Austrian Institute of Construction Engineering
Schenkenstrasse 4 | T +43 1 533 65 50
1010 Vienna | Austria | F +43 1 533 64 23
www.oib.or.at | mail@oib.or.at

Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
www.eota.eu

European Technical Assessment

ETA-20/0813 of 25.09.2023

General part

Technical Assessment Body issuing the European Technical Assessment	Österreichisches Institut für Bautechnik (OIB) Austrian Institute of Construction Engineering
Trade name of the construction product	Expansion joint VS-F
Product family to which the construction product belongs	Cantilever expansion joints for road bridges
Manufacturer	Schreiber Brücken- Dehntechnik GmbH Am Moosbach 10 + 12 74535 Mainhardt Germany
Manufacturing plant	Schreiber Brücken- Dehntechnik GmbH Am Moosbach 10 + 12 74535 Mainhardt Germany
This European Technical Assessment contains	23 pages including 13 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	European Assessment Document (EAD) 120111-00-0107 “Cantilever expansion joints for road bridges”.

Specific parts

1 Technical description of the product

The cantilever expansion joint **Expansion joint VS-F** is a kit consisting of the following components:

- Finger plates of at least steel grade S355 J2+N according to EN 10025-2 (Position 1 in Figure 1 in this ETA) with different dimensions to accommodate the range of movement capacity covered by this ETA. Details are given in Annex 1 to Annex 6.
- Anchorage consisting of anchor bolts, hexagon nuts, anchor disks and washers (Position 3 in Figure 1 in this ETA) with different dimensions. Details are given in Annex 1 to Annex 6.
- Substructure of at least steel grade S235 J2+N according to EN 10025-2 (Position 2 in Figure 1 in this ETA) with different dimensions. Details are given in Annex 1 to Annex 6.
- Sub-surface drainage system (gutter) made of EPDM and components for its fixation (Position 4 in Figure 1 in this ETA). Details are given in Annex 1 to Annex 6.

The technical details of the components of the cantilever expansion joint kit are deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik.

The subject of this European Technical Assessment (ETA) is the complete cantilever expansion joint kit **Expansion joint VS-F**.

A schematic representation of the cantilever expansion joint **Expansion joint VS-F** is shown in Figure 1 of this ETA and detailed drawings are depicted in Annex 1 to Annex 6 of this ETA.

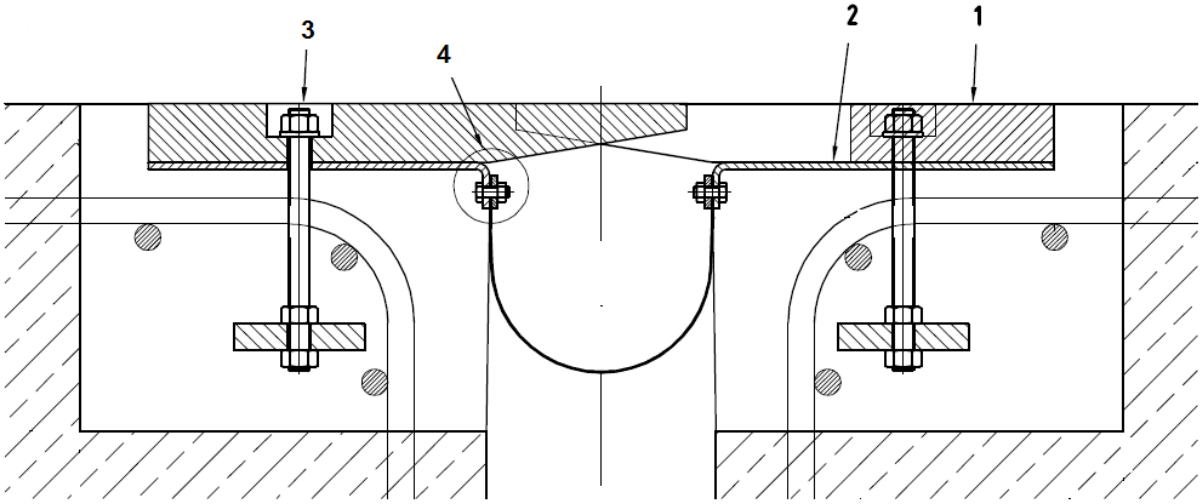


Figure 1: Exemplary cross section of the cantilever expansion joint **Expansion joint VS-F**

Key for Figure 1:

Pos.1	Finger plate
Pos.2	Substructure
Pos.3	Anchorage
Pos.4	Sub-surface drainage system (gutter)

The reinforcement and concrete for connection of the cantilever expansion joint to the bridge shown in Figure 1 are not part of the kit covered by this ETA. Nevertheless, they are contributing to the assessed performance of the kit. The minimum concrete quality for recess filling is C30/37 low shrinkage concrete according to EN 206. The anchor forces according to Annex 7 to Annex 12 of this ETA shall be considered for the dimensioning of the reinforcement for connecting the expansion joint to the sub structure (not part of the kit).

Provisions for proper installation (installation manual) of the **Expansion joint VS-F** are provided by the manufacturer for each delivered kit.

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

The cantilever expansion joint **Expansion joint VS-F** is to be used in road bridges. The expansion joint kit is designated to be applied in new structures as well as for refurbishment of structures.

The use in moveable bridges (e.g. flap bridges, swing bridges) is not covered by this ETA.

The essential characteristics of the cantilever expansion joint **Expansion joint VS-F** are assessed for an operating temperature of -40 °C up to +45 °C. The operating temperature is defined as the shade air temperature according to EN 1991-1-5, clause 1.5.2.
This has been assessed on basis of material characteristics (low temperature brittleness) of the elastomeric sub-surface drainage device (gutter) and by consideration of the minimum operating temperature for the steel elements as detailed in Clause 3.1.1 of this ETA.

The cantilever expansion joint **Expansion joint VS-F** is to be used for the user categories vehicle, cyclist and pedestrian as well as the actions categories standard action and optional action as detailed in Clause 3.1.1 of this ETA.

The provisions made in this European Technical Assessment are based on a working life of the kit of 50 years (working life category 4 according to EAD 120111-00-0107, Clause 1.2.2), provided that the kit is subject to appropriate use and maintenance as specified by the manufacturer in the maintenance instructions which follow every delivered kit. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be regarded only as a means for choosing the right product in relation to the expected economically reasonable working life of the works.

The use of the cantilever expansion joint **Expansion joint VS-F** according to this ETA is covering a maximum slope in traffic direction according to Clause 3.1.1 and Table 6 respectively.

The working life of the cantilever expansion joint kit is based on the assessment of resistance to fatigue according to the fatigue load model 1 ($FLM1_{EJ}$), meaning the fatigue life may be considered as unlimited.

For the replaceable component elastomeric sub-surface drainage system (gutter) made of EPDM, a shorter working life is indicated.

For corrosion protection the indications given in Table 1 of this ETA apply.

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

3.1 Performance of the product

Table 1: Performance of the product in relation to the essential characteristics

Basic requirements for construction works	Essential characteristics	Method of assessment	Performance
BWR 1	Mechanical resistance	EAD 120111-00-0107, Clause 2.1.1	Fulfilled. This applies for the product acc. to Clause 1 in this ETA considering the conditions given in Clause 3.1.1 of this ETA.
	Resistance to fatigue	EAD 120111-00-0107, Clause 2.2.2	Fulfilled. This applies for the product acc. to Clause 1 in this ETA considering the conditions given in Clause 3.1.1 of this ETA.
	Seismic behaviour	EAD 120111-00-0107, Clause 2.2.3	According to Clause 3.1.2 in this ETA.
	Movement capacity	EAD 120111-00-0107, Clause 2.2.4	According to Clause 3.1.3 in this ETA.
	Cleanability	EAD 120111-00-0107, Clause 2.2.5	The cantilever expansion joint is cleanable. The gutter is accessible for cleaning purposes.
	Watertightness	EAD 120111-00-0107, Clause 2.2.6	Watertight See Clause 3.1.4 in this ETA.
	Durability	EAD 120111-00-0107, Clause 2.2.7.1: Corrosion	Corrosivity categories: C4 or C5 according to EN ISO 9223, dependent on the intended use. Components made of steel: Corrosion protection systems: Durability range “high” (H) and “very high” (VH) acc. to EN ISO 12944-1 Bolts, nuts, washers: Hot dip galvanized acc. to EN ISO 10684 Stainless steel components for fixation of the gutter: A2 acc. to EN ISO 3506
		EAD 120111-00-0107, Clause 2.2.7.2: Chemicals	Gutter made of EPDM: Durable
		EAD 120111-00-0107, Clause 2.2.7.3.1: Resistance to ageing resulting from temperature	
		EAD 120111-00-0107, Clause 2.2.7.3.2: Resistance to ageing resulting from Ozone	

Basic requirements for construction works	Essential characteristics	Method of assessment	Performance
BWR 3	Content, emission and/or release of dangerous substances	EAD 120111-00-0107, Clause 2.2.8	No performance assessed.
BWR 4	Ability to bridge gaps and levels in the running surface	EAD 120111-00-0107, Clause 2.2.9.1: Allowable surface gaps and voids	Declaration of allowable gaps in respect to the user categories and different joint types is given in Clause 3.1.5 in this ETA
		EAD 120111-00-0107, Clause 2.2.9.2: Level differences in the running surface	Unloaded condition: No level differences (including steps) greater than 3 mm are occurring. Loaded condition: maximum deflection under SLS load: <1 mm for all types
	Skid resistance	EAD 120111-00-0107, Clause 2.2.10	Carriageway: PTV value 56 Footpath: PTV value 50
	Drainage capacity	EAD 120111-00-0107, Clause 2.2.11	Maximum drainage capacity 5.93 l/sec

3.1.1 Mechanical resistance and resistance to fatigue

Action categories covered by static calculation:
For the design situation ultimate limit state (ULS), the fundamental combinations of actions and the combination of actions for fatigue limit state (FLS) are considered and assessed.
For the design situation serviceability limit state (SLS) the characteristic combinations of actions and frequent combinations are considered and assessed.
Regarding optional actions, the seismic design situations are considered and assessed.

Suitability of the components made of steel (see Clause 1.1 in this ETA) for low temperature (-40 °C) is assessed according to EN 1993-1-10, table 2.1.

Assessment of mechanical resistance and resistance to fatigue is based on the following conditions:

The skew angle between the traffic direction and the longitudinal axis of the joint β = 90° has been considered in the assessment.

For the load distribution the load distribution model A according to EAD 120111-00-0107, Clause 2.2.1 has been considered in the assessment.

Table 2: Preconditions for the assessment of mechanical resistance and resistance to fatigue

Partial safety factor γ_{M0} (EN 1993-2)	1.00
Partial safety factor γ_{M2} (EN 1993-2)	1.25
Partial safety factor γ_{M3} (EN 1993-2)	1.25
Partial safety factor γ_{Mf} (EN 1993-2)	1.15
Partial safety factor γ_{Ff} (EN 1993-2)	1.00
Fatigue load model (EAD 120109-00-0107, D.2.3.3.2)	FLM 1_{EJ}
Additional dynamic amplification factor $\Delta\varphi_{fat}$ (EAD 120111-00-0107)	1.3
Vertical upswing U_v (EAD 120111-00-0107)	0.3
Horizontal upswing U_h (EAD 120111-00-0107)	0.0
Combination factor ψ_{0T} (EAD 120109-00-0107, D.2.4.2.1)	1.00
Combination factor ψ_{0d} (EAD 120109-00-0107, D.2.4.2.1)	1.00
Combination factor ψ_{0lk} (EAD 120109-00-0107, D.2.4.2.1)	0.50
Combination factor ψ_{0tk} (EAD 120109-00-0107, D.2.4.2.1)	0.50
Combination factor ψ_{0d} (EAD 120109-00-0107, D.2.4.2.4)	0.60

Outcome of the assessment of mechanical resistance:

At ULS load level and under imposed displacements, there is no contact between intersecting cantilevers.

At SLS load level the following has been assessed:
- No yielding of any part of the joint;
- Vertical deflections under loaded conditions are smaller than 1 mm;
- No contact between intersecting cantilevers;
- No separation of contact surfaces occurs.

The assessed anchor forces are given in Annex 7 to Annex 12.

Outcome of the assessment of resistance to fatigue:

No fatigue failure during the intended working life of 50 years. This has been assessed for a slope in traffic direction of 10% for types VS-F 120 to VS-F 300 and 9% for type VS-F 350 respectively.

Note: Regarding restrictions to the maximum slope in traffic direction related to movement capacity see Table 6 in this ETA.

The assessed anchor forces are given in Annex 7 to Annex 12.

3.1.2 Seismic behaviour

The assessed approaches and related maximum gaps during an earthquake are given in Table 3. Whereas, “gap” means “distance between the tooth ends of the opposing finger plates in opening position”, according to EAD 120111-00-0107, Clause 2.2.3.

Table 3: Seismic behaviour of **Expansion joint VS-F** for skew angle β = 90°

Approach according to EAD 120109-00-0107, Table D.8	**Maximum gap during earthquake**
Approach A1	As for the SLS condition
Approach A2, B1	100 mm
Approach B2	160 mm
Approach B3	240 mm
Approach B4	After earthquake: max. gap 300 mm for emergency traffic

Note: Due to the design of the finger plates, the displacements during the earthquake in horizontal and transversal direction shall not exceed the values given in Clause 3.1.3 of this ETA.

3.1.3 Movement capacity

Table 4: Movement capacity of **Expansion joint VS-F** (for an angle of 90° between main movement direction of the bridge and joint axis) in longitudinal direction

Longitudinal movement capacity			
Type	**Maximum longitudinal movement**	**Minimum opening**	**Minimum overlap *)**
	[mm]	**[mm]**	**[mm]**
VS-F 120	120	0	5
VS-F 160	160		
VS-F 200	200		
VS-F 250	250		
VS-F 300	300		
VS-F 350	350		

*) Overlap of the finger tips at maximum opening (according to EAD 120111-00-0107, Figure 4)

The maximum transversal movement capacity is 4 mm (±2 mm) for all types of **Expansion joint VS-F**.

The maximum vertical movement capacity in horizontal position (slope in traffic direction 0 %) is 10 mm (±5 mm) and applies for the longitudinal movement range of all types of **Expansion joint VS-F** according to Table 4.

The influence of longitudinal slopes with respect to the longitudinal movement capacity is given in Table 6 in this ETA.

The minimum opening of the cantilever expansion joint **Expansion joint VS-F** is 0 mm and applies for the unloaded condition as well as loading to SLS and ULS level.

The minimum overlapping of the cantilever expansion joint **Expansion joint VS-F** is 5 mm and applies for the unloaded condition as well as loading to SLS level.

The reaction forces resulting from the movement capacity test are given in Table 5.

Table 5: Reaction forces resulting from the movement capacity test

Expansion joint VS-F	
Maximum tensile force – longitudinal movement	25 N/m
Maximum compression force – longitudinal movement	-68 N/m
Maximum force – transverse direction	±11 N/m

Table 6: Maximum longitudinal slopes for cantilever expansion joint **Expansion joint VS-F** allowing the minimum opening position of 0 mm without collision of the finger plates on the opposite side for horizontal application of bridge bearings

Type	VS-F 120	VS-F 160	VS-F 200	VS-F 250	VS-F 300	VS-F 350
Maximum longitudinal slope [%]	10	7,5	7	6	6	5

Note: The values for the maximum longitudinal slope given in Table 6 for the different types of **Expansion joint VS-F** are limited due to geometrical conditions. Resistance to fatigue is assessed for a longitudinal slope of 10% for types VS-F 120 to VS-F 300 and 9% for type VS-F 350 respectively. If appropriate measures are taken to prevent collision of the finger plates on the opposite side (e.g. bridge bearings applied with the same longitudinal slope as the bridge) those higher values of longitudinal slope are covered by the product according to this ETA.

3.1.4 Watertightness

Assessment of durability of the components of the sub-surface drainage device (gutter) according to Table 1 in this ETA and the assessment of drainage capacity of the gutter according to Table 1 in this ETA demonstrates the watertightness of the product.

3.1.5 Allowable surface gaps and voids

The maximum longitudinal movement with respect to surface gaps and voids and the different user categories is given in Table 7 in this ETA.

Table 7: Standard geometry of cantilever expansion joint **Expansion joint VS-F** in respect to its movement capacity

Type	Angle between traffic direction and joint axis	Maximum opening for user category		
		Vehicles	Cyclists	Pedestrians
	β [°]	[mm]	[mm]	[mm]
VS-F 120	90	120	120	120
VS-F 160		160	160	160
VS-F 200		200	200	200
VS-F 250		250	220	250
VS-F 300		300	220	300
VS-F 350		350	220	350

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

4.1 AVCP system

According to the decision 2001/19/EC[1] of the European Commission, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V of Regulation (EU) No 305/2011) is 1.

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 in the control plan deposited by the Technical Assessment Body Österreichisches Institut für Bautechnik.

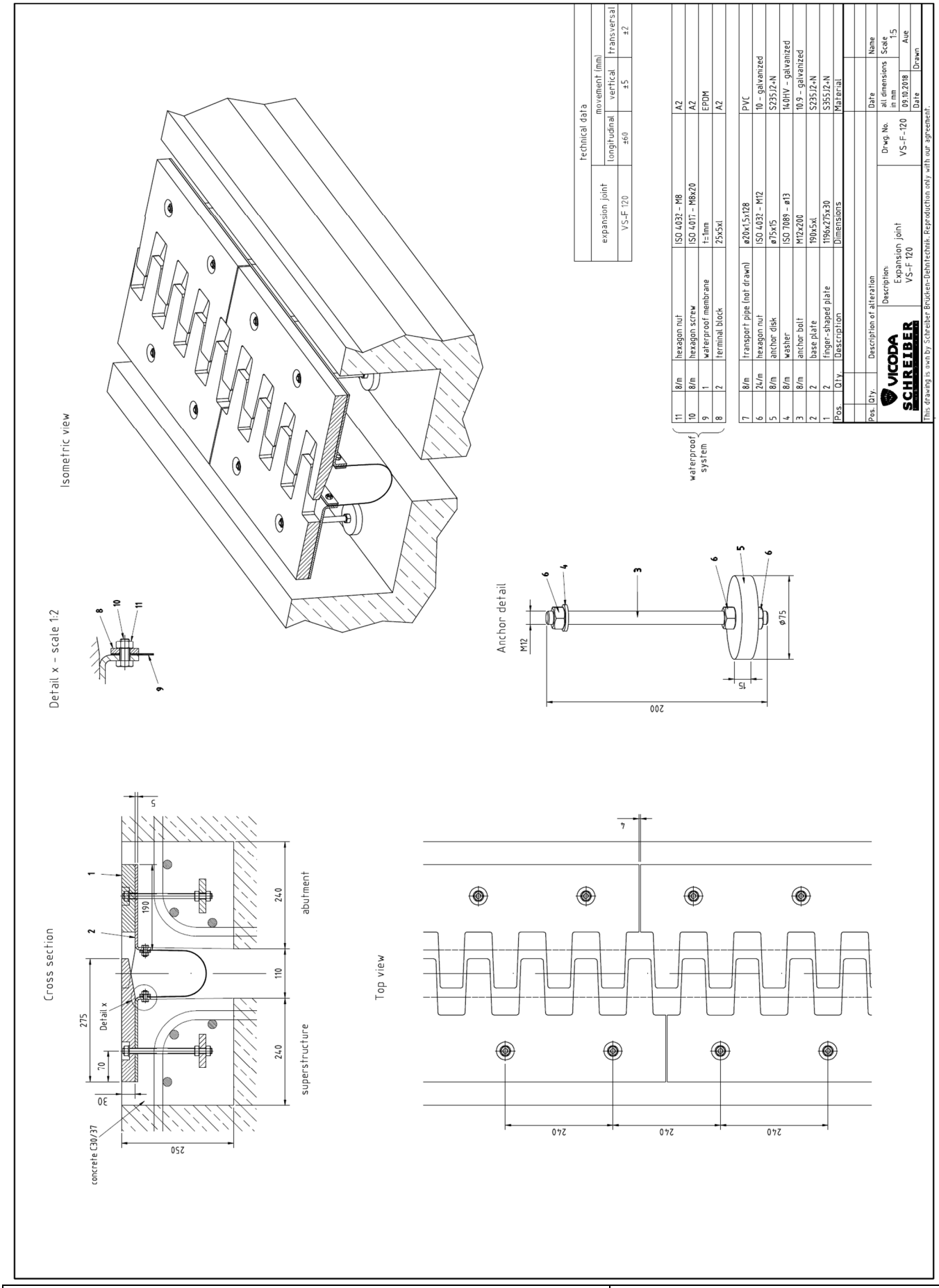
The notified product certification body shall visit the factory at least once a year for surveillance of the manufacturer.

Issued in Vienna on 25.09.2023
by Österreichisches Institut für Bautechnik

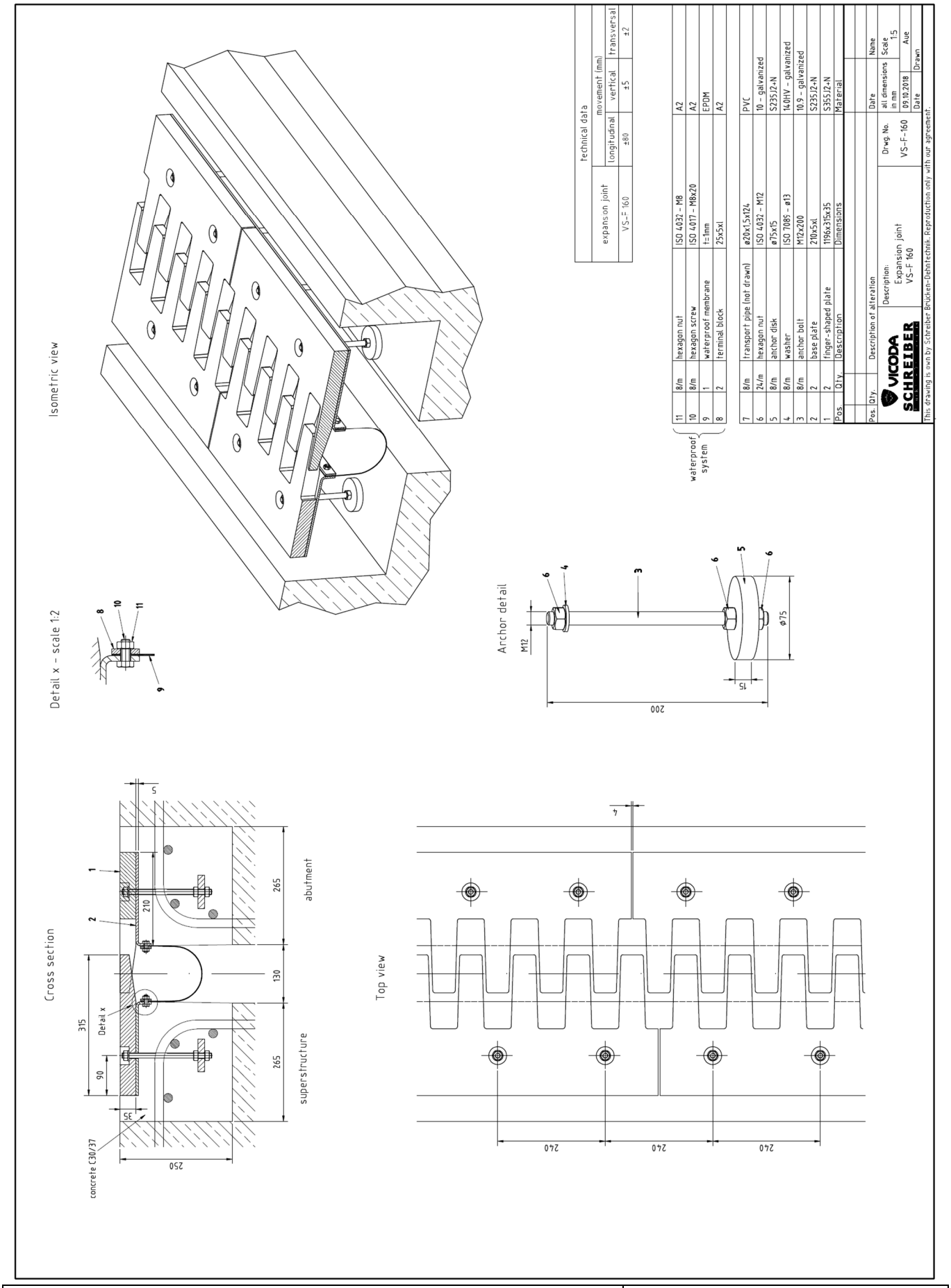
The original document is signed by:

Georg Kohlmaier
Deputy Managing Director

[1] Official Journal of the European Communities N° L 005, 10.1.2001, p. 6-7

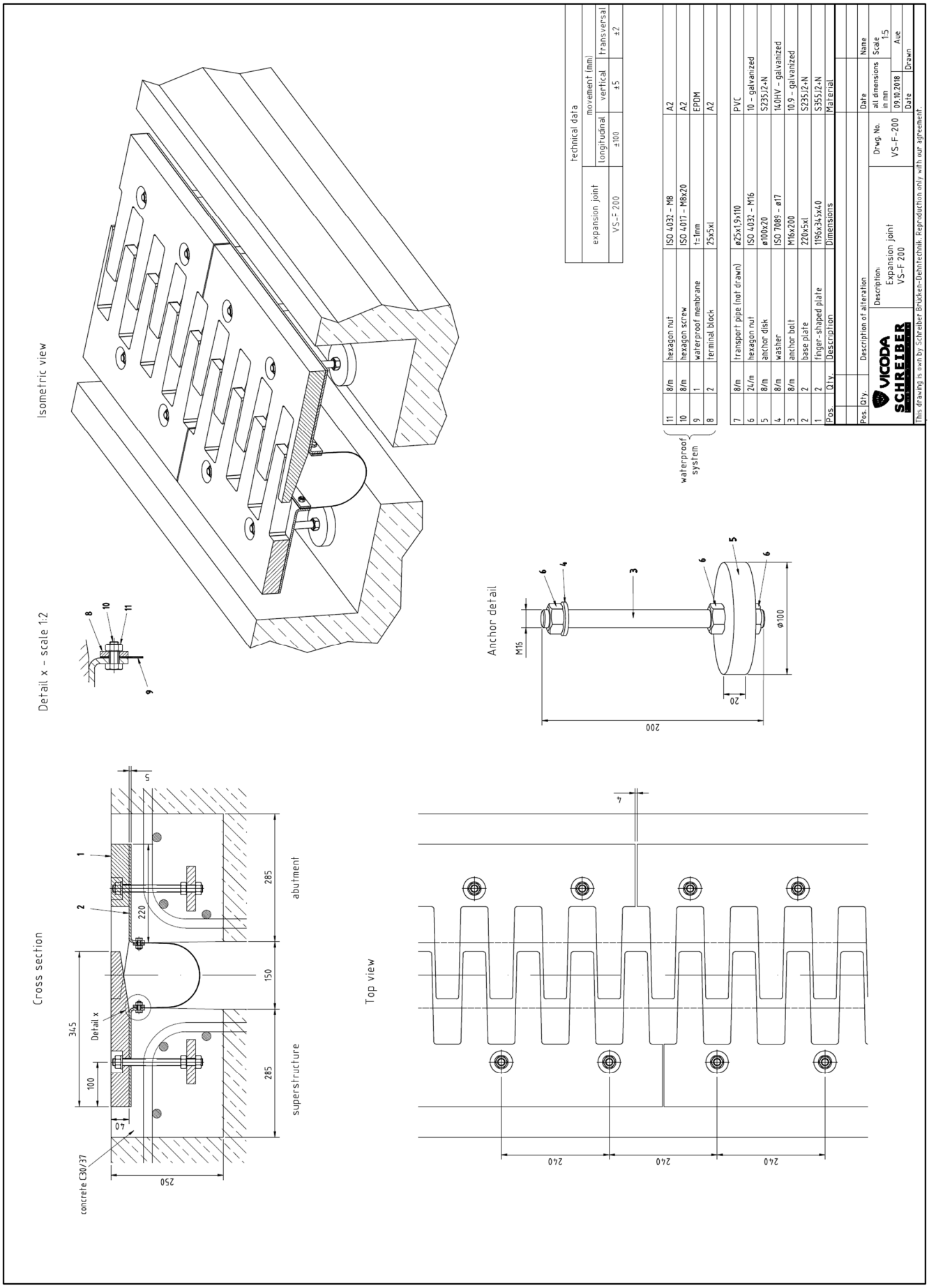


Expansion joint VS-F 120	**Annex 1** of European Technical Assessment ETA-20/0813

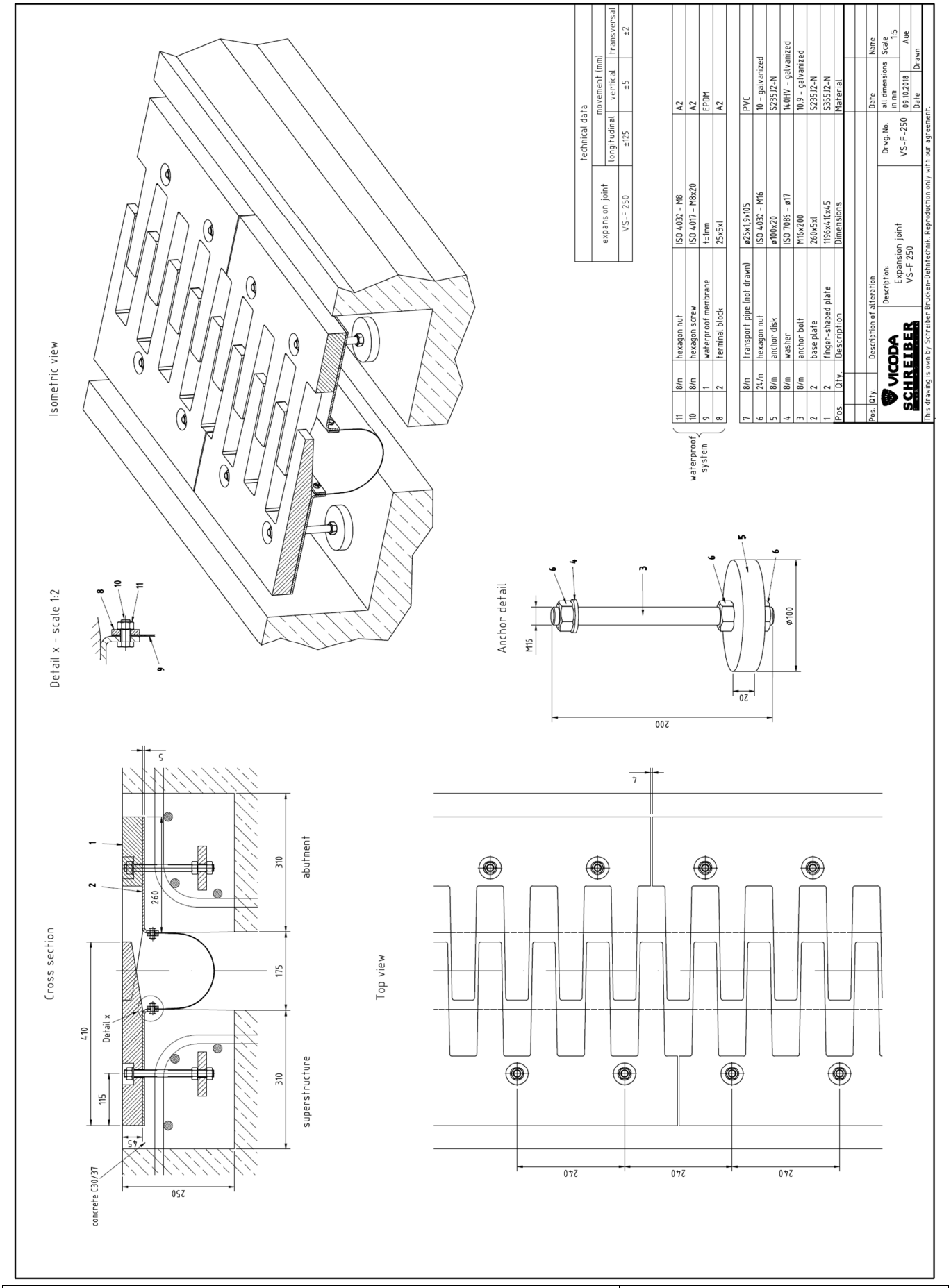


Expansion joint VS-F 160

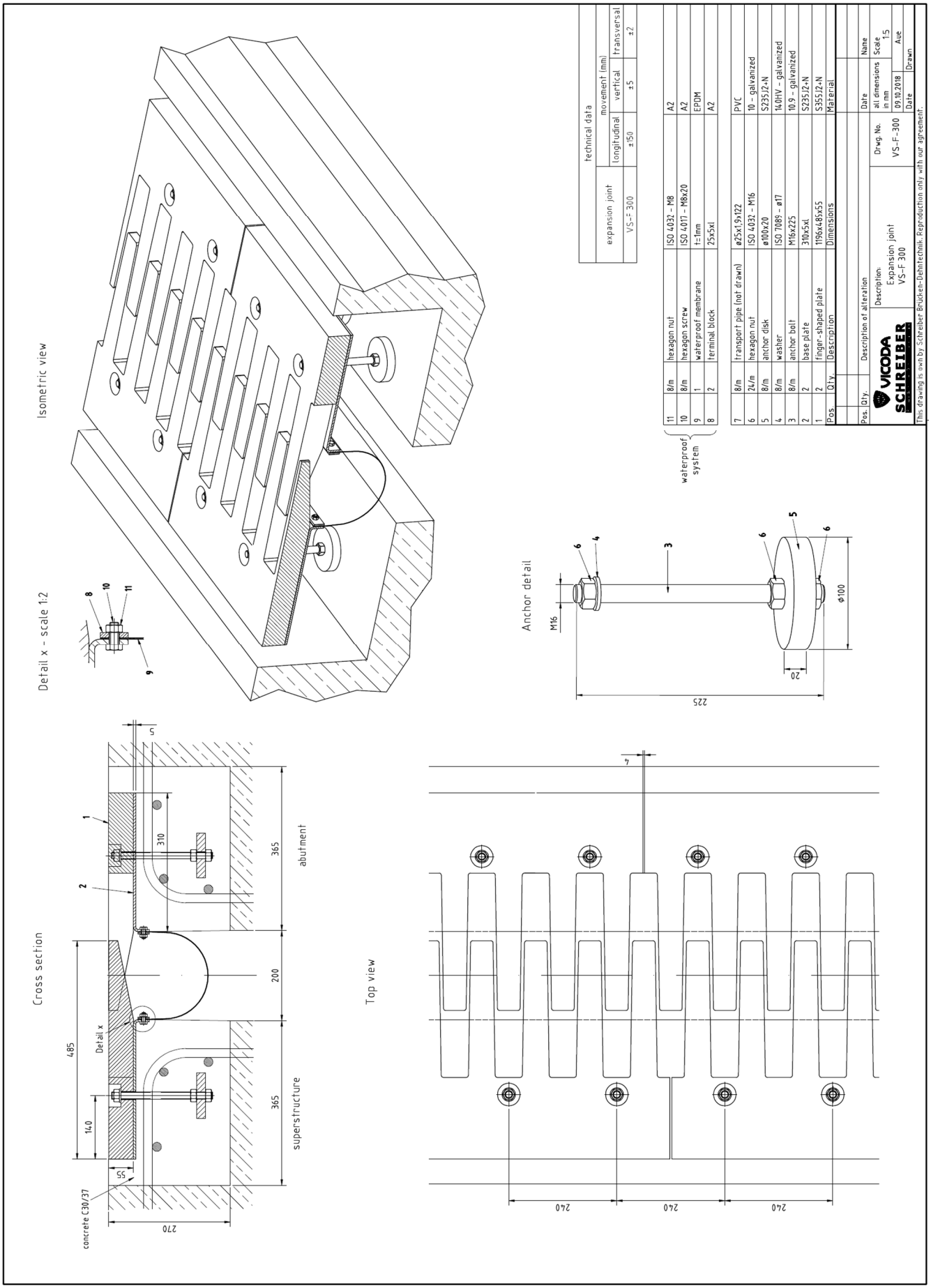
Annex 2 of European Technical Assessment ETA-20/0813



Pos.	Qty.	Description	Dimensions	Material
11	8/m	hexagon nut	ISO 4032 - M8	A2
10	8/m	hexagon screw	ISO 4017 - M8x20	A2
9	1	waterproof membrane	t=1mm	EPDM
8	2	terminal block	25x5xl	A2
7	8/m	transport pipe (not drawn)	ø25x1,9x110	PVC
6	24/m	hexagon nut	ISO 4032 - M16	10 - galvanized
5	8/m	anchor disk	ø100x20	S235J2+N
4	8/m	washer	ISO 7089 - ø17	140HV - galvanized
3	8/m	anchor bolt	M16x200	10.9 - galvanized
2	2	base plate	220x5xl	S235J2+N
1	2	finger-shaped plate	1196x345x40	S355J2+N

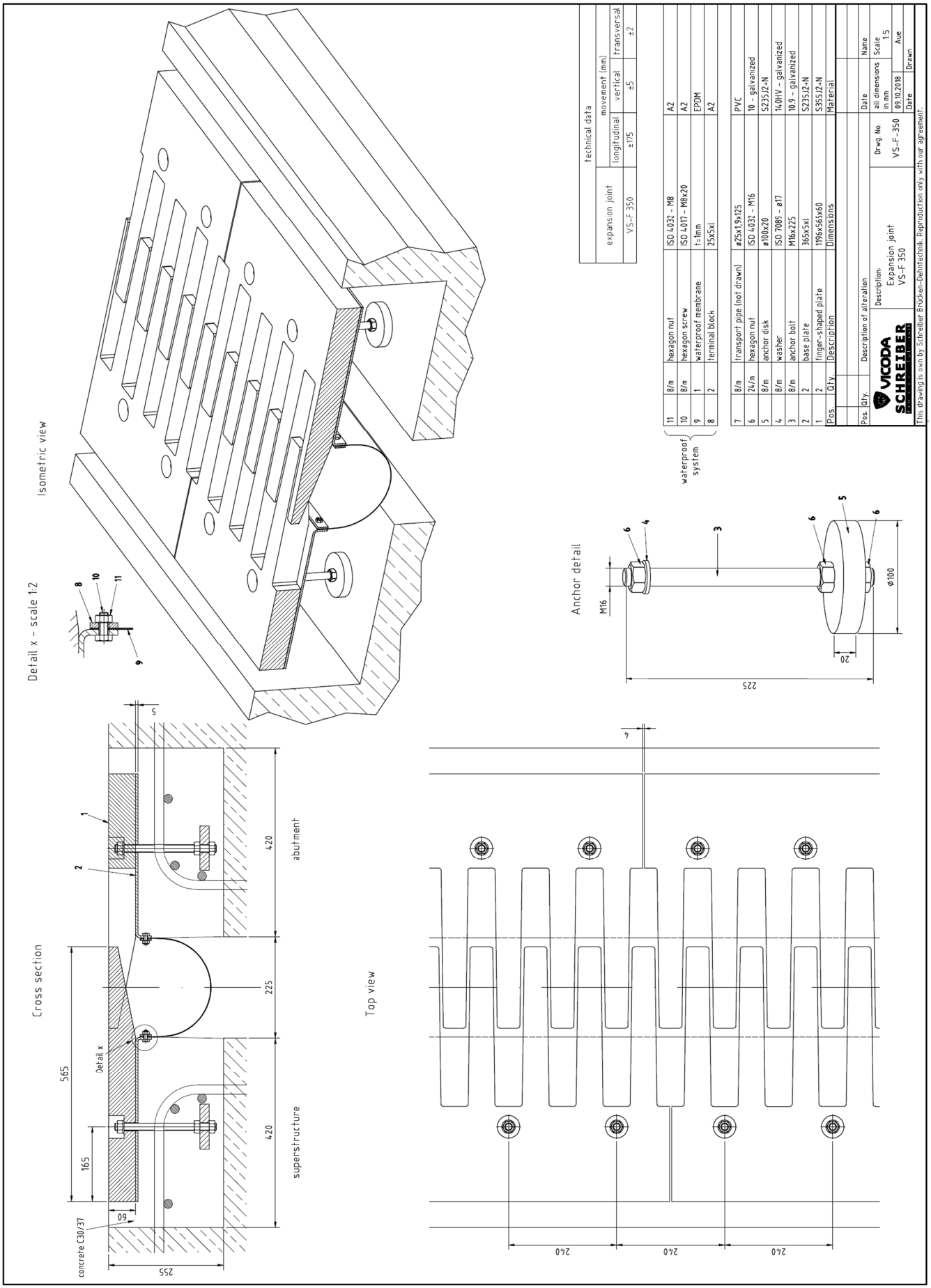


Expansion joint VS-F 250	**Annex 4** of European Technical Assessment ETA-20/0813



Expansion joint VS-F 300

Annex 5 of European Technical Assessment ETA-20/0813



Expansion joint VS-F 350

Annex 6 of European Technical Assessment ETA-20/0813

Type VS-F 120

12.1 Loads for Ultimate Limit state (inkl. partial safety factor)

$F_{Vk,Ed}$ =	202,5 kN
$F_{lk,Ed}$ =	45,3 kN

b_{Rad} = 2x250 mm = 500 mm ...effectiv loaded width

l_{Rad} = 300 mm

12.2 Loads for Fatigue Limit state (dynamic factor for vertical loads included $\Delta\varphi_{fat}$)

$F_{1k,fat}$ =	136,5 kN
$F_{1lk,fat}$ =	42,0 kN

12.3 compilation of the connection forces

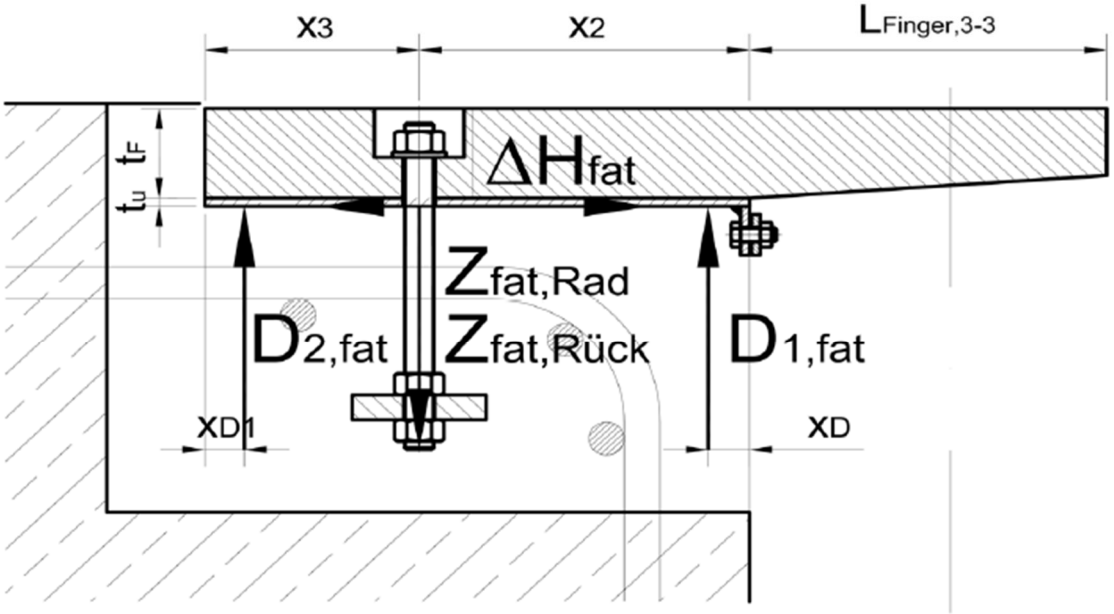
Ultimate limit State (partial safety factors included)		
Z_{Ed} [1] [kN]	D_{Ed} [2] [kN]	H_{Ed} [3] [kN]
17,7	123,9	45,3

Fatigue Limit State (upswing effect κ is onsidered by specifying $Z_{fat,Rad}$ and $Z_{fat,Rück}$ respectively $D_{1,fat}$ and $D_{2,fat}$)				
$Z_{fat,Rad}$ [1] [kN]	$D_{1,fat}$ [2] [kN]	$Z_{fat,Rück}$ [1] [kN]	$D_{2,fat}$ [2]	ΔH_{fat} [3] [kN]
loads from wheel		loads from upswing		κ = -1,00
13,3	87,6	22,3	81,2	42,0

[1] force per screw, number of participating anchor loops n = 3 Stk

[2] effecitve width b = $b_{Rad} + 2 \cdot t_{3-3}$

[3] effecitve width b = $b_{Rad} + 2 \cdot t_{3-3}$



Expansion joint VS-F 120 **Anchor forces**	**Annex 7** of European Technical Assessment ETA-20/0813

Type VS-F 160

12.1 Loads for Ultimate Limit state (inkl. partial safety factor)

$F_{Vk,Ed}$ =	202,5 kN
$F_{lk,Ed}$ =	45,3 kN

b_{Rad} = 2x250 mm = 500 mm ...effectiv loaded width

l_{Rad} = 300 mm

12.2 Loads for Fatigue Limit state (dynamic factor for vertical loads included $\Delta\varphi_{fat}$)

$F_{1k,fat}$ =	136,5 kN
$F_{1lk,fat}$ =	42,0 kN

12.3 compilation of the connection forces

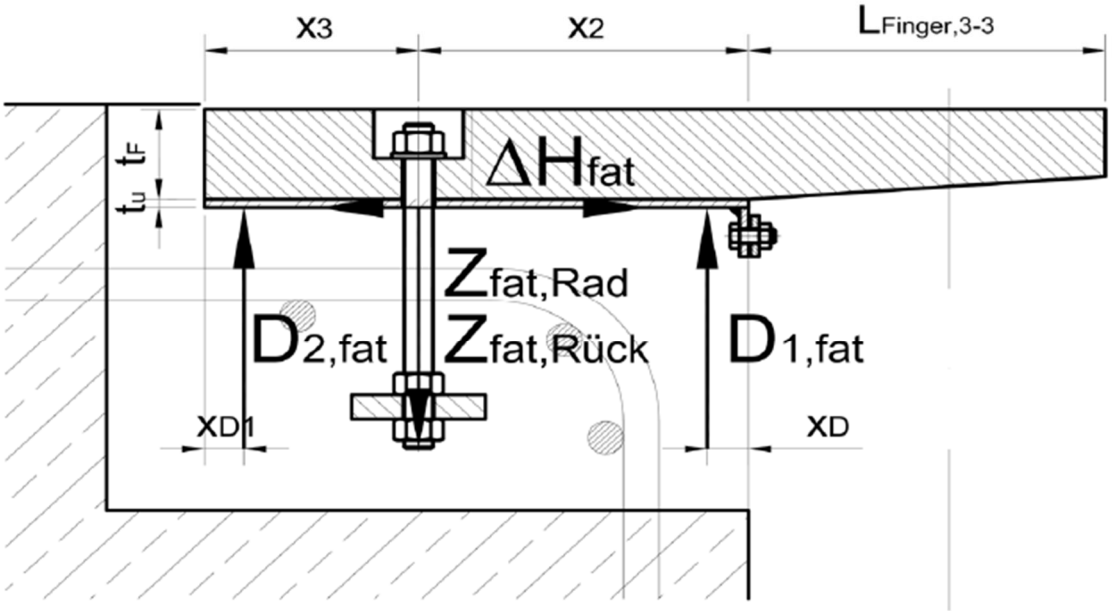
Ultimate limit State (partial safety factors included)		
Z_{Ed} [1] [kN]	D_{Ed} [2] [kN]	H_{Ed} [3] [kN]
26,4	166,9	45,3

Fatigue Limit State (upswing effect κ is onsidered by specifying $Z_{fat,Rad}$ and $Z_{fat,Rück}$ respectively $D_{1,fat}$ and $D_{2,fat}$)				
$Z_{fat,Rad}$ [1] [kN]	$D_{1,fat}$ [2] [kN]	$Z_{fat,Rück}$ [1] [kN]	$D_{2,fat}$ [2]	ΔH_{fat} [3] [kN]
loads from wheel		loads from upswing		κ = -1,00
19,4	117,3	23,1	86,9	42,0

[1] force per screw, number of participating anchor loops n = 3 Stk

[2] effecitve width b = $b_{Rad} + 2 \cdot t_{3-3}$

[3] effecitve width b = $b_{Rad} + 2 \cdot t_{3-3}$



Expansion joint VS-F 160 **Anchor forces**	**Annex 8** of European Technical Assessment ETA-20/0813

Type VS-F 200

12.1 Loads for Ultimate Limit state (inkl. partial safety factor)

$F_{Vk,Ed}$ =	202,5 kN
$F_{lk,Ed}$ =	45,3 kN

b_{Rad} = 2x250 mm = 500 mm ...effectiv loaded width

l_{Rad} = 300 mm

12.2 Loads for Fatigue Limit state (dynamic factor for vertical loads included $\Delta\varphi_{fat}$)

$F_{1k,fat}$ =	136,5 kN
$F_{1lk,fat}$ =	42,0 kN

12.3 compilation of the connection forces

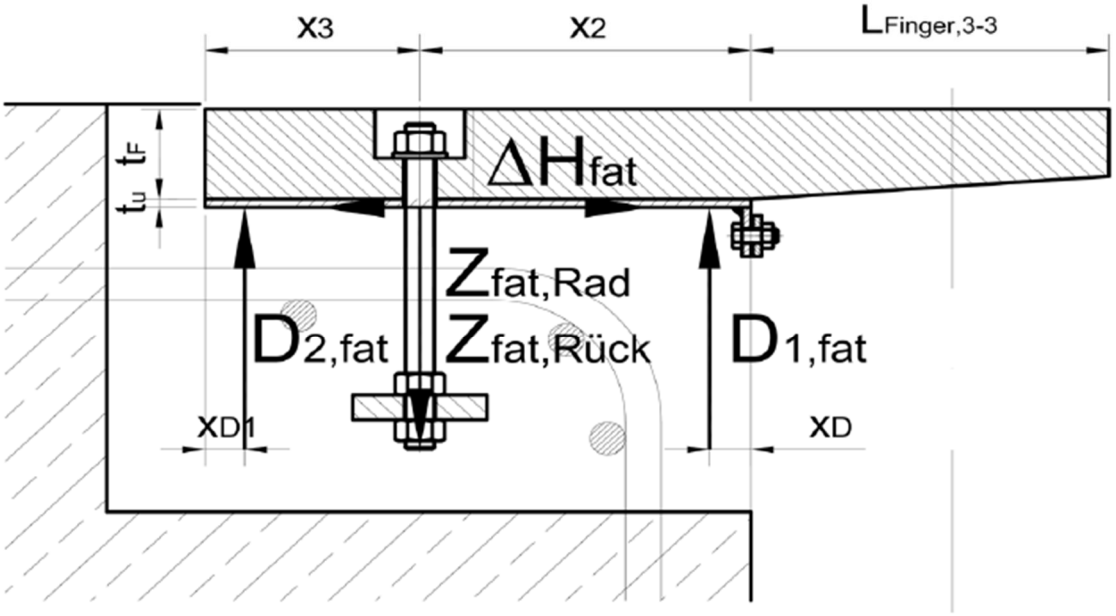
Ultimate limit State (partial safety factors included)		
Z_{Ed} [1)] [kN]	D_{Ed} [2)] [kN]	H_{Ed} [3)] [kN]
33,8	202,6	45,3

Fatigue Limit State (upswing effect κ is onsidered by specifying $Z_{fat,Rad}$ and $Z_{fat,Rück}$ respectively $D_{1,fat}$ and $D_{2,fat}$)				
$Z_{fat,Rad}$ [1)] [kN]	$D_{1,fat}$ [2)] [kN]	$Z_{fat,Rück}$ [1)] [kN]	$D_{2,fat}$ [2)]	ΔH_{fat} [3)] [kN]
loads from wheel		loads from upswing		κ = -1,00
24,6	142,0	24,8	94,9	42,0

[1)] force per screw, number of participating anchor loops n = 3 Stk

[2)] effecitve width b = b_{Rad} + 2 · t_{3-3}

[3)] effecitve width b = b_{Rad} + 2 · t_{3-3}



Expansion joint VS-F 200 **Anchor forces**	**Annex 9** of European Technical Assessment ETA-20/0813

Type VS-F 250

12.1 Loads for Ultimate Limit state (inkl. partial safety factor)

$F_{Vk,Ed}$ =	202,5 kN
$F_{Ik,Ed}$ =	45,3 kN

b_{Rad} = 2x250 mm = 500 mm ...effectiv loaded width

l_{Rad} = 300 mm

12.2 Loads for Fatigue Limit state (dynamic factor for vertical loads included $\Delta\varphi_{fat}$)

$F_{1k,fat}$ =	136,5 kN
$F_{1Ik,fat}$ =	42,0 kN

12.3 compilation of the connection forces

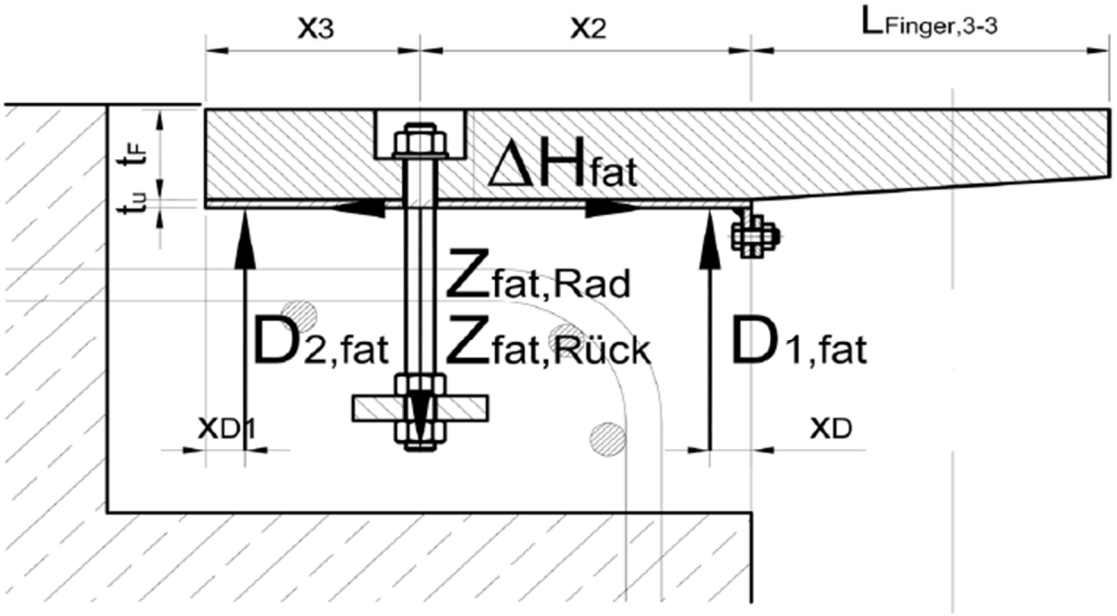
Ultimate limit State (partial safety factors included)		
Z_{Ed} [1] [kN]	D_{Ed} [2] [kN]	H_{Ed} [3] [kN]
38,3	236,3	45,3

Fatigue Limit State (upswing effect κ is onsidered by specifying $Z_{fat,Rad}$ and $Z_{fat,Rück}$ respectively $D_{1,fat}$ and $D_{2,fat}$)				
$Z_{fat,Rad}$ [1] [kN]	$D_{1,fat}$ [2] [kN]	$Z_{fat,Rück}$ [1] [kN]	$D_{2,fat}$ [2]	ΔH_{fat} [3] [kN]
loads from wheel		loads from upswing		κ = -1,00
27,5	164,3	30,4	115,8	42,0

[1] force per screw, number of participating anchor loops n = 3 Stk

[2] effecitve width b = $b_{Rad} + 2 \cdot t_{3\text{-}3}$

[3] effecitve width b = $b_{Rad} + 2 \cdot t_{3\text{-}3}$



Type VS-F 300

12.1 Loads for Ultimate Limit state (inkl. partial safety factor)

$F_{Vk,Ed}$ =	202,5 kN
$F_{lk,Ed}$ =	45,3 kN

b_{Rad} = 2x250 mm = 500 mm ...effectiv loaded width

l_{Rad} = 300 mm

12.2 Loads for Fatigue Limit state (dynamic factor for vertical loads included $\Delta\varphi_{fat}$)

$F_{1k,fat}$ =	136,5 kN
$F_{1lk,fat}$ =	42,0 kN

12.3 compilation of the connection forces

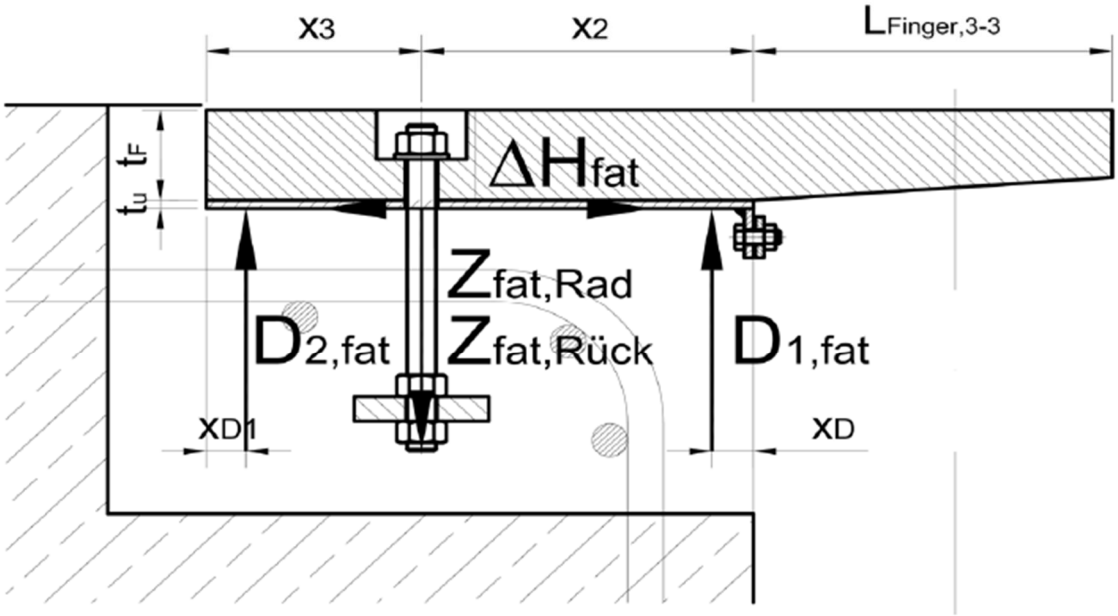
Ultimate limit State (partial safety factors included)		
Z_{Ed} [1)] [kN]	D_{Ed} [2)] [kN]	H_{Ed} [3)] [kN]
40,2	259,1	45,3

Fatigue Limit State (upswing effect κ is onsidered by specifying $Z_{fat,Rad}$ and $Z_{fat,Rück}$ respectively $D_{1,fat}$ and $D_{2,fat}$)				
$Z_{fat,Rad}$ [1)] [kN]	$D_{1,fat}$ [2)] [kN]	$Z_{fat,Rück}$ [1)] [kN]	$D_{2,fat}$ [2)]	ΔH_{fat} [3)] [kN]
loads from wheel		loads from upswing		κ = -1,00
28,8	179,6	32,2	124,5	42,0

[1)] force per screw, number of participating anchor loops n = 3 Stk

[2)] effecitve width b = b_{Rad} + 2 · t_{3-3}

[3)] effecitve width b = b_{Rad} + 2 · t_{3-3}



Expansion joint VS-F 300 **Anchor forces**	**Annex 11** of European Technical Assessment ETA-20/0813

Type VS-F 350

12.1 Loads for Ultimate Limit state (inkl. partial safety factor)

$F_{Vk,Ed}$ =	202,5 kN
$F_{lk,Ed}$ =	45,3 kN

b_{Rad} = 2x250 mm = 500 mm ...effectiv loaded width

l_{Rad} = 300 mm

12.2 Loads for Fatigue Limit state (dynamic factor for vertical loads included $\Delta\varphi_{fat}$)

$F_{1k,fat}$ =	136,5 kN
$F_{1lk,fat}$ =	38,5 kN

12.3 compilation of the connection forces

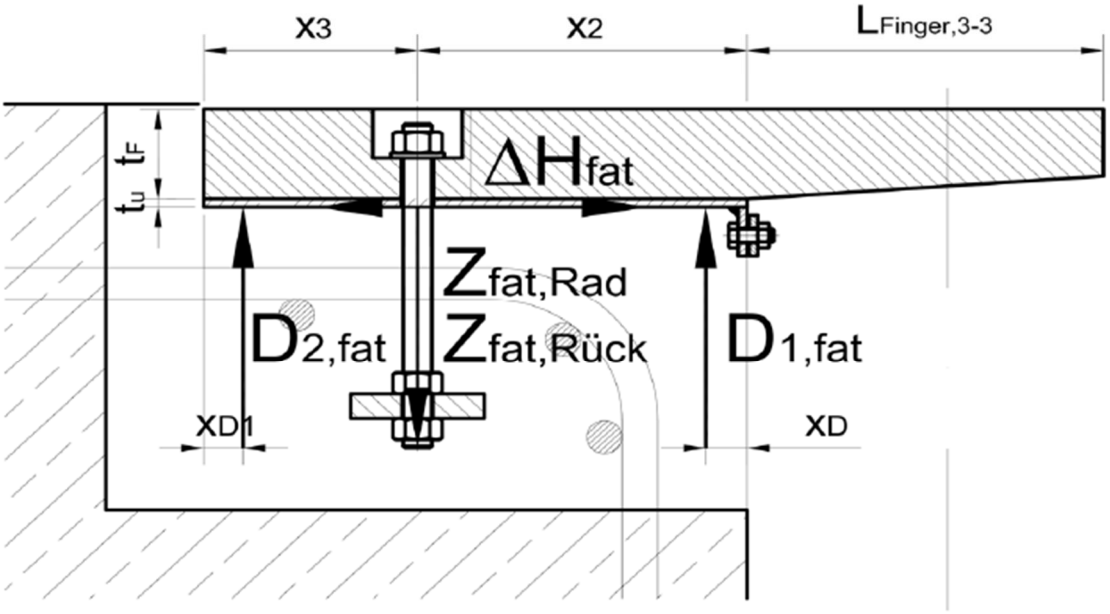
Ultimate limit State (partial safety factors included)		
Z_{Ed} [1] [kN]	D_{Ed} [2] [kN]	H_{Ed} [3] [kN]
40,8	277,6	45,3

Fatigue Limit State (upswing effect κ is onsidered by specifying $Z_{fat,Rad}$ and $Z_{fat,Rück}$ respectively $D_{1,fat}$ and $D_{2,fat}$)				
$Z_{fat,Rad}$ [1] [kN]	$D_{1,fat}$ [2] [kN]	$Z_{fat,Rück}$ [1] [kN]	$D_{2,fat}$ [2]	ΔH_{fat} [3] [kN]
loads from wheel		loads from upswing		κ = -1,00
28,5	190,2	34,4	134,6	38,5

[1] force per screw, number of participating anchor loops n = 3 Stk

[2] effecitve width b = $b_{Rad} + 2 \cdot t_{3-3}$

[3] effecitve width b = $b_{Rad} + 2 \cdot t_{3-3}$



Expansion joint VS-F 350 **Anchor forces**	**Annex 12** of European Technical Assessment ETA-20/0813

Reference documents

EAD 120111-00-0107 “Cantilever expansion joints for road bridges”
EAD 120109-00-0107 “Nosing expansion joints for road bridges”

EN 206:2013+A2:2021 “Concrete - Specification, performance, production and conformity”
EN 1991-1-5:2003 + AC:2009 “Eurocode 1: Actions on structures - Part 1-5: General actions - Thermal actions”
EN 1993-1-10:2005 + AC:2009 “Eurocode 3: Design of steel structures - Part 1-10: Material tough-ness and through-thickness properties”
EN 1993-2:2006 + AC:2009 “Eurocode 3: Design of steel structures - Part 2: Steel Bridges”
EN 10025-2:2019 “Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels”
EN ISO 3506-1:2020 “Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs with specified grades and property classes”
EN ISO 3506-2:2020 “Fasteners - Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts with specified grades and property classes”
EN ISO 4017:2022 “Fasteners - Hexagon head screws - Product grades A and B”
EN ISO 4032:2012 “Hexagon regular nuts (style 1) - Product grades A and B”
EN ISO 7089:2000 “Plain washers - Normal series - Product grade A”
EN ISO 9223:2012 “Corrosion of metals and alloys – Corrosivity of atmospheres – Classification, determination and estimation”
EN ISO 10684:2004+AC:2009 “Fasteners - Hot dip galvanized coatings”
EN ISO 12944-1:2017 “Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 1: General introduction”