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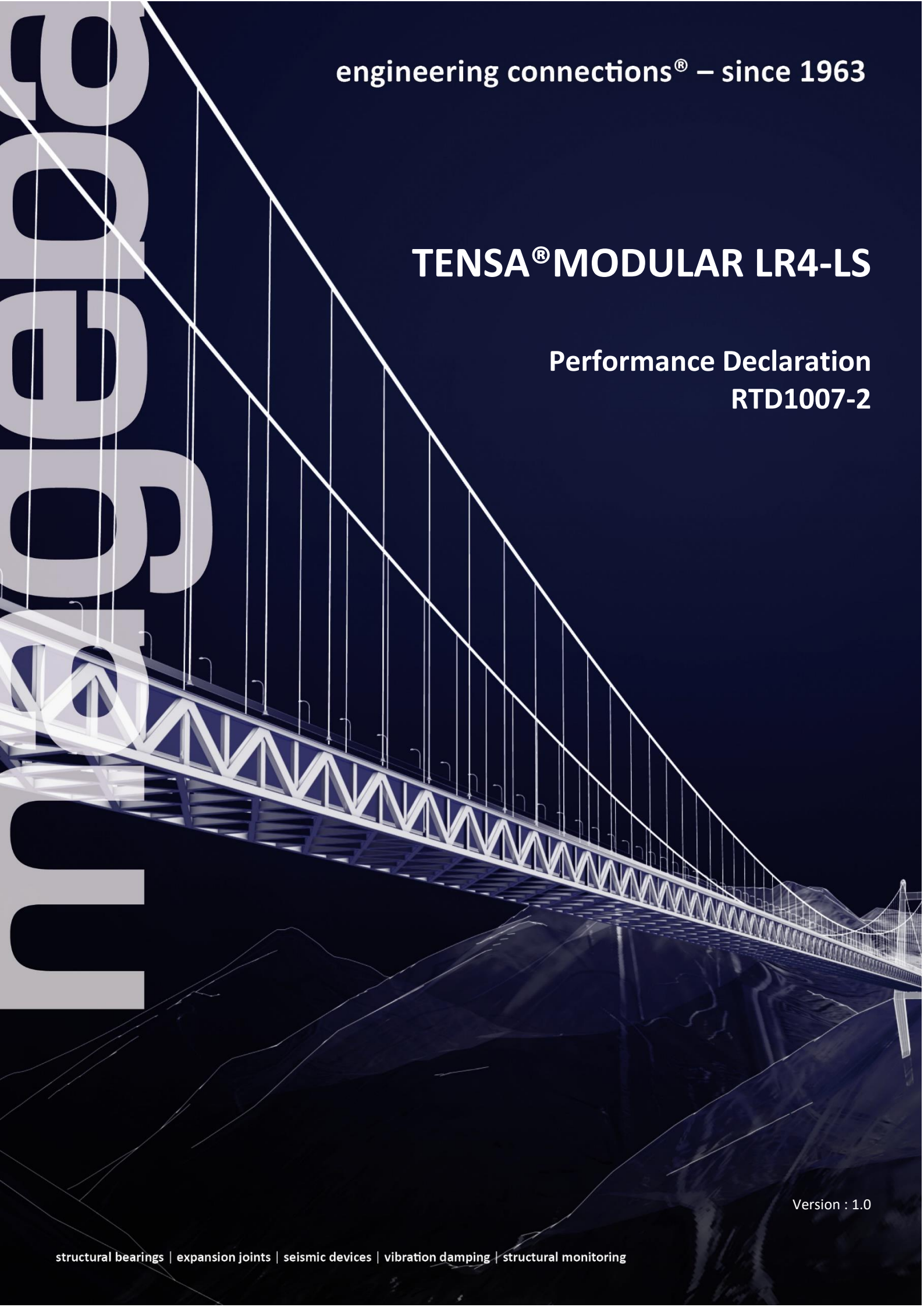
TENSA®MODULAR LR4-LS

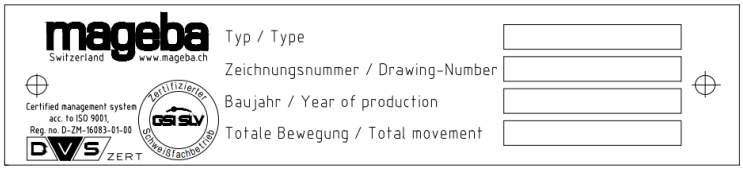
Performance Declaration
RTD1007-2

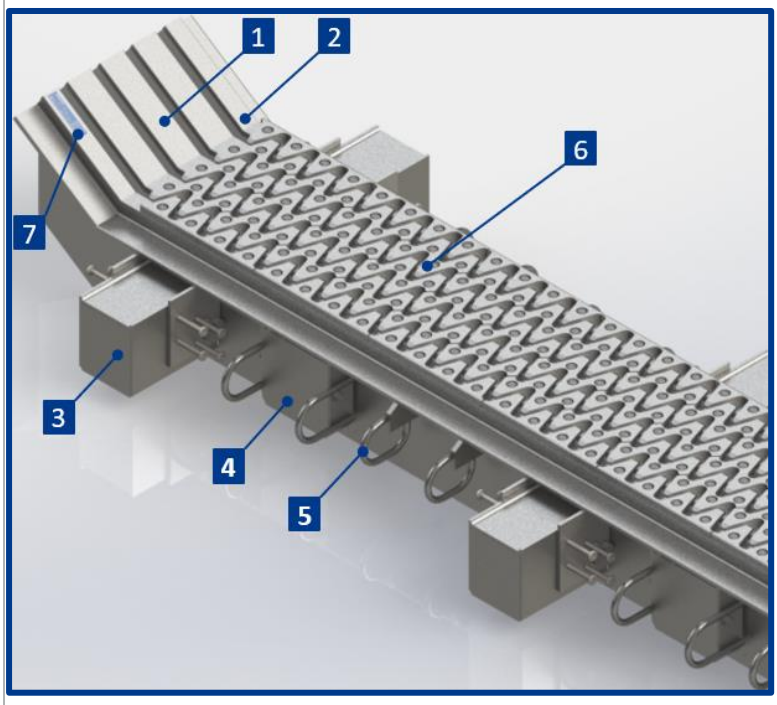


Version : 1.0

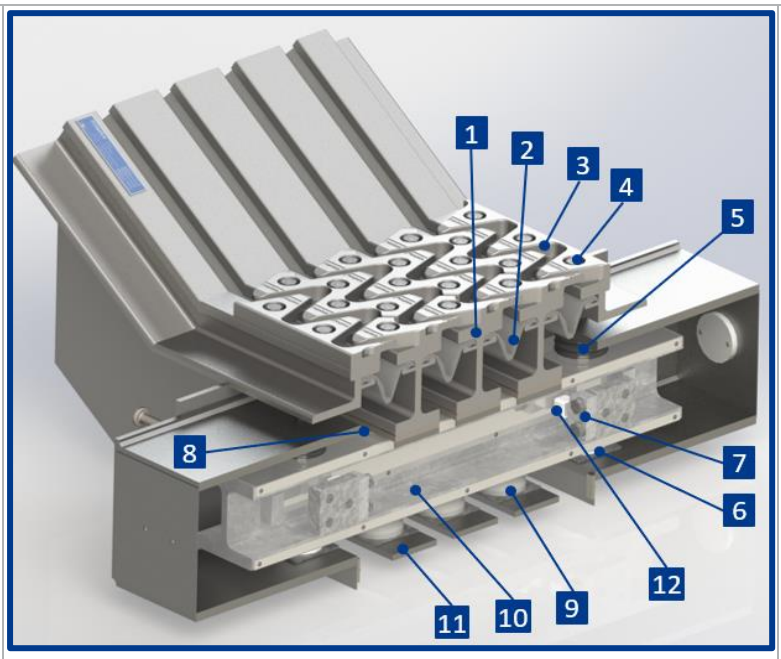
Contents

1 GENERAL

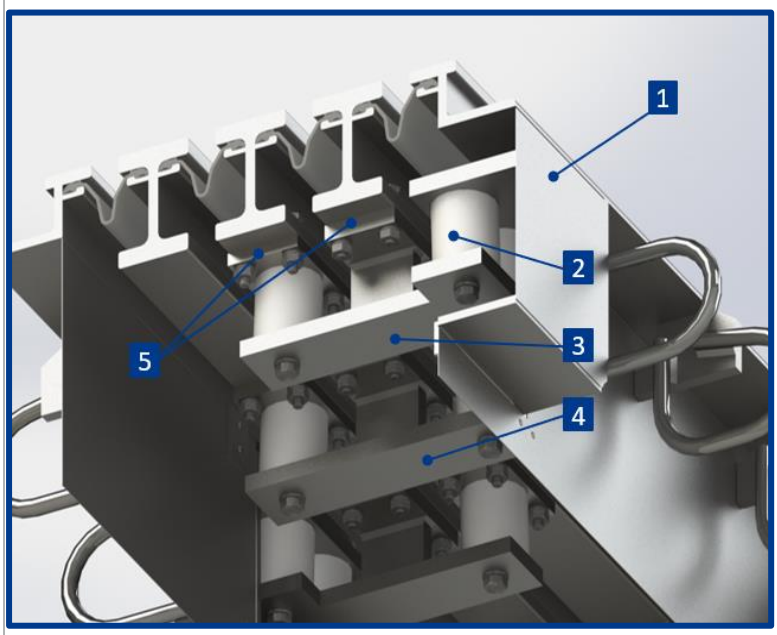
A	**Product name**	:	TENSA®MODULAR LR4-LS
B	**Manufacturer**	:	mageba SA Solistrasse 68 8180 Bülach Switzerland
C	**Concept Number RTD1007-1**	:	7.2a2
D	**System Description**	:	One sided moveable single support bar modular expansion joint with : - In concrete structure anchored edge profiles, joist boxes and control boxes. - fully elastic, from the support system separated, control system - watertight flexible rubber seals with or without hump, clamped between edge profiles and center beams. - bolted noise reducing surface plates According to drawing TENSA®MODULAR LR4-LS100-RTD-B
E	**Identification**	:	Identification plate mechanically connected to edge profile in non-driven part. 
F	**System Components**		



1. Center beam
2. Edge profile
3. Support bar box
4. Control box
5. Loop anchor
6. Sinus plates
7. ID plate



1. Center beam
2. Strip seal
3. Sinus plates
4. Bout met ROBO®LOC
5. Sliding spring ROBO®SLIDE (box)
6. Sliding bearing ROBO®SLIDE (box)
7. Fixing plate
8. Sliding bearing ROBO®SLIDE (frame)
9. Sliding spring ROBO®SLIDE (frame)
10. Support bar
11. Stirrup
12. Sliding shoe



1. Control box
2. Control spring
3. Control bracket (box)
4. Control bracket (field)
5. Distance plate

2 INTENDED USE

A	**Traffic category**	:	Traffic category 1 acc. to RTD1007-2:2014 table NB.5-4.5 (Nobs,a,ai = 2,0 · 10^6)
B	**Design life system**	:	40 years
C	**Design life components**	:	- Anchorage (embedded in structure) : 100 years (RTD1001:2017) - Structural steel elements : 40 years - Plastic and rubber components : 15 years
D	**Maintenance**	:	- Every year, cleaning of the strip seals, preferably after the winter period - Every 15 years, replacement of strip seals. Preloaded bolts and washers to be replaced when loosened*. - Every 15 years, replacement of sliding bearings, sliding springs, sliding shoes and control springs*. *advised intervals
E	**Displacement capacity**	:	Ux = 400mm (480mm ULS) Uy = ± 30mm Uz = ± 5mm (± 10mm voor vervanging oplegsysteem) Values are standard values at full closure of the expansion joint. Transverse capacity will increase with opening of the expansion joint. Widening of the joist boxes, so-called trumpet boxes, will increase transverse capacity. Joist beams can be positioned in movement direction which will eliminate transversal displacement from opening and closing for joist beam capacity. Sinus plate capacity according to table sinus plate capacity.

Transversal displacement capacity sinus plates [mm]

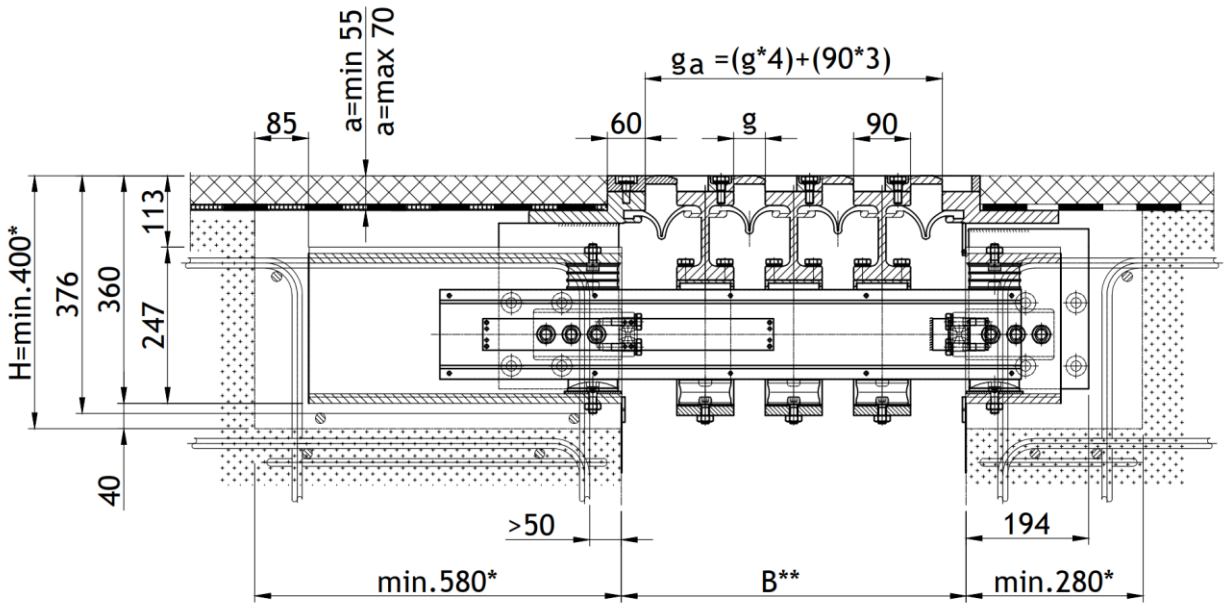
Angle	70°			75°			80°			85°			90°		
Cell gap	-y	+y	Δy	-y	+y	Δy	-y	+y	Δy	-y	+y	Δy	-y	+y	Δy
0mm	9.0	8.4	17.4	8.8	8.4	17.2	8.6	8.3	17.0	8.5	8.3	16.9	8.3	8.3	16.7
5mm	10.2	10.2	20.4	10.1	10.1	20.3	10.1	10.1	20.2	10.0	10.0	20.1	10.0	10.0	20.0
10mm	11.4	12.0	23.4	11.4	11.9	23.3	11.5	11.8	23.3	11.5	11.7	23.2	11.6	11.6	23.2
15mm	12.6	13.8	26.4	12.7	13.6	26.4	12.9	13.5	26.4	13.0	13.3	26.4	13.2	13.2	26.4
20mm	13.8	15.6	29.4	14.0	15.4	29.5	14.3	15.2	29.6	14.6	15.0	29.6	14.8	14.8	29.7
25mm	15.0	17.4	32.4	15.4	17.2	32.6	15.7	16.9	32.7	16.1	16.7	32.8	16.4	16.4	32.9
30mm	16.2	19.2	35.5	16.7	18.9	35.6	17.1	18.6	35.8	17.6	18.4	36.0	18.1	18.1	36.2
35mm	17.4	21.0	38.5	18.0	20.7	38.7	18.6	20.4	39.0	19.1	20.0	39.2	19.7	19.7	39.4
40mm	18.6	22.8	41.5	19.3	22.4	41.8	20.0	22.1	42.1	20.6	21.7	42.4	21.3	21.3	42.7
45mm	19.8	24.6	44.5	20.6	24.2	44.9	21.4	23.8	45.2	22.2	23.4	45.6	22.9	22.9	45.9
50mm	21.0	26.4	47.5	21.9	26.0	47.9	22.8	25.5	48.3	23.7	25.0	48.8	24.6	24.6	49.2
55mm	22.2	28.3	50.5	23.2	27.7	51.0	24.2	27.2	51.5	25.2	26.7	52.0	26.2	26.2	52.4
60mm	23.4	30.1	53.6	24.5	29.5	54.1	25.6	28.9	54.6	26.7	28.4	55.1	27.8	27.8	55.7
65mm	24.7	31.9	56.6	25.8	31.3	57.2	27.0	30.7	57.7	28.2	30.0	58.3	29.4	29.4	58.9
70mm	25.9	33.7	59.6	27.2	33.0	60.2	28.5	32.4	60.9	29.8	31.7	61.5	31.1	31.1	62.2
75mm	27.1	35.5	62.6	28.5	34.8	63.3	29.9	34.1	64.0	31.3	33.4	64.7	32.7	32.7	65.4
80mm	28.3	37.3	65.6	29.8	36.5	66.4	31.3	35.8	67.1	32.8	35.1	67.9	34.3	34.3	68.7
85mm	29.5	39.1	68.6	31.1	38.3	69.4	32.7	37.5	70.3	34.3	36.7	71.1	35.9	35.9	71.9
90mm	30.7	40.9	71.6	32.4	40.1	72.5	34.1	39.2	73.4	35.8	38.4	74.3	37.6	37.6	75.2
95mm	31.9	42.7	74.7	33.7	41.8	75.6	35.5	40.9	76.5	37.4	40.1	77.5	39.2	39.2	78.4
100mm	33.1	44.5	77.7	35.0	43.6	78.7	36.9	42.7	79.7	38.9	41.7	80.7	40.8	40.8	81.6

Transversal displacement capacity sinus plates [mm]															
Angle	45°			50°			55°			60°			65°		
Cell gap	-y	+y	Δy	-y	+y	Δy	-y	+y	Δy	-y	+y	Δy	-y	+y	Δy
0mm	9.8	8.4	18.2	9.6	8.4	18.0	9.4	8.4	17.9	9.3	8.4	17.7	9.1	8.4	17.5
5mm	10.4	10.4	20.9	10.4	10.4	20.8	10.3	10.3	20.7	10.3	10.3	20.6	10.2	10.2	20.5
10mm	11.1	12.5	23.7	11.2	12.4	23.6	11.2	12.3	23.6	11.3	12.2	23.5	11.3	12.1	23.4
15mm	11.8	14.5	26.4	12.0	14.4	26.4	12.1	14.2	26.4	12.3	14.1	26.4	12.4	13.9	26.4
20mm	12.5	16.6	29.1	12.8	16.4	29.2	13.0	16.2	29.2	13.3	16.0	29.3	13.5	15.8	29.4
25mm	13.2	18.6	31.8	13.5	18.4	32.0	13.9	18.1	32.1	14.3	17.9	32.2	14.6	17.6	32.3
30mm	13.9	20.6	34.6	14.3	20.4	34.7	14.8	20.1	34.9	15.3	19.8	35.1	15.7	19.5	35.3
35mm	14.6	22.7	37.3	15.1	22.3	37.5	15.7	22.0	37.8	16.3	21.7	38.0	16.8	21.3	38.2
40mm	15.2	24.7	40.0	15.9	24.3	40.3	16.6	24.0	40.6	17.3	23.6	40.9	17.9	23.2	41.2
45mm	15.9	26.8	42.7	16.7	26.3	43.1	17.5	25.9	43.4	18.3	25.5	43.8	19.0	25.1	44.2
50mm	16.6	28.8	45.5	17.5	28.3	45.9	18.4	27.9	46.3	19.3	27.4	46.7	20.1	26.9	47.1
55mm	17.3	30.8	48.2	18.3	30.3	48.7	19.3	29.8	49.1	20.3	29.3	49.6	21.2	28.8	50.1
60mm	18.0	32.9	50.9	19.1	32.3	51.4	20.2	31.7	52.0	21.3	31.2	52.5	22.4	30.6	53.0
65mm	18.7	34.9	53.6	19.9	34.3	54.2	21.1	33.7	54.8	22.3	33.1	55.4	23.5	32.5	56.0
70mm	19.4	37.0	56.4	20.7	36.3	57.0	22.0	35.6	57.6	23.3	35.0	58.3	24.6	34.3	58.9
75mm	20.0	39.0	59.1	21.4	38.3	59.8	22.9	37.6	60.5	24.3	36.9	61.2	25.7	36.2	61.9
80mm	20.7	41.0	61.8	22.2	40.3	62.6	23.7	39.5	63.3	25.3	38.8	64.1	26.8	38.0	64.9
85mm	21.4	43.1	64.5	23.0	42.3	65.4	24.6	41.5	66.2	26.3	40.7	67.0	27.9	39.9	67.8
90mm	22.1	45.1	67.3	23.8	44.3	68.1	25.5	43.4	69.0	27.3	42.6	69.9	29.0	41.8	70.8
95mm	22.8	47.1	70.0	24.6	46.3	70.9	26.4	45.4	71.9	28.2	44.5	72.8	30.1	43.6	73.7
100mm	23.5	49.2	72.7	25.4	48.3	73.7	27.3	47.3	74.7	29.2	46.4	75.7	31.2	45.5	76.7

F	**Operating range**	:	Installation angle: 45° to 135° * Longitudinal slope: ≤ 4% Temperature range: -40°C to +70°C *maximum angle joist beam – driving direction: 67°

G	Structure geometry :

One sided moveable system (concrete – concrete connection)

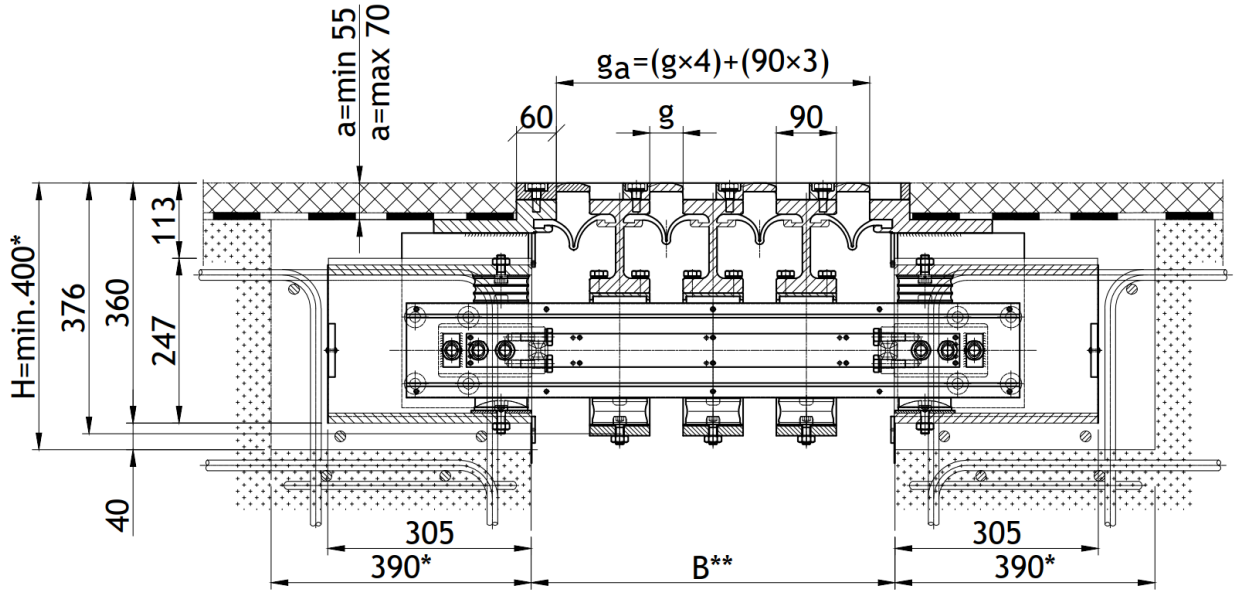


B	Structural gap
H	Recess heigth
g	Cell width (joint gap)
g_a	Pre-setting value (distance between edge profiles)
a	Asphalt height

	Fully closed	Middle position	Fully open
g (cell width)	**0 mm**	**50 mm**	**100 mm**
g_a (pre-setting value)	**270 mm**	**470mm**	**670 mm**
B (structural gap)	**346 mm**	**546 mm**	**746 mm**

*	Recommended values shown. Smaller recesses are possible depending on maximum aggregate size.
**	Minimum dimension “B” = g x 4 Maximum dimension “B” = g_a + 80mm

Two sided moveable system (concrete – concrete connection)

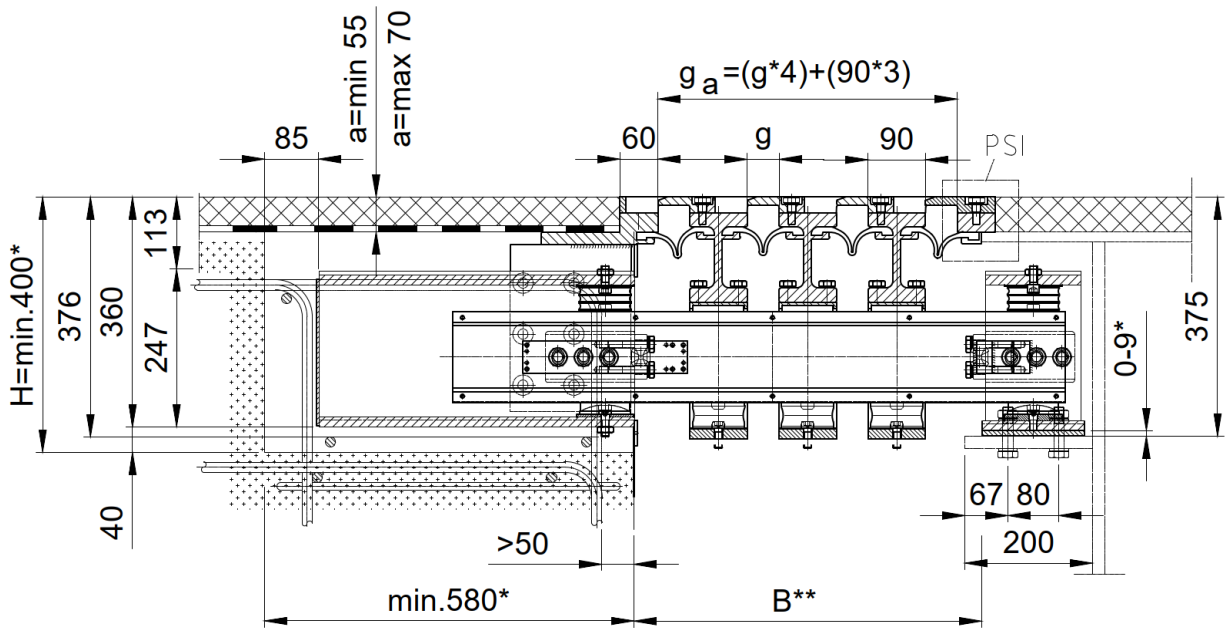


B	Structural gap
H	Recess heigth
g	Cell width (joint gap)
g_a	Pre-setting value (distance between edge profiles)
a	Asphalt height

	Fully closed	Middle position	Fully open
g (cell width)	0 mm	50 mm	100 mm
g_a (pre-setting value)	270 mm	470mm	670 mm
B (structural gap)	346 mm	546 mm	746 mm

*	Recommended values shown. Smaller recesses are possible depending on maximum aggregate size.
**	Minimum dimension “B” = g x 4 Maximum dimension “B” = g_a + 80mm

One sided moveable system (concrete – steel connection)



B	Structural gap
H	Recess heigth
g	Cell width (joint gap)
g_a	Pre-setting value (distance between edge profiles)
a	Asphalt height
PSI	Project Specific Interface connection edge profile to steel deck (not part of the general approval.)

	Fully closed	Middle position	Fully open
g (cell width)	0 mm	50 mm	100 mm
g_a (pre-setting value)	270 mm	470mm	670 mm
B (structural gap)	346 mm	546 mm	746 mm

*	Recommended values shown. Smaller recesses are possible depending on maximum aggregate size.
**	Minimum dimension “B” = g x 4 Maximum dimension “B” = g_a + 40mm

3 MECHANICAL RESISTANCE AND STABILITY

A	**Mechanical resistance**	:	Characteristic SLS, ULS and ALS loads				
			Vertical load	Lane 1	Q_{1k} =	300kN	RTD 1007-2:2014, Table B1.1
				Lane 2	Q_{2k} =	200kN	RTD 1007-2:2014, Table B1.1
				Lane 3	Q_{3k} =	100kN	RTD 1007-2:2014, Table B1.1
			Horizontal (breaking/acceleration) load:		Q_{lk} =	120kN	RTD 1007-2:2014, B1.2.2.1 [2]
			Horizontal (centrifugal) load:	Lane 1	Q_{tk1} =	60kN	RTD 1007-2:2014, B1.2.2.2 [4]
				Lane 2	Q_{tk2} =	40kN	RTD 1007-2:2014, B1.2.2.2 [4]
				Lane 3	Q_{tk3} =	20kN	RTD 1007-2:2014, B1.2.2.2 [4]
			Vertical impact load:		Q_{vks} =	100kN	RTD 1007-2:2014, B1.2.2.3
			Horizontal impact load:		Q_{lks} =	15kN	RTD 1007-2:2014, B1.2.2.3 [5]
			Vertical wheel load footway:		Q_{fwk} =	35kN	RTD 1007-2:2014, B1.2.1.2
			Accidental vertical wheel load on curb:		A_{dV} =	0kN	RTD 1007-2:2014, B1.2.2.4.2
			Accidental horizontal wheel load on curb:		A_{dH} =	10kN	RTD 1007-2:2014, B1.2.2.4.2
B	**Resistance to fatigue**	:	Infinite Working Life Model: $FLM1_{EJ}$				
C	**Partial factors**	:	Y_{M0} =	1.00	NEN-EN 1993-2+C1/NB, Section 6.1 [Table NB.2]		
			Y_{M1} =	1.00	NEN-EN 1993-2+C1/NB, Section 6.1 [Table NB.2]		
			Y_{M2} =	1.25	RTD 1007-2:2014, clause 5.2.3.2 [Table 5.1]		
			Y_{M3} =	1.25	NEN-EN 1993-2+C1/NB, Section 6.1 [Table NB.2]		
			Y_C =	1.50	NEN 1992-1-1, Section 2.4.2.4		
			α_{cc} =	1.00	NEN 1992-1-1, Section 3.1.6		
			k1 =	0.85	NEN 1992-1-1, Section 6.8.2		
			α_{Qi} =	1.00	NEN 1992-2, Section 4.3.2		
			Y_{Mf} (bolted-joints) =	1.35	RTD 1007-2:2014, clause 5.2.3.2 [Table 5.2]		
			Y_{Mf} (cross-beam) =	1.35	RTD 1007-2:2014, clause on 5.2.3.2 [Table 5.2]		
			Y_{Mf} (other-component) =	1.15	RTD 1007-2:2014, clause 5.2.3.2 [Table 5.2]		
D	**Reaction forces**	:	Horizontal reaction forces to structure				
			Maximum tensile force		16.1 kN/m		
			Maximum compression force		35.4 kN/m		
			Maximum transverse reaction force		± 2.8 kN/m		
E	**Resistance to wear**	:	Resistant		EAD 120113-00-0107 clause 2.2.6 *Accumulated sliding path for sliding springs and sliding bearings with ROBO®SLIDE L2 120km*		
F	**Water tightness**	:	Watertight		EAD 120113-00-0107 clause 2.2.7 *Assessment according to: EAD120109-00-0107 Annex D and Annex F*		

4 SAFETY IN USE

A	**Allowable surface gaps and voids**	:	EAD 120113-00-0107 article 2.10.1 a. vehicles: no restrictions, maximum cell width (g) 100mm in SLS b. cyclists: no restrictions, maximum cell width (g) 100mm in SLS c. pedestrians: maximum cell width (g) 80mm in SLS
B	**Level differences in the running surface**	:	Without any imposed horizontal deformations and in unloaded condition the difference in the levels of the running surface of the joints from the ideal line between the two adjacent pavements in the traffic direction shall not be greater than 5mm.Steps shall not be greater than 3mm (without considering surface texture and discontinuities due to gaps and voids).
C	**Skid resistance**	:	++ acc. to RTD1007-1 Attachment 1 *Optional features for improved skid resistance:* - *ROBO®GRIP anti skid surface.* - *recessed lamella's with high grip inlay*
D	**Drainage capacity**	:	The expansion joint allows to be design to follow the surface of the pavement, kerbs etc. and will not form an obstacle for water flowing over the surface. Project specific drainage systems acc. EAD120113-00-0107 article 2.2.12 are optional.

5 PROTECTION AGAINST NOISE

A	**Noise emission**	:	Emission levels for a 90° skew angle above the expansion joint acc. to RTD1007-1

Speed vehicles	Noise emission [GLW]
80 km/h	81.3 dB(A)
90 km/h	82.6 dB(A)
100 km/h	83.7 dB(A)
110 km/h	84.8 dB(A)
120 km/h	85.8 dB(A)
130 km/h	86.7 dB(A)

Emission levels below the structure and optional noise reducing measures shall be specified on a project specific basis.

6 ASPECTS OF DURABILITY

A	**Corrosivity category**	:	EN ISO 9223 corrosivity category C5
B	**Durability**	:	EN ISO 14713-1 Durability "VH" Very High
C	**Corrosion protection system**	:	Hot Dip Galvanized acc. to EN ISO 1461 with increased zinc layer thickness of 140µm acc EN ISO 14713-1