



European Technical Approval ETA-13/0675

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

Trigon SG

Zulassungsinhaber
Holder of approval

Eduard Hueck GmbH & Co. KG
Postfach 18 68
58505 Lüdenscheid
DEUTSCHLAND

Zulassungsgegenstand
und Verwendungszweck
*Generic type and use
of construction product*

Fassade mit punktgehaltener Isolierverglasung und tragender
Verklebung
*Facade punctually anchored with structural bonding and an insulating
glass unit*

Geltungsdauer:
Validity: vom
from
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to

28 June 2013

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Herstellwerke
Manufacturing plants

Werke 1 bis 30
Plant 1 to 30

Diese Zulassung umfasst
This Approval contains

35 Seiten einschließlich 17 Anhänge
35 pages including 17 annexes

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998⁴, as amended by Article 2 of the law of 8 November 2011⁵;*
 - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶.
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¹ Official Journal of the European Communities L 40, 11 February 1989, p. 12
² Official Journal of the European Communities L 220, 30 August 1993, p. 1
³ Official Journal of the European Union L 284, 31 October 2003, p. 25
⁴ *Bundesgesetzblatt Teil I 1998*, p. 812
⁵ *Bundesgesetzblatt Teil I 2011*, p. 2178
⁶ Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of the product and intended use

1.1 Definition of the construction product

This European technical approval applies to the façade with the trade name Trigon SG of the company Eduard Hueck GmbH & Co. KG, Lüdenscheid. Trigon SG is a structural sealant glazing system. The European Technical Approval (ETA) includes the structural sealant between the glass panes and the U-profile and spacer, the mechanical fixing of the elements to a transom-mullion system (Annex 1), the mechanical self-weight support and the retaining devices for the case of structural sealant failure (emergency retainers).

The insulating glass units are punctually anchored on site to the transom-mullion structure using retaining devices inserted into the U-profile. The self-weight of the insulating glass units being always supported by glass supports.

The insulating glass units may consist of two or three glass panes. The U-profile is inserted into the insulating glass edge next to the inner pane. In case of wind suction loads the outer as well as the middle pane are borne via the structural sealant of the insulating glass edge, the inner pane is held mechanically via retaining devices (toggles).

The maximum dimensions of the infill elements are 3000 mm x 5000 mm (width x height or height x width respectively). The infill elements are supported on at least two sides by the toggles.

1.2 Intended use

The infill elements shall be factory-made and are installed in mullion-transom façades.

The angle of inclination to the vertical shall not exceed 10° with a slope to the inside. As overhead glazing a slope to the horizontal of 7° to 80° is possible. For overhead glazing laminated safety glass shall be used as inner pane. The structural bond shall not be permanently subjected to tension.

By using special toggles, polygonal façades can be executed.

The use of infill elements for the stiffening of other building elements or as safety barrier is not covered by this ETA.

According to the definition in ETAG 002-1⁷ type I or type II is possible for the present construction. For type I mechanical self-weight supports plus retaining devices to reduce danger in case of bond failure are necessary. For type II only mechanical self-weight supports are necessary. Specific requirements of the Member States shall be observed when using the construction.

1.3 Intended working life of the construction product

The provisions made in this European technical approval are based on an assumed working life of the façade Trigon SG of 25 years, provided that the conditions laid down in sections 4.2/5.1/5.2 for packaging / transport / storage / installation / use / maintenance / repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the construction.

⁷ ETAG-002-1: Guideline for European technical approval for Structural Sealant Glazing Systems (SSGS), Part 1: Supported and unsupported systems

2 Characteristics of product and methods of verification

2.1 Characteristics of the product

2.1.1 Insulating glass unit

For the façade Trigon SG double or triple glazed insulating units are used (Annexes 1, 1a, 1b, 1c, 1d and 3).

The double or triple glazed insulating units consist of an exterior pane made of float glass (soda lime silicate glass), heat strengthened glass, thermally toughened soda lime silicate safety glass, heat-soaked thermally toughened soda lime silicate safety glass or laminated safety glass made of two panes of float glass, heat strengthened glass or thermally toughened soda lime silicate safety glass (Annex 1c) and an interior glass pane made of float glass (soda lime silicate glass), heat strengthened glass, thermally toughened soda lime silicate safety glass, heat-soaked thermally toughened soda lime silicate safety glass or laminated safety glass in accordance with Annex A.

For the triple glazed insulating units the middle pane is a monolithic one.

The glass panes may be entirely or partially enameled or coated, if their adhesive behaviour has been verified before, according to ETAG 002-1 with the adhesives described in 2.1.4. The specification of the enamel or coating shall be defined in the respective European technical approval of the sealant or in another European technical approval or in national stipulations. If other enamels or coatings of the glass panes are used, the bonded area of the glass pane shall be left out from this enamel or coating.

Furthermore it shall be observed that when using coated glass according to EN 1096-4⁸ the coated glass surface may not be oriented towards the PVB-interlayer.

2.1.2 U-profile

In the area of the load-bearing insulating glass edge a U-profile (Annex 2) is embedded continuously or in pieces of the length of 100 mm along the supported edges of the pane.

The following products are to be used as U-profiles.

Product	Art. No.	Surface condition	Adhesives that may be used
Stainless Steel 1.4301 with strength class S275	Z 917109	ETA-01/0005	DC 993
Stainless Steel 1.4301 with strength class S275	Z 917109	ETA-03/0038	Sikasil SG 500
EN AW 6060 aluminium as per EN 573-3 ⁹ , state T66 as per EN 755-2 ¹⁰	P 499633	Anodised aluminium: colours E6-C0 and E6-C35, Fa. König, Metallveredelung GmbH, Lauchringen*; colours E6-C0 and E6-C35, Fa. HD Wahl GmbH, Jettingen-Scheppach*	DC 993
EN AW 6060 aluminium as per EN 573-3, state T66 as per EN 755-2	P 499633	Anodised aluminium: colours E6-C0 and E6-C35, Fa. König, Metallveredelung GmbH, Lauchringen*; colours E6-EV1 and E6-C35, Fa. HD Wahl GmbH, Jettingen-Scheppach*	Sikasil SG 500

* The specifications of the anodising process are deposited with Deutsches Institut für Bautechnik.

2.1.3 Spacer and primary seal

Spacers are applied for which a system check according to EN 1279-2¹¹ is available. The edge seal of the insulating glass is manufactured with a primary seal of butyl according to the following table and a secondary seal (load-bearing insulating glass edge) of silicone sealants according to 2.1.4.

Permissible combinations of structural sealants and adjacent materials				
Load bearing sealant	Materials in contact			
	Naphtatherm BU-S, Fa. Kömmerling	Sika Glaze IG-5 PIB, Sika Services AG	Round cord Climafill standard, Fa. NMC sa	Sika Spacer Tape HD Sika Services AG
DC 993	X		X	
Sikasil SG 500		X		X

The compatibility of the primary seal with the load-bearing silicone sealants is verified. Detailed compatibility information is deposited with Deutsches Institut für Bautechnik.

⁹ EN 573-3:2009 Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical composition and form of products

¹⁰ EN 755-2:2008 Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 2: Mechanical properties

¹¹ EN 1279-2:2002 Glass in building - Insulating glass units - Part 2: Long term test method and requirements for moisture penetration

2.1.4 Structural sealant

The structural glass edge seal with the U-profiles shall be executed with the structural sealant DC 993 according to ETA-01/0005¹² or Sikasil SG 500 according to ETA-03-0038¹³.

The processing requirements of the respective structural sealant manufacturer shall be respected at the factory.

2.1.5 Glass support and setting blocks

Supporting devices with a width of 100 mm in accordance with Annex 4 bear the self-weight of the glass (Annexes 1b, 4, 4a and 4b).

The following products are to be used as setting blocks.

Permissible combinations of structural sealants and adjacent materials		
Load bearing sealant	Setting block	
	GLSV Standardklotz, Fa. Gluske BKV GmbH	Silicon with shore hardness 90±5 from M-S Silicon GmbH & Co KG, Dortmund
DC 993	X	*
Sikasil SG 500		*
* Compatibility to be tested during initial type testing		

The length of the supporting device depends on the total thickness of the insulating glass unit. It shall be ensured that at least half of the thickness of the exterior pane of the insulating glass unit is supported. In case of an exterior glass pane out of laminated safety glass, at least half of the outer pane of the laminated safety glass shall be supported.

2.1.6 Mechanical fixing devices - toggles

The toggles are made of aluminum EN AW 6063 T66 according to EN 573-3 and EN 755-2 (Annexes 1b, 1c and 5).

For the positioning of the toggles it shall be observed that the distance "e" between two toggles is limited to 150 mm < e ≤ 400 mm. The first toggle is situated at min. 50 mm and max. 200 mm from the corner in the case of the horizontal pane edge and at min. 50 mm and max. 150 mm in the case of the vertical pane edge (Annex 7). The distances may vary within the given range for special applications.

If only two sides of the pane are supported, two toggles right next to each other are required next to the corner. These toggles are regarded as one.

For polygonal façades special toggles according Annex 5a may be used.

The toggles can be fixed in two different ways, V1 with the fixing screw in the screwing channel only and V2 being screwed into the screwing channel and through its web into the profile (Annex 1b).

2.1.7 Mechanical safety devices (emergency retainers)

For the load case of bond failure the horizontal wind suction loads are absorbed and passed on by emergency retainers. Two types of emergency retainers are used. One of them is flat (plate), made of stainless steel 1.4310, the other "hat-shaped", made of aluminium EN AW 6063 T66 according to EN 573-3 and EN 755-2 (Annex 6). The minimum distance between two emergency retainers is 500 mm. The distance of the first emergency retainer from the corner of the pane shall be less than half of the distance between two of them.

¹² ETA-01/0005 "DOW CORNING 993 and 895, Sealants used in structural sealant glazing systems to bond glass onto metal", UBAtc; Validity to 05/04/2017

¹³ ETA-03/0038 „Sikasil SG 500, Structural sealant for use in structural glazing kits”, DIBt; Validity to 15/03/2014

The necessity to use such emergency retainers is regulated by the respective Member States. In Germany, emergency retainers are required for all sealed infill elements installed at heights of 8 m or more.

2.1.8 Joint sealing

After assembly, the joints between infill elements are to be sealed using one of the weather sealants according the following table.

Permissible combinations of structural sealants and adjacent materials				
Load bearing sealant	Weather sealant			Ventilation
	DC 791 DC 757 Dow Corning	WS 605 S WS 680 SC Sika Services	"dry" sealant system, silicone Fa. HUECK	Silicone profile for ventilation Fa. HUECK
DC 993	X		*	*
Sikasil SG 500		X	*	*
* Compatibility to be tested during initial type testing				

2.1.9 Requirement for the preparation of the adhesion surfaces

The processing guidelines of the system supplier Eduard Hueck GmbH & Co. KG and the requirements of the structural sealant manufacturer regarding the pre-treatment of contact surfaces and the structural sealant processing according to section 2.1.4, which were provided to Deutsches Institut für Bautechnik, shall be considered.

2.2 Method of verification

2.2.1 General

The assessment of the fitness for the intended use of the infill elements in relation to the essential requirements for safety in case of fire (ER 2), for hygiene, health and the environment (ER 3), for safety in use (ER 4), protection against noise (ER 5) and for energy economy and heat retention (ER 6) has been made in accordance with the "Guideline for European Technical Approval for Structural Sealant Glazing Kits" (ETAG 002-1) and CUAP 04.04/46.

2.2.2 Safety in case of fire (ER 2)

According to Commission Decision 96/603/EC, glass will be classified in category A1 and the silicone sealant in accordance with section 2.1.4 will be classified in category F.

The resistance to fire can only be assessed for the entire façade construction and shall be verified separately.

Note: A European reference fire scenario for facades has not been laid down. In some Member States the classification of Trigon SG according to EN 13501-1¹⁴ might not be sufficient for the use in facades. An additional assessment of Trigon SG according to national provisions (e.g. on the basis of a large scale test) might be necessary to comply with Member States regulations, until the existing European classification system has been completed.

¹⁴

EN 13501-1:2007+A1:2009

Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

2.2.3 Hygiene, health and the environment (ER 3)

The air permeability class A4 and water tightness class RE1200 according to EN 13830¹⁵ were determined.

Relating to "Dangerous substances" the manufacturer of the infill elements has made a declaration of compliance with the Council Directive 76/769/EEC of 27 July 1976 published with amendments in the EC Official Journal.

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

2.2.4 Safety in use (ER 4)

2.2.4.1 General

The stability of the infill elements and their anchorage to the structure shall be verified by taking particular account of the following loads:

- self-weight,
- wind,
- temperature,
- exposure to climatic conditions.

The regulations concerning load application and load combinations in the Member States, in which the structural sealant glazing kit is used, shall be observed, for safety factor recommendations see Annex B.

In the context of issuing this ETA the verification of impact safety of the structure was not performed.

2.2.4.2 Glass panes

The glass shall be verified as linear supported glass according to national regulations of the respective Member States for actions in accordance with section 2.2.4.1. The deflection of a two- or three-edge supported glass pane in case of service load shall not exceed $a/100$, a being the span length or the length of the unsupported edge of the pane respectively.

For the load case of bond failure the stresses in the outer glass pane shall be verified according to national regulations (see Annex B).

In addition for the load case of bond failure the maximum deflection of the outer glass pane shall be verified by:

$$f_{\text{glass}} \leq \frac{3}{4} \cdot (2a - 3)^{\frac{1}{2}}$$

a : length of the shortest glass edge (4-sided support) or span length (2-sided support) [mm]

f_{glass} : deflection of the outer glass pane in case of bond failure under characteristic loads according to 2.2.4.1 [mm]

Tolerances of 3 mm for installation are respected in the formula and shall be observed.

2.2.4.3 Mechanical fixing devices - toggles

The toggles (see 2.1.6) shall be verified for the effects of actions according to section 2.2.4.1. The load capacities for the polygonal toggles shall be distinguished between infields in polygonal façades where two elements of similar size are placed side by side and endfields of a polygonal façade. The load bearing capacity of the different toggles is given in table 1.

Table 1: Load bearing capacity of the toggles

Group	Type	Article No.	$F_{Rk,V1}$ [kN]	$F_{Rk,V2}$ [kN]
Standard toggle one-sided	-	993945	0,68	1,37
	-	993974		
	-	996395		
Standard toggle two-sided	-	993946	2,66	2,77
	-	993975		
Polygonal toggle A-D in infields	A	993976	0,68	1,37
	B	993977		
	C	993978		
	D	993979		
Polygonal toggle E-H in infields	E	993980	2,34	2,33
	F	993981		
	G	993982		
	H	993983		
Polygonal toggle I-O in infields	I	993984	5,34	4,89
	J	996279		
	K	996278		
	L	996277		
	M	996276		
	N	996275		
	O	996255		
Polygonal toggle P-T in infields	P	996256	2,62	3,91
	Q	996257		
	R	996258		
	S	938086		
	T	938087		
Polygonal toggles A-T in endfields	A-T	-	0,68	1,37

The design calculation is to be done in accordance with the national provisions of the Member States, for details see Annex B.

The support reactions of the toggles due to a load on the glass pane shall be calculated by FEM simulation.

The maximum distance between two toggles can be calculated according to following manual calculation alternatively to FEM simulation:

$$150 \text{ mm} \leq e_{\max} = F_{Rd}/p_d \leq 400 \text{ mm}$$

$$F_{Rd} = F_{Rk} / (\gamma_M \times \gamma_D)$$

$F_{Rk,V1}$: characteristic value of the load-bearing capacity variant 1, screwed into the screwing channel only

$F_{Rk,V2}$: characteristic value of the load-bearing capacity variant 2, screwed into the screwing channel and through its web into the profile

$$p_d = q_d \cdot a \text{ (for infields)}$$

$$p_d = q_d \cdot a/2 \text{ (for endfields)}$$

γ_M : according to Annex B

$\gamma_D = 1,25$ (for support reaction in continuous beam on the safe side)

$q_d = \gamma_A \cdot q_k$ (design wind suction load [N/mm²])

γ_A : according to national provisions

a : length of the shortest glass edge (4-sided support) or span length (2-sided support) [mm]

If only two sides of the pane are supported two toggles right next to each other are required next to the corner. These toggles are regarded as one.

The polygonal toggles shall be stressed by symmetric loads to adopt the higher load bearing capacity of the toggles and to avoid torsional stress in the frame profiles and unallowable deformation. If this cannot be assured only the load bearing capacity for toggles in endfields as per table 1 is possible.

The minimum embedment depth of the toggles into the U-profiles is to be 7 mm.

2.2.4.4 Structural bond

The structural bond shall be verified under the actions given in section 2.2.4.1. It shall be verified that the structural bond does not obtain any stresses exceeding the design stresses according to the respective ETA for the structural sealant (see 2.1.4).

The effective thickness r_{eff} of the structural bond with inserted U-profile (for triple glazed insulating units: inner bond of the insulating glass) shall be verified by:

$$r_{\text{eff}} = r/k \geq \beta \cdot a \cdot q_k / (2 \cdot \sigma_{\text{des}})$$

r : thickness of the structural bond [mm]

$$k = (-1,5 \cdot d / 400 + 3)$$

d : distance of first toggle to the neighbouring glass corner [mm]

a : length of the shortest glass edge (4-sided support) or span length (2-sided support) [mm]

q_k : characteristic wind suction loads according to 2.2.4.1 on the structural bond with U-profile [N/mm²]

β : proportional value of the wind load to be transferred by the structural bond depending on the stiffness of the single panes

$$\sigma_{\text{des}} = R_{u,5} / \gamma_{\text{tot}} \text{ (according to ETA for the structural sealant) [N/mm}^2\text{]}$$

γ_{tot} : global safety factor according to Annex B

The allowable design stress of the structural sealant is given in its respective ETA (see 2.1.4).

The design of the structural bond has to be carried out in accordance with the regulations of the Member State, in which the infill elements will be used (see Annex B).

2.2.4.5 Glass supports

The glass supports according to 2.1.5 shall be verified for the self-weight loading of the infill element according to national regulations (see Annex B). The centre of gravity of the self weight of the infill elements shall be controlled. The eccentricity of the load may not exceed 37 mm. For details see the processing guidelines of the system supplier Eduard Hueck GmbH & Co. KG.

The resistance of the different glass supports is given in table 2 to table 4.

Table 2: Load bearing capacity of standard glass supports (Full infill element)

System	Article No. glass support	F _{Rk} [kN]
Trigon 50	996165	2,60
	996166	2,60
	996167	3,00
	996168	3,00
Trigon 60	996327	2,60
	996328	2,60
	996329	3,00
	996330	3,00
	499682	4,50
	499635	6,00

Table 3: Load bearing capacity of reinforced glass supports (full infill element)

System	Article No. transom	Glass thickness [mm]	Variation	F _{Rk} [kN]
Trigon 50 Trigon 60	519353 or 519354	40 to 48	without angle	2,60
			with 1 angle	3,10
			with 2 angles	3,50
		50 to 58	without angle	2,20
			with 1 angle	2,70
			with 2 angles	3,10

Table 4: Load bearing capacity of glass supports for high infill weights (full infill element)

System	T-connector	Fixing of vertical glass support	Insert profile in mullion	F _{Rk} [kN]
Trigon 50/ Trigon 60	Standard T-connector	4 screws	without insert profile	4,44
		2 screws/2 bolts		
	T-connector for high loads	4 screws		7,22
		2 screws/2 bolts		
	Insert profile as T-connector	4 screws	with insert profile	9,92
		2 screws/2 bolts		

2.2.4.6 Mechanical safety devices (emergency retainers)

Mechanical safety devices (see 2.1.7) may be installed in case of bond failure according to the requirements of the national regulations of the Member States. Bond failure shall be regarded as an exceptional load case. The safety devices shall be located on at least two opposing edges of the glass pane. The load bearing capacity of the safety devices are given in table 5.

Table 5: Load capacity of mechanical safety devices

Safety device	Article No.	Load	F _{Rk} [kN]
Hat	997260	one-sided	3,17
		symmetric	5,84
Plate	997259	one-sided	2,54
		symmetric	3,62

The design calculation is to be done in accordance with the national provisions of the Member States, for details see Annex B.

The support reactions of the mechanical safety devices due to a load on the outer glass pane shall be calculated by FEM simulation.

The required distance "e" between two safety devices can alternatively be calculated according to the following manual calculation when respecting the constructive requirements as follows. The distance "d" of the first safety device from the corner has to be inferior to the distance "e" between two safety devices. The minimum distance between two safety devices is 500 mm.

$$500 \text{ mm} \leq e_{\max} = F_{Rd}/p_d$$

$$F_{Rd} = F_{Rk} / (\gamma_M \cdot \gamma_D)$$

$$p_d = q_d \cdot a \text{ (for infields)}$$

$$p_d = q_d \cdot a/2 \text{ (for endfields)}$$

$$\gamma_M = \text{according to Annex B}$$

$$\gamma_D = 1,25 \cdot 1,125 = 1,41 \text{ (for support reactions in continuous beams with cantilever arm, on the safe side)}$$

$$q_d = \gamma_A \cdot q_k \text{ (design wind suction load [N/mm}^2\text{])}$$

$$\gamma_A: \text{ according to Annex B}$$

$$a: \text{ length of the shortest glass edge (4-sided support) or span length (2-sided support) [mm]}$$

2.2.4.7 Deflection of the framing profiles

The deflection of the framing profiles supporting the pane edges shall not exceed - in the area of the pane edge - 1/200 of the pane edge length concerned. For pane edges of insulating glasses it shall, however, not exceed 15 mm.

2.2.5 Protection against noise (ER 5)

In the context of issuing this ETA the verification of performance capacities of the protection against noise was not performed. For the verification of the entire façade structure, regarding the protection against noise, the regulations of the Member States shall apply.

2.2.6 Energy economy and heat retention (ER 6)

For the verification of the entire façade structure, regarding the energy economy and thermal insulation according EN ISO 12631¹⁶ the following U_t (transom) and U_m (mullion) values are given:

TRIGON 50 with PP insulating web

Profile	b_f [mm]	l_f [mm]	U_t / U_m [W/m ² K]
519 300	50	32	1.408
519 352	50	100.5	1.476
519 356	50	193.5	1.504

$$U_t / U_m \text{ [W/m}^2\text{K]} = 0.0006 * l_f \text{ [mm]} + 1.3999$$

TRIGON 60 with PP insulating web

Profile	b_f [mm]	l_f [mm]	U_t / U_m [W/m ² K]
523 300	60	32	1.336
523 352	60	100.5	1.398
523 356	60	193.5	1.425

$$U_t / U_m \text{ [W/m}^2\text{K]} = 0.0005 * l_f \text{ [mm]} + 1.3281$$

TRIGON 50 with foam profiles

Profile	b_f [mm]	l_f [mm]	U_t / U_m [W/m ² K]
519 300	50	32	0.911
519 352	50	100.5	0.939
519 356	50	193.5	0.951

$$U_t / U_m \text{ [W/m}^2\text{K]} = 0.0002 * l_f \text{ [mm]} + 0.9075$$

TRIGON 60 with foam profiles

Profile	b_f [mm]	l_f [mm]	U_t / U_m [W/m ² K]
523 300	60	32	0.874
523 352	60	100.5	0.901
523 356	60	193.5	0.913

$$U_t / U_m \text{ [W/m}^2\text{K]} = 0.0002 * l_f \text{ [mm]} + 0.8705$$

b_f = profile height [mm]

l_f = profile depth [mm]

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the decision of the European Commission of 24.06.1996 published in the Official Journal of the European Communities L 254 of 08.10.1996 the system 2+ of attestation of conformity for structural sealant glazing kit according to type I of ETAG 002-1 and the system 1 of attestation of conformity for type II of the ETAG 002-1 apply. These systems are defined in the following:

System 1: Certification of the conformity of the product by a notified body on the basis of:

- (a) Tasks for the manufacturer:
 - (1) factory production control;
 - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;
- (b) Tasks for the notified body:
 - (3) initial type-testing of the product;
 - (4) initial inspection of factory and of factory production control;
 - (5) continuous surveillance, assessment and approval of factory production control;

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

- (a) Tasks for the manufacturer:
 - (1) initial type-testing of the product;
 - (2) factory production control;
 - (3) testing of samples taken at the factory in accordance with a prescribed test plan.
- (b) Tasks for the notified body:
 - (4) certification of factory production control on the basis of:
 - initial inspection of factory and of factory production control;
 - continuous surveillance, assessment and approval of factory production control.

3.2 Responsibilities

To ensure that the product is in conformity with this European technical approval the following controls are required. They are described in detail in the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.¹⁷

The manufacturer may only use the initial / raw / constituent materials stated in the technical documentation of this European technical approval.

Tasks for the assessment of conformity for system 1

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of SSG-systems in order to undertake the actions laid down in the following table. For this purpose, the control plan shall be handed over by the manufacturer to the approved body involved.

¹⁷ The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity.

	Tasks	Contents
Manufacturer	Factory production control	Permanent internal control of production; all the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. The results shall be recorded and evaluated in accordance with the provisions of the control plan. Type, scope, frequency and documentation of the tests are laid down in the control plan.
	Testing of samples taken at the factory	Testing of samples taken at the factory in accordance with a prescribed control plan.
Notified Body	Initial type-testing of the product	In the manufacturing plant an initial type-testing is required. Execution and documentation of the tests in accordance with the control plan by an approved body.
	Initial inspection of the manufacturing plant and factory production control	The notified body has to verify that the manufacturing plant, in particular the staff and equipment, and the factory production control, are suitable to ensure continuous and orderly manufacturing of the products in compliance with the provisions given in section 2.1 and in the Annexes of the European technical approval.
	continuous surveillance, assessment and approval of factory production control	The notified body shall perform at least twice a year a surveillance at the manufacturing plant. It shall be verified that the factory production control is maintained taking into account the specified control plan.
	EC certificate of conformity	The approved certification body shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

Tasks for the assessment of conformity for system 2+

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of SSG-systems in order to undertake the actions laid down in the following table. For this purpose, the control plan shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

	Tasks	Contents
Manufacturer	Initial type-testing of the product	Execution and documentation of the tests in accordance with the control plan.
	Factory production control	Permanent internal control of production; all the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. The results shall be recorded and evaluated in accordance with the provisions of the control plan. Type, scope, frequency and documentation of the tests are laid down in the control plan.
	Testing of samples taken at the factory	Testing of samples taken at the factory in accordance with a prescribed control plan.
Notified Body	Initial inspection of the manufacturing plant and factory production control	The notified body has to verify that the manufacturing plant, in particular the staff and equipment, and the factory production control, are suitable to ensure continuous and orderly manufacturing of the product in compliance with the provisions given in section 2.1 and in the Annexes of the European technical approval.
	continuous surveillance, assessment and approval of factory production control	The notified body shall perform at least twice a year a surveillance at the manufacturing plant. It shall be verified that the factory production control is maintained taking into account the specified control plan.
	EC certificate of conformity	The approved certification body shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

The EC certificates and the results of the factory production control and the continuous surveillance shall be submitted by the notified body or the manufacturer to the Deutsches Institut für Bautechnik, on request.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled, the certificate of conformity has to be invalidated and Deutsches Institut für Bautechnik has to be informed.

3.3 CE marking

The CE marking shall be affixed on the product itself, on the label attached to it, on the packaging or on the accompanying document. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the manufacturer (legal entity responsible for the manufacturer) and the manufacturing plant,
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product (system 1),

- the number of the EC certificate for the factory production control (system 2+),
- the number of the European technical approval,
- - identification of the product Trigon SG 50/60.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The European technical approval is issued for the product on the basis of agreed information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval, and if so whether further assessment or alterations to the approval shall be necessary.

The infill elements may only be manufactured in the manufacturing plants as noted on the front page. The manufacturers are to be trained by Eduard Hueck GmbH & Co. KG, Lüdenscheid.

The surfaces to be sealed may only be prepared in conformity with the manufacturing directives. Bubbles, holes or inclusions in the structural sealant are not permissible.

4.2 Installation

The infill elements shall be fixed to the supporting structure according to the processing guidelines of the company Eduard Hueck GmbH & Co. KG, Lüdenscheid, such, that no restraints may occur in the elements. The installation shall be performed by experts only, which have been trained for these works by the company Eduard Hueck GmbH & Co. KG, Lüdenscheid.

When the toggles of the infill elements are installed only on two sides of the pane (uniaxial load), two toggles are required next to each corner of the pane.

It shall be ensured that at least half of the thickness of the exterior pane of the insulating glass unit is supported. In case of an exterior glass pane out of laminated safety glass, at least half of the outer pane of the laminated safety glass shall be supported.

Each emergency retainer (see 2.1.7) shall cover the edge of the glass according Annex 6, respecting 3 mm tolerance for installation.

In endfields the emergency retainers shall be supported opposite to the glass pane by appropriate means.

European technical approval

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English translation prepared by DIBt

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5 Indications to the manufacturer

5.1 Packaging, transport and storage

The manufacturer shall take suitable precautions for packaging, transport and storage to ensure that glass elements are protected against damage by, e.g. breakage, scratching, splitting or contamination.

Suitable arrangements have to be made to prevent the application of unacceptable loads to the structural seal, for example the provision of suitable racks, and to prevent exposure to water, solar radiation or significant changes of temperature, by protecting with covers.

5.2 Use, maintenance, repair

The cleaning of the façade may only be performed by using water with the addition of not more than 1 % surface-active agents without any other chemical additives and/or any aggressive cleaning methods (e.g. blast-cleaning with steam pressure).

Uwe Bender
Head of Department

beglaubigt:
Herr

National provisions for glass products

Annex A

1. Provisions for the production of float glass (soda lime silicate glass)*

Class	Member States	Technical rule	Additional provisions
A	Germany	DIN EN 572-9 and Bauregelliste ('Construction Products List') A Part 1, serial No 11.10	Indication of the bending tensile strength
B		EN 572-9	

2. Provisions for the production of thermally toughened soda lime silicate safety glass (ESG)*

Class	Member States	Technical rule	Additional provisions
A	Germany	DIN EN 12150-2 and Bauregelliste ('Construction Products List') A Part 1 serial No 11.12	Indication of the bending tensile strength
B		EN 12150-2	

3. Provisions for the production of heat-soaked soda lime silicate safety glass (ESG-H)*

Class	Member States	Technical rule
A	Germany	Provisions for the production of heat-soaked thermally toughened soda lime silicate safety glass (ESG-H), see <i>Bauregelliste</i> ('Construction Products List') A Part 1, serial No 1.13
B		EN 14179-2

4. Provisions for the production of heat strengthened soda lime silicate glass (TVG)*

Class	Member States	Technical rule
A	Germany	DIN EN 1863-2 and allgemeine bauaufsichtliche Zulassung ('National technical approval') for heat strengthened soda lime silicate glass/TVG
B		EN 1863-2

5. Provisions for the production of laminated safety glass with PVB foil (VSG)*

Class	Member States	Technical rule
A	Germany	DIN EN 14449 and Provisions for the production of laminated safety glass with PVB foil, see <i>Bauregelliste</i> ('Construction Products List') A Part 1, serial No 11.14
B		EN 14449

6. Provisions for the production of insulating glass units *

Class	Member States	Technical rule	Additional provisions
A	Germany	DIN EN 1279-5 and Bauregelliste ('Construction Products List') A Part I, serial No 11.16	Indication of the bending tensile strength
B		EN 1279-5 and EN 15434	

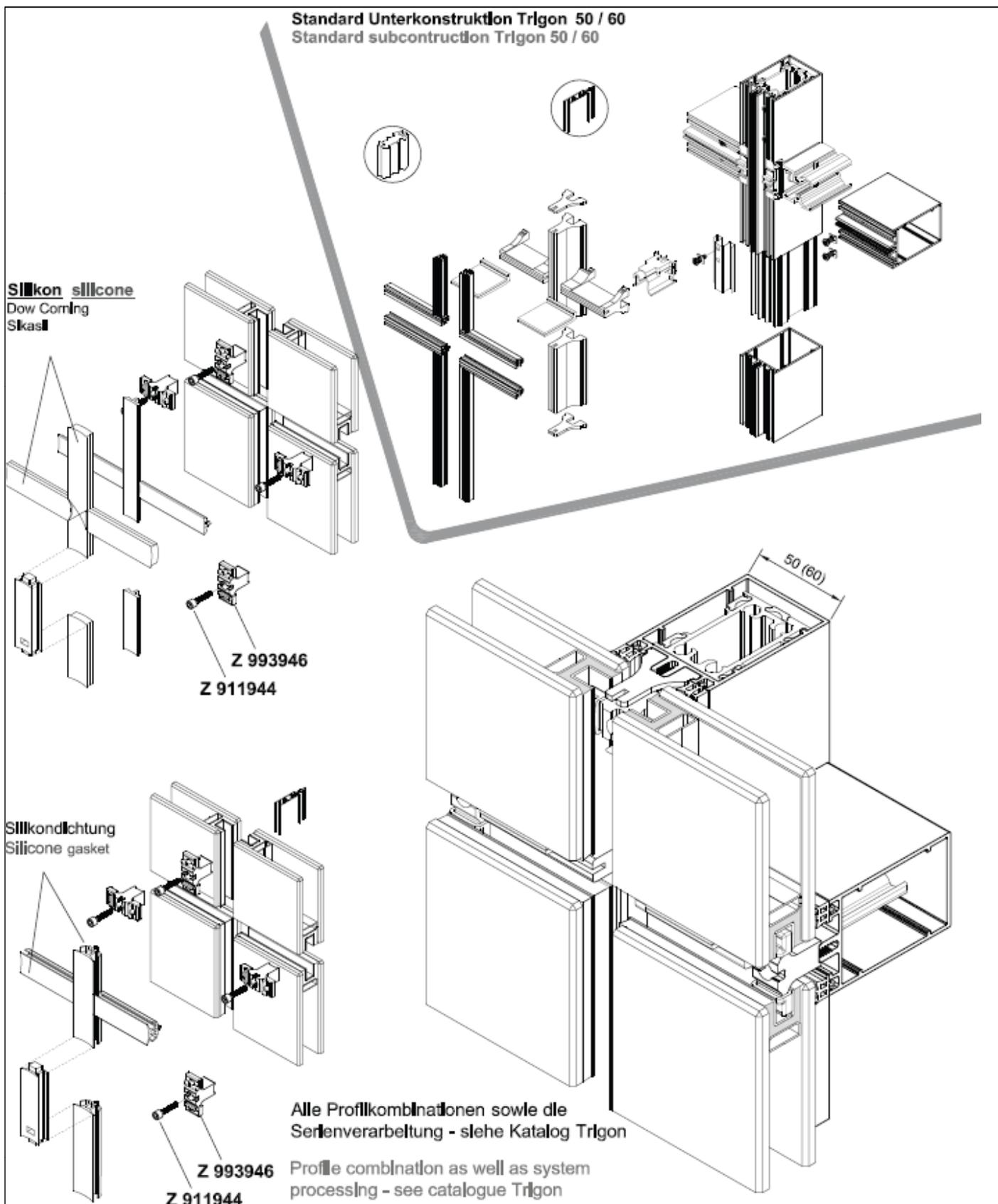
* The national provisions of the Member States, not listed in this column, shall be taken into account.

Annex B

National provisions for design calculation

System part	Class	Member state	Values	Additional provisions
Glass pane in case of bond failure	A	Germany	$\gamma_M = 1,1$	γ_A is chosen according to the national provisions for accidental loads
Mechanical fixing devices (Toggle)	A	Germany	$\gamma_M = 1,25$	γ_A is chosen according to the national provisions
Structural bond with U-profile	A	Germany	$\gamma_{tot} = 6$	The verification is executed with characteristic loads as γ_{tot} is a global safety factor
Outer structural bond on triple glazed insulating unit		Germany	$r \geq 6 \text{ mm}$ $\gamma_{tot} = 6$	Verification according to ETAG 002-1
Glass supports	A	Germany	$\gamma_M = 1,0$ $\gamma_A = 1,0$	γ_M and γ_A are chosen according to the national provisions for serviceability limit state
Mechanical safety devices in case of bond failure	A	Germany	$\gamma_M = 1,1$	γ_A is chosen according to the national provisions for accidental loads

* The respective national provisions of the member states not listed here are to be respected.

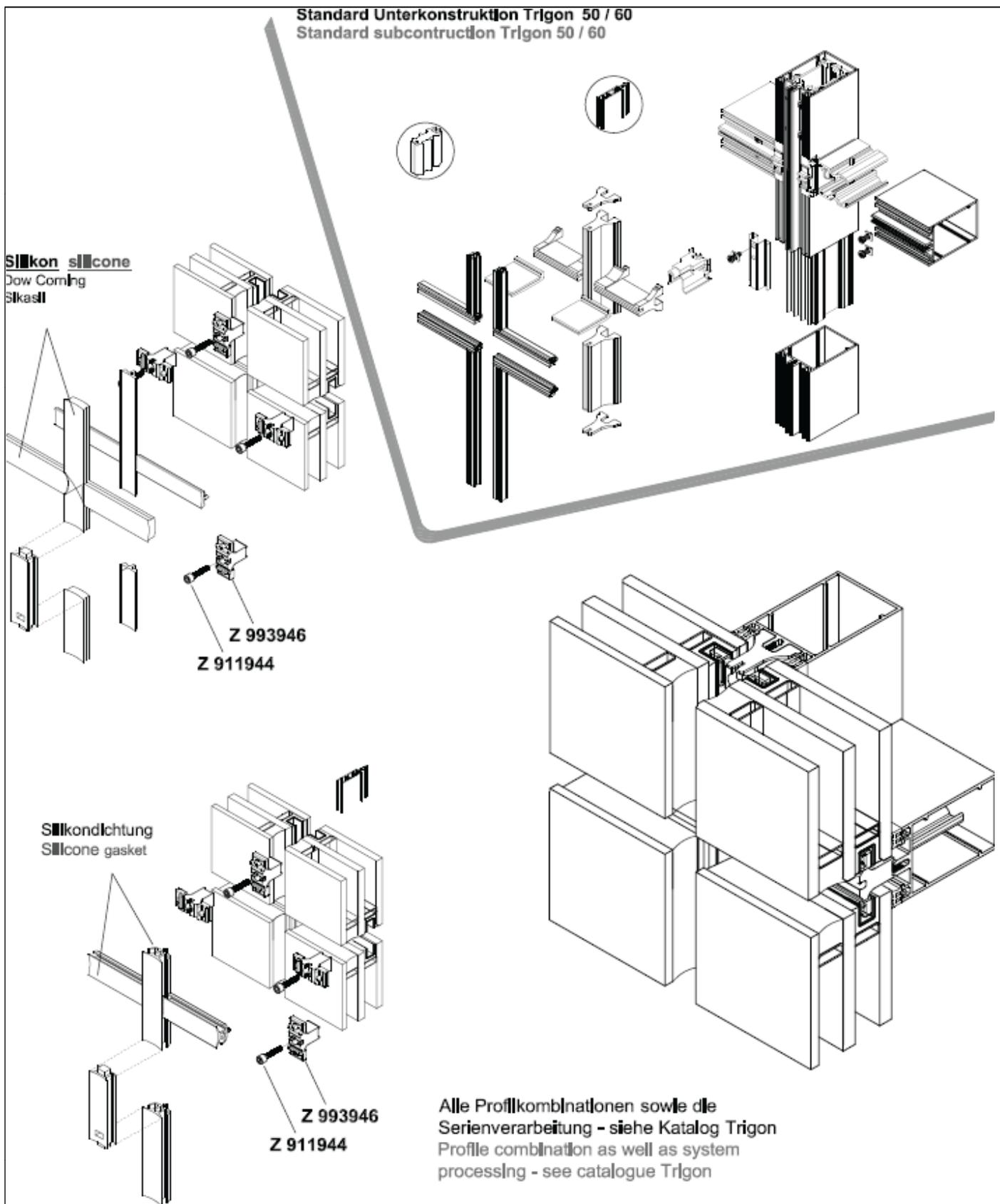


Electronic copy of the ETA by DIBt: ETA-13/0675

Trigon SG

System scheme - Double insulating glass unit

Annex 1



Electronic copy of the ETA by DIBt: ETA-13/0675

Trigon SG

System scheme - Triple insulating glass unit

Annex 1a

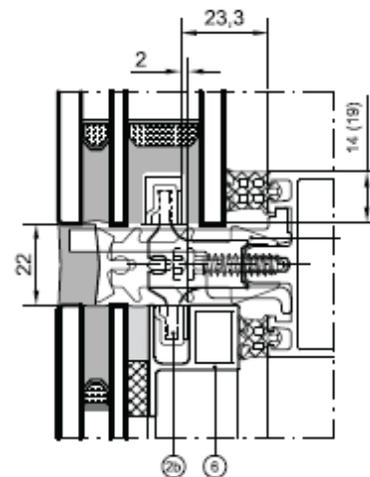
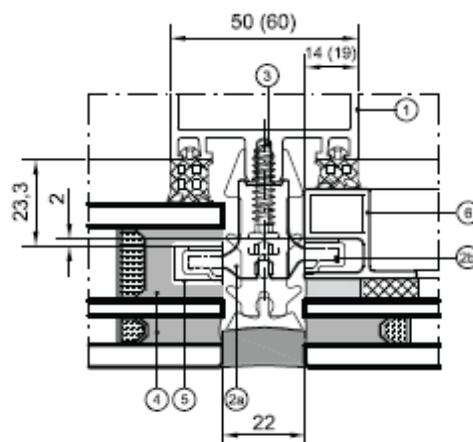
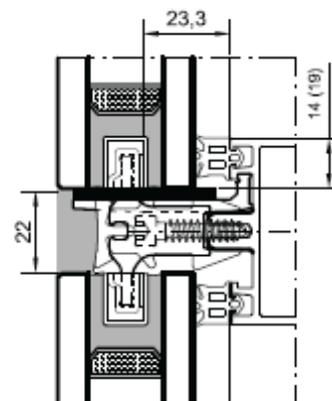
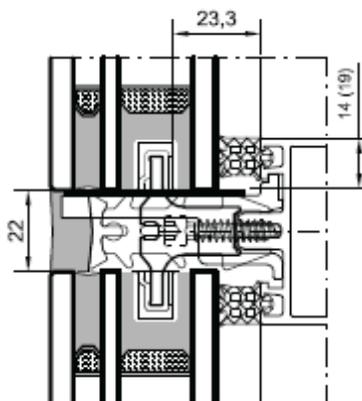
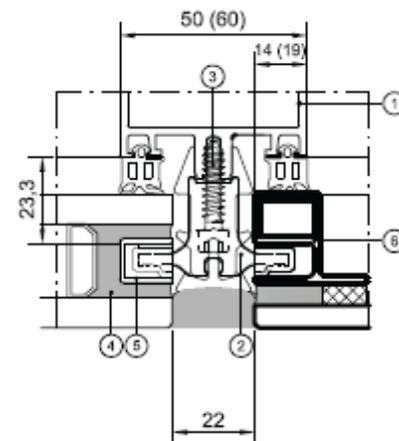
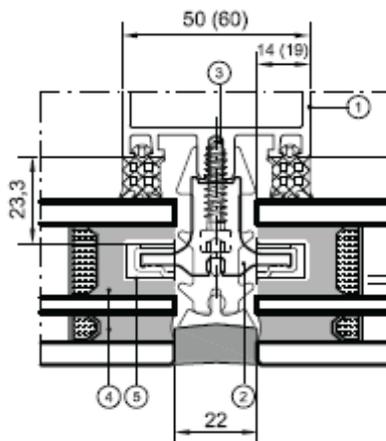
Systemübersicht Trigon mit 2-fach und 3-fach Isolierverglasung und Brüstungsverglasung
System-scheme Trigon with double and triple insulating glazing and spandrel glazing

- ① Pfostenprofil / Riegelprofil
Mullion profile / Transom profile
- ② Glashalter Doppelseitig Z 993946
Double toggle
- ②a Glashalter Einseitig Z 993945
Single toggle
- ②b Glashalter Einseitig 2mm Versatz Z 996395
Single toggle 2mm offset
- ③ Fassadenschraube
Façade fixing screw
- ④ Dow corning DC993/DC3362 / Sikas SG 500
Sealant
- ⑤ Alu / Edelstahl U-Profil P 499633 / Z 917109
Alu / stainless steel U-profile
- ⑥ Aluminiumprofil P 519903
Aluminium profile

Befestigungsvarianten
Fbding variants

V1

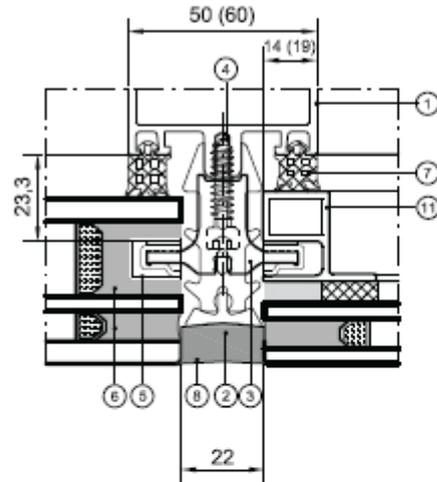
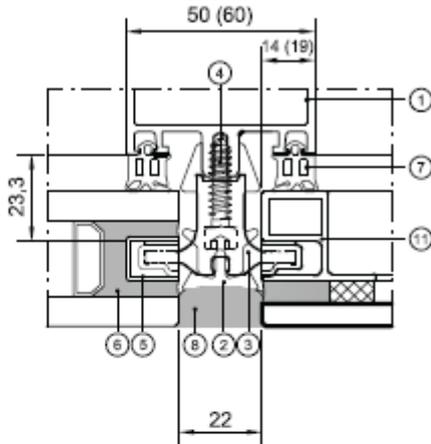
V2



Trigon SG

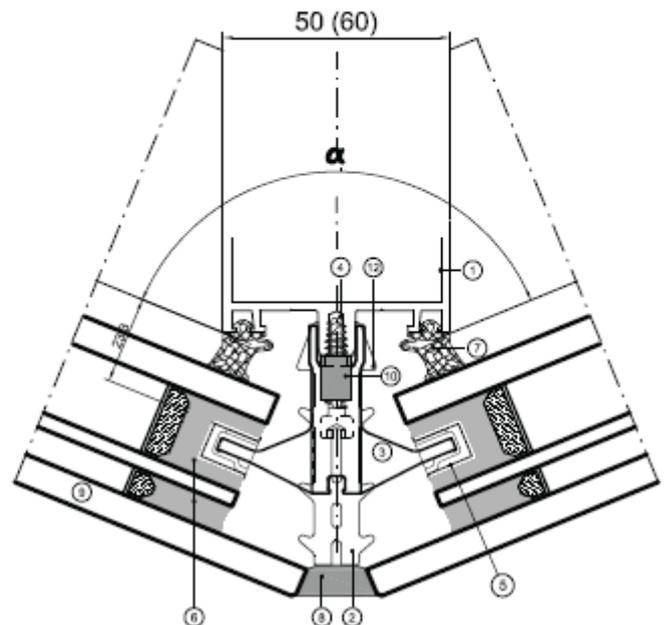
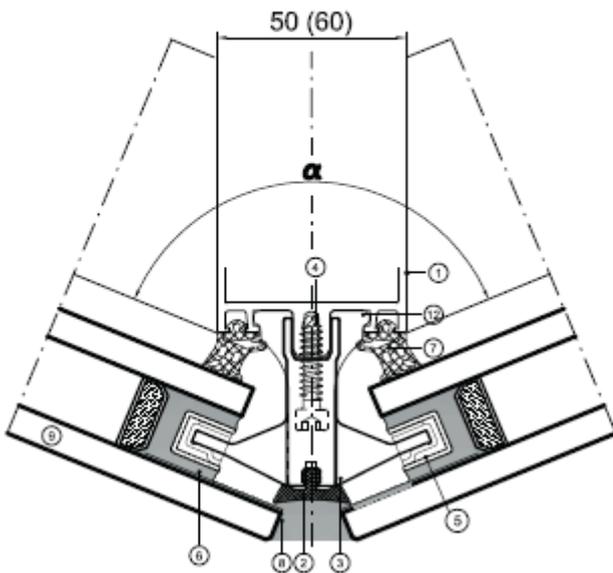
System scheme - Sectional drawing - Type of fixing V1 and V2

Annex 1b



- ① Pfosten / Riegelprofil
Mullion profile / Transom profile
- ② PE - Trägerprofil
Sealing gasket
- ③ Glashafter nach Tabelle
Single Toggle as per table
- ④ Fassadenschraube
Façade fixing screw
- ⑤ Alu / Edelstahl U-Profil P 499633 / Z 917109
Alu / stainless steel U-profile
- ⑥ Dow corning 993 / 3362 / Sikasil SG 500
Sealant
- ⑦ Glasdichtung Innen, s. Verglasungstabelle Fassade
Internal glazing gasket, cf. façade glazing table

- ⑧ Dow corning 791 / Sikasil WS 605 S
Sealant acc. to. 2.1.8.8
- ⑨ Aussenschleibe aus ESG, ESG-H oder VSG aus 2x ESG
Outer pane made of thermally toughened safety glass with or without heat-soaked or laminated glass LSG
- ⑩ Distanzclip Z 918070
Distance clip
- ⑪ Aluminiumprofil P 519903
Aluminium profile
- ⑫ Dämmprofil, s. Verglasungstabelle Fassade
Insulating profile, cf. façade glazing table

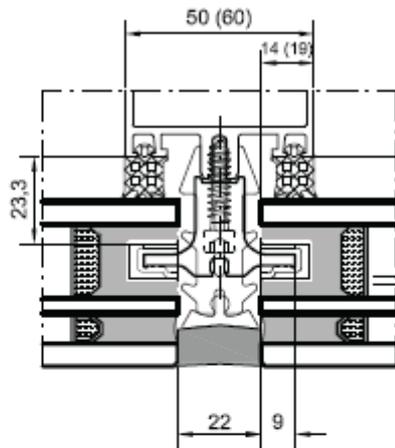


Trigon SG

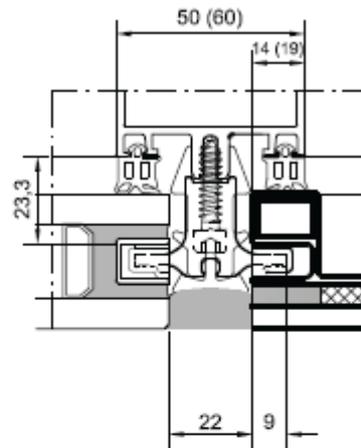
System scheme - Sectional drawing - Polygonal façade

Annex 1c

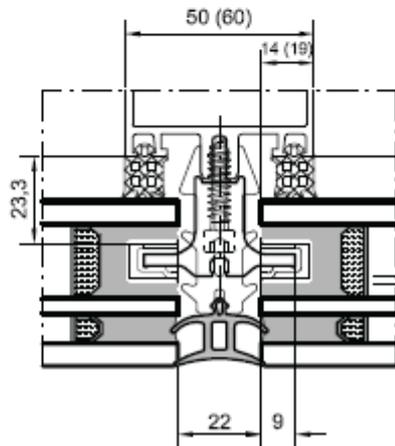
Systemübersicht Trigon - Wetter Versiegelung
System-scheme Trigon - weather sealing



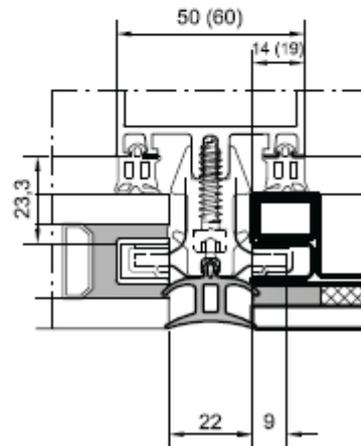
planmäßiger Toggleeinstand
regular toggle setting



Nassversiegelung
Wet seal



planmäßiger Toggleeinstand
regular toggle setting



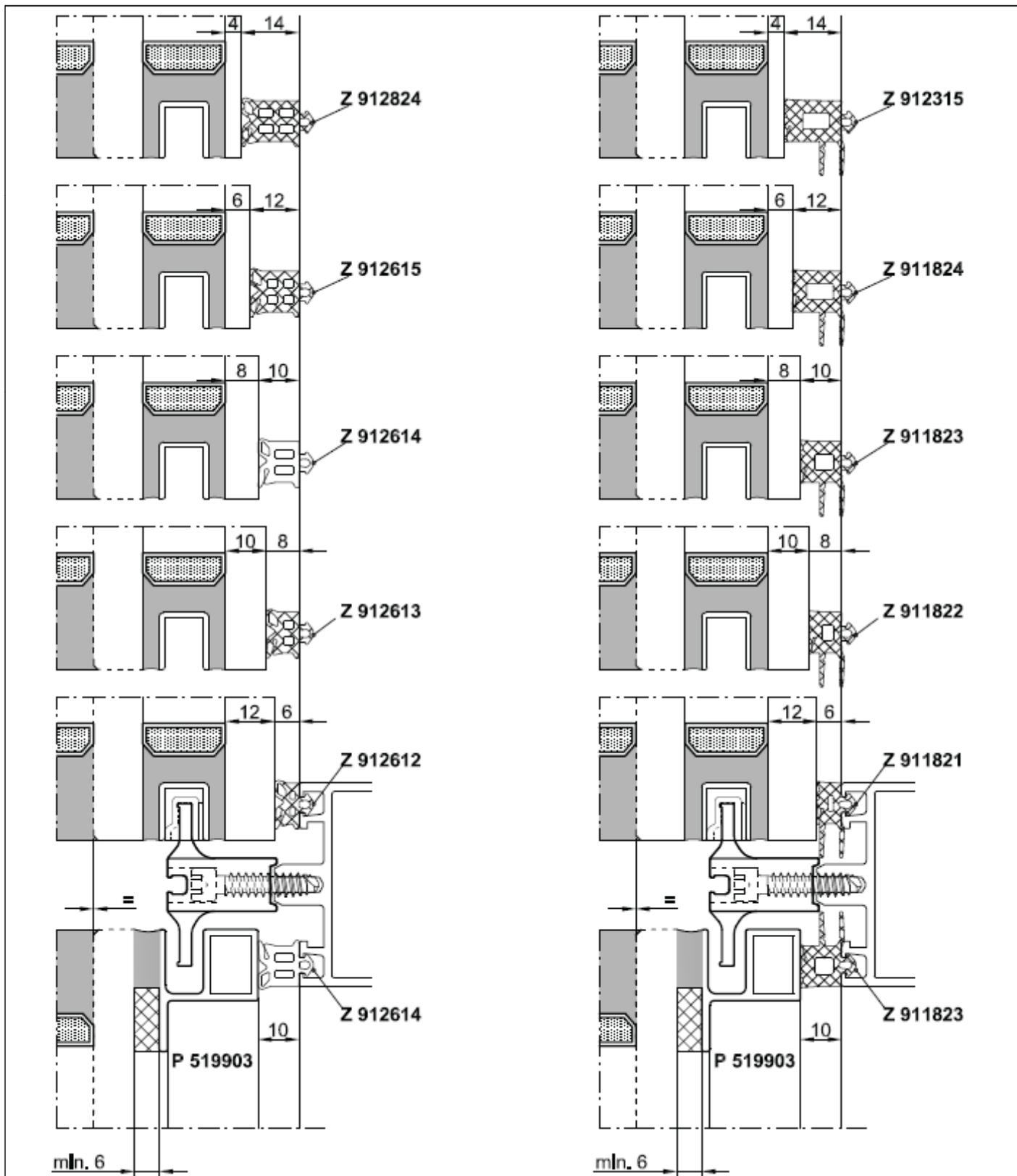
Trockenversiegelung
Dry seal

Trigon SG

System scheme - Anchoring depth of the toggles - Sealing

Annex 1d

<p>Standard</p>	<p>Verglasung mit durchlaufendem U - Profil Glazing with continous U - profile</p>	<p>Standard</p>	
<p>Alu oder Stahl Alu or Steel</p>			
<p>Standard</p>	<p>Verglasung mit U - Profil - Kurzstücken Glazing with shortpieces of U - profiles</p>	<p>Standard</p>	
<p>Aus Z 917109 oder P 499633 In Eigenfertigung hergestellt. Made of Z 917109 or P 499633 by others.</p>	<p>100</p> <p>Alu oder Stahl Alu or Steel</p>	<p>Aus Z 917109 oder P 499633 In Eigenfertigung hergestellt. Made of Z 917109 or P 499633 by others.</p>	
	<p>Aluminium EN-AW 6060 Surface: E6-C0</p>		<p>Stainless steel 1.4301 S275 Surface: 2B seldenmatt</p>
<p>Trigon SG</p>		<p>Annex 2</p>	
<p>U-profiles</p>			

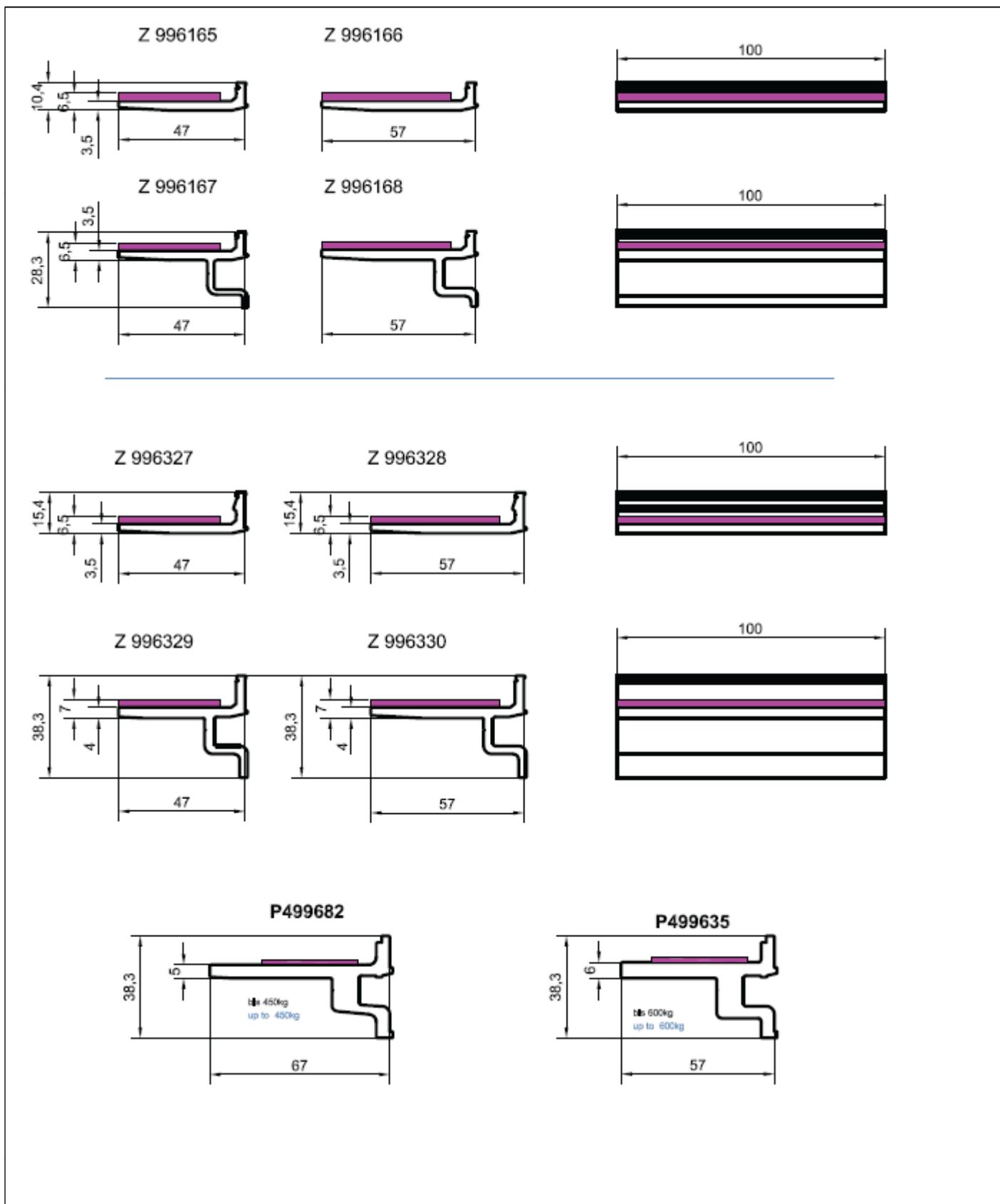


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Trigon SG

Gaskets

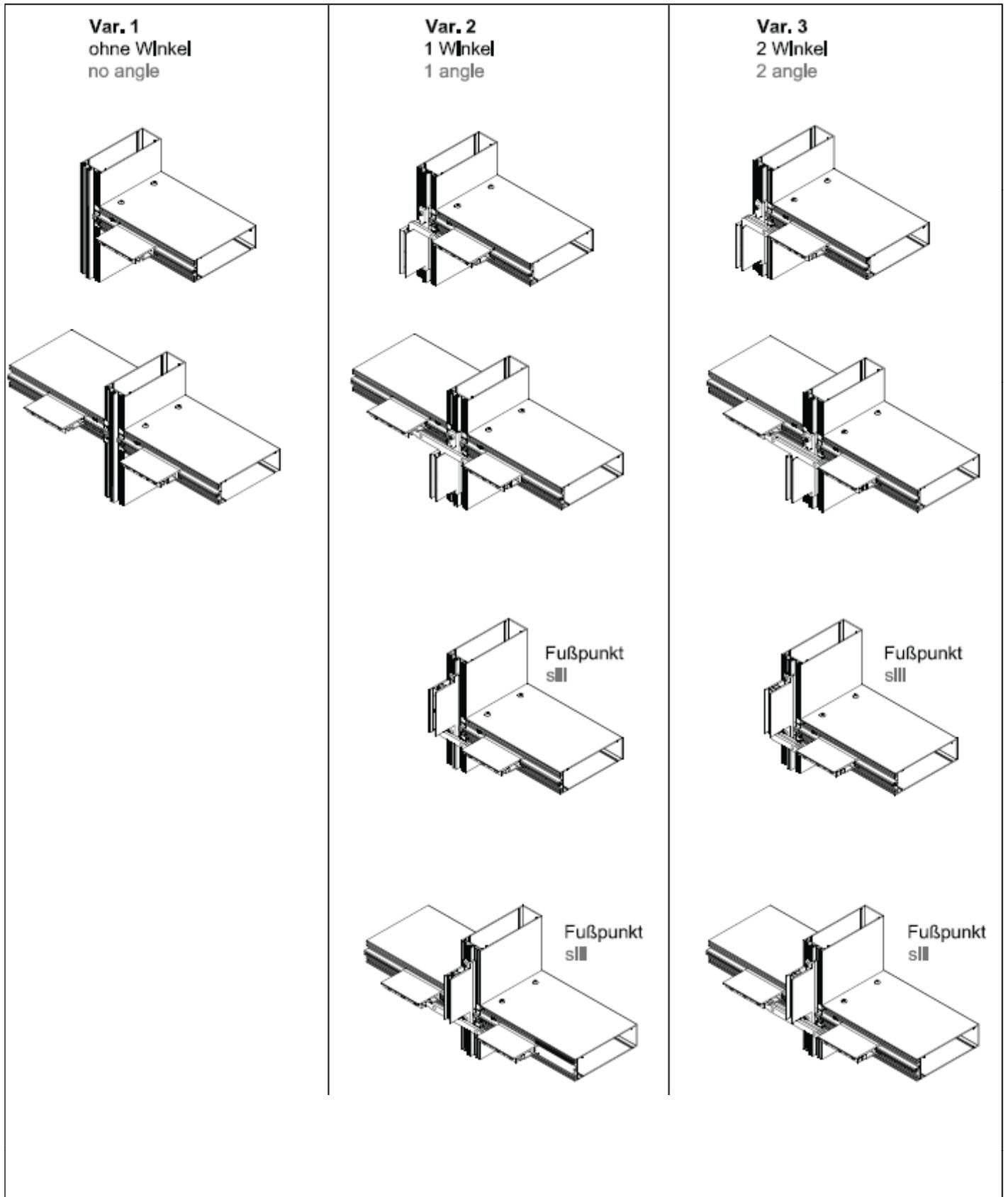
Annex 3



Trigon SG

Glass support

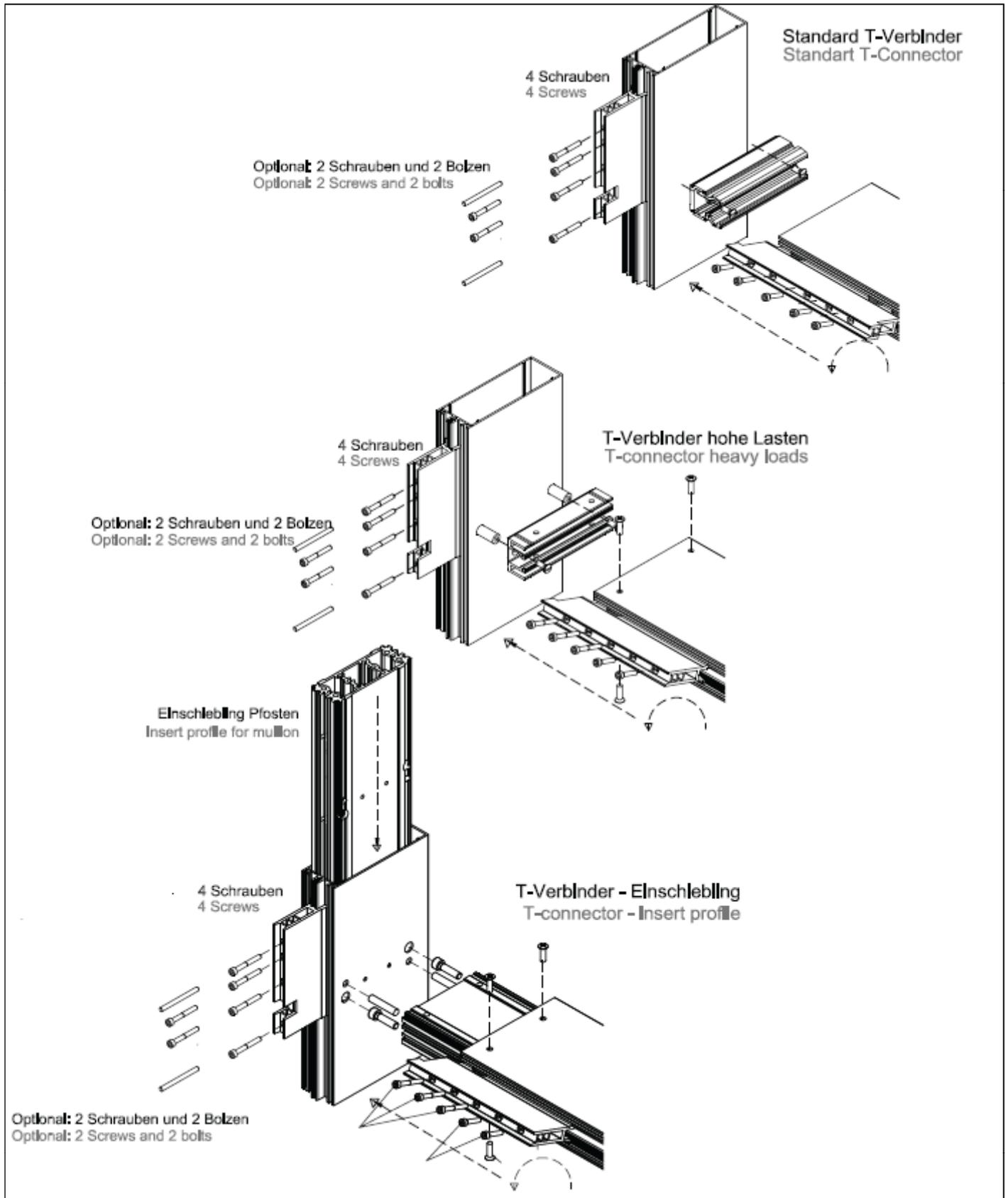
Annex 4



Trigon SG

Glass support

Annex 4a



Electronic copy of the ETA by DIBt: ETA-13/0675

Trigon SG

Glass support

Annex 4b



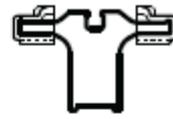
Z 996395



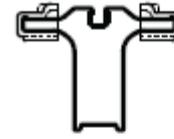
Z 993945



Z 993974



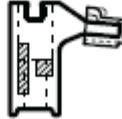
Z 993946



Z 993975



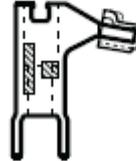
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Z914589 (B)



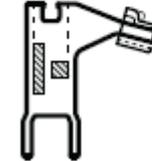
Z914590 (C)



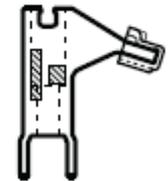
Z914591 (D)



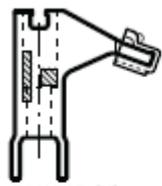
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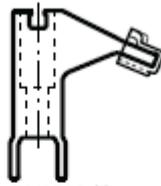
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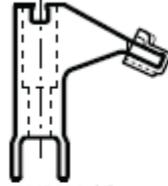
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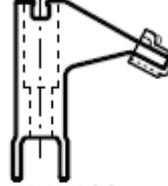
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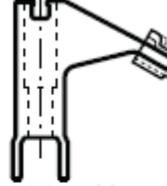
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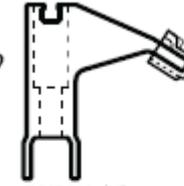
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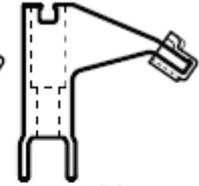
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Z917020 (L)



Z917019 (M)



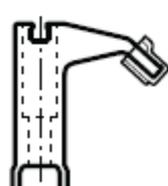
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Z917000 (O)



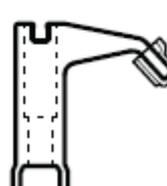
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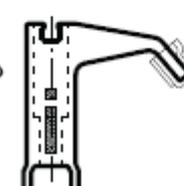
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Z917003 (R)



Z939171 (S)



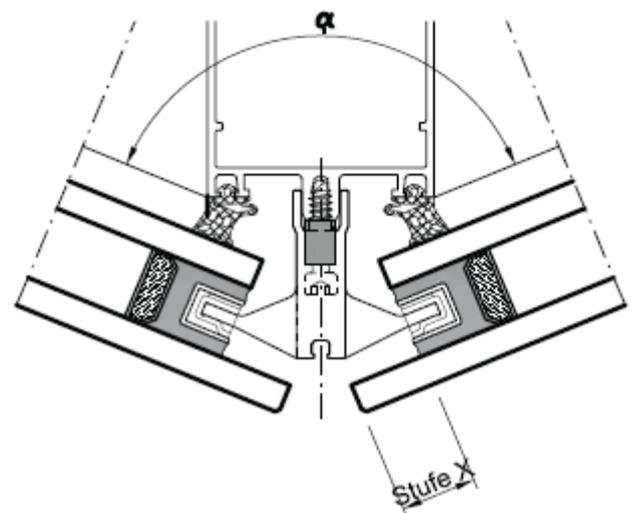
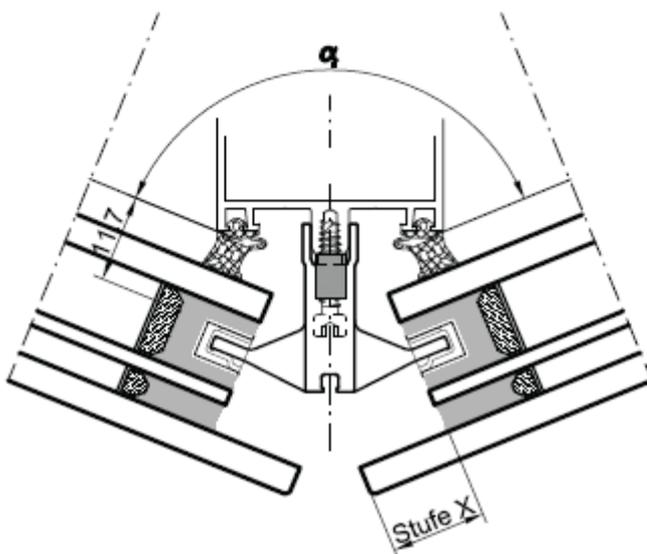
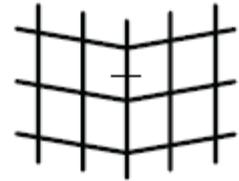
Z939172 (T)

Trigon SG

Toggles

Annex 5

Winkelbereich α Angle range α	Artikel Nr. Article No.	Kennung Identifier	Stufe X Step X
171° - 176°	Z 993976	A	3
166° - 171°	Z 993977	B	5
161° - 166°	Z 993978	C	7
156° - 161	Z 993979	D	9
151° - 156°	Z 993980	E	11
146° - 151°	Z 993981	F	13,5
141° - 146°	Z 993982	G	16
136° - 141°	Z 993983	H	18
131° - 136°	Z 993984	I	20,5
126° - 131°	Z 996279	J	23,5
121° - 126°	Z 996278	K	26,5
116° - 121°	Z 996277	L	29
111° - 119°	Z 996276	M	32
106° - 111°	Z 996275	N	36
101° - 106°	Z 996255	O	27
96° - 101°	Z 996256	P	31
91° - 96°	Z 996257	Q	35
86° - 91°	Z 996258	R	40
81° - 86°	Z 996171	S	45
76° - 81°	Z 996172	T	51

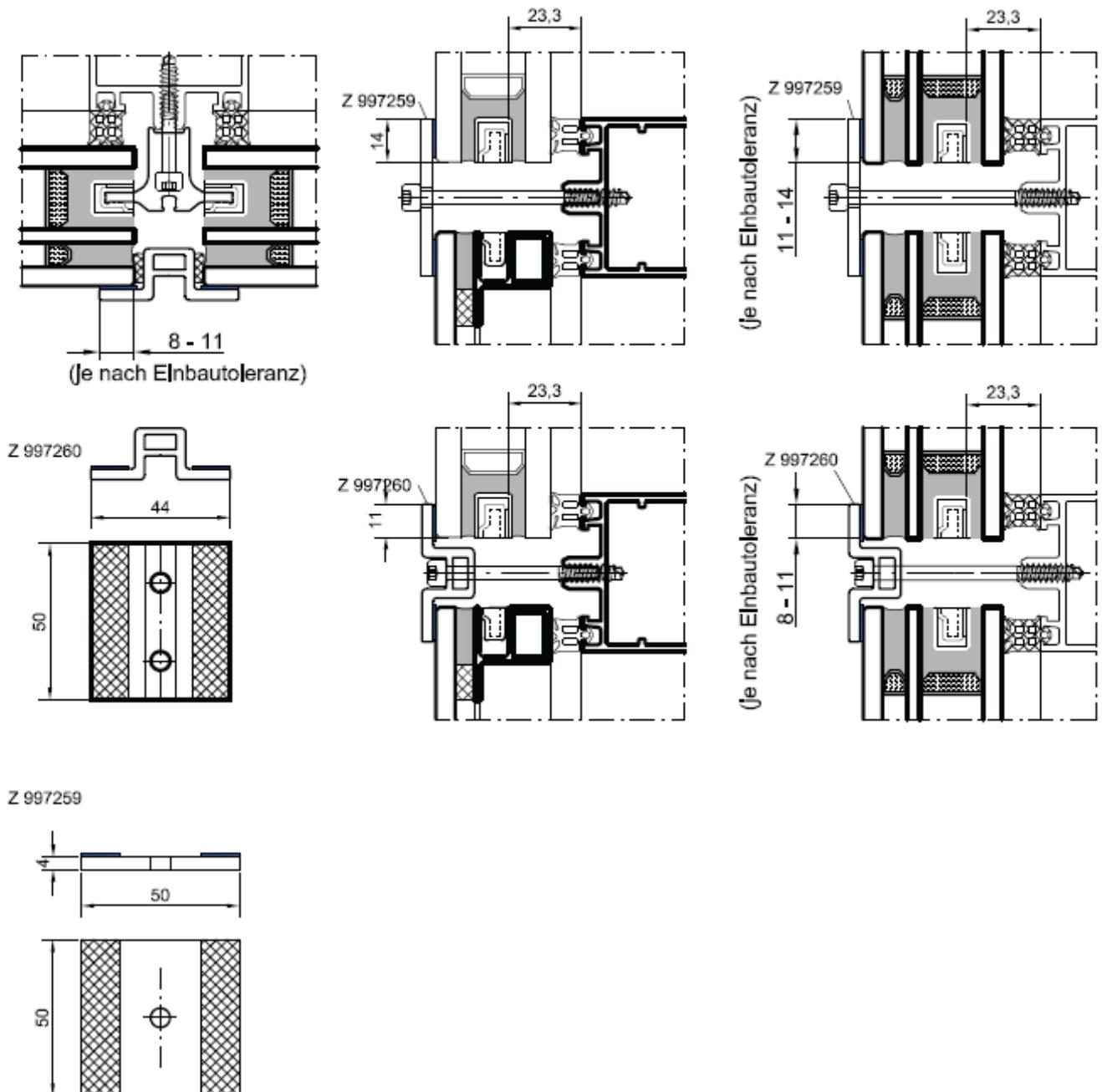


Trigon SG

Toggles for polygonal façades

Annex 5a

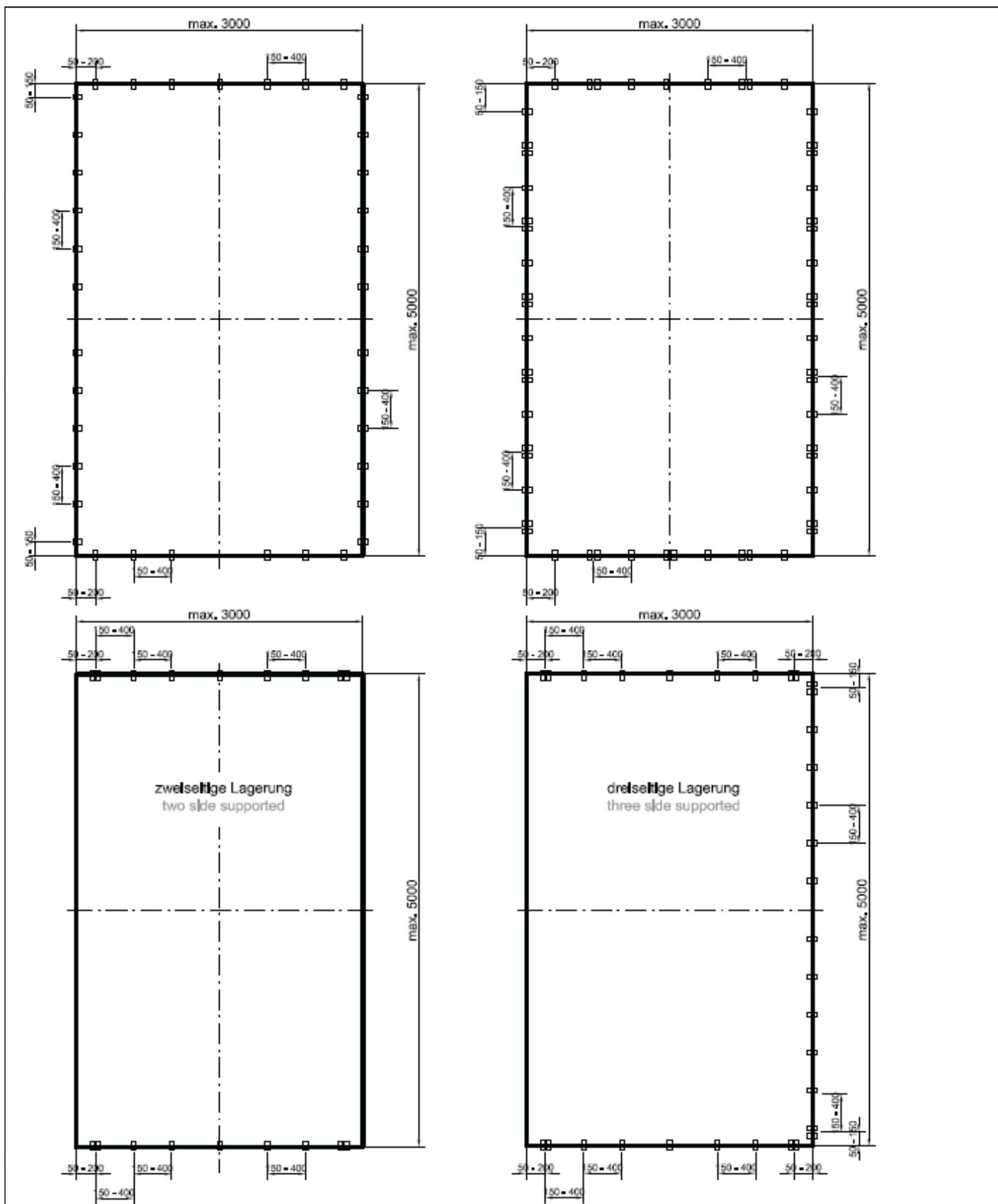
Nothalter Trigon für 2-fach und 3-fach Isolierverglasung und Brüstungsverglasung
Safety device for double and triple Insulating glazing and spandrel glazing



Trigon SG

Mechanical safety devices (emergency retainers)

Annex 6



Trigon SG

Arrangement of the toggles

Annex 7