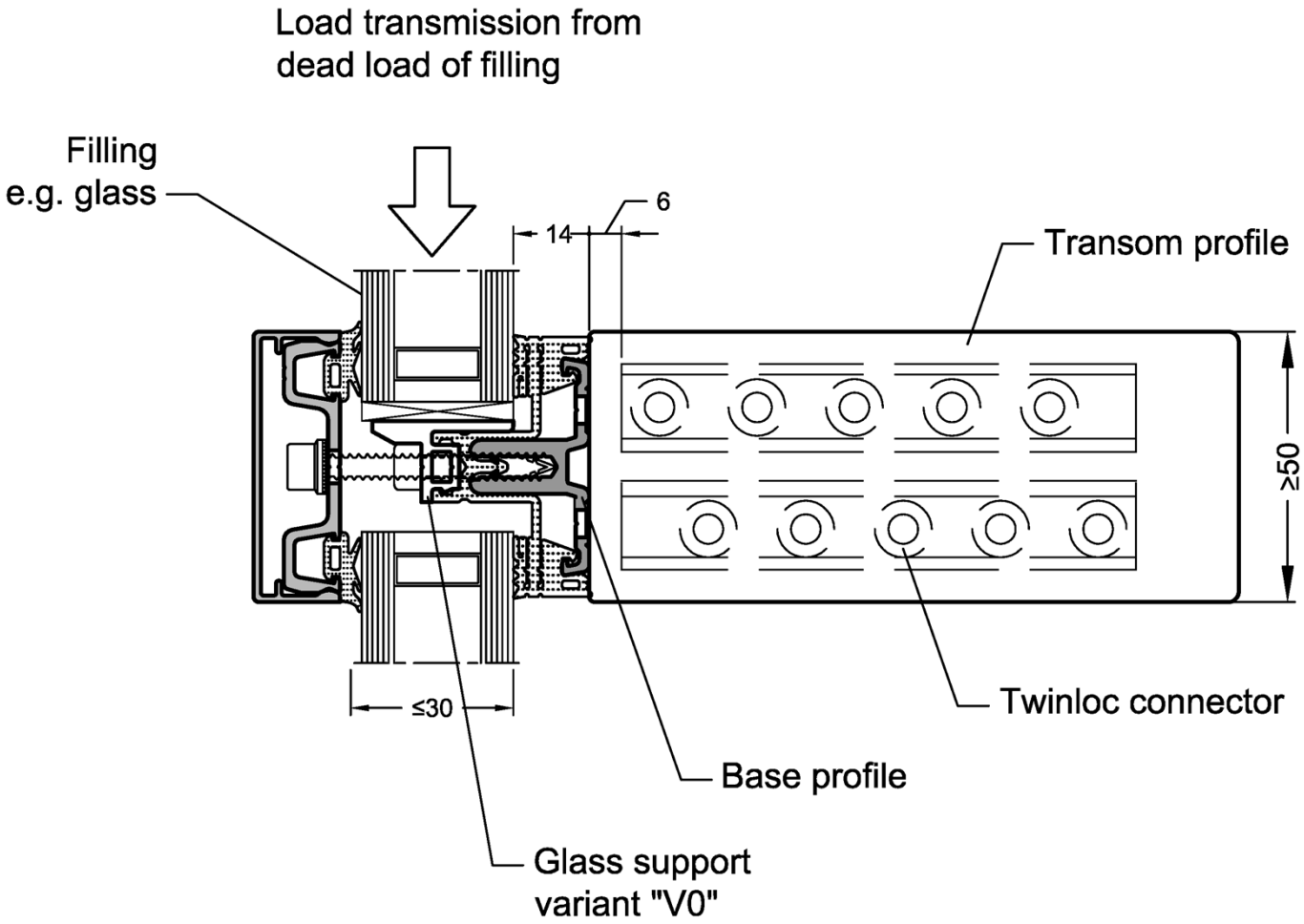
'Twinloc' connector	Annex 4.14
Single components Connecting pin	



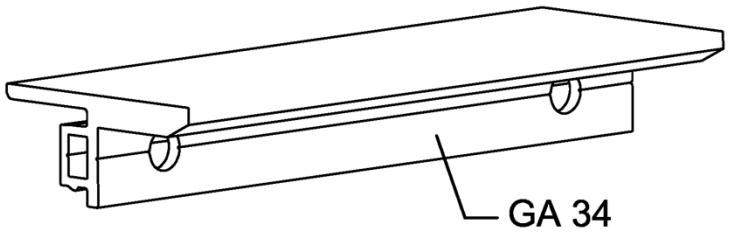
'Twinloc' connector	Annex 4.15
Mullion-transom connection Variant V0 Basic conifguration	



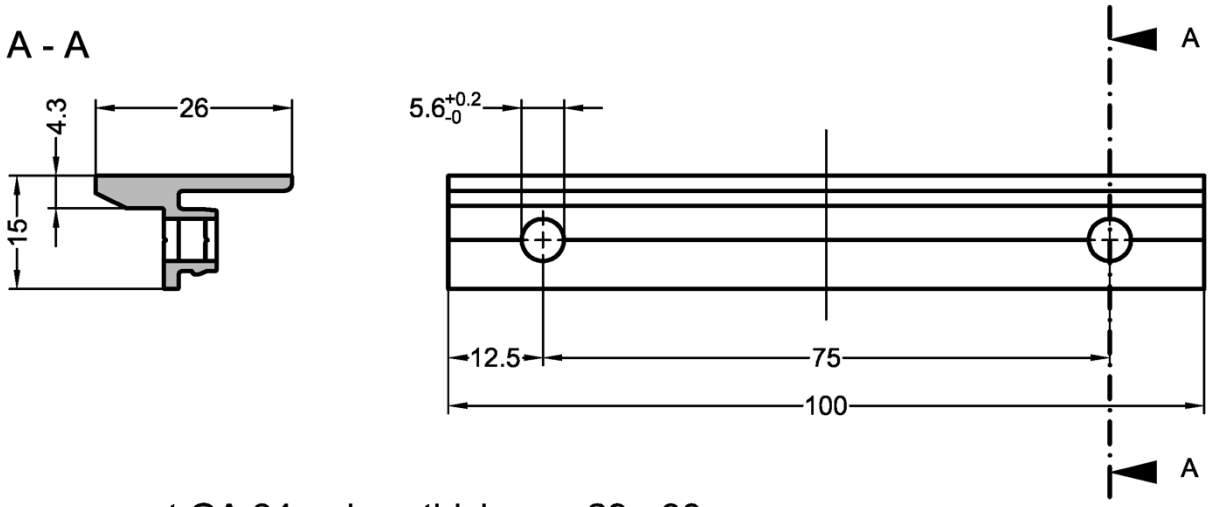
'Twinloc' connector	Annex 4.16
Mullion-transom connection Variant V0 Side view	



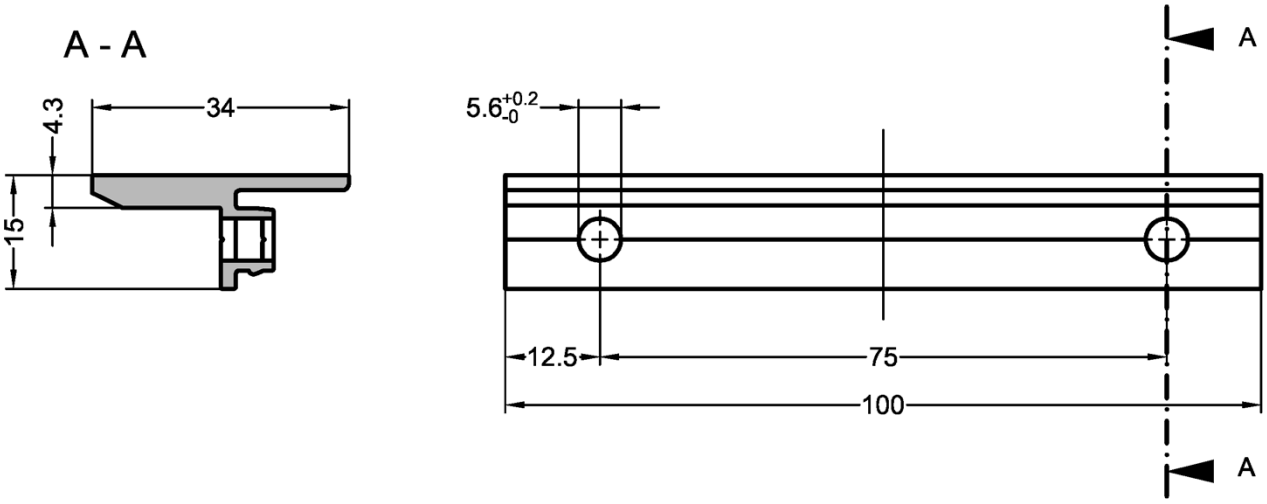
'Twinloc' connector	Annex 4.17
Mullion-transom connection Variant V0 Limitation of the eccentricity of load	



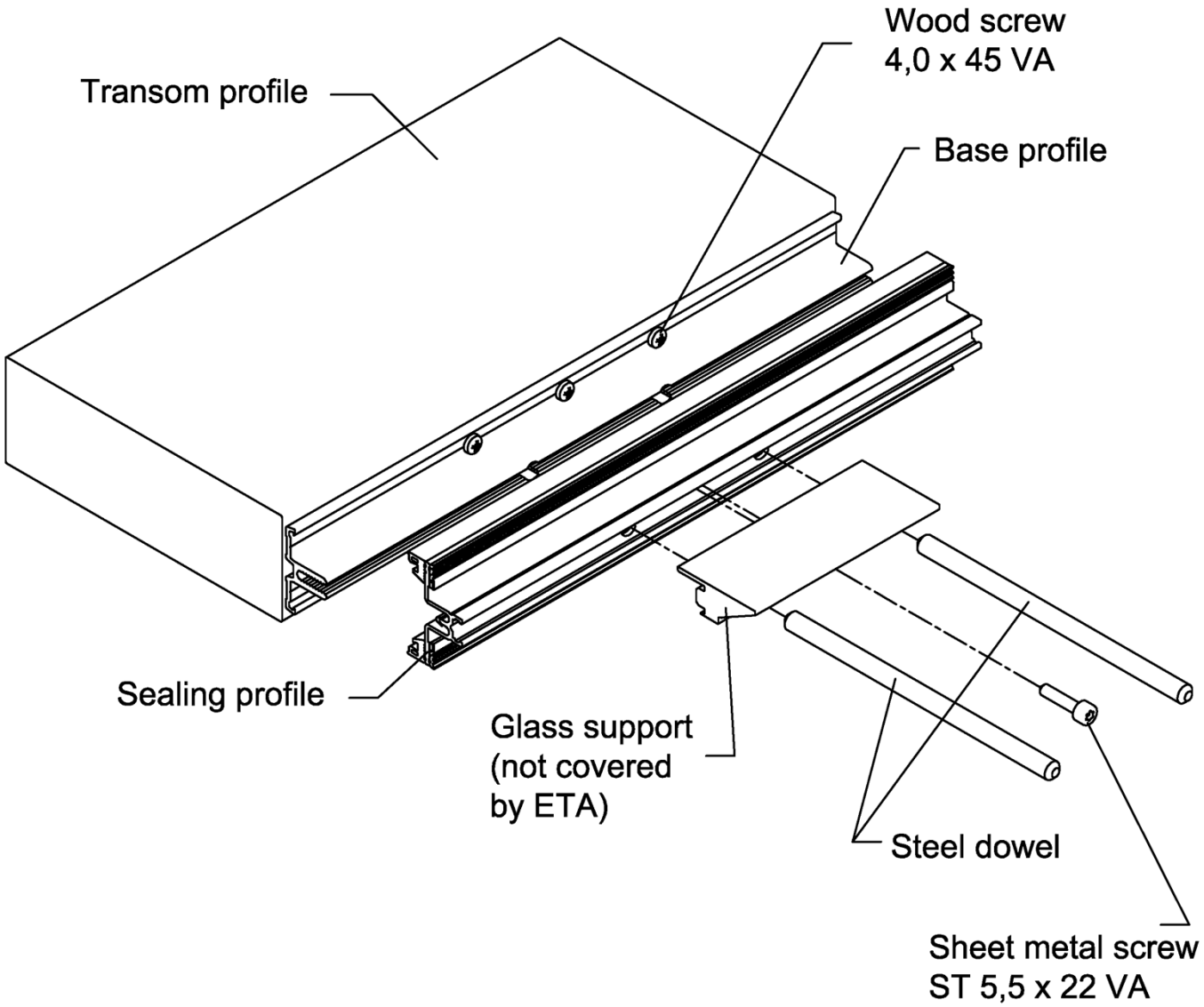
Glass support GA 26 - glass thickness 18 - 28 mm



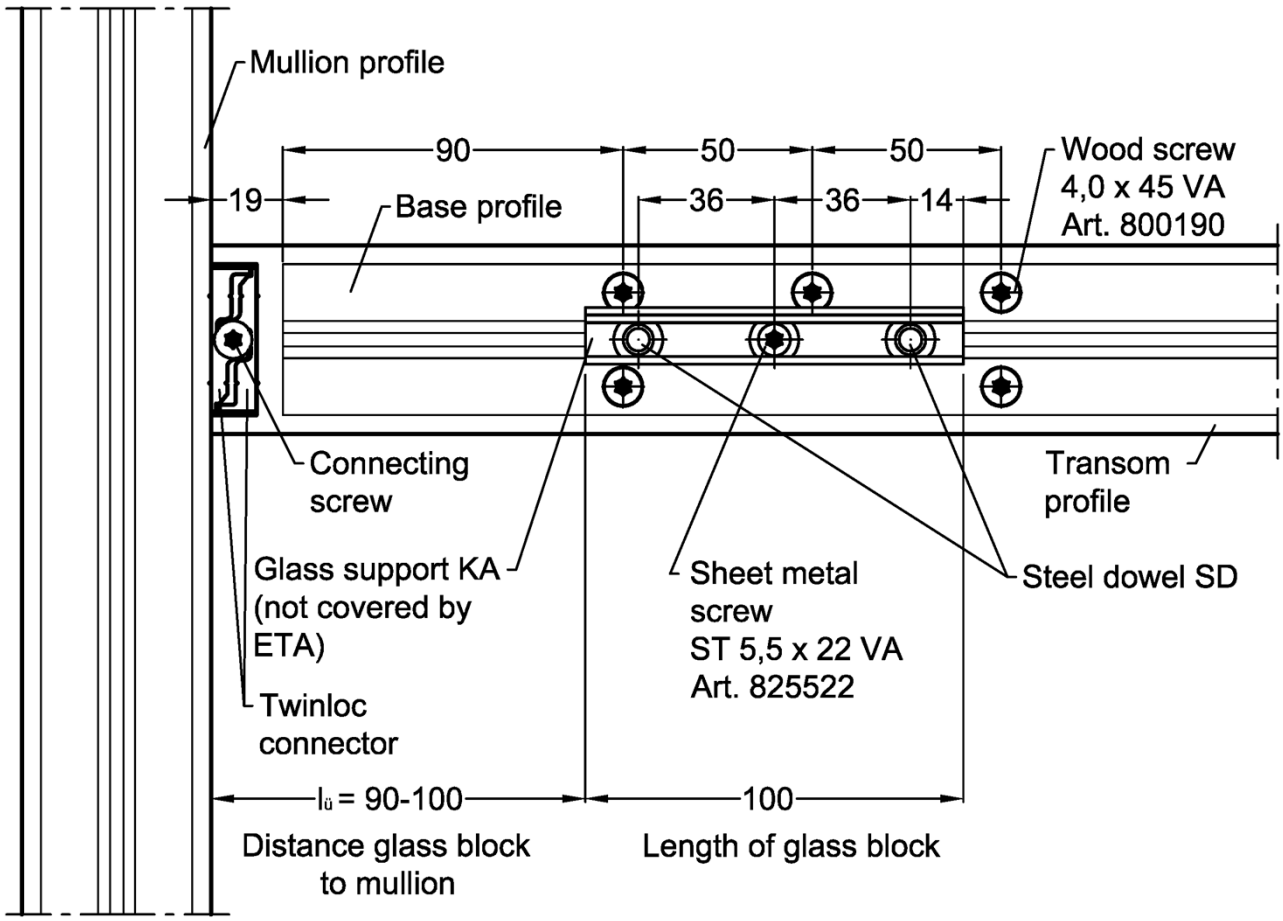
Glass support GA 34 - glass thickness 29 - 30 mm



'Twinloc' connector	Annex 4.18
Mullion-transom connection Variant V0 Glass supports GA 26 and GA 34	



'Twinloc' connector	Annex 4.19
Mullion-transom connection Variant Lara glass support – SD 02 Basic configuration	



'Twinloc' connector	Annex 4.20
Mullion-transom connection Variant Lara glass support – SD 02 Side view	

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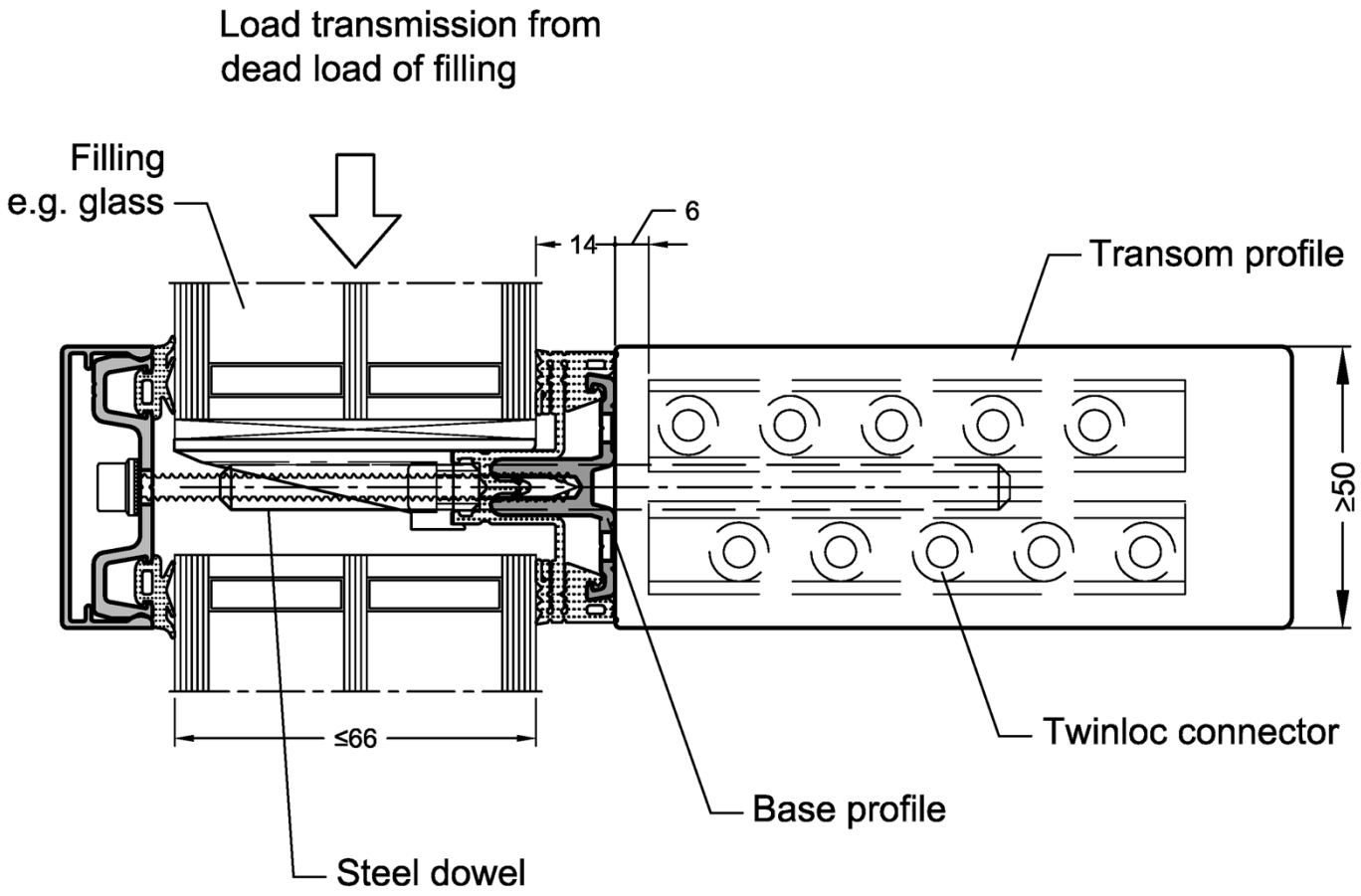
Design variant "SD02"



'Twinloc' connector	Annex 4.21
Mullion-transom connection Variant Lara glass support – SD 02 Limitation of the eccentricity of load	

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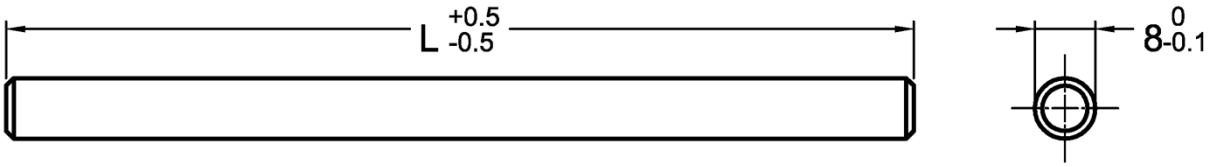
Steel dowel SD

Material: V2A 1.4301



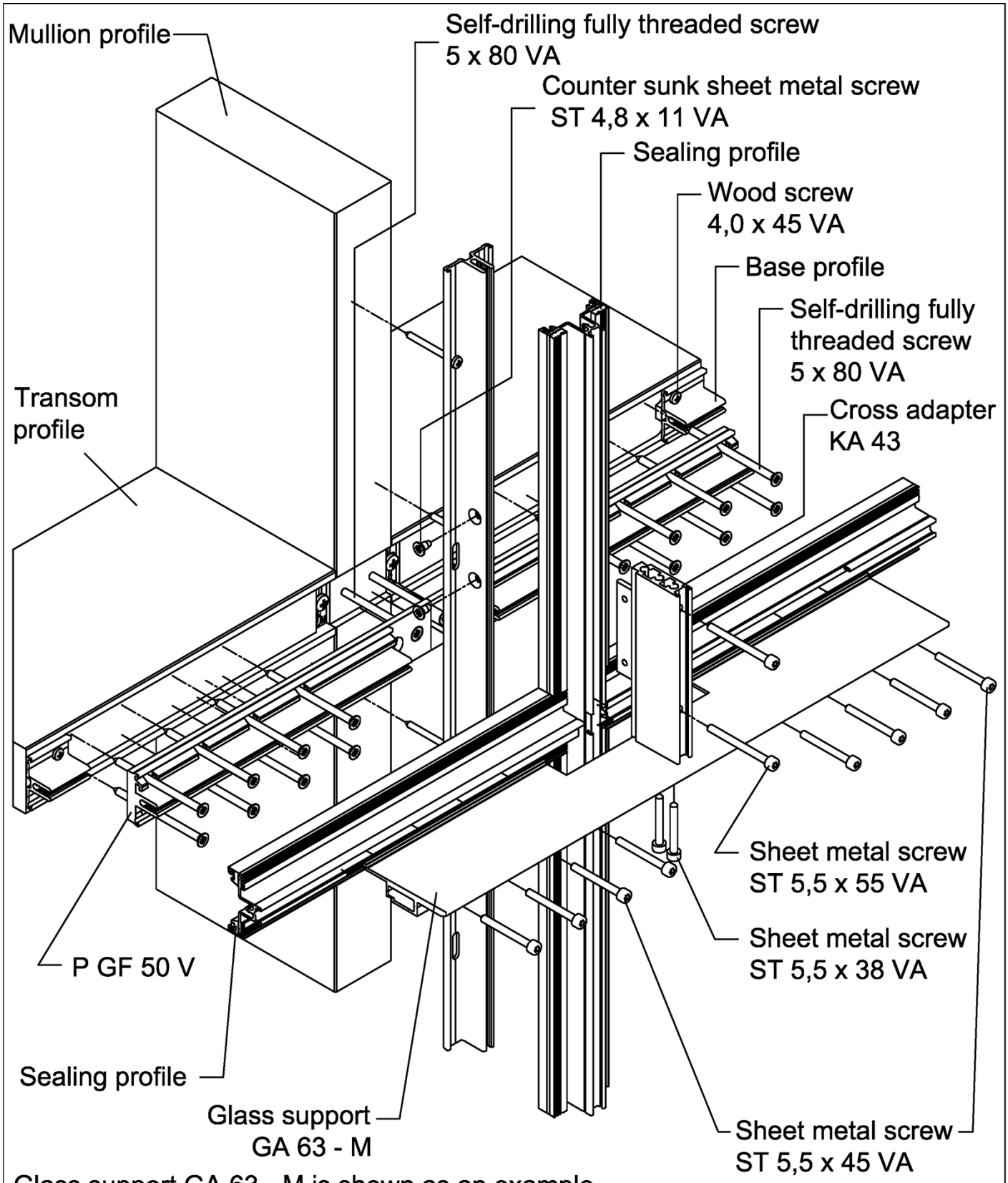
Selection of steel dowel length in mm

Glass thinkness in mm	Transom depth in mm			Glass support
	59-76	77-94	> 95	
24	90	90	120	KA26
26	90	90	120	KA26
28	90	90	120	KA26
30	90	90	120	KA26
32	90	90	120	KA34
34	90	90	120	KA34
36	90	90	120	KA34
38	90	90	120	KA34
40		120	145	KA42
42		120	145	KA42
44		120	145	KA42
46		120	145	KA42
48		120	145	KA50
50		120	145	KA50
52		120	145	KA50
54		120	145	KA50
56		145	145	KA58
58		145	145	KA58
60		145	145	KA58
62		145	145	KA58
64		145	145	KA58

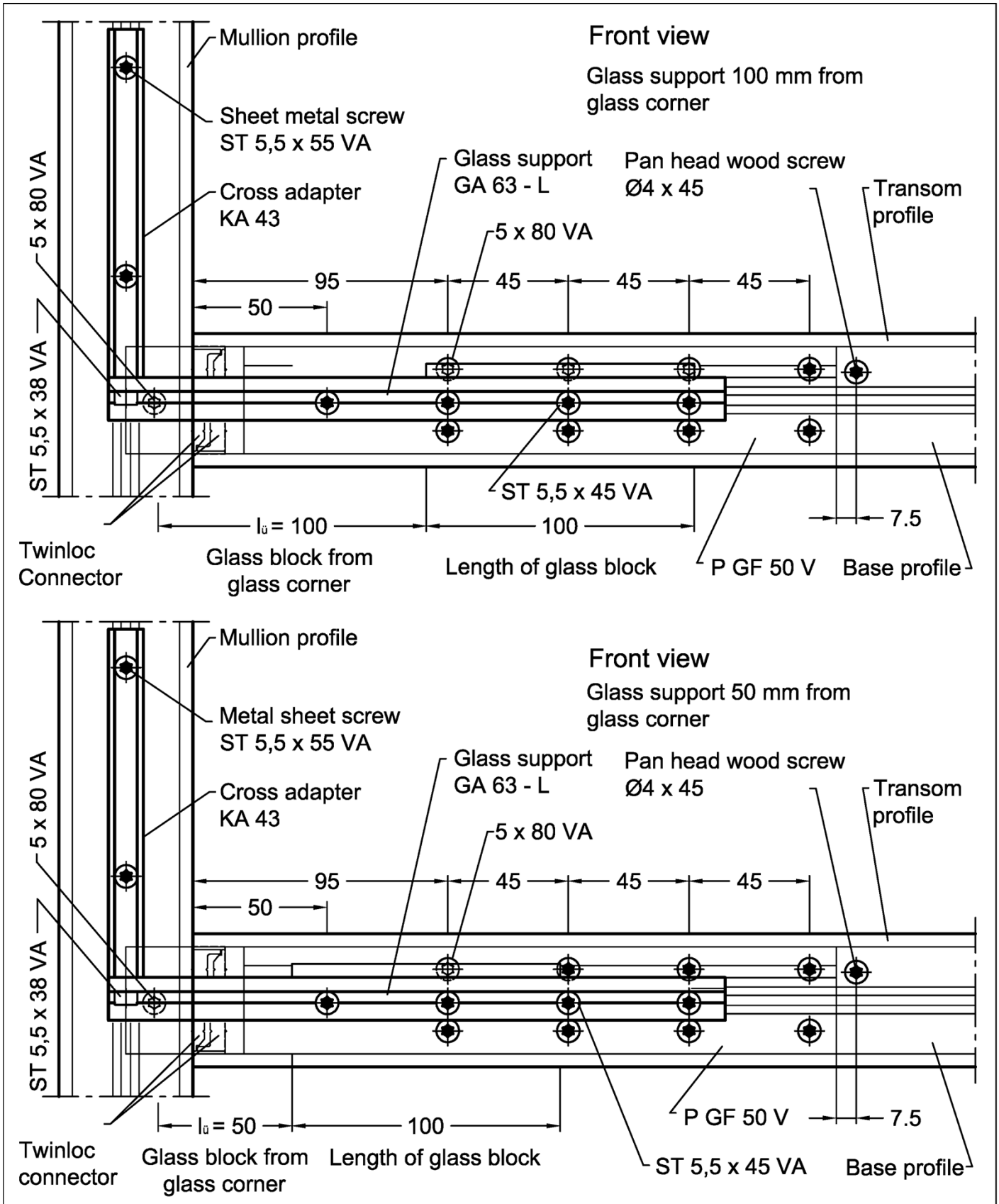
'Twinloc' connector

Mullion-transom connection
Variant Lara glass support – SD 02
Steel dowel

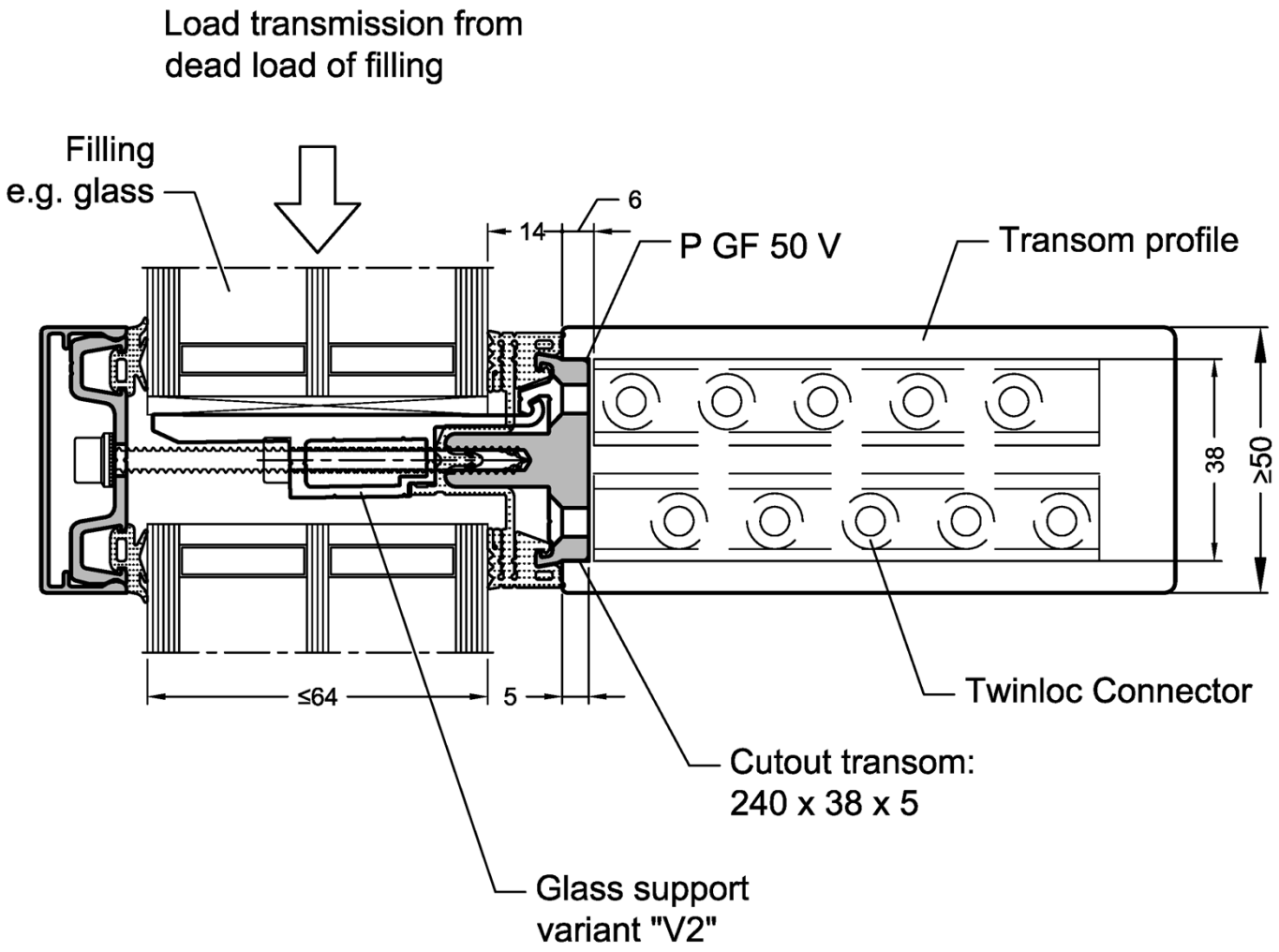
Annex 4.22



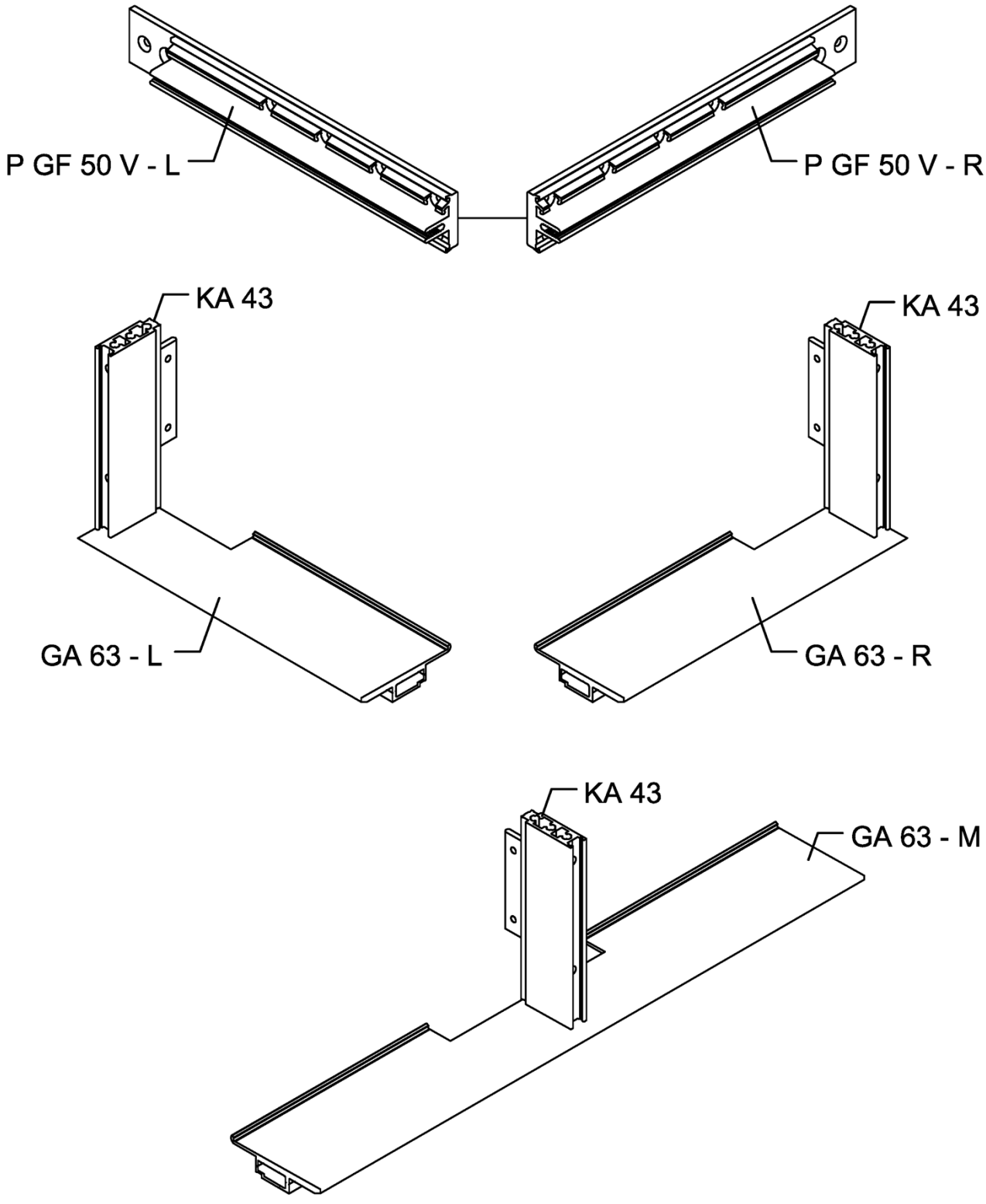
'Twinloc' connector	Annex 4.23
Mullion-transom connection Lara heavy duty variant V2 Basic configuration	



'Twinloc' connector	Annex 4.24
Mullion-transom connection Lara heavy duty variant V2 Side view	



'Twinloc' connector	Annex 4.25
Mullion-transom connection Lara heavy duty variant V2 Limitation of the eccentricity of load	



'Twinloc' connector	Annex 4.26
Mullion-transom connection Lara heavy duty variant V2 Reinforcement profiles/ glass supports	

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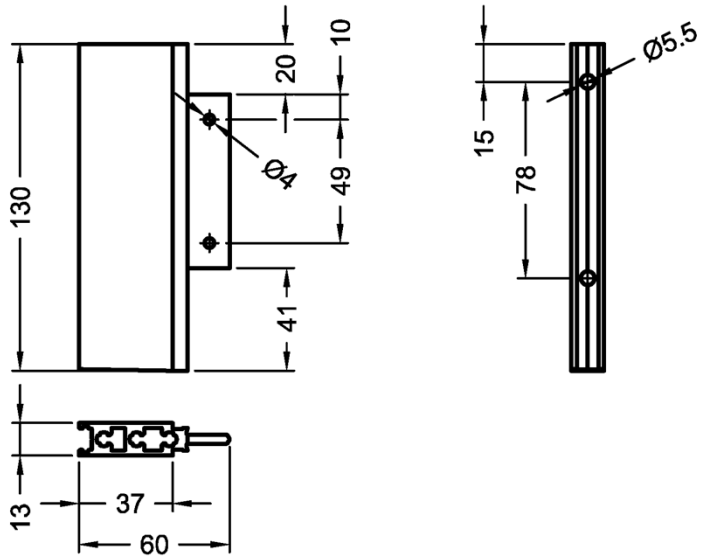
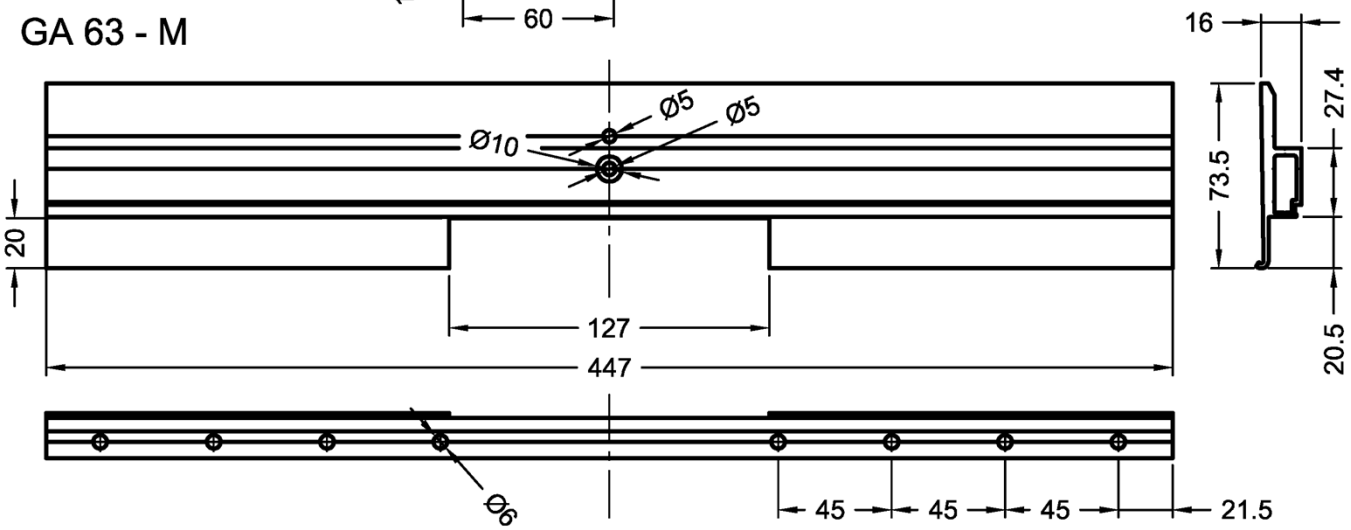
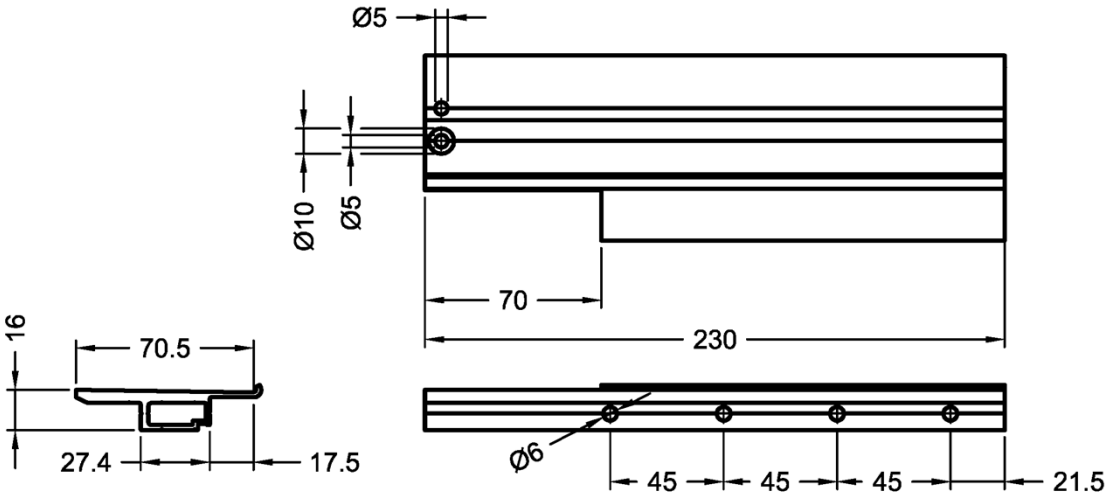
KA 43



GA 63 - M



GA 63 - L is shown as an example, GA 63 - R is mirror-inverted



'Twinloc' connector	Annex 4.27
Mullion-transom connection Lara heavy duty variant V2 Glass supports	

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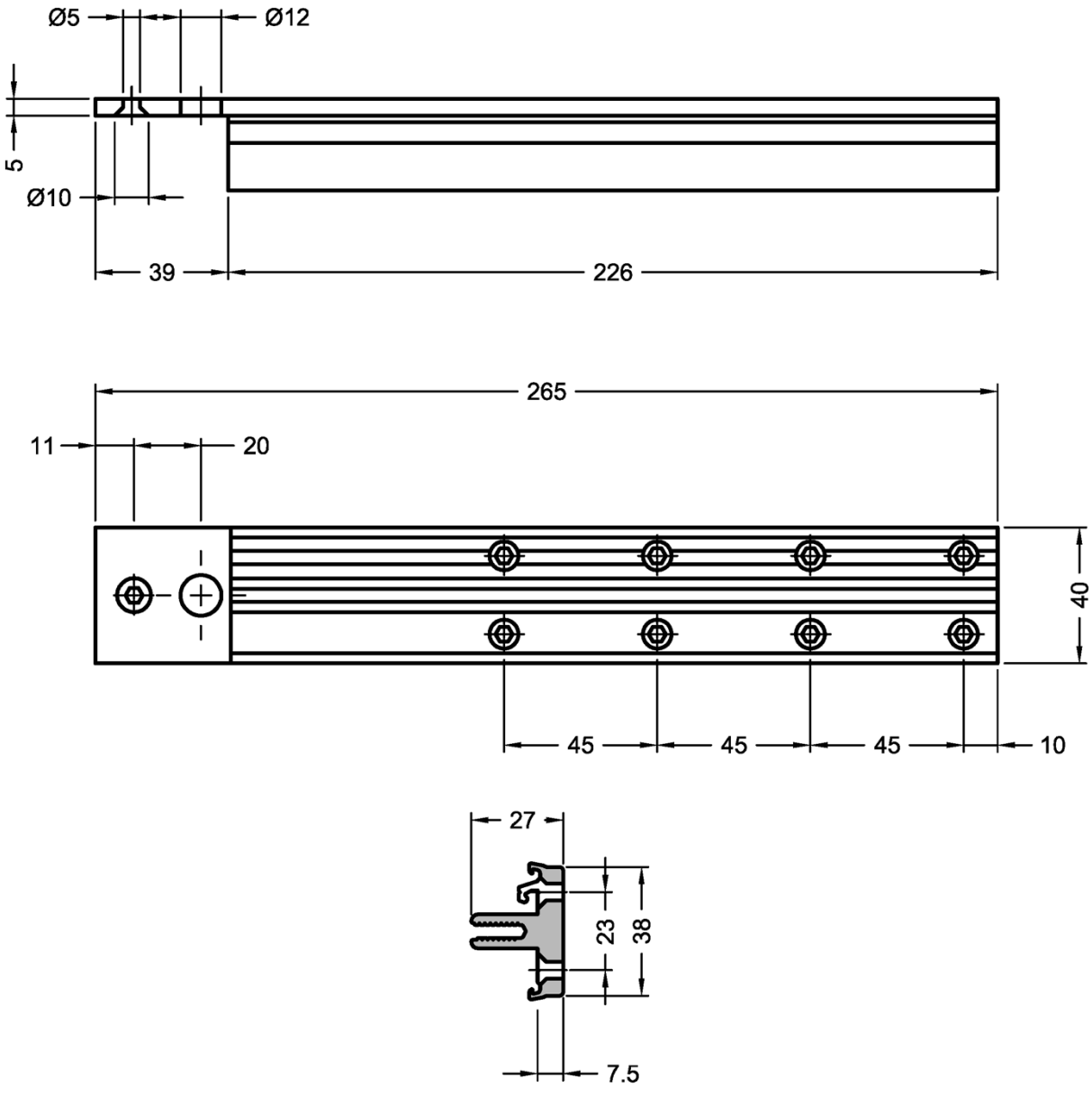
Glass support P GF 50 V - L is shown as an example
P GF 50 V - R is mirror-inverted



'Twinloc' connector	Annex 4.28
Mullion-transom connection Lara heavy duty variant V2 Reinforced base profile P GF 50 V	

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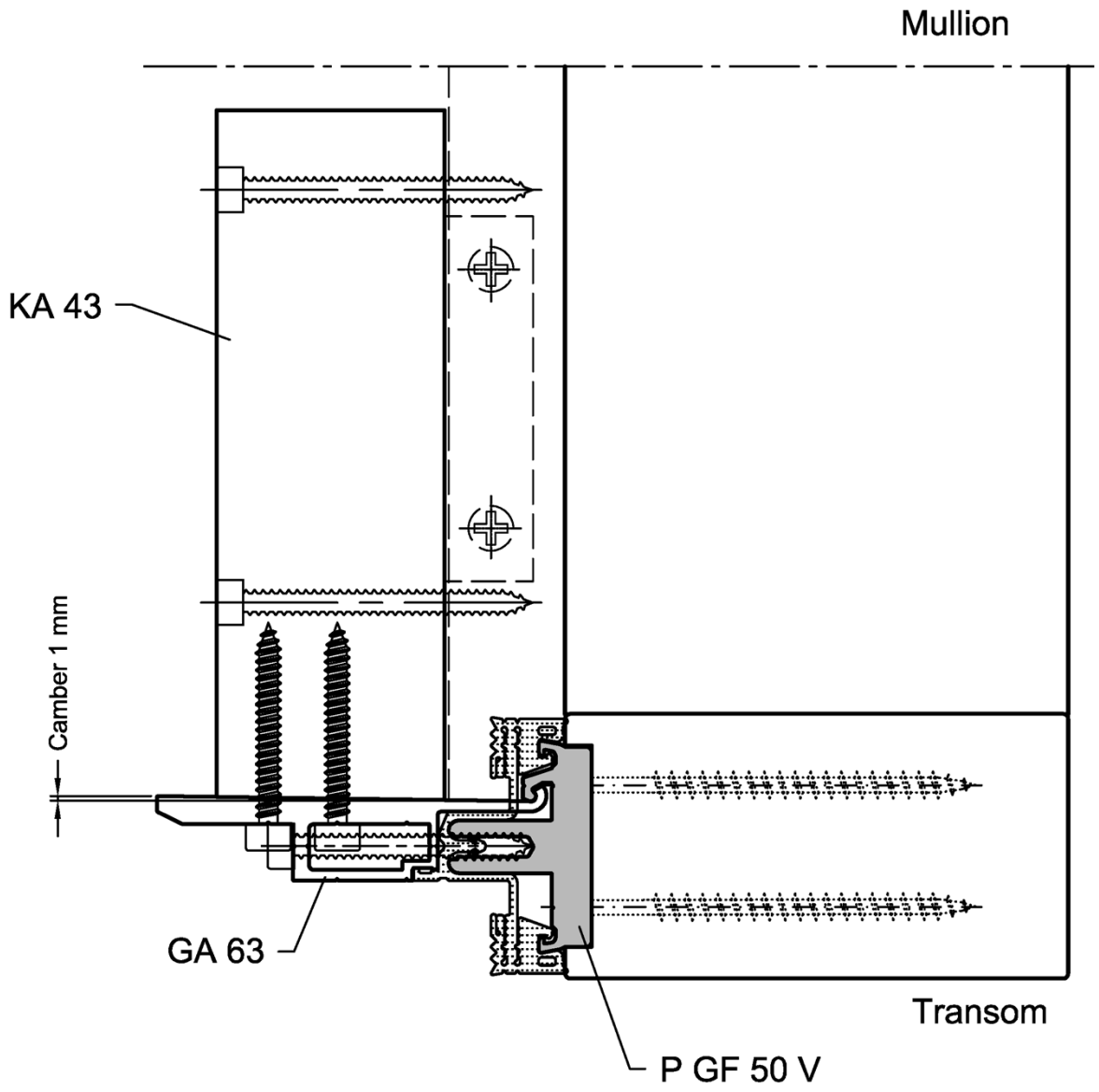
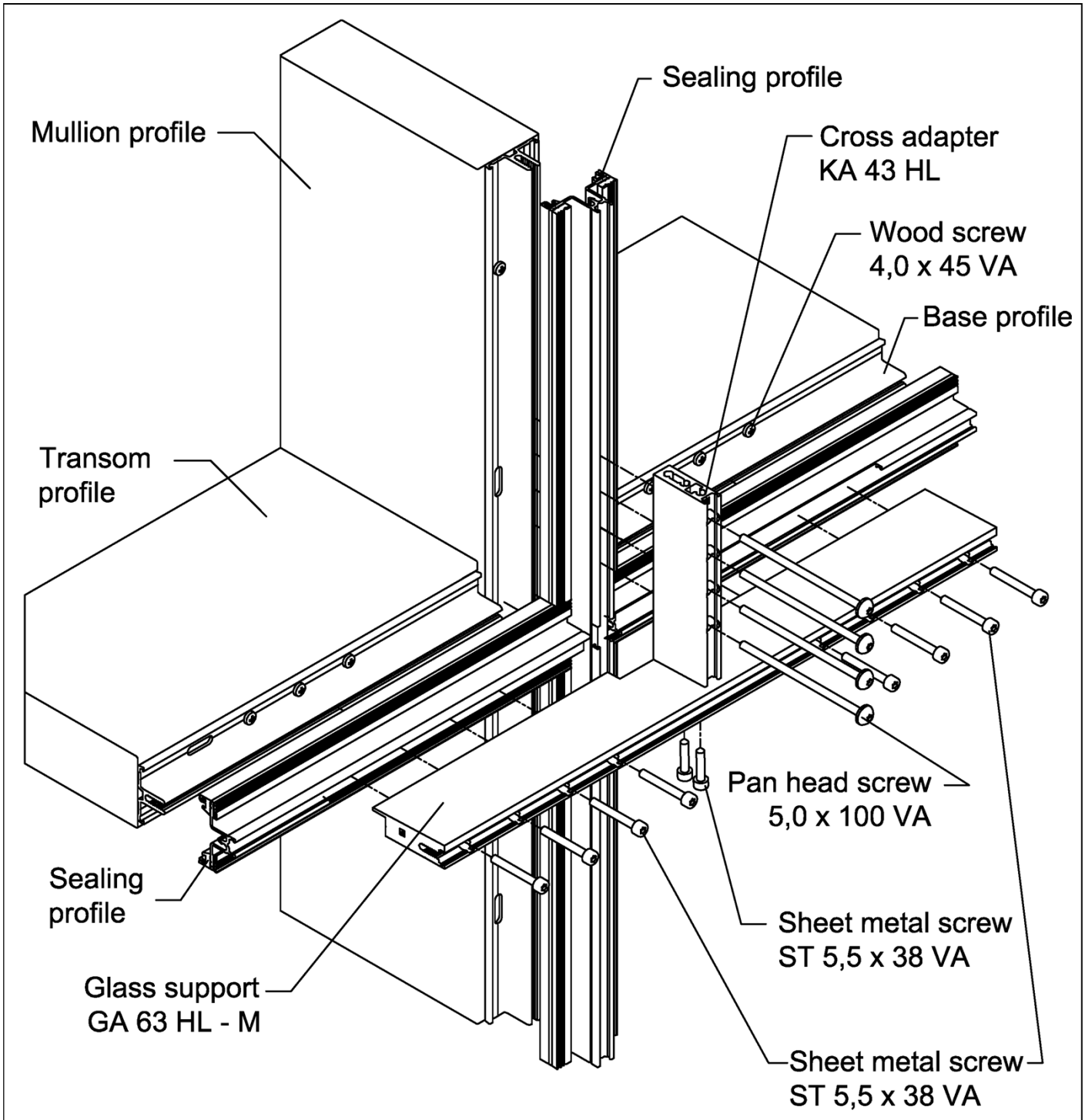
Heavy duty glass support variant V2



'Twinloc' connector	Annex 4.29
Mullion-transom connection Lara heavy duty variant V2 Superelevation of the heavy duty glass supports	



Glass support GA 63 HL - M is shown as an example

'Twinloc' connector	Annex 4.30
Mullion-transom connection Lara heavy duty variant V3 Basic configuration	

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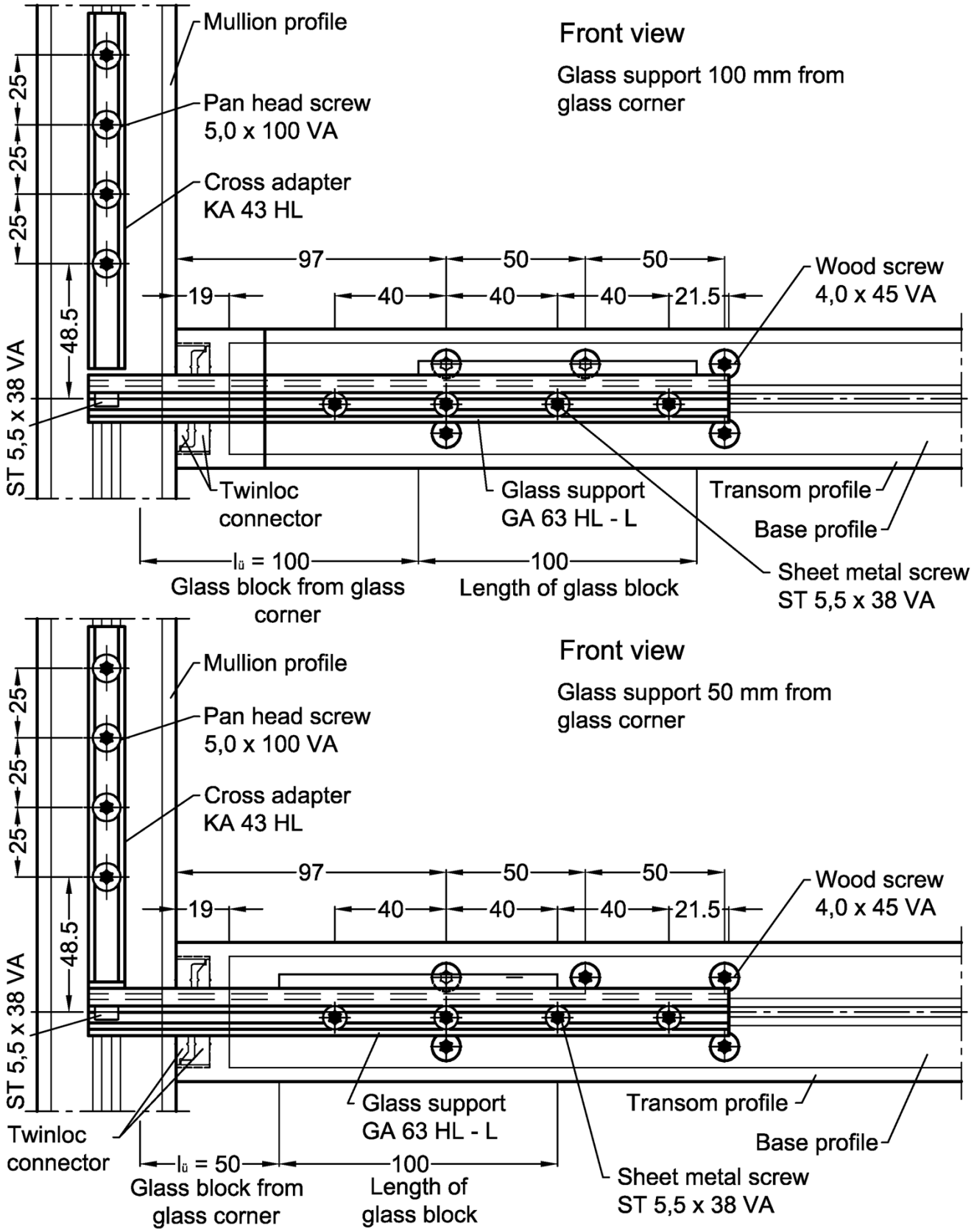
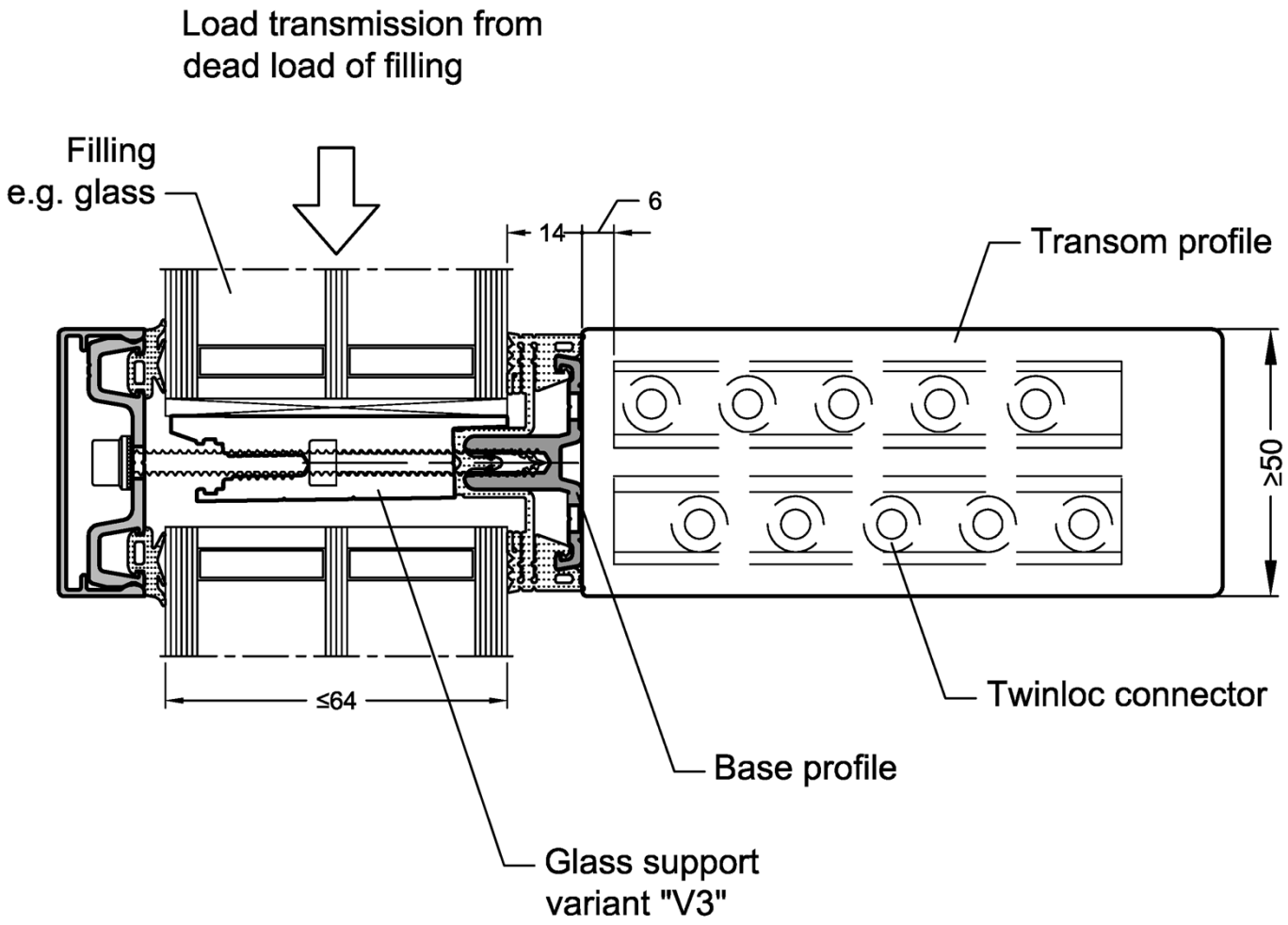


'Twinloc' connector

Mullion-transom connection
Lara heavy duty variant V3
Side view

Annex 4.31



'Twinloc' connector	Annex 4.32
Mullion-transom connection Lara heavy duty variant V3 Limitation of the eccentricity of load	

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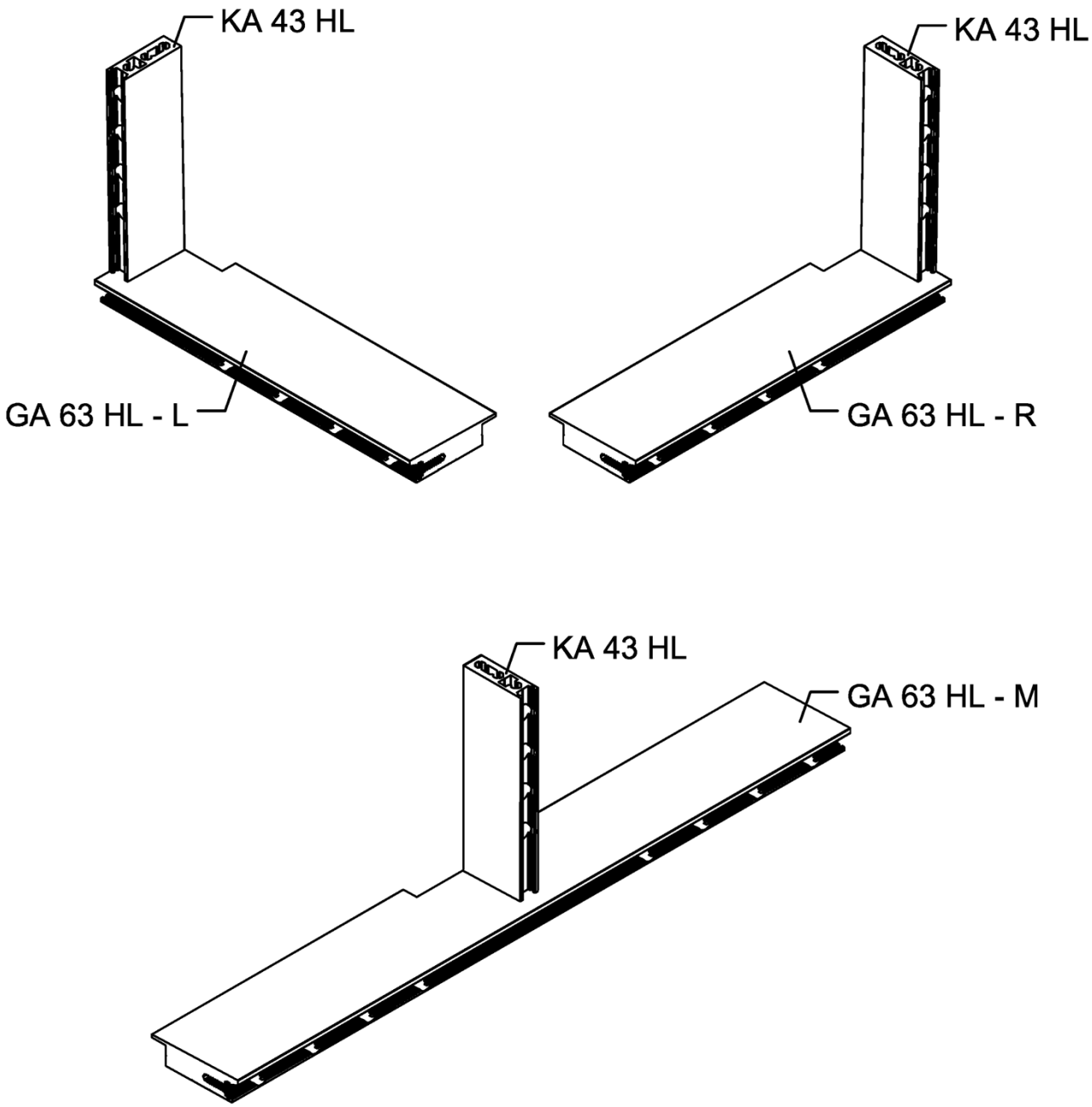

'Twinloc' connector	Annex 4.33
Mullion-transom connection Lara heavy duty variant V3 Reinforcement profiles/ Glass supports	

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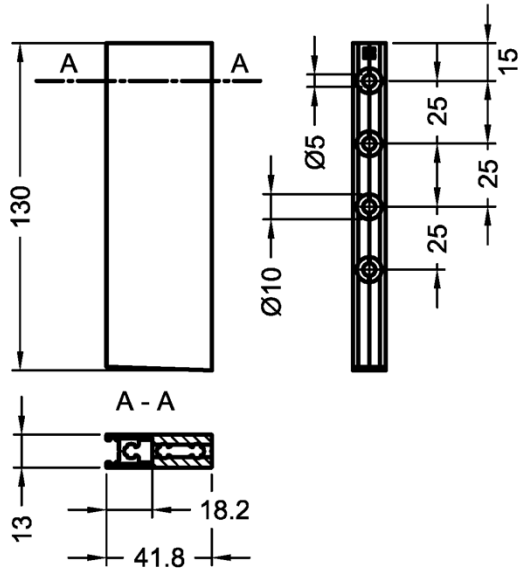
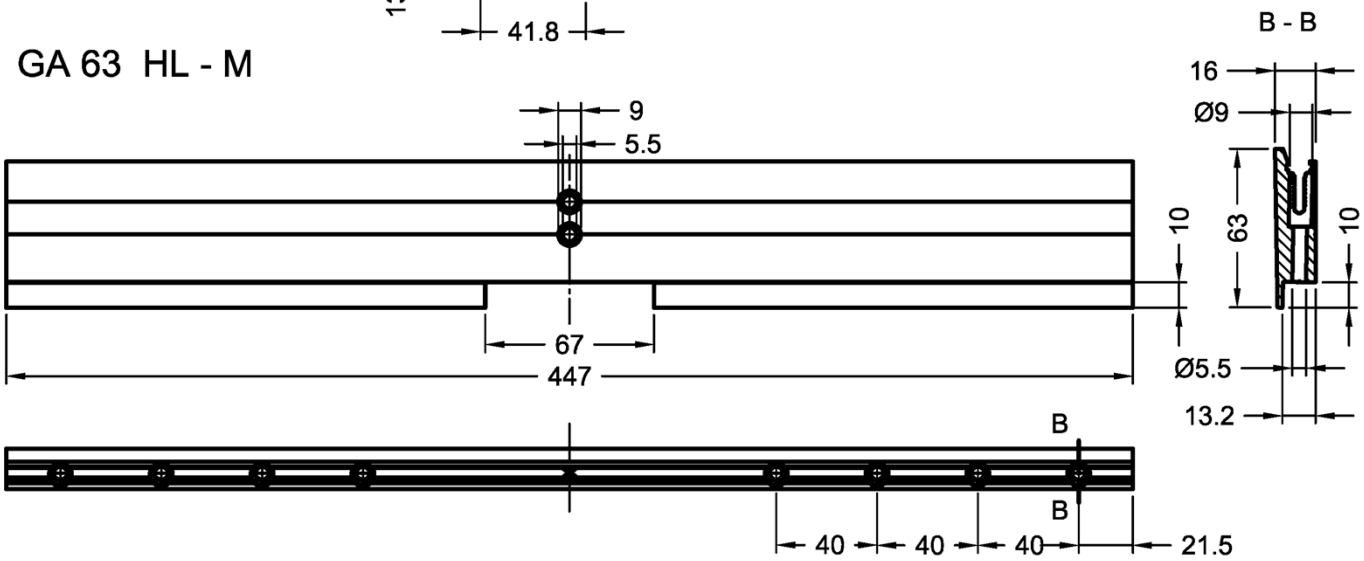
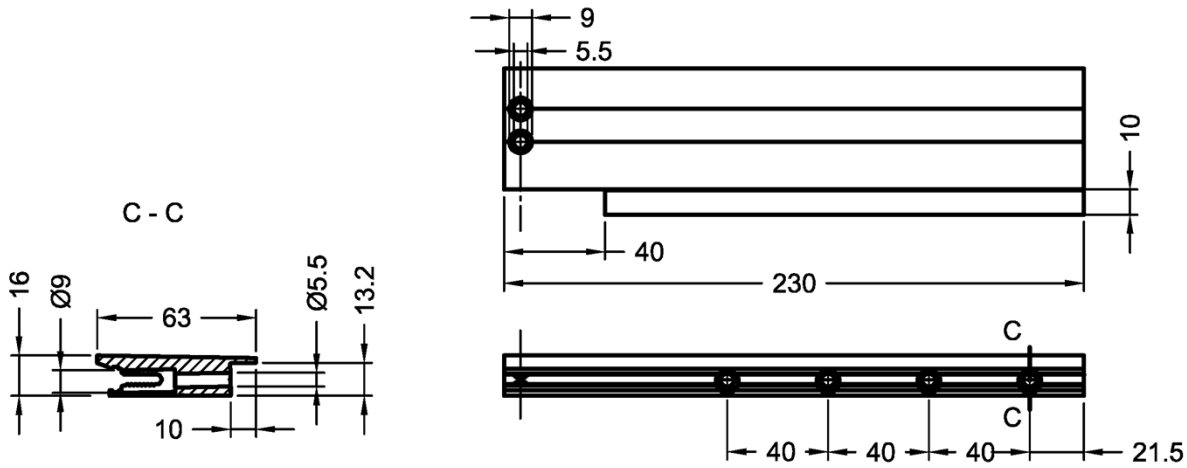
KA 43 HL



GA 63 HL - M



GA 63 HL - L is shown as an example, GA 63 HL - R is mirror-inverted



'Twinloc' connector	Annex 4.34
Mullion-transom connection Lara heavy duty variant V3 Glass supports	

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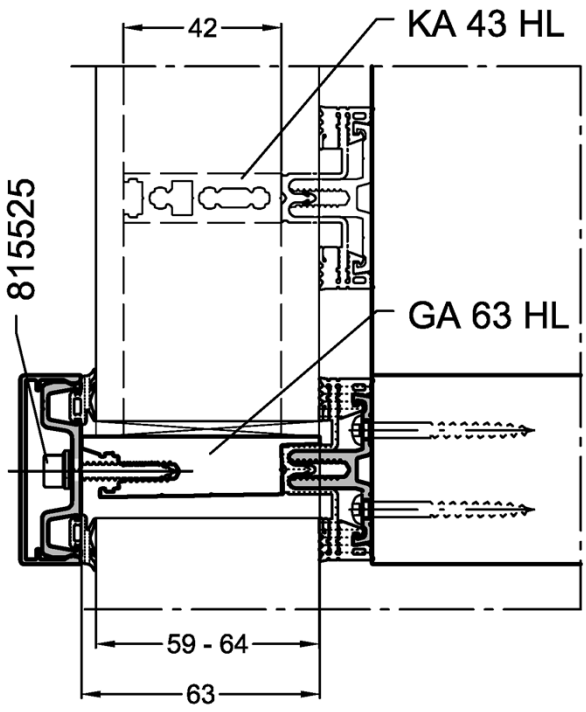
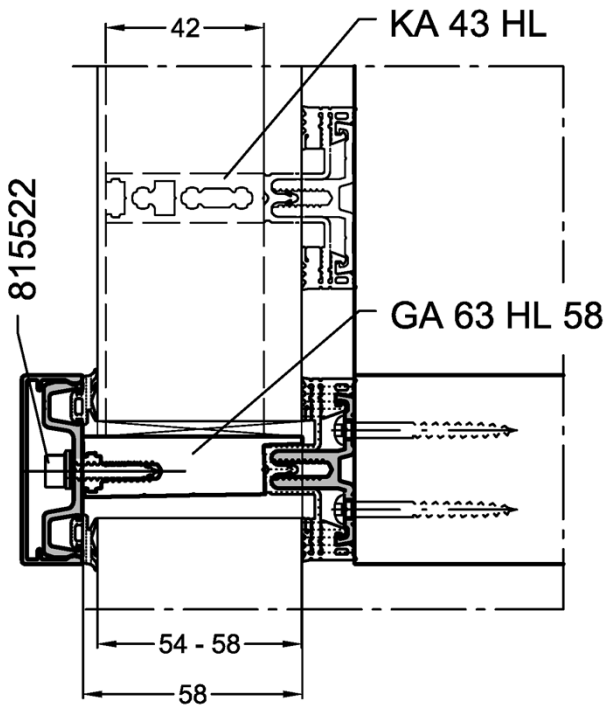
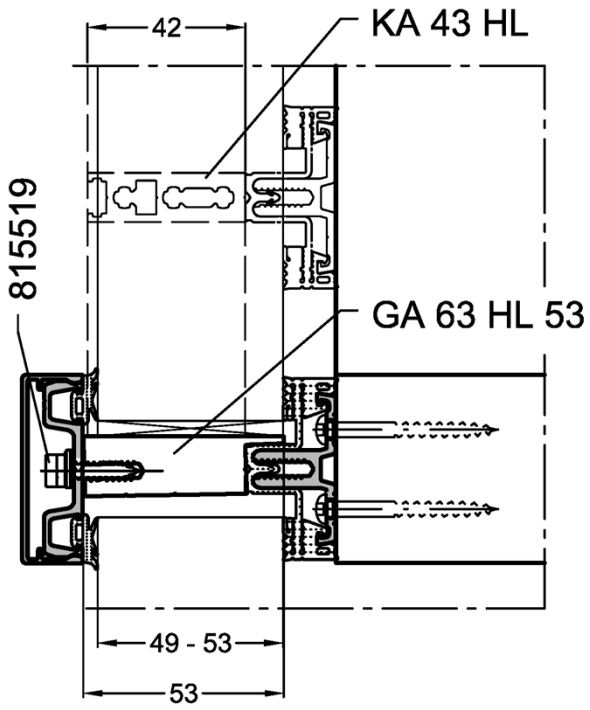
Glass thickness 59 - 64 mm



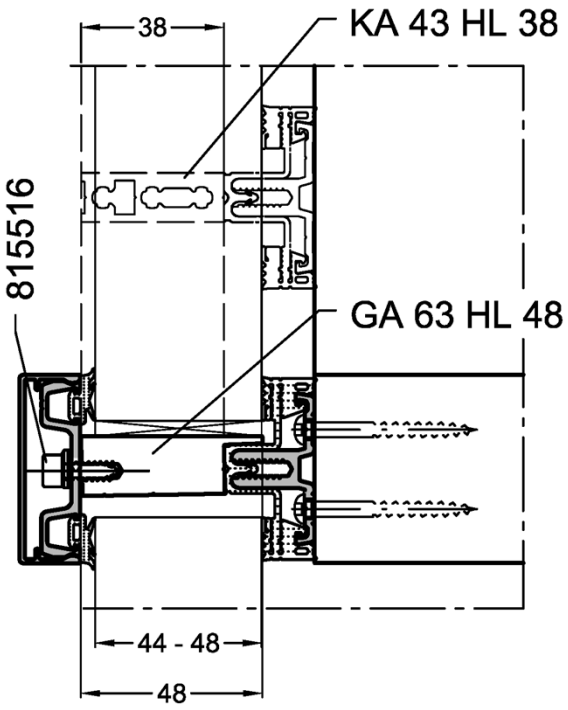
Glass thickness 54 - 58 mm



Glass thickness 49 - 53 mm



Glass thickness 44 - 48 mm



'Twinloc' connector	Annex 4.35
Mullion-transom connection Lara heavy duty variant V3 Overview glass supports with permitted glass thicknesses	

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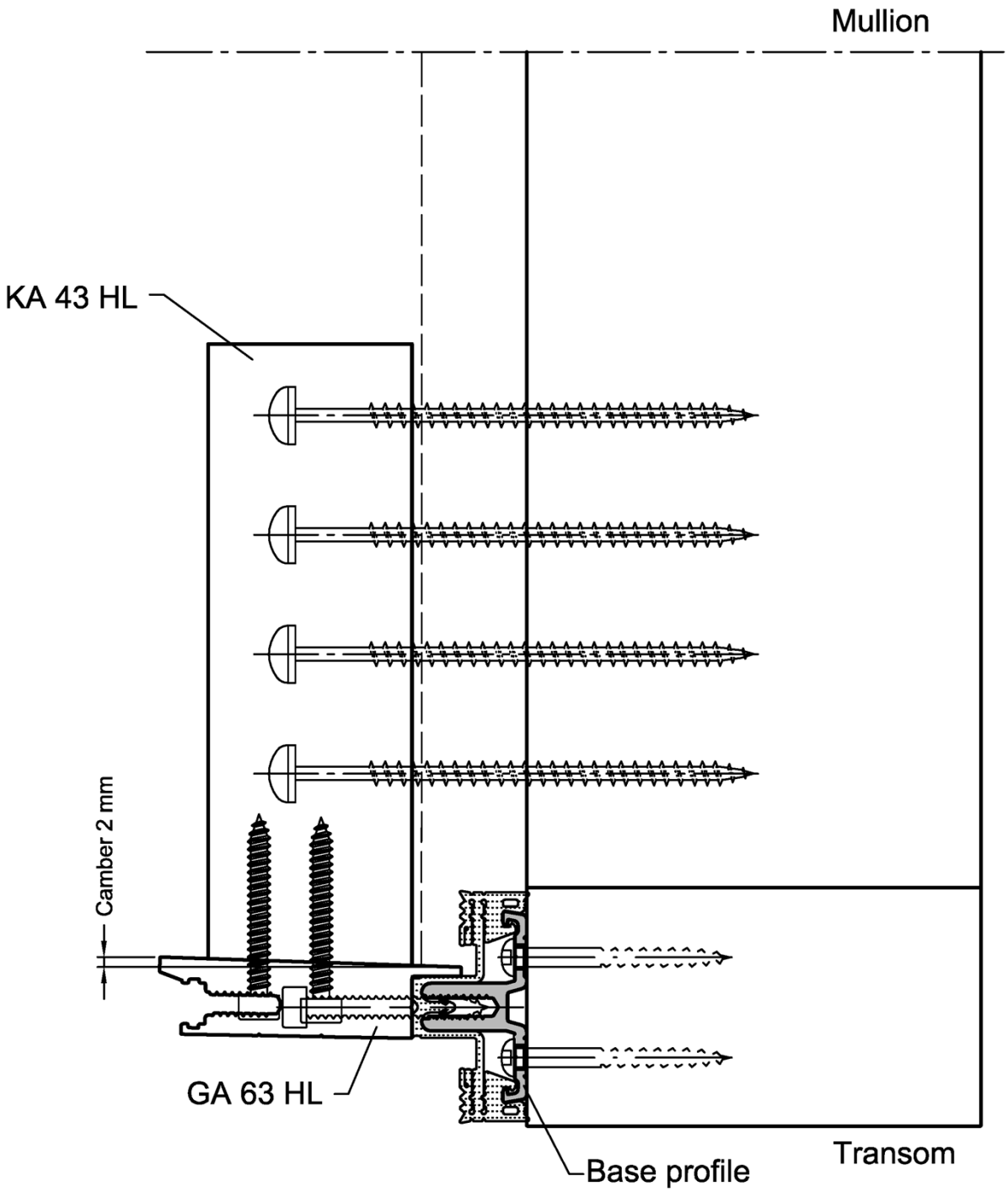
Heavy duty glass support variant V3



'Twinloc' connector	Annex 4.36
Mullion-transom connection Lara heavy duty variant V3 Superelevation of the heavy duty glass supports	

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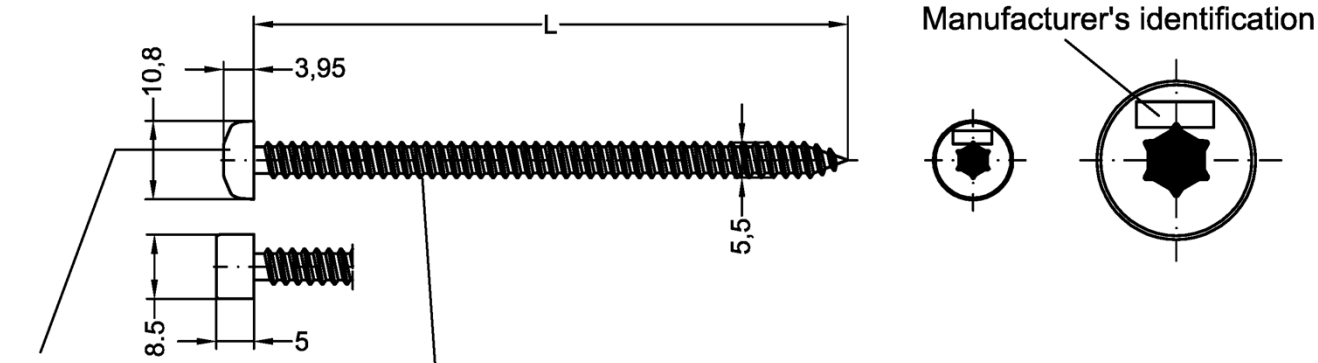
Connecting screw Twinloc: stainless steel sheet metal screw ST 5,5

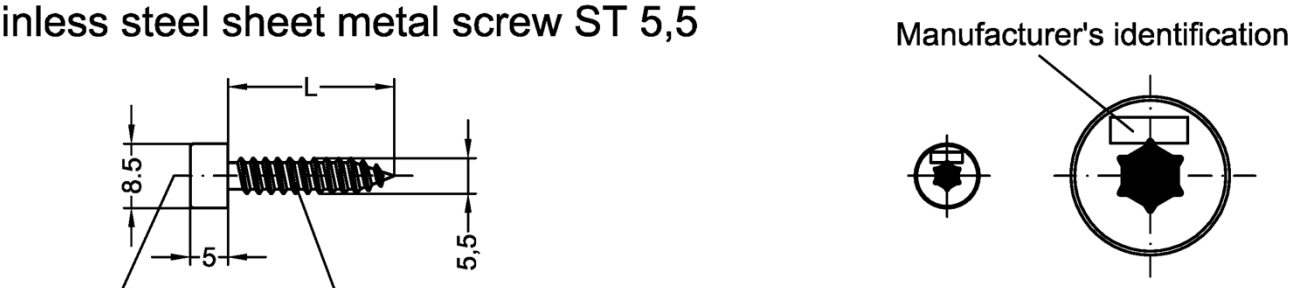


Drive: Torx T25
Head according to DIN 7981, alternatively: Head according to DIN 912

Full-length thread in accordance with DIN EN ISO 1478

Sheet metal screw Ø5,5	L = 38 mm	for TL 41
Sheet metal screw Ø5,5	L = 55 mm	for TL 59
Sheet metal screw Ø5,5	L = 75 mm	for TL 77
Sheet metal screw Ø5,5	L = 90 mm	for TL 95
Sheet metal screw Ø5,5	L = 120 mm	for TL 131, TL 221

Connecting screw glass support: stainless steel sheet metal screw ST 5,5



Drive: Torx T25
Head according to DIN 912

Full-length thread in accordance with DIN EN ISO 1478

Sheet metal screw Ø5,5	L = 22 mm	for glass support GA 26, GA34, KA 26 - KA 58
Sheet metal screw Ø5,5	L = 38 mm	for glass support V 2, V3
Sheet metal screw Ø5,5	L = 45 mm	for glass support V 2
Sheet metal screw Ø5,5	L = 55 mm	for glass support V 2

'Twinloc' connector	Annex 4.37
Screws	

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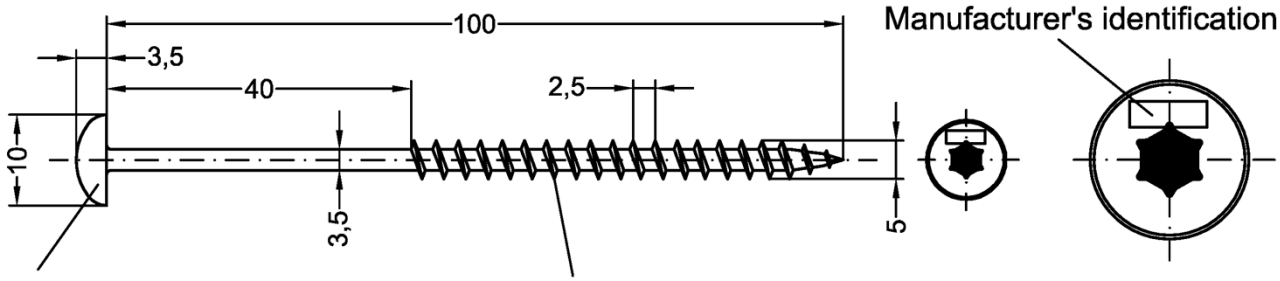
Connecting screw glass support V3: stainless steel pan head screw 5,0 x 100

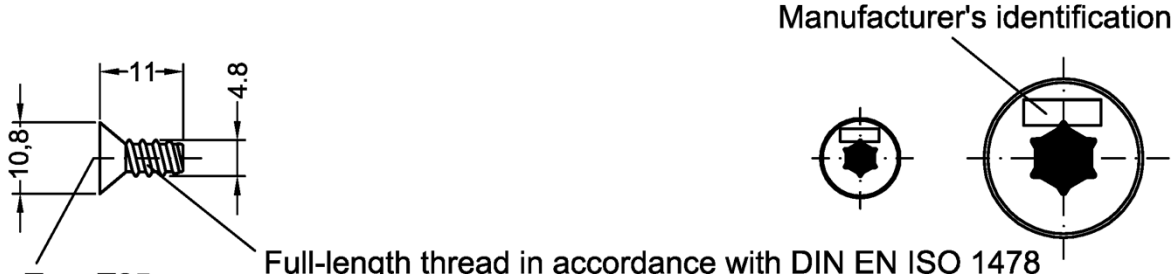


Drive: Torx T25
Head according to DIN 7981, alternatively: Head according to DIN 912

Partial thread

Pan head screw Ø5,0 L = 100 mm for intersection adapter KA 43 HL

Connecting screw glass support V2: Stainless steel countersunk sheet metal screw ST 4,8



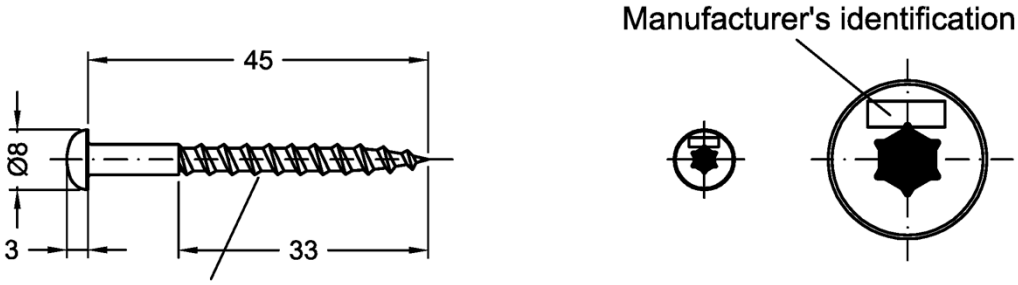
Drive: Torx T25
Head according to DIN 912

Full-length thread in accordance with DIN EN ISO 1478

Countersunk sheet metal threaded screw Ø4,8 L = 11 mm for intersection adapter KA 43

Connecting screw base profile: stainless steel wood screw 4,0 x 45

Drive: Torx T20
Head according to DIN 7996



Partial thread according to DIN 7998

'Twinloc' connector	Annex 4.38
Screws	