Deutsches Institut für Bautechnik

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Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

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European Technical Assessment ETA-18/0132 of 25 July 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B
Product family to which the construction product belongs	Products related to installation systems supporting technical equipment for building services such as pipes, conduits, ducts and cables
Manufacturer	Hilti AG Feldkircherstraße 100 9494 Schaan FÜRSTENTUM LIECHTENSTEIN
Manufacturing plant	L 1000446
This European Technical Assessment contains	16 pages including 12 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 280016-00-0602

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Specific Part

1 Technical description of the product

Objects of this European Technical Assessment are the Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B. The MQA-M10-B, MQA-M12-B and MQA-M16-B pipe ring saddles consist of a nut and a clamping plate made of steel, which are connected to one another by means of a spring element made of PET. The pipe ring saddles have a centred round opening. The opening in the nut is used to fasten threaded elements, e.g. threaded rods.

Annex A describes the dimensions and materials of the MQA-M10-B, MQA-M12-B and MQA-M16-B pipe ring saddles.

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

The performance given in Section 3 can only be assumed if the Hilti MQA-M10-B, MQA-M12-B and MQA-M16-B pipe ring saddles are used in compliance with the specifications and under boundary conditions set out in Annex B. The test and assessment methods on which this European Technical Assessment is based lead to an assumption of a working life of the Hilti MQA-M10-B, MQA-M12-B and MQA-M16-B pipe ring saddles of at least 50 years in final use under ambient temperatures in indoor areas. 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 works.

In accordance with the European Assessment Document EAD 280016-00-0602, the product is intended to be used in

a) installations for the support of sprinkler kits;
b) installations for the support of other building service elements such as pipes, conduits, ducts and cables.

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

3.1 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire: Steel	Class A1
Reaction to fire: Plastic parts	not relevant for fire growth in accordance with TR021 and therefore do not need to be classified

3.2 Safety and accessibility in use (BWR 4)

Essential characteristic	Performance
Shape	see Annex A
Dimensions	see Annex A
Material	see Annex A
Characteristic pull-out resistance at ambient temperatures	see Annex C
Pull-out resistance with $\varepsilon_{B,\theta a} \leq 2\%$ at elevated temperatures	see Annex D
Pull-out resistance with $\varepsilon_{B,\theta a} > 2\%$ at elevated temperatures	see Annex D

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

In accordance with the European Assessment Document EAD 280016-00-0602, the following legal bases apply:

- In case of intended use a) specified in Section 2:
  Decision of the commission N° 1996/577/EC:
  System 1 applies for the assessment and verification of constancy of performance (AVCP).
- In case of intended use b) specified in Section 2:
  Decision of the commission N° 1999/472/EC:
  System 3 applies for the assessment and verification of constancy of performance (AVCP).

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

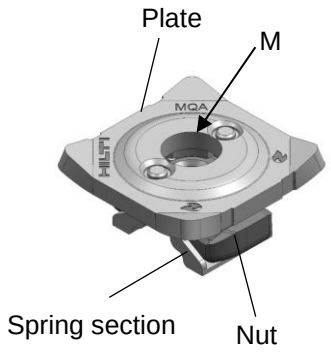
The technical details necessary for the implementation of the system for the assessment and verification of constancy of performance are laid down in the control plan (confidential part of this European Technical Assessment) deposited at Deutsches Institut für Bautechnik.

Issued in Berlin on 25 Juli 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

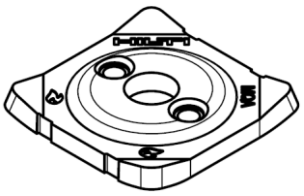
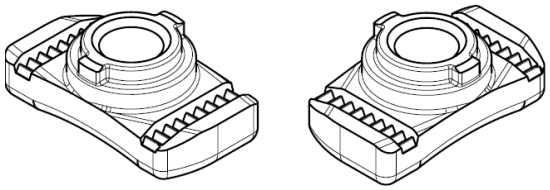
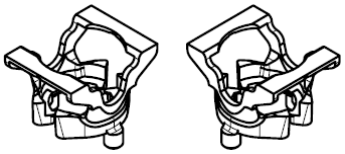
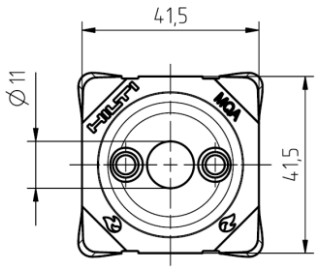
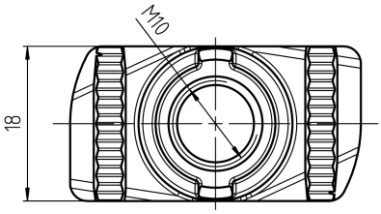
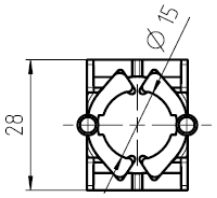
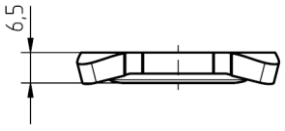
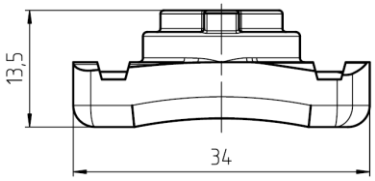
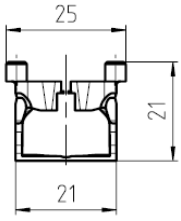
beglaubigt:
Dr. Häßler

Table A1.1: Dimensions and materials of the pipe ring saddles

Illustration	Item number	Designation	M [mm]	Materials
	2199452	MQA-M10-B	10	Plate: DD11 in accordance with EN 10111[1)], zinc coated Nut: C4C in accordance with EN 10263-2, zinc coated Spring section: PET
	2199453	MQA-M12-B	12	
	2199454	MQA-M16-B	16	

[1)] with 235 N/mm² ≤ R_{eL} ≤ 340 N/mm², Method of deoxidation: fully killed

Table A1.2: Dimensions of the components of the pipe ring saddle MQA-M10-B [in mm]

Plate	Nut	Spring section
		
		
		

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B

Description of the product
Dimensions and materials

Annex A1

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Table A2.1: Dimensions of the components of the pipe ring saddle MQA-M12-B [in mm]

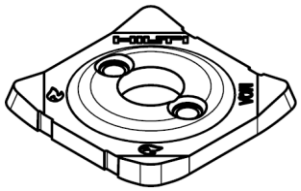
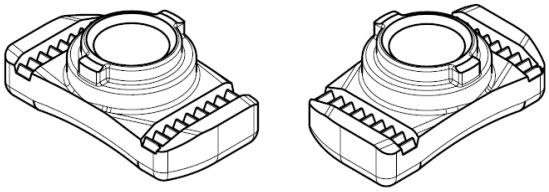
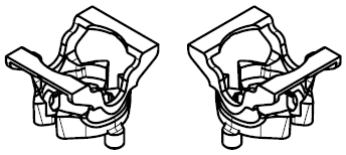
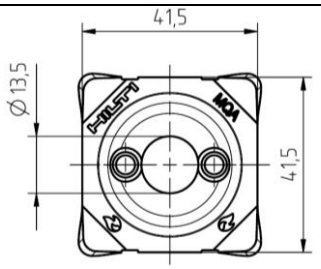
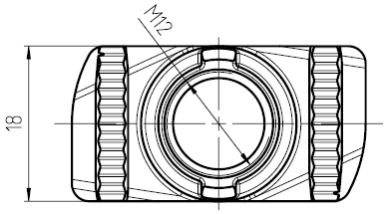
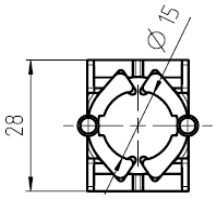
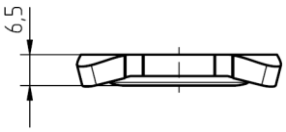
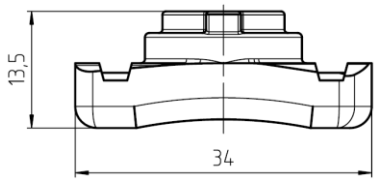
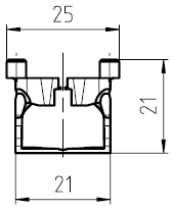
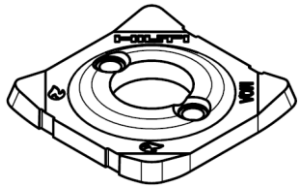
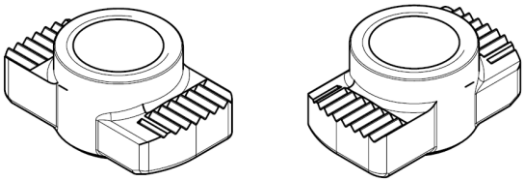
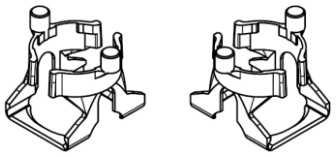
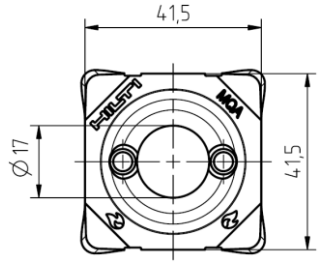
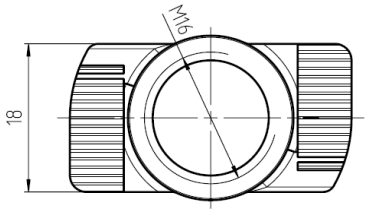
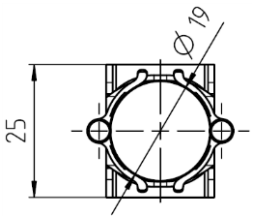
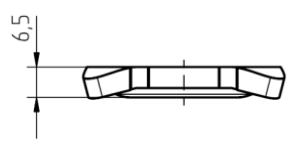
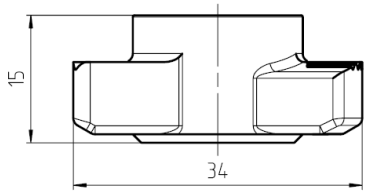
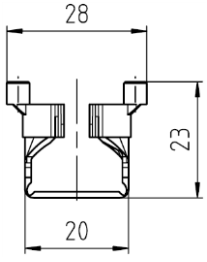
Plate	Nut	Spring section
		
		
		

Table A2.2: Dimensions of the components of the pipe ring saddle MQA-M16-B [in mm]

Plate	Nut	Spring section
		
		
		

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex A2
Description of the product Dimensions and materials	

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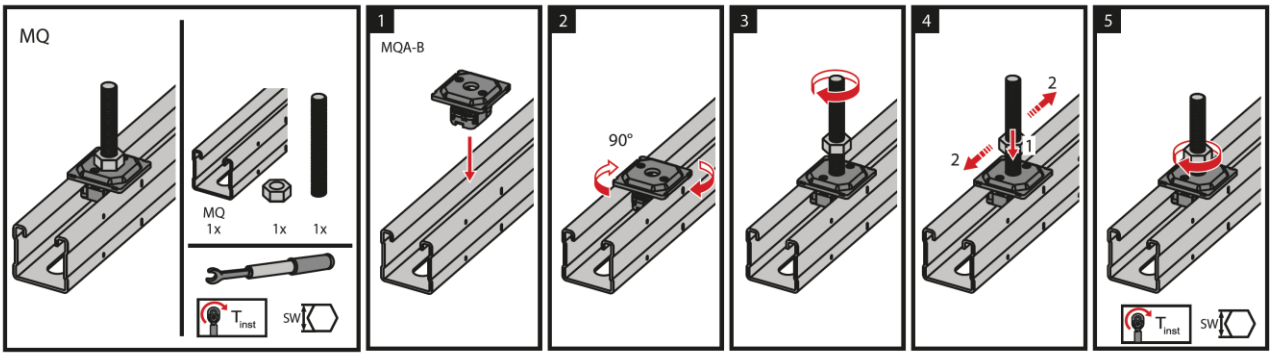
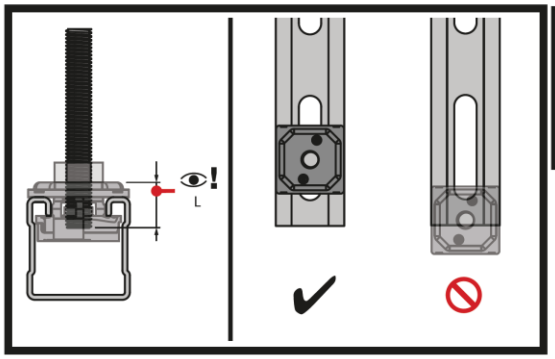
- Hilti pipe ring saddles MQA-M10-B, MQA-M12-B und MQA-M16-B are used to transfer building services component loads such as ducts and equipment for sprinklers, water, heating, cooling, ventilation, electrical and other systems. Hilti pipe ring saddles MQA-M10-B, MQA-M12-B und MQA-M16-B are performing this loadbearing function at ambient and elevated temperatures under the conditions described in Section 2 of this European Technical Assessment.
- Hilti pipe ring saddles MQA-M10-B, MQA-M12-B und MQA-M16-B are deployed for the fixation of threaded rods in installation systems in combination with hexagonal nuts.
- The performance of MQA-M10-B, MQA-M12-B and MQA-M16-B results in connection with zinc coated threaded rods of strength class 4.8 in accordance with DIN 976-1 as per Table B2.1, zinc coated hexagonal nuts of strength class 8 in accordance with ISO 4032 as per Table B2.2 and installation channels according to Annex B3 to B6.
- Information on resistance at ambient and elevated temperatures applies to static and centric actions. The time values in conjunction with the resistance values at elevated temperatures refer to the boundary conditions of the standard temperature / time curve (STTC) according to EN 1363-1.
- The channels are cut to length centrally between the longholes or the roundholes at the marking. The cut channel lies within a range of 2 mm from both sides of the marking.
- Prior to installation, it must be ensured that the supported components, the threaded rods, the anchoring to the base material and the base material itself are suitable to withstand the resistance values of the pipe ring saddles as well as of the installation system and that they have a fireproof certificate.
- Installation must be carried out by qualified personnel and under the supervision of the site manager. The general assembly instructions of the manufacturer apply.





SW	T_{inst}	l_{min}
M10	17 mm	18 Nm (14ft-lb)	18 mm
M12	19 mm	31 Nm (24ft-lb)	20 mm
M16	24 mm	40 Nm (30ft-lb)	23 mm

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex B1
Requirements for performance assessment	

Table B2.1: Dimensions and materials of threaded rods for use with MQA-M10-B, MQA-M12-B, MQA-M16-B

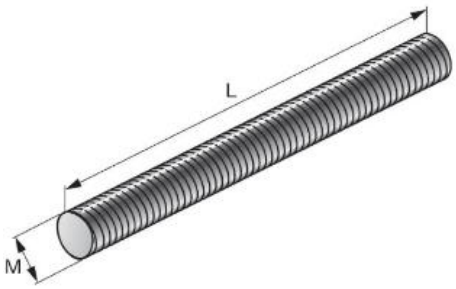
Illustration	Item number	Designation	M thread	L [mm]	Material
	339795	AM10x1000 4.8	M10	1000	Strength class 4.8 in accordance with DIN 976-1, zinc coated
	339796	AM10x2000 4.8	M10	2000	
	216418	AM10x3000 4.8	M10	3000	
	339797	AM12x1000 4.8	M12	1000	
	216420	AM12x2000 4.8	M12	2000	
	216421	AM12x3000 4.8	M12	3000	
	216422	AM16x1000 4.8	M16	1000	
	216423	AM16x2000 4.8	M16	2000	
	216424	AM16x3000 4.8	M16	3000	

Table B2.2: Dimensions and materials of hexagonal nuts for use with MQA-M10-B, MQA-M12-B, MQA-M16-B

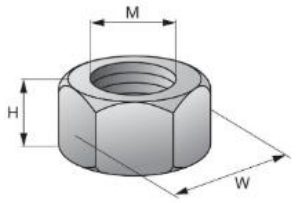
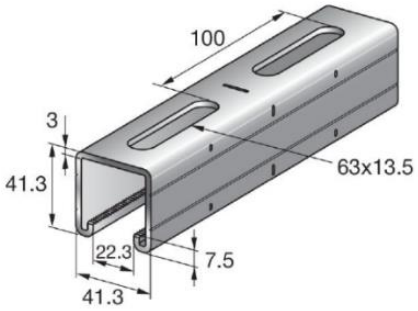
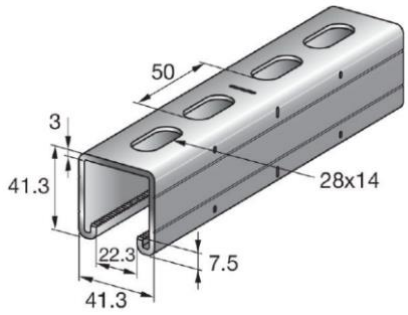
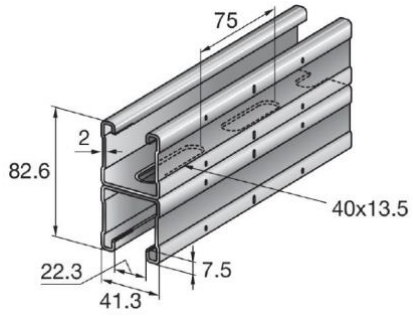
Illustration	Item number	Designation	M thread	W [mm]	H [mm]	Material
	216466	M10 hexagonal nut	M10	17	8	Strength class 8 in accordance with ISO 4032, zinc coated
	216467	M12 hexagonal nut	M12	19	10	
	216468	M16 hexagonal nut	M16	24	13	

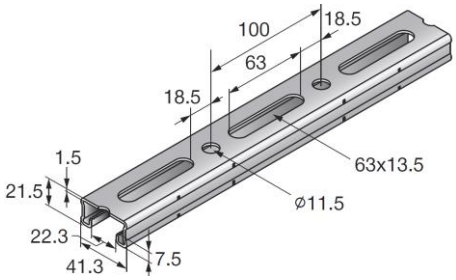
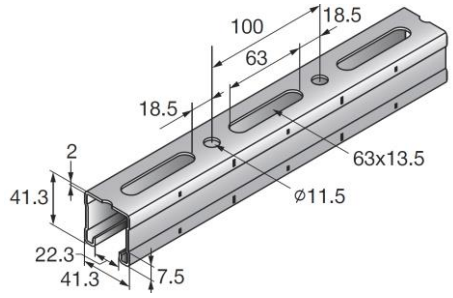
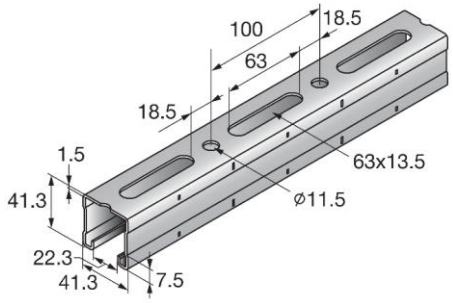
Table B3: Dimensions and materials of installation channels MQ-41/3, MQ-41/3 LL und MQ-41 D

Illustration[2)]	Item number	Designation	Length [m]	Materials
	369596	MQ-41/3 3M	3	S250GD+Z275-M-A-C in accordance with EN 10346
	369597	MQ-41/3 6M	6	
	2048102	MQ-41/3 3M LL	3	S250GD+Z275-M-A-C in accordance with EN 10346
	2048103	MQ-41/3 6M LL	6	
 Two profiles of MQ-41 D channel are connected in the area of the holes in the back of the channels in a shape-fitting and force-fitting way as a kind of riveted connection.	369603	MQ-41 D 3m	3	S250GD+Z275-M-A-C in accordance with EN 10346
	369604	MQ-41 D 6m	6	

[2)] Dimensions in mm

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex B3
Requirements for performance assessment	

Table B4: Dimensions and materials of installation channels MQ-21.5, MQ-41 und MQ-41-L

Illustration[2)]	Item number	Designation	Length [m]	Materials
	2184773	MQ-21.5 6m	6	S280GD+Z140-M-A-C in accordance with EN 10346
	2184772	MQ-21.5 3m	3	
	2184771	MQ-21.5 2m	2	
	369592	MQ-41 6m	6	S250GD+Z275-M-A-C in accordance with EN 10346
	369591	MQ-41 3m	3	
	304559	MQ-41 2m	2	
	2141964	MQ-41-L 6m	6	S250GD+Z140-M-A-C in accordance with EN 10346
	2141965	MQ-41-L 3m	3	
	2141966	MQ-41-L 2m	2	

[2)] Dimensions in mm

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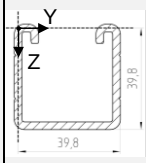
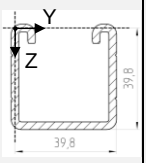
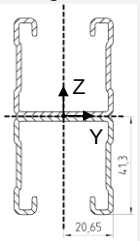
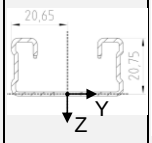
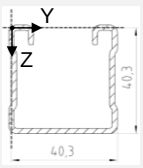
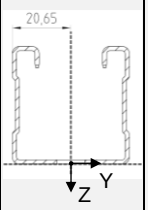
Table B5: Section properties of installation channels for use with MQA-M10-B, MQA-M12-B, MQA-M16-B

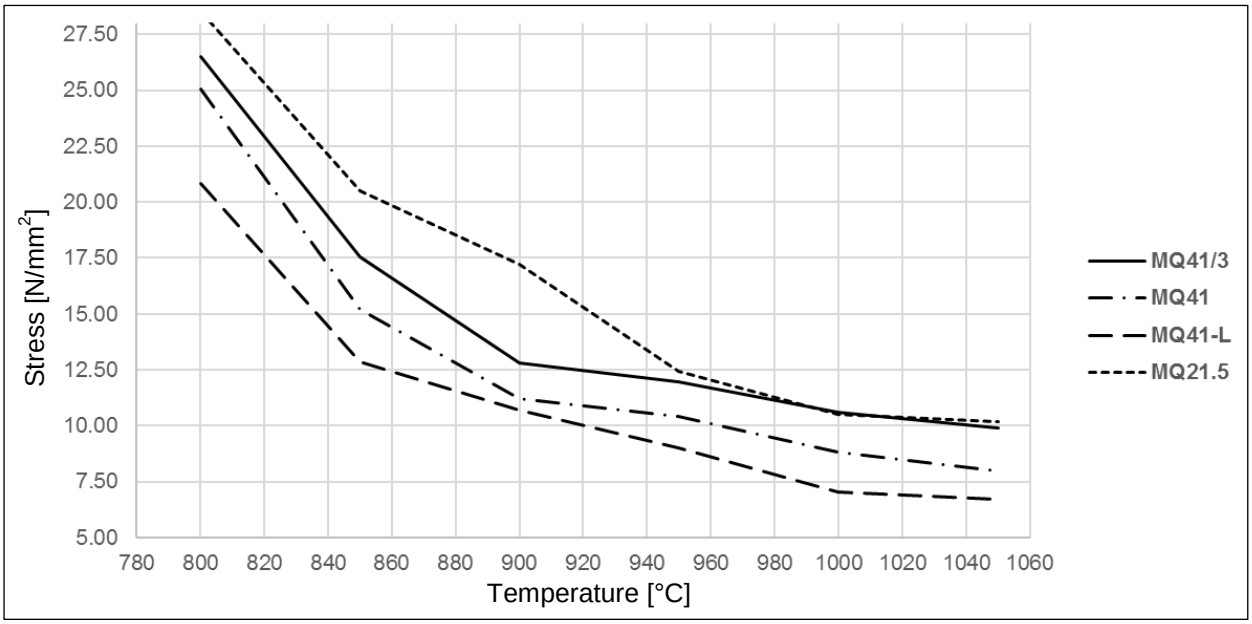
Description	Symbol	MQ-41/3	MQ-41/3 LL	MQ-41 D	MQ-21.5	MQ-41	MQ-41-L	Unit
								
Classification cross section in accordance with EN 1993-1-1	-	3	3	3	3	3	3	-
Cross section areas	A	375.88	379.93	545.97	142.71	263.62	199.57	mm^2
	A_{tot}	375.88	379.93	545.97	142.71	263.62	199.57	mm^2
Shear areas	A_y	48.69	54.43	66.37	23.47	27.23	20.24	mm^2
	A_z	195.47	194.59	197.58	41.86	131.51	98.37	mm^2
Centroid position	$y_{C,0}$	19.15	19.15	0.00	0.00	19.65	0.00	mm
	$z_{C,0}$	20.57	20.76	0.00	-9.12	20.52	-19.91	mm
Moments of inertia	I_y	76963.50	78224.80	323585.00	9168.75	57501.00	44773.00	mm^4
	I_z	107949.00	108011.00	154070.00	37416.40	76416.00	58981.50	mm^4
Inclination of principal axes	α	90.00	90.00	0.00	90.00	90.00	90.00	°
Polar moments of inertia	I_p	184913.00	186236.00	477656.00	46585.10	133917.00	103754.00	mm^4
	$I_{p,M}$	778900.00	780561.00	477656.00	115093.00	601859.00	469974.00	mm^4
Radii of gyration	i_y	14.31	14.35	24.35	8.02	14.77	14.98	mm
	i_z	16.95	16.86	16.80	16.19	17.03	17.19	mm
Polar radii of gyration	i_p	22.18	22.14	29.58	18.07	22.54	22.80	mm
	$i_{p,M}$	45.52	45.33	29.58	28.40	47.78	48.53	mm
Warping radius of gyration	$i_{\omega,M}$	7.02	7.02	17.32	6.85	7.19	7.44	mm
Torsional constant	J	848.88	856.29	575.03	76.58	269.75	112.13	mm^4
Secondary torsional constant	J_s	105319.00	105394.00	91246.30	25157.50	74075.40	565590.00	mm^4
Location of the shear center	$y_{M,0}$	19.15	19.15	0.00	0.00	19.65	0.00	mm
	$z_{M,0}$	60.32	60.31	0.00	12.77	62.63	22.92	mm
	y_M	0.00	0.00	0.00	0.00	0.00	0.00	mm
	z_M	39.75	39.55	0.00	21.90	42.11	42.84	mm
Warping constants	$I_{\omega,C}$	2.09277E+08	2.07678E+08	1.43225E+08	23255400.00	1.66135E+08	1.34296E+08	mm^6
	$I_{\omega,M}$	38387600	38417600.00	1.43225E+08	5395050.00	31116700.00	26017600	mm^6
	$r_{\omega,M}$	0.00	0.00	0.00	0.00	0.00	0.00	-
Section moduli	$S_{y,max}$	4002.48	4108.45	7834.29	928.54	2906.72	2248.07	mm^3
	$S_{y,min}$	-3487.10	-3514.15	-7833.74	-788.66	-2672.22	-2093.62	mm^3
	$S_{z,max}$	5227.58	5230.56	7460.71	1811.93	3700.53	2856.29	mm^3
	$S_{z,min}$	-5277.58	-5230.56	-7460.71	-1811.93	-3700.54	-2856.25	mm^3
Torsional section modulus	S_t	282.96	285.43	287.51	51.06	134.88	75.76	mm^3
Max. plastic bending moment	$M_{pl,y,k}$	NPA[3)]	NPA	NPA	NPA	NPA	NPA	kNm
	$M_{pl,z,k}$	NPA	NPA	NPA	NPA	NPA	NPA	kNm
Max. plastic section moduli	Z_y	NPA	NPA	NPA	NPA	NPA	NPA	mm^3
	Z_z	NPA	NPA	NPA	NPA	NPA	NPA	mm^3
Plastic shear areas	$A_{pl,y}$	NPA	NPA	NPA	NPA	NPA	NPA	mm^2
	$A_{pl,z}$	NPA	NPA	NPA	NPA	NPA	NPA	mm^2
Area bisecting axis position	$f_{y,0}$	NPA	NPA	NPA	NPA	NPA	NPA	mm
	$f_{z,0}$	NPA	NPA	NPA	NPA	NPA	NPA	mm
Plastic shear forces	$V_{pl,y,k}$	NPA	NPA	NPA	NPA	NPA	NPA	kN
	$V_{pl,z,k}$	NPA	NPA	NPA	NPA	NPA	NPA	kN
Plastic axial force	$N_{pl,k}$	NPA	NPA	NPA	NPA	NPA	NPA	kN
Buckling curves	BC_y	c	c	c	c	c	c	-
	BC_z	c	c	c	c	c	c	-

[3)] NPA: No performance assessed

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex B5
Requirements for performance assessment	

Table B6.1: Channel material stress[4)] at different temperatures of the component and $\varepsilon_{B,\theta a}$ = 2%

Temperature [°C]	Stress [N/mm²]			
	MQ-41/3 or MQ-41/3 LL	MQ-41	MQ-41-L	MQ-21.5
800	26.51	25.06	20.83	28.53
842*	19.00	16.77	14.11	21.80
850	17.57	15.19	12.83	20.52
900	12.82	11.21	10.69	17.24
945*	12.05	10.49	9.19	12.91
950	11.96	10.41	9.02	12.43
1000	10.58	8.82	7.02	10.52
1006*	10.50	8.72	6.98	10.48
1049*	9.91	7.97	6.73	10.18
1050	9.90	7.96	6.73	10.17



[4)] determined based on unsteady thermal creep tests
[*)] interpolated values of the channel material stress

Table B6.2: Temperatures[5)] after 30, 60, 90 and 120 minutes according to standard temperature / time curve (STTC)

Time according to STTC [min]	30	60	90	120
Temperature [°C]	842	945	1006	1049

[5)] Furnace temperatures according to STTC;
It can be assumed that the component temperature corresponds to the furnace temperature.

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex B6
Requirements for performance assessment	

Table C1: Characteristic pull-out resistance at ambient temperatures

Pipe ring saddle	Installation channel	Characteristic pull-out resistance	Partial safety coefficient[6)]
		F_{Rk} [kN]	γ_M
MQA-M10-B	MQ-41/3	23.26	2.08
	MQ-41/3 LL		
	MQ-41	15.08	2.15
	MQ-41 D		
	MQ-41-L	7.39	1.76
	MQ-21.5	7.09	1.69
MQA-M12-B	MQ-41/3	20.63	1.84
	MQ-41/3 LL		
	MQ-41	15.92	2.27
	MQ-41 D		
	MQ-41-L	8.02	1.91
	MQ-21.5	6.93	1.65
MQA-M16-B	MQ-41/3	21.70	1.94
	MQ-41/3 LL		
	MQ-41	11.79	1.68
	MQ-41 D		
	MQ-41-L	6.89	1.64
	MQ-21.5	6.29	1.50

[6)] provided that no other national regulations apply

Table D1.1: Parameter of the regression curve $F_{Rk}(t) = c_3 (c_1 + c_2 / t)$ for $\varepsilon_{B,\theta a} \leq 2\%$

Pipe ring saddle	Installation channel	c_1 [-]	c_2 [-]	c_3 [-]	t_{min} [minutes]	t_{max} [minutes]
MQA-M10-B MQA-M12-B	MQ-41/3	695.324	27657.410	0.704	20	150
	MQ-41/3 LL					
	MQ-41	345.949	28750.936	0.713	26	120
	MQ-41 D					
	MQ-41-L	-462.03	35853.38	0.8808	30	33
	MQ-21.5	110.27	19232.88	0.9786	30	48
MQA-M16-B	MQ-41/3	758.416	38174.329	0.844	26	130
	MQ-41/3 LL					
	MQ-41	345.949	28750.936	0.713	26	120
	MQ-41 D					
	MQ-41-L	-462.03	35853.38	0.8808	30	33
	MQ-21.5	110.27	19232.88	0.9786	30	48

Table D1.2: Pull-out resistance $F_{Rk,t}$ at elevated temperatures and $\varepsilon_{B,\theta a} \leq 2\%$

Pipe ring saddle	Installation channel	$F_{Rk,30}$ [N]	$F_{Rk,60}$ [N]	$F_{Rk,90}$ [N]	$F_{Rk,120}$ [N]
MQA-M10-B MQA-M12-B	MQ-41/3	1138	813	705	651
	MQ-41/3 LL				
	MQ-41	930	589	475	NPA[7)]
	MQ-41 D				
	MQ-41-L	646	NPA	NPA	NPA
	MQ-21.5	735	NPA	NPA	NPA
MQA-M16-B	MQ-41/3	1710	1176	998	909
	MQ-41/3 LL				
	MQ-41	930	589	475	NPA
	MQ-41 D				
	MQ-41-L	646	NPA	NPA	NPA
	MQ-21.5	735	NPA	NPA	NPA

[7)] NPA: No performance assessed

Symbols and designation

$\varepsilon_{B,\theta a}$	Channel bending strain at elevated temperatures θ_a
$F_{Rk,t}$	Resistance after an exposure time t to elevated temperatures
$F_{Rk}(t)$	Resistance time function at elevated temperatures

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex D1
Pull-out resistance with $\varepsilon_{B,\theta a} \leq 2\%$ at elevated temperatures	

Table D2: Parameter of the regression curve $F_{Rk}(t) = c_3 (c_1 + c_2 / t)$ for $\varepsilon_{B,\theta a} > 2\%$

Pipe ring saddle	Installation channel	c_1 [-]	c_2 [-]	c_3 [-]	t_{min} [minutes]	t_{max} [minutes]
MQA-M10-B	MQ-41/3	445.338	18381.52	0.917	26	130
	MQ-41/3 LL					
	MQ-41	255.989	15310.519	0.865	22	120
	MQ-41 D					
	MQ-41-L	102.97	16294.33	0.9344	21	60
	MQ-21.5	406.83	11709.31	0.9900	33	49
MQA-M12-B	MQ-41/3	434.765	24088.663	0.872	26	123
	MQ-41/3 LL					
	MQ-41	255.989	15310.519	0.865	22	120
	MQ-41 D					
	MQ-41-L	102.97	16294.33	0.9344	21	60
	MQ-21.5	406.83	11709.31	0.9900	33	49
MQA-M16-B	MQ-41/3	434.382	19535.05	0.907	22	139
	MQ-41/3 LL					
	MQ-41	255.989	15310.519	0.865	22	120
	MQ-41 D					
	MQ-41-L	NPA[7)]	NPA	NPA	NPA	NPA
	MQ-21.5	NPA	NPA	NPA	NPA	NPA

[7)] NPA: No performance assessed

Symbols and designation see Annex D1

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex D2
Pull-out resistance with $\varepsilon_{B,\theta a} > 2\%$ at elevated temperatures	

Table D3: Pull-out resistance $F_{Rk,t}$ at elevated temperatures and $\varepsilon_{B,\theta a}$ > 2%

Pipe ring saddle	Installation channel	$F_{Rk,30}$ [N]	$F_{Rk,60}$ [N]	$F_{Rk,90}$ [N]	$F_{Rk,120}$ [N]
MQA-M10-B	MQ-41/3	970	689	595	549
	MQ-41/3 LL				
	MQ-41	663	442	369	NPA[7)]
	MQ-41 D				
	MQ-41-L	604	NPA	NPA	NPA
	MQ-21.5	789	NPA	NPA	NPA
MQA-M12-B	MQ-41/3	1080	729	613	554
	MQ-41/3 LL				
	MQ-41	663	442	369	NPA
	MQ-41 D				
	MQ-41-L	604	NPA	NPA	NPA
	MQ-21.5	789	NPA	NPA	NPA
MQA-M16-B	MQ-41/3	984	689	590	541
	MQ-41/3 LL				
	MQ-41	663	442	369	NPA
	MQ-41 D				
	MQ-41-L	NPA	NPA	NPA	NPA
	MQ-21.5	NPA	NPA	NPA	NPA

[7)] NPA: No performance assessed

Symbols and designation see Annex D1

Hilti pipe ring saddle MQA-M10-B, Hilti pipe ring saddle MQA-M12-B and Hilti pipe ring saddle MQA-M16-B	Annex D3
Pull-out resistance with $\varepsilon_{B,\theta a}$ > 2% at elevated temperatures	