

MANUALE SISTEMI DI INSTALLAZIONE MEDIO-LEGGERE.

Dati tecnici sistema MQ ver. 01/2017



Terms of common cooperation / Legal disclaimer

The product loading capacities published in these Technical Data Sheets are only valid for the mentioned codes or technical data generation methods and the defined application conditions (e.g. ambient temperature load capacity not valid in case of fire, data not valid in support structures when mixed with third party products), assuming sufficient fastener, base material and building structure strength. Additional calculations, checks and releases by the responsible structural engineer might be needed to clarify the capacity of base material and building structure. Suitability of structures combining different products for specific applications needs to be verified by conducting a system design and calculation, using for example Hilti PROFIS software. In addition, it is crucial to fully respect the Instructions for Use and to assure clean, unaltered and undamaged state of all products at any time in order to achieve this loading capacity (e.g. misuse, modification, overload, corrosion). As products but also technical data generation methodologies evolve over time, technical data might change at any time without prior notice. We recommend to use the latest technical data sheets published by Hilti.

In any case the suitability of structures combining different products for specific applications need to be checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for any specific facility. This book only serves as an aid to interpret the suitability of structures combining different products for specific applications without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application. User must take all necessary and reasonable steps to prevent or limit damage. The suitability of structures combining different products for specific applications are only recommendations that need to be confirmed with a professional designer and/or structural engineers to ensure compliance with User's specific jurisdiction and project requirements.



Content and overview of this manual

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Content and overview of this manual

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	HUS3-H8 Direct fixation to concrete	Various	77			
	HST3-M10 Direct fixation to concrete	Various	83			



MQ System L&P - Ch	annels	3		
Designation		Item number		Yield strength 1.1 Material safety factor
MQ-21 2m		2148545		1.4
MQ-21 3m MQ-21 6m		2148544	Charact	Permissible stress Recommended capacity limit
MQ-41-L 2m		2141966		Self weight
MQ-41-L 3m		2141965		Live loads
MQ-41-L 6m		2141964		Action Resistance
Technical data			MQ-21	MQ-41-L
For girder MI / cross section including torsion				
Cross-sectional area	А	[mm ²]	182.12	199.57
Channel weight		[kg/m]	1.43	1.6
Wall thickness		[mm]	2.0	1.5
Material				
yield strength	$\mathbf{f}_{\mathbf{y},\mathbf{k}}$	[N/mm ²]	290	290
permissible stress*	σ_{rec}	[N/mm ²]	188.3	188.3
E-module		[N/mm ²]	210000	210000
Surface				
hot dip galvanized		[µm]	approx. 20	approx. 10
Cross-section values Y-axis				
Axis of gravity A	e ₁	[mm]	11.13	21.44
Axis of gravity B	e ₂	[mm]	9.47	19.86
moment of inertia	l _y	[cm ⁴]	0.99	4.48
Section modulus A	W_{y1}	[cm ³]	0.89	2.09
Section modulus B	W_{y2}	[cm ³]	1.05	2.25
Radius of gyration	i _y	[cm]	0.74	1.50
Permissible moment	My	[Nm]	168	394
Cross-section values Z-axis				
moment of inertia	ا _z	[cm ⁴]	4.63	5.90
Section modulus	Wz	[cm ³]	2.24	2.86
Radius of gyration	i _z	[cm]	1.59	1.72
Data to the torsion				
torsional moment of inertia	lt	[mm ⁴]	151.17	112.13
torsional section modulus	W _t	[mm ³]	75.59	75.76



Installation Technical Manual - Technical Data - MQ system light & project

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Item number
2141906
2141907

Corrosion protection:

Electro galvanized

Weight:

M 8 - 53g M10 - 53g

Submittal text:

Part, combining channel nut with metric internal thread M8 or M10 and channel plate. Installation by mounting to open side of channel and rotation to 45°. Fixation by screwing in threaded rod ant tightening a counter nut to pre-defined installation torque. Typically used for fixing pipe-rings and other threaded rod connections to installation channel. Can transfer tension, compression and shear loads.

Material properties:

· · ·				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR -	f = 235 N	f = 360 N	E = 210000 N	G = 80769 N
DIN EN 10025	$m_y = 233$ mm^2	mm^2	mm^2	$d = 80709 \frac{1}{mm^2}$

Instruction For Use:







Possible loading cases			
Standard			

Design criteria used for loading capacity

Methodology:

Finite element analysis

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:







Loading case: Standard		Combinations covered by loading case	
BOM: For fixation on M8 threa 1x MQA-S M8 1x M8 nut 1x AM8x1000 t-rod For fixation on M10 threa 1x MQA-S M10 1x M10 nut 1x AM10x1000 t-rod	ided rod 2141906 216465 339793 or various aded rod 2141907 216466 339795 or various	Saddle nut installed in all sizes of MQ channel opened up or down	

Recommended loading capacity - simplified for most common applications







Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low (< -10 $^{\circ}\,$ C), no high (> +100 $^{\circ}\,$ C) temperatures



Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. MQA-S-M8



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
2.10	2.10			4.2	
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]

valid for edge distance ≥ 100mm

2. MQA-S-M10



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3.00	3.00			4.2	
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]

valid for edge distance ≥ 100mm

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MQZ-P Bored plate

Designation	Item number
MQZ-P9	2141908
MQZ-P11	2141909

Corrosion protection:

Electro galvanized

Weight:

MQZ-P9 - 35g MQZ-P11 - 35g

Submittal text:

Installation channel plate for fixation channels to threaded rods. Typically used in pairs to open side and back of channels in combination with counter nuts. Single piece usage for anchor fixation through the channel directly to base material. Geometry allows clamping of channel walls and high load transfer.

Material properties:

material properties.				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR -	f = 235 N	$f = 360 - \frac{N}{N}$	E = 210000 <u>N</u>	$G = 80769 \frac{N}{N}$
DIN EN 10025	mm^2 mm ²	mm^2	mm^2	mm^2

Instruction For Use:

Simplified, not attached to the packaging Loading case "Both sides,,







MQZ-P Bored plate

Possible loadi	ng cases	
Both sides		

Design criteria used for loading capacity

Methodology:

Finite element analysis

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:





MQZ-P Bored plate

Possible load	ing cases
Both sides	

Loading case: Both sides	Combinations covered by loading case
BOM:For fixation on M8 threaded rod2x MQZ-P9 bored plate214192x M8 nut216461x AM8x1000 t-rod33979For fixation on M10 threaded rod2x MQZ-P11 bored plate2x M10 nut216441x AM10x1000 t-rod33979	r various r various



Design loading capacity - 3D	1/2
Method	
Veld sherogin Design load Design load 5.55 Soft weight 1.5 Live load Resistance	
Limiting components of capacity evaluated	in following tables:
1. Bored plate	



2/2

MQZ-P Bored plate

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures Г

Possible	loadii	ng cases	
Both side	s		
	● 		

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.





+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
				5.00	5.00
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]

for MQ-41-L and MQ-41 channel

2. MQZ-P11



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				5.00	5.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

for MQ-41-L and MQ-41 channel

Designation	Item number
MQZ-TW-M8	2142030
MQZ-TW-M10	2142031

Corrosion protection:

Electro galvanized

Weight:

MQZ-TW-M8 - 37g MQZ-TW-M10 - 37g

Submittal text:

Part, combining 45x3 mm washer and a metric nut M8 or M10 in one element. Typically used for fixation of channels to threaded rods. Can be used in pairs to open and back side of channel. Version M10 can be used as single piece to back of the channel with nut fitting to channel long holes and securing untightening.

Material properties:

material properties.				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR -	f = 235 <u>N</u>	$f = 360 - \frac{N}{N}$	E = 210000 N	$G = 80769 \frac{N}{N}$
DIN EN 10025	$m_y = 200$ mm ²	mm^2	mm ²	mm ²

Instruction For Use:



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Design criteria used for loading capacity

Methodology:

Finite element analysis

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:





Possible loading cases				
Bottom side Both sides				

BOM: hex-head of the TW locked in the slot of the channel Integrated hexagon head of the TW locked in of the channel For fixation on M10 threaded rod 1x MQZ-TW-M10 2142031 1x AM10x1000 t-rod 339795 or various M10 nut securing either TW or the anchor 216466	n the slot TW or

Recommended loading capacity - simplified for most common applications			
Method	Z	±Fx,rec. ±Fy,rec. ±Fz,rec.	
Characteristic load Serf weight Live loads	×y	[kN] [kN] -3.00 These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.	
Action Resistance	•		

Design loading capacity - 3D	1/2
Method	
Vest strength Copies had Copies by line Copies by l	
Limiting components of capacity evaluated	in following tables:
1. Trapeze wheel	



2/2

MQZ-TW Trapeze Wheel

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures



Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.





+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				0.0	4.20
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

for MQ-41-L and MQ-41 channel

Condition:

hex-head of the TW locked in the slot of the channel - nut used for securing either TW or anchor and hex nut used for securing either the TW or anchor



Possible loading cases				
Bottom s	side	Both sid	es	
			<i>₩</i> • <i>Ш</i> • − −	

Loading case: Both sides		Combinations covered by loading case
BOM: For fixation on M8 threaded rod 2x MQZ-TW-M8 trapeze wheel 1x AM8x1000 t-rod For fixation on M10 threaded rod 1x MQZ-TW-M10 1x AM10x1000 t-rod	2142030 339793 or various 2142031 339795 or various	Integrated hexagon head should be heading out of the channels - for all sizes of the MQ system channels. For both orientations of the channel - open down or open up

Recommended loading capacity - simplified for most common applications					
Method	z		±Fx,r ec.	±Fy,r ec.	±Fz,r ec.
Vield strength	× y	M8	[kN]	[kN]	[kN] 2.50
Characteristic load SetTweight Live loads		M10 These values capacity limits directions, use	are individual or For any combi	ne directional nations of mu and their corr	3.00 maximal ultiple esponding
Action Resistance		interaction for	mulas.		

Design loading capacity - 3D	1/2
Method	
Ved strength and Design hed	
Limiting components of capacity evaluated	in following tables:
1. Trapeze wheel	



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low (< -10 $^{\circ}\,$ C), no high (> +100 $^{\circ}\,$ C) temperatures



Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. MQZ-TW-M8



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				3.5	3.5
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

for MQ-41-L and MQ-41 channel

2. MQZ-TW-M10

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				4.2	4.2
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

for MQ-41-L and MQ-41 channel

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Designation	Item number	
MQW-L-1/1	2142020	
		Ø12.5 21

Corrosion protection:

Electro galvanized

Weight:

159g

Submittal text:

Basic angle for connecting installation channels at 90°. Usage with MQM-M10 channel wing nuts and screws M10x20 – one at each side. Material thickness of 6mm and asymmetrical length of the sides. Can be used also for fixation of threaded rods and anchors M10 and M12.

Material	properties:

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$F_y = 235 \frac{N}{mm^2}$	$F_{u} = 360 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
DD11 MOD - HN 555-1 2012.3				

Instruction For Use:

Simplified, not attached to the packaging







Possible loadi	ng cases	
Standard		

Design criteria used for loading capacity

Methodology:

Analytic calculation Hardware tests

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures –Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	03.2012
•	EN 1993-1-1	Eurocode 3: Design of steel structures –Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures –Part 1-3: General	
		rules-Supplementary rules for cold-formed members and	
		sheeting	09.2010
•	EN 1993-1-5	Eurocode 3: Design of steel structures –Part 1-5:Plated	
		structural elements	06.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures –Part 1-8: Design	
		of joints	03.2012
•	RAL-GZ 655	Pipe Support	04.2008

Software:

- Mathcad 15.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:





Possible loading cases				
Standard				

Loading case: Standard		Combinations covered by loading case	
BOM:		Angle perpendicularly connecting two open sections of	
1x MQW-L-1/1	2142020	channels	
2x MQM-M10 wing nut 2x M10x20 hexagon head screw	369626 216453		

Recommended loading capacity - simplified for most common applications						
Method	Z	±Fx,rec.	±Fy,rec.	±Fz,rec.		
Treid strength	x x	[кіл] 1.27	[KN] 0.00	2.50		
Characteristic load Saft weight Live loads Action Resistance		These values are in capacity limits. For directions, use desi interaction formulas	ndividual one direct any combinations ign values and thei s.	tional maximal of multiple r corresponding		

Design loading capacity - 3D	1/2
Method	
Ved sterryth Capacity ind Design load 23 Cell Annold 1.5 Live load Action Pressions	
Limiting components of capacity evaluated	in following tables:
1. Steel connector	2. Wing nut



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loading cases				
Standard				

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3.15	5.84	0.00	0.00	4.85	4.45
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
0.00	0.00	0.00	0.00	0.00	0.00

Interaction:

$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} \leq 1$$

2. Wing nut



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3.55	4.88	0.00	0.00	7.00	7.00
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
0.00	0.00	0.00	0.00	0.00	0.00

Interaction:

$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} \le$$

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1

2/2

Designation	Item number	
MQW-L-2/1	2142021	1

Corrosion protection:

Electro galvanized

Weight:

241g

Submittal text:

Basic angle for connecting installation channels at 90°. Usage with MQM-M10 channel wing nuts and screws M10x20 – two on the long side and one on the short side. Material thickness of 6mm. Can be used also for fixation of threaded rods and anchors M10 and M12.

Material properties:

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR -	f - 225 N	f - 360 N	E = 210000 N	C = 80760 N
DIN EN 10025	$m_y = 235$ mm^2	mm^2	$L = 210000 \text{ mm}^2$	$G = 80709 \frac{1}{mm^2}$

Instruction For Use:

Simplified, not attached to the packaging







Possible loading cases		
Standard		

Design criteria used for loading capacity

Methodology:

- Analytic calculation
- Hardware tests

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures –Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	03.2012
•	EN 1993-1-1	Eurocode 3: Design of steel structures –Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures –Part 1-3: General	
		rules-Supplementary rules for cold-formed members and	
		sheeting	09.2010
•	EN 1993-1-5	Eurocode 3: Design of steel structures –Part 1-5:Plated	
		structural elements	06.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures –Part 1-8: Design	
		of joints	03.2012
•	RAL-GZ 655	Pipe Support	04.2008

Software:

- Mathcad 15.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:





Possible loadi	ng cases	
Standard		

Loading case: Standard		Combinations covered by loading case
BOM: 1x MQW-L-2/1 3x MQM-M10 wing nut 3x M10x20 hexagon head screw	2142021 369626 216453	Angle perpendicularly connecting two open sections of channels



Design loading capacity - 3D	1/2
Method	
Veld storyth Capacity Init Design load Capacity Init Lise load Lise load Action Resistance	
Limiting components of capacity evaluated	in following tables:
1. Steel connector	2. Wing nut



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low (< -10 $^{\circ}$ C), no high (> +100 $^{\circ}$ C) temperatures

Possible loading cases		
Standard		

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Steel connector



+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
3.75	5.84	1.55	1.55	4.85	4.45
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
5.84	5.84	0.00	0.00	0.00	0.00

Interaction:

$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \le 1$$

2. Wing nut



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.60	4.88	0.75	0.75	12.60	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
6.25	6.25	0.00	0.00	0.00	0.00

Interaction:

Tension and shear parallel to channel

$$\frac{x.Ed}{x} + \frac{F_{z.Ed}}{z} \le 1$$

Shear transverse to channel

$$\frac{F_{y,Ed}}{F_{y,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} \le 1$$

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Package content

MQW-H2 Angle

Designation MQW-H2	Item number 2141929	75
Corrosion protection: Electro galvanized		4
Weight: 211g		8

Submittal text:

Angle for connecting two channels at 90° in combination with two channel connectors MQN. Angle geometry and integrated bends allows high stiffness and direct load transfer to the installation channel.

Material properties:				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S275JR - DIN EN 10025-2	$F_y = 275 \frac{N}{mm^2}$	$F_{u} = 430 \frac{N}{mm^2}$	E = 210000 $\frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:



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MQW-H2 Angle

Possible loading cases		
Standard		

Design criteria used for loading capacity

Methodology:

- Finite element analysis
- · Hardware tests

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

static loads

no fatigue loads

Simplified drawing:





MQW-H2 Angle

Possible loading cases		
Standard		

Loading case: Standard	Combinations covered by loading case
BOM: 1x MQW-H2 2141929 2x MQN push button 369623	Angle perpendicularly connecting two open sections of channels

Recommended loading capacity - simplified	l for most common a	applicat	ions		
Method Vield strength I.4 Permissible stress Characteristic load Sett weight Live loads Action Resistance Resistance	y x	±Fx,rec. [kN] 2.50 These values are in capacity limits. For directions, use des interaction formula	±Fy,rec. [kN] 1.86 ndividual one direct any combinations s ign values and thei s.	+ Fz,rec. [kN] 2.50 ional maximal of multiple r corresponding	
					-

Design loading capacity - 3D				1/2
Method				
Veld strength and expanding inst Design label Sector Presidence		in following to	bloot	
1. Steel connector	2. MQN on horizontal channel (MQ-41-L)		3. MQN on vertical channel (MQ-41-L)	



MQW-H2 Angle

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low (< -10 $^{\circ}\,$ C), no high (> +100 $^{\circ}\,$ C) temperatures

Possible loading cases		
Standard		

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Steel connector	+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
	5.48	8.40	2.60	2.60	8.40	5.48
↓ z	+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
y x	11.20	11.20	0.00	0.00	0.00	0.00
	$\frac{\text{Interaction:}}{\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.T}}{F_{y.T}}}$	$\frac{\text{Ed}}{\text{Rd}} + \frac{\text{F}_{\text{z.Ed}}}{\text{F}_{\text{z.Rd}}}$	$+ \frac{M_{x.Ed}}{M_{x.Rd}} +$	$\frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}}$	$\frac{M_{z.Ed}}{M_{z.Rd}} \le 1$	
2. MQN on horizontal channel (MQ-41-L)	+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
↓ Z	6.72	6.72	Not decisive	Not decisive	Not decisive	3.50
	+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
	Not	Not	Not	Not	Not	Not
	decisive	decisive	decisive	decisive	decisive	decisive
	Interaction: Interaction i	s not neces	sary			
3. MQN on vertical channel (MQ-41-L)	+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
	[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
↓ z	3.50	Not decisive	Not decisive	Not decisive	6.72	6.72
	+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
	Not	Not	Not	Not	Not	Not
	decisive	decisive	decisive	decisive	decisive	decisive
	Interaction: Interaction i	s not neces	sary			

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Designation	Item number
MQW-L-6/2	2141928

Corrosion protection:

Electro galvanized

Weight:

555g

Submittal text:

Base connector for installation channels at 90°. Usage with two MQM-M10 channel wing nuts and screws M10x20. Fixation holes at the three sides of the connector allowing rotation of channel open side - when used with 41x41 or 41x21D channels. Two anchor holes with dimensions 18x11mm.

Material properties:

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	E = 210000 $\frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:

Simplified, not attached to the packaging

Loading case "Centric,,

Loading case "Eccentric,,







Possible loading cases		
Centric	ntric Eccentric	

Design criteria used for loading capacity

Methodology:

- Analytic calculation
- · Hardware tests

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	03.2012
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	09.2010
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	06.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Mathcad 15.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:







Loading case: Centric		Combinations covered by loading case
BOM: 1x MQW-L-6/2 2x MQM-M10 wing nut 2x M10x20 hexagon head screw	2141928 369626 216453	Rail support connecting perpendicularly channel to base material



Design loading capacity - 3D	1/2
Method	
Ved strongth Capacity limit Design load Capacity limit Capacity limit Capa	
Limiting components of capacity evaluated	in following tables:
1. Steel connector	2. Wing nuts



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loadi	ng cases	
Centric	Eccentric	

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
4.09	4.09	1.25	1.25	12.99	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
5.13	5.13	8.47	8.47	3.34	3.34
Interaction:					

 $\frac{\mathsf{F}_{x.\mathsf{Ed}}}{\mathsf{F}_{x.\mathsf{Rd}}} + \frac{\mathsf{F}_{y.\mathsf{Ed}}}{\mathsf{F}_{y.\mathsf{Rd}}} + \frac{\mathsf{F}_{z.\mathsf{Ed}}}{\mathsf{F}_{z.\mathsf{Rd}}} + \frac{\mathsf{M}_{x.\mathsf{Ed}}}{\mathsf{M}_{x.\mathsf{Rd}}} + \frac{\mathsf{M}_{y.\mathsf{Ed}}}{\mathsf{M}_{y.\mathsf{Rd}}} + \frac{\mathsf{M}_{z.\mathsf{Ed}}}{\mathsf{M}_{z.\mathsf{Rd}}} \leq 1$

2. Wing nuts



n MQ-41 -2mm thick channel profile								
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]			
0.88	0.88	4.91	5.91	12.60	12.60			
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]			
35.00	35.00	9.38	9.38	22.40	22.40			
nteraction: Shear transverse to channel: Shear parallel to channel: Pull-out:								
$\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} \le 1 \qquad \qquad \frac{F_{z,Ed}}{F_{z,Rd}} \le 1 \qquad \qquad \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \le 1$								
In MQ-41 - 1.5mm thick channel profile								
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]			
0.60	0.60	2.45	2.95	11.86	11.86			
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]			
17.50	17.50	6.38	6.38	11.20	11.20			
nteraction: shear transverse to channel: Shear parallel to channel: Pull-out:								
$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}}$	≤ 1	$\frac{F_{Z}.Ed}{F_{Z}.Rd} \leq 1$		$\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}}$	$+ \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$			

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MQW-L-6/2 Rail support

Possible loading cases				
Centric	Eccentric			

Loading case: Eccentric		Combinations covered by loading case
BOM: 1x MQW-L-6/2 2x MQM-M10 wing nut 2x M10x20 hexagon head screw	2141928 369626 216453	Rail support connecting perpendicularly channel to base material



Design loading capacity - 3D	1/2
Method	
Veid strungth Capacity limit Design load Sold strungth 1.6 Live hald Action Residence	
Limiting components of capacity evaluated	in following tables:
1. Steel connector	2. Wing nuts



MQW-L-6/2 Rail support

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loading cases					
Centric	Eccentric				

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]	
4.09	4.09	1.25	1.25	9.43	7.14	
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]	
5.13	5.13	8.47	8.47	3.34	3.34	
nteraction: x.Ed ^F y.Ed ^F z.Ed ^M x.Ed ^M y.Ed ^M z.Ed						

	+	+	+	+	+ >
F _{x Rd}	F _{v Rd}	F _{z Rd}	M _{x Rd}	M _{v Rd}	M _{z Rd}

+Fx,Rd [kN]-Fx,Rd [kN]+Fy,Rd [kN]-Fy,Rd [kN]+Fz,Rd [kN]-Fz,Rd [kN]4.914.910.881.0512.6012.60+Mx,Rd [kNcm]-Mx,Rd [kNcm]+My,Rd [kNcm]-My,Rd [kNcm]+Mz,Rd [kNcm]-Mz,Rd [kNcm]6.256.2535.0035.0022.4022.406.256.2535.0035.0022.4022.40ruir-out.ruir-out.Fy,Ed Fy,Rd Fy,Rd-Fx,Rd Fx,Rd-Mz,Rd [kNcm]nMQ-41 - 1.5mm thick channel:Fz,Ed Fz,Rd-Fx,Rd [kN]-Fy,Rd [kN]-Fz,Rd [kN]1.5mm thick channel:Fx,Rd [kN]-Fx,Rd [kN]-Fz,Rd [kN]-Fz,Rd [kN]2.450.600.7211.8611.86+Mx,Rd [kN]-Mx,Rd [kNcm]-Mz,Rd [kNcm]4.254.2517.5017.5011.2011.20htteraction: ihear transverse to channel:Shear parallel to channel: Fy,Rd [kN]-Mz,Rd [kN]4.254.2517.5017.5011.2011.20Pull-out: Fx,Ed Fx,Rd-Mz,Ed [kNcm]Colspan="4">Pull-out: Fx,Ed Fx,Rd-Mz,Ed [KNcm]-Mx,Rd [kNcm]-Mz,Rd [kNcm]-My,Rd [kNcm]-Mz,Rd [kNcm]-Mx,Rd [kNcm]-Mz,Rd [kNcm	n MQ-41 -2mm thick channel profile						
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]	
+Mx,Rd [kNcm]-Mx,Rd [kNcm]+My,Rd [kNcm]-My,Rd [kNcm]+Mz,Rd [kNcm]-Mz,Rd [kNcm]6.256.2535.0035.0022.4022.40Shear parallel to channel:Function: Shear parallel to channel:Function: Fy,Ed $\frac{M_x.Ed}{M_x.Rd} \le 1$ $\frac{F_z.Ed}{F_z.Rd} \le 1$ Fz,Ed Fy,Rd $\frac{M_x.Ed}{M_x.Rd} \le 1$ Fz,Ed Fx,Rd $\frac{F_z.Ed}{F_z.Rd} \le 1$ FX,Rd [kN] $\frac{F_y,Rd}{[kN]}$ $\frac{F_y,Rd}{[kN]}$ $\frac{F_z,Rd}{[kN]}$ $\frac{F_z,Rd}{[kN]}$ 2.452.450.600.7211.8611.86+Mx,Rd [kNcm] $\frac{F_W,Rd}{[kNcm]}$ $\frac{F_W,Rd}{[kNcm]}$ $\frac{F_W,Rd}{[kNcm]}$ $\frac{F_W,Rd}{[kNcm]}$ Pull-out:Fy,Ed $\frac{M_x,Rd}{[x,Rd]} \le 1$ Shear parallel to channel:Pull-out:F_x,Rd $[kNcm]$ Pull-out:F_x,Ed $\frac{M_x,Rd}{[kNcm]} \le 1$ Pull-out:F_x,Ed $\frac{M_x,Rd}{[kNcm]} \le 1$ Pull-out:F_x,Ed $\frac{M_x,Rd}{M_x,Rd} \le 1$ Fz,Ed $\frac{F_z,Ed}{F_x,Rd} \le 1$ Fz,Ed 	4.91	4.91	0.88	1.05	12.60	12.60	
6.256.2535.0035.0022.4022.40Interaction: ishear transverse to channel:Shear parallel to channel:Full-out. $F_{y,Ed} + M_{x,Rd} \leq 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \leq 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \leq 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \leq 1$ In MQ-41 - 1.5mm thick channel profile+Fx,Rd [kN]-Fx,Rd [kN]+Fy,Rd [kN]-Fy,Rd [kN]+Fz,Rd [kN]2.452.450.600.7211.8611.86+Mx,Rd [kNcm]-Mx,Rd [kNcm]+My,Rd [kNcm]-Mz,Rd [kNcm]-Mz,Rd [kNcm]4.254.2517.5017.5011.2011.20Interaction: interaction: interaction: inter transverse to channel:Fz_Ed Fz_Ed s_rdShear parallel to channel:Pull-out: Fz_Ed F_z,RdFz_Ed Fz_Rd s_1 $F_{y,Ed} + \frac{M_{x,Ed}}{M_{x,Rd}} \leq 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \leq 1$ Full-out: Fz_Ed F_{x,Rd} + My,Rd s_RdShear parallel to channel:	+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]	
$\begin{array}{c} \begin{array}{c} \label{eq:product} \begin{tabular}{lllllllllllllllllllllllllllllllllll$	6.25	6.25	35.00	35.00	22.40	22.40	
$ \begin{array}{c c} F_{y,Rd} + \frac{M_{x,Rd}}{M_{x,Rd}} \leq 1 & \frac{F_{z,Rd}}{F_{z,Rd}} \leq 1 & \frac{F_{x,Rd}}{F_{z,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \begin{array}{c} F_{y,Rd} + \frac{M_{x,Rd}}{M_{y,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \begin{array}{c} F_{x,Rd} + \frac{M_{y,Rd}}{M_{z,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \begin{array}{c} F_{x,Rd} + \frac{M_{y,Rd}}{M_{z,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \begin{array}{c} F_{x,Rd} + \frac{M_{y,Rd}}{M_{z,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \begin{array}{c} F_{x,Rd} + \frac{M_{y,Rd}}{M_{z,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \begin{array}{c} F_{x,Rd} + \frac{M_{y,Rd}}{M_{z,Rd}} + \frac{M_{y,Rd}}{M_{z,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \begin{array}{c} F_{x,Rd} + \frac{M_{x,Rd}}{M_{x,Rd}} + \frac{M_{z,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \end{array} \end{array} \right) \\ \hline \begin{array}{c} F_{x,Rd} + \frac{M_{x,Rd}}{M_{x,Rd}} + \frac{M_{x,Rd}}{M_{z,Rd}} \leq 1 \\ \hline \end{array} \end{array} $	nteraction:	e to channel:	Shear parall	el to channel:	Fuil-out.		•
In MQ-41 - 1.5mm thick channel profile+Fx,Rd [kN]-Fx,Rd [kN]+Fy,Rd [kN]-Fy,Rd [kN]+Fz,Rd [kN]-Fz,Rd [kN]2.452.450.600.7211.8611.86+Mx,Rd [kNcm]-Mx,Rd [kNcm]+My,Rd [kNcm]-My,Rd [kNcm]+Mz,Rd [kNcm]-Mz,Rd [kNcm]4.254.2517.5017.5011.2011.20Near parallel to channel: Spect of $\frac{F_{x,Ed}}{F_{x,Rd}} \neq \frac{M_{x,Ed}}{M_{y,Rd}} \neq \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$	$\frac{F_{y,Ed}}{F_{y,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} \leq 1 \qquad \qquad \frac{F_{z,Ed}}{F_{z,Rd}} \leq 1 \qquad \qquad \frac{F_{x,Ed}}{F_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \leq 1$						
+Fx,Rd [kN]-Fx,Rd [kN]+Fy,Rd [kN]-Fy,Rd [kN]+Fz,Rd [kN]-Fz,Rd [kN]2.452.450.600.7211.8611.86+Mx,Rd [kNcm]-Mx,Rd [kNcm]+My,Rd [kNcm]-My,Rd [kNcm]+Mz,Rd [kNcm]-Mz,Rd [kNcm]4.254.2517.5017.5011.2011.20hear transverse to channel: $\frac{F_{y,Ed}}{F_{x,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} \le 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \le 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \le 1$	In MQ-41 -	1.5mm thic	k channel	profile			
2.452.450.600.7211.8611.86+Mx,Rd [kNcm]-Mx,Rd [kNcm]+My,Rd [kNcm]-My,Rd [kNcm]+Mz,Rd [kNcm]-Mz,Rd [kNcm]4.254.2517.5017.5011.2011.204.254.2517.5017.5011.2011.20Netraction: Shear parallel to channel:Shear parallel to channel: $\frac{F_{z,Ed}}{F_{z,Rd}} \le 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \le 1$ $\frac{F_{z,Ed}}{F_{z,Rd}} \le \frac{M_{z,Ed}}{M_{z,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} \le 1$	+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]	
+Mx,Rd [kNcm]-Mx,Rd [kNcm]+My,Rd [kNcm]-My,Rd [kNcm]+Mz,Rd [kNcm]-Mz,Rd [kNcm]4.254.2517.5017.5011.2011.20interaction: interaction: interaction: ishear transverse to channel:Shear parallel to channel: $F_{z,Ed} + \frac{M_{x,Ed}}{M_{x,Rd}} \le 1$ $F_{z,Ed} \le 1$ $F_{z,Ed} \le 1$	2.45	2.45	0.60	0.72	11.86	11.86	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]	
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	4.25	4.25	17.50	17.50	11.20	11.20	
$F_{y,Rd} + \frac{x_{Rd}}{M_{x,Rd}} \le 1 \qquad \frac{z_{LC}}{F_{z,Rd}} \le 1 \qquad F_{x,Rd} + \frac{w_{y,Rd}}{M_{y,Rd}} + \frac{w_{z,Rd}}{M_{z,Rd}} \le 1$	Interaction: Shear transverse to channel: Shear parallel to channel: Pull-out: Fund My Ed Fanter Fx:Ed My.Ed Mz.Ed						

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Designation	Item number
MQP-41	2141927

Corrosion protection:

Electro galvanized

Weight:

587g

Submittal text:

Base connector for installation channels at 90°. Welded base plate gives stiffness and bending load capacity. Usage with two MQN channel connectors. Fixation holes at the three sides of the connector allowing rotation of channel open side - when used with 41x41 or 41x21D channels. Two anchor holes with dimensions 18x11mm.

Material properties:

• •				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR -	f = 235 N	$f = 360 - \frac{N}{N}$	E = 210000 <u>N</u>	$G = 80769 \frac{N}{N}$
DIN EN 10025	$m_y = 233$ mm^2	mm^2	mm^2	$d = 80703 \frac{1}{mm^2}$

Instruction For Use:



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Possible loading cases				
Centric	Eccentric			

Design criteria used for loading capacity

Methodology:

· Finite element analysis

•	Standards	and	codes:
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•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:





Possible loading cases				
Centric	Eccentric			

Loading case: Centric	Combinations covered by loading case
BOM: 1x MQP-41 2141927 2x MQN push button 369623	Rail support connecting perpendicularly channel to base material



Design loading capacity - 3D			1/:
Method			
Ved storyth Design load Capacity linit Design load Capacity linit Linit linit li		in following to	
1. Steel connector	2. Push buttons		3. Welds



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loading cases					
Centric	Eccentric				

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.



For MQ-41 - 1.5mm thick channel profile					
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN
3.00 / 4.50*	3.00 / 4.50*	3.00	3.00	7.00	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
14.00	14.00	20.00	20.00	6.00	6.00

* For MQ-41 - 2mm thick channel profile Interaction: $\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$

+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Not decisive	Not decisive	7.00	7.00	11.86	11.86
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
24.50	24.50	Not decisive	Not decisive	11.20	11.20

Interaction:

For local normal resistance

$$\frac{F_{z.Ed}}{F_{z.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$$

For local shear resistance parallel to channel

 $\frac{F_{z.Ed}}{2} \leq 1$ F_{z.Rd}

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Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

3. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]	
10.12	10.12	5.14	5.14	13.00	13.00	
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]	
28.45	28.45	38.00	38.00	8.89	8.89	
Interaction:						
$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$						

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Possible loading cases				
Centric	Eccentric			

Loading case: Eccentric	Combinations covered by loading case
BOM: 1x MQP-41 2141927 2x MQN push button 369623	Rail support connecting perpendicularly channel to base material



Design loading capacity - 3D)			1/3
Method				
Limiting components of capa	acity evaluated	in following ta	ıbles:	
1. Steel connector	2. Push button		3. Welds	



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loading cases				
Centric	Eccentric			

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.



or MQ-41 - 1.5mm thick channel profile					
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
5.50	5.50	1.70	1.70	7.00	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
9.00	9.00	35.00	35.00	6.00	6.00

Interaction:

 $\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$

2. Push buttons



For MQ-41 - 1.5mm thick channel profile

+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
7.00	7.00	1.70	1.70	11.86	11.86
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
5.95	5.95	35.52	35.52	11.20	11.20

Interaction:

For local normal resistance

 $\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$

For local shear resistance parallel to channel

 $\frac{F_{z.Ed}}{1} \leq 1$

F_{z.Rd} For local shear resistance perpendicular to channel

 $\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \leq 1$

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Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

3. Welds



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
12.92	12.92	5.03	5.03	16.60	16.60
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
14.23	14.23	38.00	38.00	8.89	8.89
Interaction:					
$\frac{x.Ed}{x.Rd} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$					

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MQ System Light & Project

M8 Threaded rod channel through bolt

Designation If M8 Threaded rod channel through bolt AM8x1000 4.8 threaded rod 3 AM8x2000 4.8 threaded rod 3 AM8x3000 4.8 threaded rod 3 M8 nut 2 Corrosion protection: 3 Threaded rod galvanized 5µm Washer galvanized 5µm Weight: 3 Threaded rod - as per used length Washer - 27g Nut - 5g	tem number 339793 339794 216415 82856 216465 M = 8 mm DI = 8,4 mm DA = 40 mm H = 7 mm W = 13 mm W = 13 mm Package content Individual items
Material was neutron.	

material properties.				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Threaded rod				
Steel grade 4.8 DIN 976-1	$F_y = 320 \frac{N}{mm^2}$	$F_{u} = 400 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
Washer				
Steel S235JR/DD11MOD				
DIN EN 10025-2 2005.4/HN 547 2004.10	$F_y = 235 \frac{N}{mm^2}$	$F_{u} = 360 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Nut	- mm	nin	mm	min
Steel grade 8	$F_{y} = 640 \frac{N}{mm^2}$	$F_{u} = 800 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$

Instruction For Use:

Simplified, not attached to the packaging Loading case "Both sides,,





M8 Threaded rod channel through bolt

Possible loading cases		
Both sides		

Design criteria used for loading capacity

Methodology:

• Finite element analysis

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:



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M8 Threaded rod channel through bolt

Possible loading cases		
Both sides		

Loading case: Both sides	Combinations covered by loading case
BOM: 2x A 8,4/40 washer 282856 2x M8 nut 216465 1x AM8x1000 4.8 threaded rod 339793	Threaded rod connection through bolting the channel - opened up or down secured by two large washers and nuts from both sides of the channel

Recommended loading capacity - simplified	d for most common a	applications	
Method			7 190
Yield strength		[kN] [kN] [k	<n]< th=""></n]<>
Permissible stress	Z	2.	.50
Characteristic load Setf weight Live loads Action Resistance	yx	These values are individual one directional ma capacity limits. For any combinations of multip directions, use design values and their corresp interaction formulas.	aximal ale bonding

Design loading capacity - 3D	1/2
Method	
Ved strength Design load Capacity linit Capacity linit Linit Linit Linit Linit Linit Action Perspirator	
Limiting components of capacity evaluated	in following tables:
1. Washer and nut	



M8 Threaded rod channel through bolt

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loadi	Possible loading cases		
Both sides			

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				3.50	3.50
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm

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MQ System Light & Project

M10 Threaded rod channel through bolt

Designation M10 Threaded	rod channel through bolt AM10x1000 4.8 threaded rod AM10x2000 4.8 threaded rod AM10x3000 4.8 threaded rod A 10,5/40 washer M10 nut	Item number 339795 339796 216418 282857 216466	M = 10 mm $DI = 10.5 mm$
Corrosion prot Threaded rod Washer Nut Weight: Threaded rod Washer Nut	fection: galvanized 5µm galvanized 5µm galvanized 5µm - as per used length - 27g - 10g		H = 8 mm W = 17 mm Package content Individual items

Material	properties.
material	properties.

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Threaded rod				
Steel grade 4.8 DIN 976-1	$F_y = 320 \frac{N}{mm^2}$	$F_{u} = 400 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
Washer	nin	mm	nin	nunc
Steel S235JR/DD11MOD				
DIN EN 10025-2 2005.4/HN 547 2004.10	$F_y = 235 \frac{N}{mm^2}$	$F_{u} = 360 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = $80769 \frac{N}{mm^2}$
Nut				
Steel grade 8	$F_y = 640 \frac{N}{mm^2}$	$F_{u} = 800 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$

Instruction For Use:

Simplified, not attached to the packaging Loading case "Both sides,,



M10 Threaded rod channel through bolt

Possible loadi	ng cases	
Both sides		

Design criteria used for loading capacity

Methodology:

• Finite element analysis

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:

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Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 52

M10 Threaded rod channel through bolt

Possible loadi	ng cases	
Both sides		
- 3 - 3		

Loading case: Both sides	Combinations covered by loading case
BOM: 2x A 10,5/40 washer 282857 2x M10 nut 216466 1x AM10x1000 4.8 threaded rod 339795	Threaded rod connection through bolting the channel - opened up or down secured by two large washers and nuts from both sides of the channel

Recommended loading capacity - simplified for most common applications					
Method	+Ex rec +Ev rec +Ez rec				
Vield strength 1.4 Permissible stress Recommended	z 3.00				
Characteristic load Set weight Live loads Action Resistance	These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.				

Design loading capacity - 3D	1/2
Method	
Design load Expanding load Design load Expanding load 1.5 Expanding load Live load Penalarce	
Limiting components of capacity evaluated	in following tables:
1. Washer and nut	

M10 Threaded rod channel through bolt

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loadi	ng cases	
Both sides		
-9-30		

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				4.20	4.20
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm

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312362 312363 312365	M 840
312367	P S S S S
312368	73° 35 30 20
312369	
	M = 8 mm L = see designation HHK 41 M8xL Package content
	312362 312363 312365 312367 312368 312369

Material properties:				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Threaded rod				
Steel grade 4.8 DIN 976-1	$F_{y} = 320 \frac{N}{mm^{2}}$	$F_{u} = 400 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
Washer	, mm	mm	nun	mm
Steel S235JR/DD11MOD				
DIN EN 10025-2 2005.4/HN 547 2004.10	$F_v = 235 \frac{N}{mm^2}$	$F_{u} = 360 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Nut	, mm	mm	mm	mm
Steel grade 8	$F_y = 640 \frac{N}{mm^2}$	$F_u = 800 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$

Instruction For Use:

HHK 41 M8X100 - 94g HHK 41 M8X120 -100g HHK 41 M8X150 - 110g

Simplified, not attached to the packaging

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Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 55

Possible loading cases		
Standard		

Design criteria used for loading capacity

Methodology:

· Finite element analysis

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:

L = see designation HHK 41 M8xL

Possible loadi	ng cases		
Standard			

Loading case: Standard	Combinations covered by loading case
BOM: 1x HHK HHK 41 M8X40 312361 HHK 41 M8X50 312362 HHK 41 M8X60 312363 HHK 41 M8X80 312365 HHK 41 M8X100 312365 HHK 41 M8X120 312367 HHK 41 M8X150 312368	Threaded bolt connection into a channel using simple channel nut, large washer and nut

Design loading capacity - 3D	1/2
Method	
Vad stevryth Design load Capacity linit Capacity linit 1.5 Line load Action Pagestance	
Limiting components of capacity evaluated	in following tables:
1. T-bolt	

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Standard		

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Washer and nut

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				3.50	3.50
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm

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Designation	Item number
HHK 41 M10X40	312371
HHK 41 M10X60	312373
HHK 41 M10X80	312374
HHK 41 M10X100	312375
HHK 41 M10X150	312377

Corrosion protection:

Threaded rod	galvanized 5µm
Washer	galvanized 5µm
Nut	galvanized 5µm
Weight:	
HHK 41 M10X40	- 77g
HHK 41 M10X60	- 92g
HHK 41 M10X80	- 105 g
HHK 41 M10X100) - 116g
HHK 41 M10X150) - 141g

Material properties:				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Threaded rod				
Steel grade 4.8 DIN 976-1	$F_y = 320 \frac{N}{mm^2}$	$F_{u} = 400 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
Washer				
Steel S235JR/DD11MOD				
DIN EN 10025-2 2005.4/HN 547 2004.10	$F_v = 235 \frac{N}{mm^2}$	$F_{u} = 360 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Nut	, mm	nm	mm	mm
Steel grade 8	$F_{y} = 640 \frac{N}{mm^2}$	$F_{u} = 800 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$

Instruction For Use:

Simplified, not attached to the packaging

Possible loading cases		
Standard		

Design criteria used for loading capacity

Methodology:

• Finite element analysis

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:

Possible loading cases		
Standard		

Loading case: Standard	Combinations covered by loading case
BOM: 1x HHK HHK 41 M10X40 312371 HHK 41 M10X60 312373 HHK 41 M10X80 312374 HHK 41 M10X100 312375 HHK 41 M10X150 312377	Threaded bolt connection into a channel using simple channel nut, large washer and nut

Design loading capacity - 3D	1/2
Method	
Vad stevryth Design load Capacity linit 1.5 Linis load Action Presidence	
Limiting components of capacity evaluated	in following tables:
1. T-bolt	

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Standard		

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Washer and nut

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				4.20	4.20
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm

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Designation	Item number
MQK-L-21/200	2141924
MQK-L-21/300	2141925
MQK-L-21/450	2141926
MQK-L-21/450	2141926

Corrosion protection:

Sendzimir galvanized

Weight:

MQK-L-21/200 - 437g MQK-L-21/300 - 581g MQK-L-21/450 - 797g

Submittal text:

L-shape bent installation bracket with channel section 41x21x2mm. Two anchor holes 16x11mm on the short side and elongated holes with step 50mm on the long side. Direct fixation with anchors to base material or to other channels with two MQM-M10 wing nuts and M10x20 screws. Usage with open side up or down.

Material properties:

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus	
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$	

Instruction For Use:

Simplified, not attached to the packaging

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Boundary conditions - Terms of common cooperation / Legal disclaimer and guidelines as defined at the beginning of this book need to be mandatorily respected. 63

Possible loading cases			
Bracket only Fixed to the wall Fixed to the with HST3 - M10 with HUS3		Fixed to the wall with HUS3 - H8	Fixed on channel

Design criteria used for loading capacity

Methodology:

- Analytic calculation
- · Hardware tests

Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	03.2012
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	09.2010
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	06.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Mathcad 15.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:

L = see designation MQK-L21/L

Possible loading cases			
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
	Jan and Jan an		

Loading case: Bracket only	Combinations covered by loading case
BOM: 1x MQK-L-21 MQK-L-21/200 2141924 MQK-L-21/300 2141925 MQK-L-21/450 2141926	Bracket ready to use

Design loading capacity - 3D	1/2
Method	
Veld storugh Capacity limit Design load Design load 1.5 Live load Action Peendance	
Limiting components of capacity evaluated	in following tables:
1. Steel part of the bracket	

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Design loading capacity - 3D

2/2

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Steel part of the bracket

y x
v

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04
Interaction:					

 $\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{y.Ed}}{F_{y.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$

Bracket only Fixed to the wall with HST3 - M10 Fixed to the wall with HUS3 - H8 Fixed on channel Image: Ima	Possible loading cases				
	Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel	
		A Contraction of the second se	T.		

Loading case: Fixed to the wall with HST3 - M10	Combinations covered by loading case	
BOM: 1x MQK-L-21 MQK-L-21/200 2141924 MQK-L-21/300 2141925 MQK-L-21/450 2141926 2x HST3 M10x90 30/10 stud anchor 2105712 2x MQZ-E21 plastic end cap 370598	Bracket fixed to concrete (B20/25) wall with two HST3 M10 anchors	

Design loading capacity - 3D)		1/3
Method			
Veld strength Design load Capacity Init Capacity Init Capacity Init Live load Action Resistance			
Limiting components of capa	acity evaluated	in following ta	ibles:
1. Steel part of the bracket	2. Anchors		3. Local checks (bearing, friction)

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Design loading capacity - 3D

2/3

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04
nteraction: $\frac{F_{x.Ed}}{F_{x.Ed}} + \frac{F_{y.Ed}}{F_{x.Ed}} + \frac{F_{x.Ed}}{M_{x.Ed}} + \frac{M_{y.Ed}}{M_{x.Ed}} + \frac{M_{z.Ed}}{M_{x.Ed}} \le 1$					

2. Anchors

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.50	9.00	10.00	10.00	16.00	16.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
90.00	90.00	48.00	45.00	11.75	11.75

Note: For load cases Fy and Mx, also the anchor in slotted hole parallel to force must be statically considered.

If slotted hole is not filled with dynamic set, additional deformation occur on connector to overcome slotted hole. Otherwise for unfilled holes refer to values shown in 3) which consider friction between washer and channel.

$$\frac{\mathsf{F}_{x.Ed}}{\mathsf{F}_{x.Rd}} + \frac{\mathsf{M}_{y.Ed}}{\mathsf{M}_{y.Rd}} + \frac{\mathsf{M}_{z.Ed}}{\mathsf{M}_{z.Rd}} = \beta_N \leq 1 \quad \frac{\mathsf{F}_{y.Ed}}{\mathsf{F}_{y.Rd}} + \frac{\mathsf{F}_{z.Ed}}{\mathsf{F}_{z.Rd}} + \frac{\mathsf{M}_{x.Ed}}{\mathsf{M}_{x.Rd}} = \beta_V \leq 1$$

$$\beta_{N} + \beta_{V} \le 1.2$$

3/3

MQK-L-21 Bracket

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

3. Local checks (bearing, friction)

+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Not decisive	Not decisive	0.57	0.57	4.32	7.92
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
2.29	2.29	Not deceive	Not decisive	Not decisive	Not decisive

Interaction:

 $\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \leq 1$

Possible loading cases				
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel	
	Jan and Jan an			

Loading case: Fixed to the wall with HUS3 - H8	Combinations covered by loading case
BOM: 1x MQK-L-21 MQK-L-21/200 2141924 MQK-L-21/300 2141925 MQK-L-21/450 2141926 2x HUS3-H 8x55 5/-/- screw anchor 2079794 2x MQZ-E21 plastic end cap 370598	Bracket fixed to concrete (B20/25) wall with two HUS3 H 8 anchors

Design loading capacity - 3D			1/3
Method			
Ved strength out Design load Capacity linit Capacity linit Capacity linit Capacity linit Capacity linit Capacity linit Capacity linit Capacity linit		in following to	blac.
1. Steel part of the bracket	2. Anchors		3. Local checks (bearing, friction)

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Design loading capacity - 3D

2/3

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Steel part of the bracket

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04
Interaction: $\frac{F_{x.Ed}}{F_{x.Ed}} + \frac{F_{y.Ec}}{F_{x.Ed}}$	$\frac{d}{d} + \frac{F_{z.Ed}}{F_{z.Ed}} + \frac{N}{N}$	$\frac{M_{x.Ed}}{M_{x.Ed}} + \frac{M_{y.Ed}}{M_{x.Ed}}$	$+\frac{M_{z.Ed}}{M_{z.Ed}} \le 1$		

2. Anchors

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00	7.50	4.40	4.40	8.30	8.30
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
40.00	40.00	29.00	28.00	8.00	8.00

Embedment depth 60mm , concrete slab (base material) min. thickness 120mm, concrete quality >C20/25

Note: For load cases Fy and Mx, also the anchor in slotted hole parallel to force must be statically considered.

If slotted hole is not filled with dynamic set, additional deformation occur on connector to overcome slotted hole. Otherwise for unfilled holes refer to values shown in 3) which consider friction between

 $\frac{F_{x,Ed}}{F_{x,Rd}} + \frac{M_{y,Ed}}{M_{y,Rd}} + \frac{M_{z,Ed}}{M_{z,Rd}} = \beta_N \leq 1 - \frac{F_{y,Ed}}{F_{y,Rd}} + \frac{F_{z,Ed}}{F_{z,Rd}} + \frac{M_{x,Ed}}{M_{x,Rd}} = \beta_V \leq 1$

 $\beta_{N} + \beta_{V} \le 1.2$

3/3

MQK-L-21 Bracket

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

3. Local checks (bearing, friction)

+Fx,Rd	-Fx,Rd	+Fy,Rd	-Fy,Rd	+Fz,Rd	-Fz,Rd
[kN]	[kN]	[kN]	[kN]	[kN]	[kN]
Not decisive	Not decisive	0.57	0.57	4.32	7.92
+Mx,Rd	-Mx,Rd	+My,Rd	-My,Rd	+Mz,Rd	-Mz,Rd
[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]	[kNcm]
2.29	2.29	Not deceive	Not decisive	Not decisive	Not decisive

Interaction:

 $\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \leq 1$


MQK-L-21 Bracket

Possible loading cases					
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel		
	Jos mark				

Loading case: Fixed on channel		Combinations covered by loading case
BOM: 1x MQK-L-21 MQK-L-21/200 MQK-L-21/300 MQK-L-21/450 2x MQM-M10 wing nut 2x M10x20 hexagon head screw 2x MQZ-E21 plastic end cap	2141924 2141925 2141926 369626 216453 370598	Bracket fixed to MQ System channel



Design loading capacity - 3D			1/3
Method			
Ved strength Design load Design load apparty limit Design load apparty limit Live load apparty limit Acton Resistance			
Limiting components of capa	acity evaluated	in following ta	bles:
1. Steel part of the bracket	2. Wing nuts in the ch	nannel	3. Local checks (bearing, friction)



MQK-L-21 Bracket

Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures



Design loading capacity - 3D

2/3

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Steel part of the bracket



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04
$ \begin{array}{l} \begin{array}{l} \begin{array}{l} \begin{array}{l} \begin{array}{l} \hline F_{x.Ed} \\ \hline F_{x.Rd} \end{array} + \displaystyle \frac{F_{y.Ed}}{F_{y.Rd}} + \displaystyle \frac{F_{z.Ed}}{F_{z.Rd}} + \displaystyle \frac{M_{x.Ed}}{M_{x.Rd}} + \displaystyle \frac{M_{y.Ed}}{M_{y.Rd}} + \displaystyle \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1 \end{array} \end{array} \end{array} $					

2.1. Wing nuts in the channel



in MQ/2mm thick wall channel as base

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
4.35	12.64	0.69	0.69	7.00	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
6.25	6.25	46.11	44.01	11.13	11.13

Interaction:

Pull-out

Transverse shear (perpendicular to channel)

 $\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \leq 1$

 $\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \leq 1$

Note: For load cases Fy and Mx, also the wing nut in the slotted hole parallel to force must be statically considered. Therefore additional deformation occur on connector to overcome slotted hole. Otherwise refer to values shown in 3) which consider friction between washer and channel.



3/3

MQK-L-21 Bracket

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

2.2. Wing nuts in the channel



n MQ/1.5mm thick wall channel as base					
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
2.17	7.26	0.47	0.47	7.00	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
4.25	4.25	23.43	22.38	5.57	5.57
Interaction:					
Pull-out Transverse shear (nemendicular to channel)					

Note: For load cases Fy and Mx, also the wing nut in the slotted hole parallel to force must be statically considered. Therefore additional deformation occur on connector to overcome slotted hole. Otherwise refer to values shown in 3) which consider friction between washer and channel.

 $\frac{\mathsf{F}_{x.\mathsf{Ed}}}{\mathsf{F}_{x.\mathsf{Rd}}} + \frac{\mathsf{M}_{y.\mathsf{Ed}}}{\mathsf{M}_{y.\mathsf{Rd}}} + \frac{\mathsf{M}_{z.\mathsf{Ed}}}{\mathsf{M}_{z.\mathsf{Rd}}} \leq 1 \qquad \qquad \frac{\mathsf{F}_{y.\mathsf{Ed}}}{\mathsf{F}_{y.\mathsf{Rd}}} + \frac{\mathsf{M}_{x.\mathsf{Ed}}}{\mathsf{M}_{x.\mathsf{Rd}}} \leq 1$

3. Local checks (bearing, friction)



-Fz,Rd [kN]	+Fz,Rd [kN]	-Fy,Rd [kN]	+Fy,Rd [kN]	-Fx,Rd [kN]	+Fx,Rd [kN]
7.92	4.32	0.57	0.57	Not decisive	Not decisive
-Mz,Rd [kNcm]	+Mz,Rd [kNcm]	-My,Rd [kNcm]	+My,Rd [kNcm]	-Mx,Rd [kNcm]	+Mx,Rd [kNcm]
Not decisive	Not decisive	Not decisive	Not deceive	2.29	2.29
2.29 2.29 140t decisive decisive decisive decisive					

 $\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \leq 1$



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HUS3-H8 Direct fixation to concrete

Designation	Item number				
Channel					
MQ-21 2m	2148545				
MQ-21 3m	2148544				
MQ-21 6m	2148543				
MQ-41-L 2m	2141966				
MQ-41-L 3m	2141965				
MQ-41-L 6m	2141964				
Screw anchor					
HUS3 - H8x55 5/-/- screw anchor	2079794				
Washer for loading case HUS-H8&W in channel slot					
A 10.5/20 washer	282851				
Corrosion protection:Channelsendzimir galvanized average 10µmScrew anchorzinc plated min 5µm					
Weight: Channel MQ-21 1430 g/m Channel MQ-41-L 1600 g/m Anchor 32.9 g					



material properties:				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Channel				
Steel S250GD - DIN EN 10346	$F_y = 290 \frac{N}{mm^2}$	$F_{u} = 330 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
Anchor				
Carbon steel	$F_{y} = 695 \frac{N}{mm^{2}}$	$F_{u} = 810 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = $80769 \frac{N}{mm^2}$

Instruction For Use:

Simplified, not attached to the packaging Loading case "HUS3-H8 in anchor hole,,



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Loading case "HUS3-H8&W (and M10 washer) in

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Design criteria used for loading capacity

Methodology:

· Finite element analysis

• Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:





Possible loadi	ng cases		
HUS3-H8 in rounded ,,anchor hole,,.	HUS3-H8&W in channel (oblong) slot		
Loading case: H	US3-H8 in rounded	I "anchor hole,,.	Combinations covered by loading case
BOM: Channel MQ-21 2m MQ-21 3m MQ-21 6m MQ-41-L 2m MQ-41-L 3m MQ-41-L 6m Screw anchor HUS3 - H8x55 5/-/-		2148545 2148544 2148543 2141966 2141965 2141964 2079794	Direct fixation of channel on concrete fixed by HUS3-H8 through ,,Anchor hole,, in the channel

Design loading capacity - 3D	1/2
Method	
Vedd stergth Copacity find Copacity find 1.5 Live tood Action Residence	
Limiting components of capacity evaluated	in following tables:
1. Channel local pull through	



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures



Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Channel local pull through



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
					4.40
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm, min concrete quality C20/25, no edge influence, no other anchor distance influence, min concrete slab (base material) thickness 120mm

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A 10.5/20 washer

HUS3-H8 Direct fixation to concrete



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Design loading capacity - 3D	1/2
Method	
Ved strength Corporation Corporation International Corporational C	
Limiting components of capacity evaluated	in following tables:
1. Channel local pull through	



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures



Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Channel local pull through	+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
						4.05
	+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
	Condition: va Cź m	alid for chann 20/25, no ed in concrete s	el edge dista ge influence, lab (base ma	ance ≥ 100mr no other and aterial) thickn	m, min concru chor distance ess 120mm	ete quality influence,

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MQ System Light & Project

HST3-M10 Direct fixation to concrete

Designation	Item number
Channel	
MQ-21 2m	2148545
MQ-21 3m	2148544
MQ-21 6m	2148543
MQ-41-L 2m	2141966
MQ-41-L 3m	2141965
MQ-41-L 6m	2141964
Stud anchor	
HST3 M10x90 30/10 stud anchor	2105712
Corrosion protection:	
Channel sendzimir galvanized average 10µm	
Screw anchor zinc plated min 5µm	
Weight:	
Channel MQ-21 1430 g/m	
Channel MQ-41-L 1600 g/m	
Anchor 58.0 g	



Material properties:				
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Channel Steel S250GD - DIN EN 10346 Anchor	$F_y = 290 \frac{N}{mm^2}$	$F_u = 330 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$
Carbon steel	$F_{y} = 640 \frac{N}{mm^{2}}$	$F_{u} = 800 \frac{N}{mm^{2}}$	$E = 210000 \frac{N}{mm^2}$	G = 80769 $\frac{N}{mm^2}$

Instruction For Use:

Simplified, not attached to the packaging







Design criteria used for loading capacity

Methodology:

· Finite element analysis

• Standards and codes:

•	EN 1990	Basics of structural design	03.2003
•	EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General	
		actions – densities, self-weight, imposed loads for buildings	09.2011
•	EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General	
		rules and rules for buildings	03.2012
•	EN 1993-1-3	Eurocode 3: Design of steel structures – Part 1-3: General	
		rules- Supplementary rules for cold-formed members and	
		sheeting	03.2012
•	EN 1993-1-5	Eurocode 3: Design of steel structures – Part 1-5: Plated	
		structural elements	03.2012
•	EN 1993-1-8	Eurocode 3: Design of steel structures – Part 1-8: Design of	
		joints	03.2012
•	EN 10025-2	Hot rolled products of structural steels- Part 2: technical	
		delivery conditions for non-alloy structural steels	02.2005
•	RAL-GZ 655	Pipe Supports	04.2008

Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

Simplified drawing:





Possible loadi	ng cases		
HST3-M10 in rounded ,,anchor hole,,.	HST3-M10 in channel (oblong) slot		
Loading case: St	tandard		Combinations covered by loading case
BOM: Channel Channel MQ-21 2m MQ-21 3m MQ-21 6m MQ-41-L 2m MQ-41-L 3m MQ-41-L 6m Screw anchor HST3 M10x90 30/10		2148545 2148544 2148543 2141966 2141965 2141964 2105712	Direct fixation of channel on concrete fixed by HST3-M10 through ,,Anchor hole,, in the channel



Design loading capacity - 3D		1/2
Method		
Ved strength Capacity find Cenign tool 1.5 Live tool Action Residence		
Limiting components of capacity evaluated	in following tables:	
1. Channel local pull through		



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low ($< -10^{\circ}$ C), no high ($> +100^{\circ}$ C) temperatures

Possible loading cases		
HST3-M10 in rounded ,,anchor hole,,.	HST3-M10 in channel (oblong) slot	

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Channel local pull through



+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
					4.60
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm, min concrete quality C20/25, no edge influence, no other anchor distance influence, min concrete slab (base material) thickness 120mm

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HST3-M10 Direct fixation to concrete Possible loading cases HST3-M10 HST3-M10 in rounded in channel "anchor hole". (oblong) slot Loading case: Standard Combinations covered by loading case BOM: Direct fixation of channel on concrete fixed Channel by HST3-M10 through (oblong) slot in the channel Channel MQ-21 2m 2148545 MQ-21 3m 2148544 MQ-21 6m 2148543 MQ-41-L 2m 2141966 MQ-41-L 3m 2141965 MQ-41-L 6m 2141964 Screw anchor HST3 M10x90 30/10 2105712

Recommended loading capacity - simplified for most common applications					
Method Vield strength Permissible stress Characteristic toad Self weight Live loads Action Resistance	y ± Fx, rec. ± Fy, rec. ± Fz, rec. [kN] [kN] 2.89 These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.				

Design loading capacity - 3D	1/2
Method	
Ved shringh Design led Cesign load 1.5 A-ton Persistance	
Limiting components of capacity evaluated	in following tables:
1. Channel local pull through	



Conditions of the loading capacity tables:

- Just for static loads
- No fatigue loads
- No low (< -10 $^{\circ}$ C), no high (> +100 $^{\circ}$ C) temperatures

Possible loadi	ng cases	
HST3-M10 in rounded ,,anchor hole,,.	HST3-M10 in channel (oblong) slot	

Design loading capacity - 3D

Summary of design loads*

NOTE: all values in interaction formulas should be used in absolute values! The values below are referred to the coordinate system shown in the drawing.

1. Channel local pull through						
	+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
						4.05
	+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
	Condition: va Ca m	alid for chann 20/25, no ed in concrete s	iel edge dista ge influence, ilab (base ma	ance ≥ 100m no other and aterial) thickn	m, min concr chor distance ess 120mm	ete quality e influence,

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