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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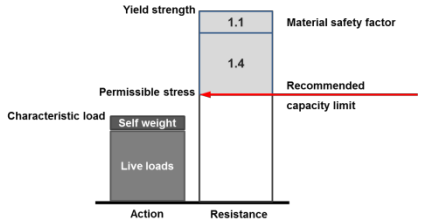
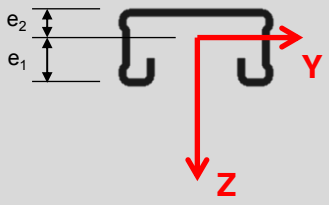
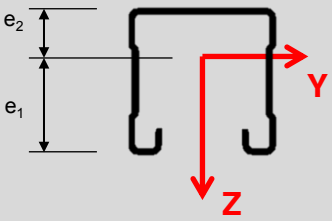
MQ System L&P - Channels

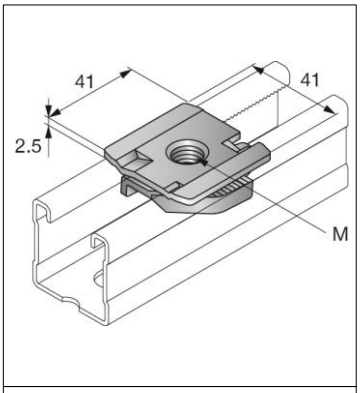
Designation	Item number
MQ-21 2m	**2148545**
MQ-21 3m	**2148544**
MQ-21 6m	**2148543**
MQ-41-L 2m	**2141966**
MQ-41-L 3m	**2141965**
MQ-41-L 6m	**2141964**



Technical data			MQ-21	MQ-41-L
For girder MI / cross section including torsion				
Cross-sectional area	A	[mm²]	182.12	199.57
Channel weight		[kg/m]	1.43	1.6
Wall thickness		[mm]	2.0	1.5
Material				
yield strength	$f_{y,k}$	[N/mm²]	290	290
permissible stress*	σ_{rec}	[N/mm²]	188.3	188.3
E-module		[N/mm²]	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	I_y	[cm⁴]	0.99	4.48
Section modulus A	W_{y1}	[cm³]	0.89	2.09
Section modulus B	W_{y2}	[cm³]	1.05	2.25
Radius of gyration	i_y	[cm]	0.74	1.50
Permissible moment	M_y	[Nm]	168	394
Cross-section values Z-axis				
moment of inertia	I_z	[cm⁴]	4.63	5.90
Section modulus	W_z	[cm³]	2.24	2.86
Radius of gyration	i_z	[cm]	1.59	1.72
Data to the torsion				
torsional moment of inertia	It	[mm⁴]	151.17	112.13
torsional section modulus	W_t	[mm³]	75.59	75.76

MQA-S Saddle nut

Designation	Item number
MQA-S M8	**2141906**
MQA-S M10	**2141907**



Package content

Corrosion protection:
Electro galvanized

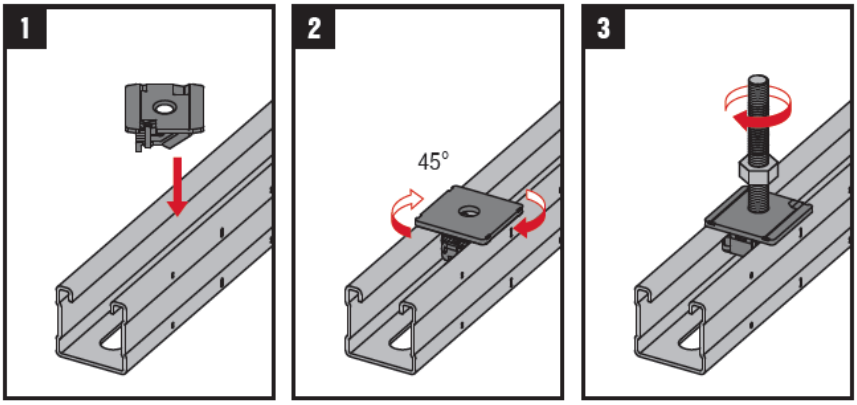
Weight:
M 8 - 53g
M10 - 53g

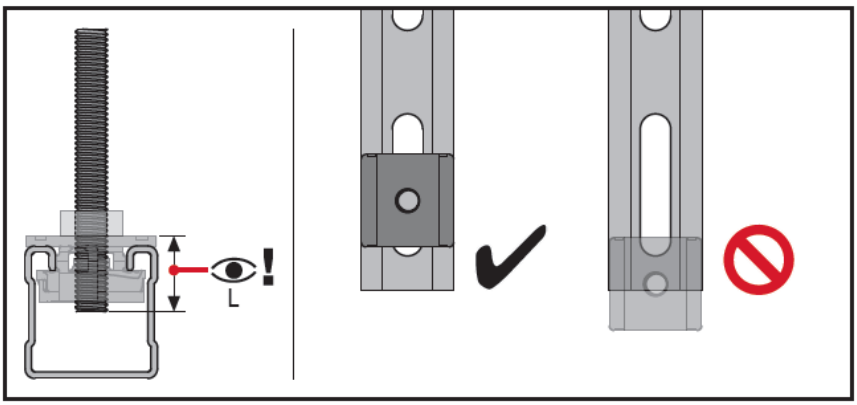
Submittal text:
Part, combining channel nut with metric internal thread M8 or M10 and channel plate. Installation by mounting to open side of channel and rotation to 45°. Fixation by screwing in threaded rod ant tightening a counter nut to pre-defined installation torque. Typically used for fixing pipe-rings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

Material properties:

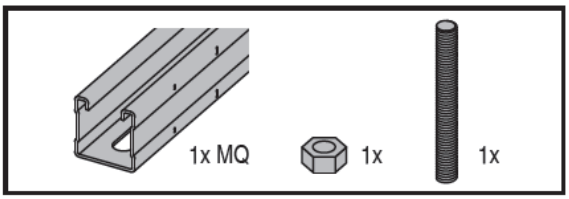
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:

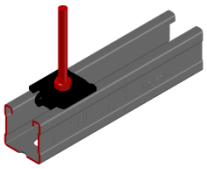




	SW	Tinst	Lmin
M8	13mm	9 Nm (7ft-lb)	18mm
M10	17mm	18 Nm (14ft-lb)	18mm



MQA-S Saddle nut

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis

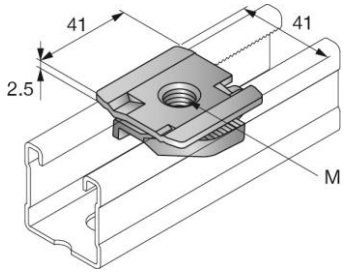
Standards and codes:

• 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

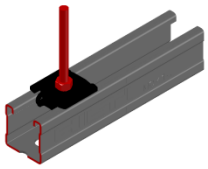
Software:
- Ansys 16.0
- Microsoft Excel

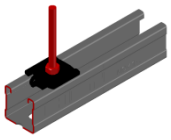
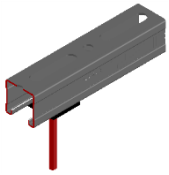
Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:



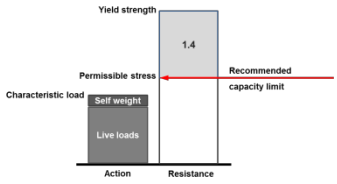
MQA-S Saddle nut

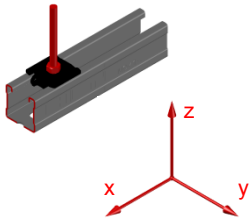
Standard		
		

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

Recommended loading capacity - simplified for most common applications

Method



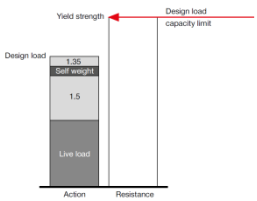


	±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
M8	1.50		3.00
M10	2.14		3.00

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

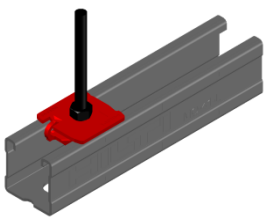
Design loading capacity - 3D 1/2

Method



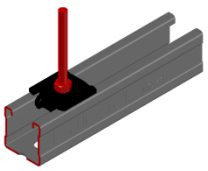
Limiting components of capacity evaluated in following tables:

1. Saddle nut



MQA-S Saddle nut

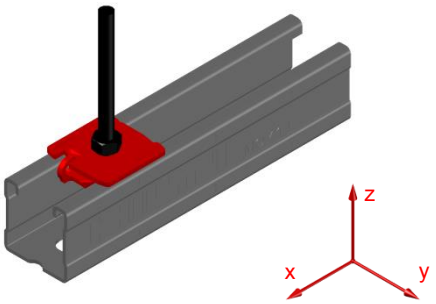
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Standard		
		

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.

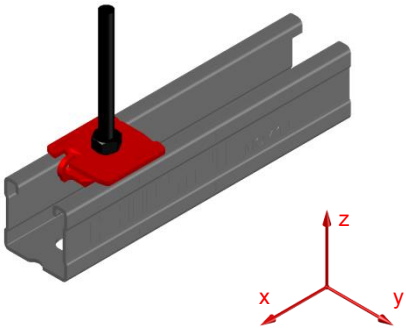
1. MQA-S-M8



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

valid for edge distance ≥ 100mm

2. MQA-S-M10

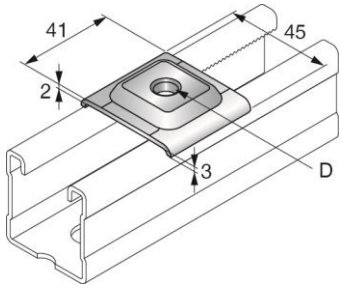


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00	3.00			4.2	
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

valid for edge distance ≥ 100mm

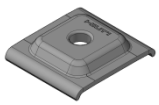
MQZ-P Bored plate

Designation	Item number
MQZ-P9	**2141908**
MQZ-P11	**2141909**



MQZ-P 9 - D= 9.5 mm
MQZ-P11 - D=11.5 mm

Package content



Corrosion protection:
Electro galvanized

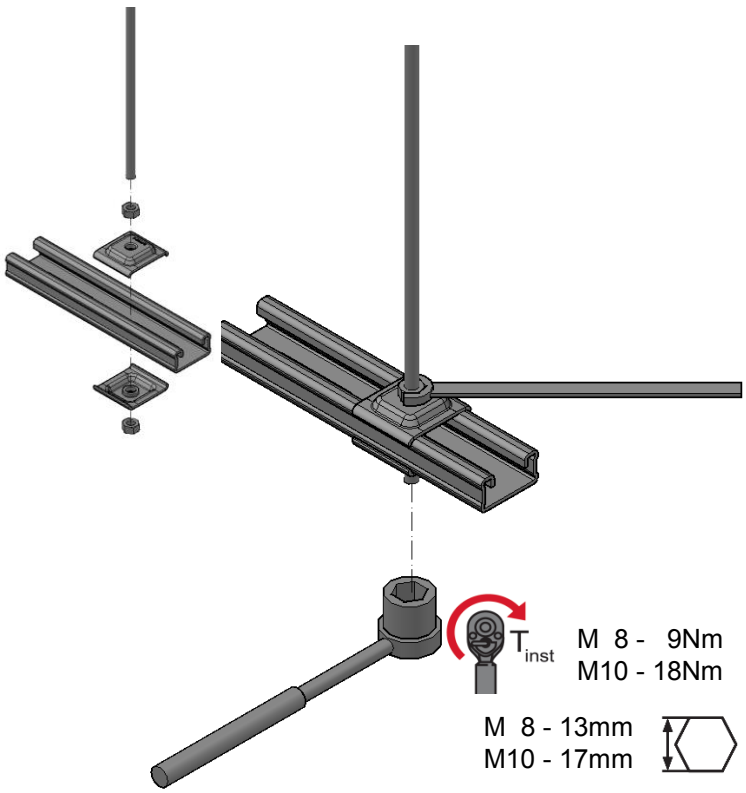
Weight:
MQZ-P9 - 35g
MQZ-P11 - 35g

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.

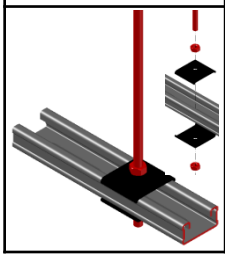
Material properties:

Material	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 ,,Both sides,,



MQZ-P Bored plate

Possible loading cases		
Both sides		
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis

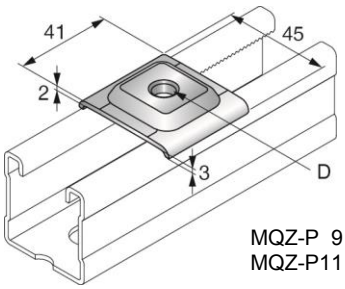
Standards and codes:

• 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

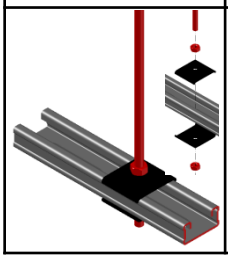
Environmental conditions:
- static loads
- no fatigue loads

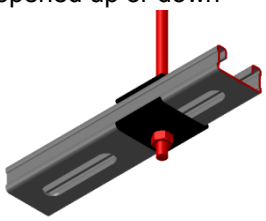
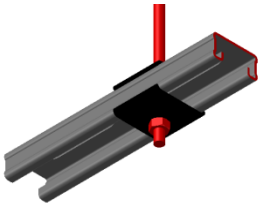
Simplified drawing:



MQZ-P 9 - D= 9.5 mm
MQZ-P11 - D=11.5 mm

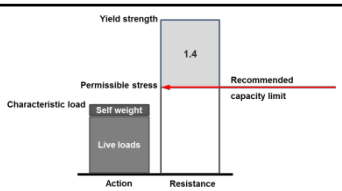
MQZ-P Bored plate

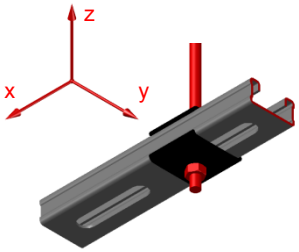
Possible loading cases		
Both sides		
		

Loading case: Both sides	Combinations covered by loading case
BOM: For fixation on M8 threaded rod **2x MQZ-P9 bored plate** **2141908** **2x M8 nut** **216465** **1x AM8x1000 t-rod** **339793 or various** For fixation on M10 threaded rod **2x MQZ-P11 bored plate** **2141909** **2x M10 nut** **216466** **1x AM10x1000 t-rod** **339795 or various**	Channel washer installed on all sizes of MQ channel opened up or down  

Recommended loading capacity - simplified for most common applications

Method



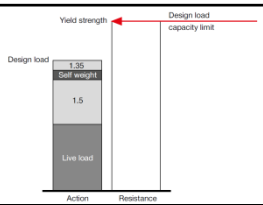


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		3.57

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

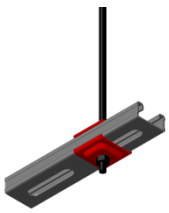
Design loading capacity - 3D 1/2

Method



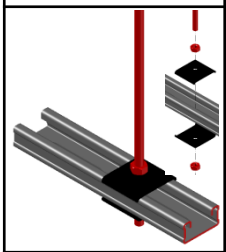
Limiting components of capacity evaluated in following tables:

1. Bored plate



MQZ-P Bored plate

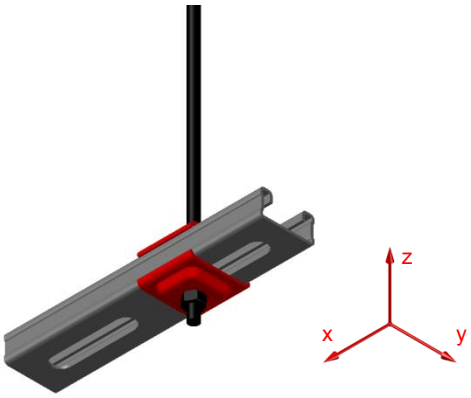
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Both sides		
		

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.

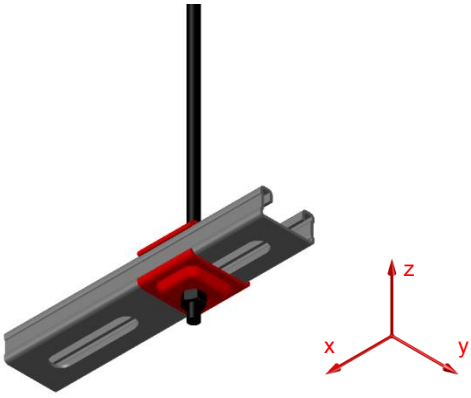
1. MQZ-P9



+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

2. MQZ-P11

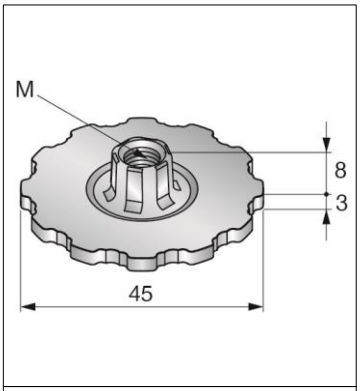


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				5.00	5.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

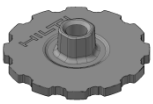
for MQ-41-L and MQ-41 channel

MQZ-TW Trapeze Wheel

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



Package content



Corrosion protection:
Electro galvanized

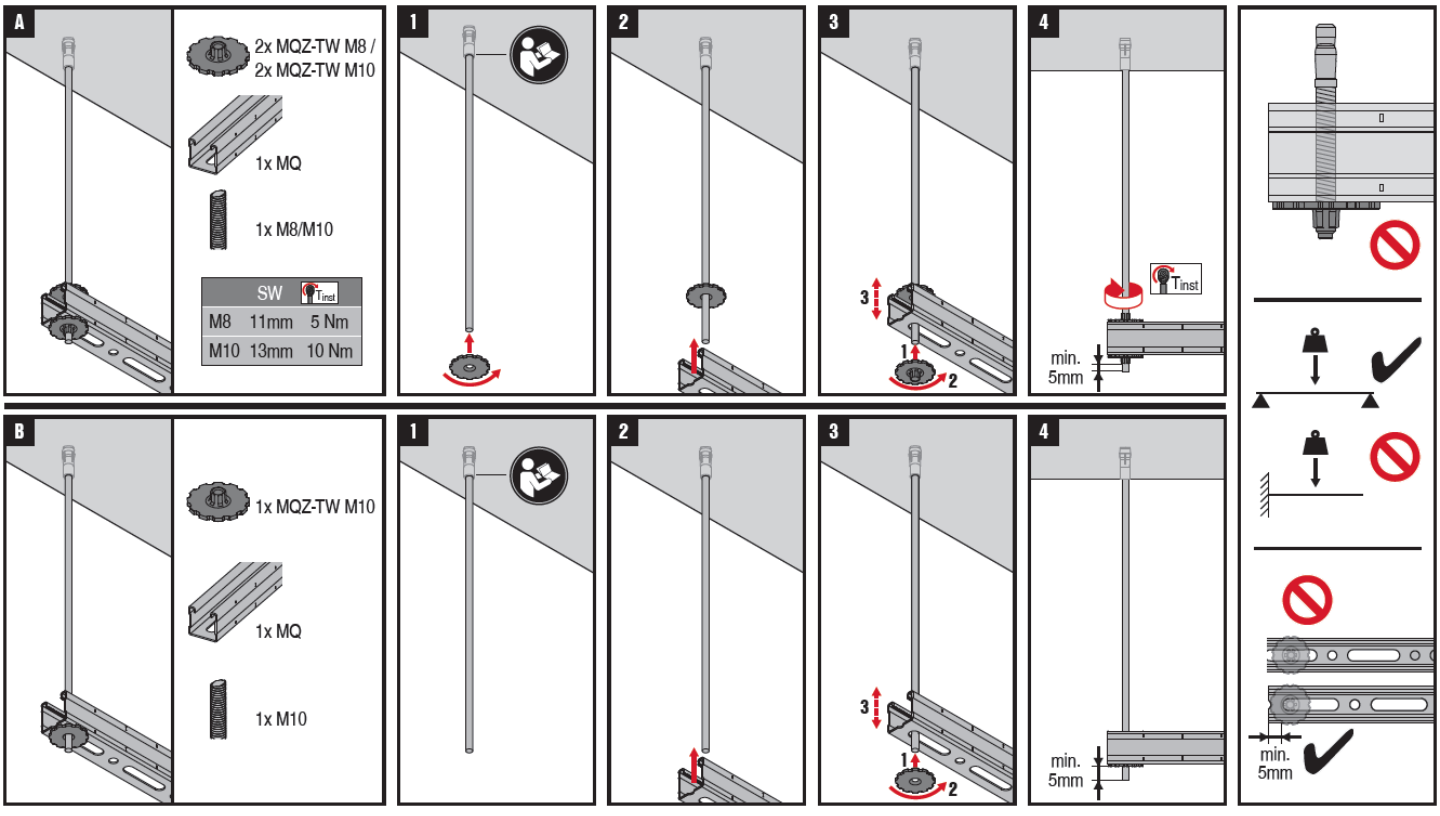
Weight:
MQZ-TW-M8 - 37g
MQZ-TW-M10 - 37g

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.

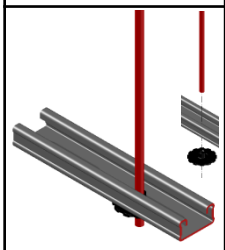
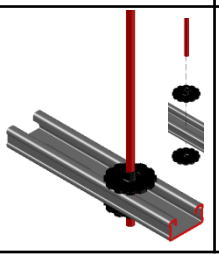
Material properties:

Material	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:



MQZ-TW Trapeze Wheel

Possible loading cases		
Bottom side	Both sides	
		

Design criteria used for loading capacity

Methodology:
- Finite element analysis

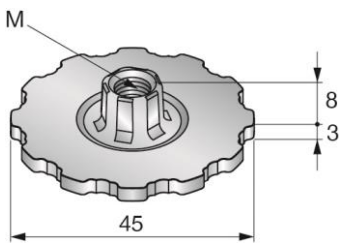
Standards and codes:

• 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

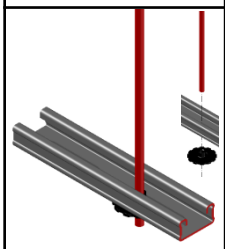
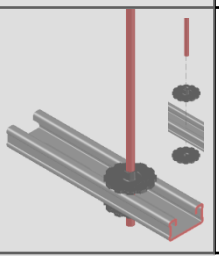
Software:
- Ansys 16.0
- Microsoft Excel

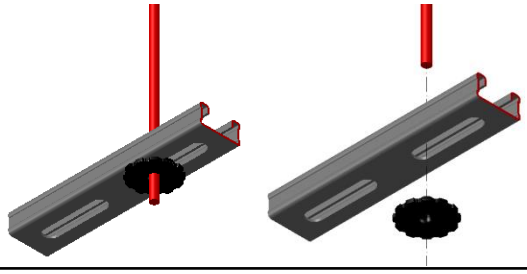
Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:



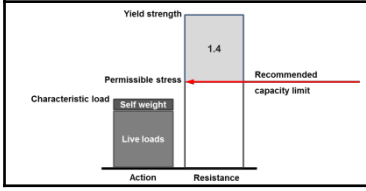
MQZ-TW Trapeze Wheel

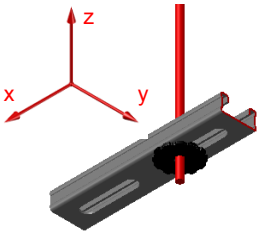
Possible loading cases		
Bottom side	Both sides	
		

Loading case: Bottom side	Combinations covered by loading case
BOM: hex-head of the TW locked in the slot 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 **1x M10 nut** **216466**	Integrated hexagon head of the TW locked in the slot of the channel - nut used for securing either TW or anchor 

Recommended loading capacity - simplified for most common applications

Method



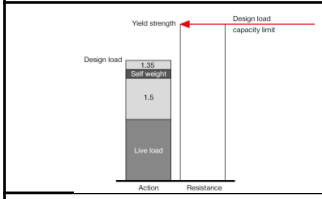


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		-3.00

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

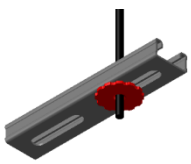
Design loading capacity - 3D 1/2

Method



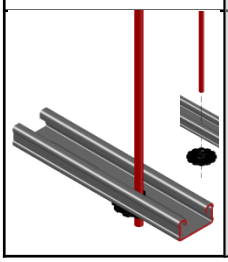
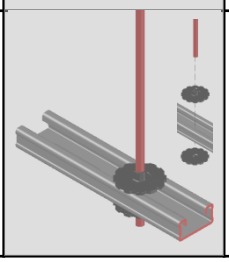
Limiting components of capacity evaluated in following tables:

1. Trapeze wheel



MQZ-TW Trapeze Wheel

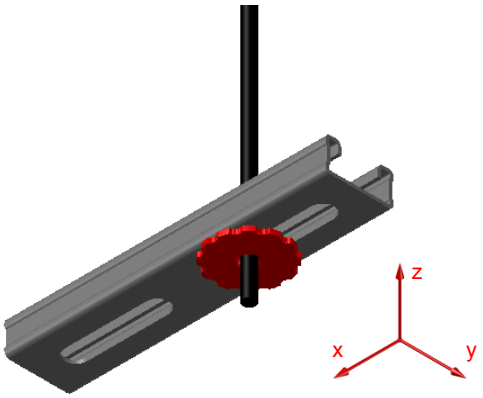
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Bottom side	Both sides	
		

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.

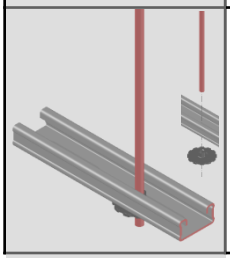
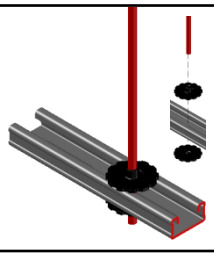
2. MQZ-TW-M10

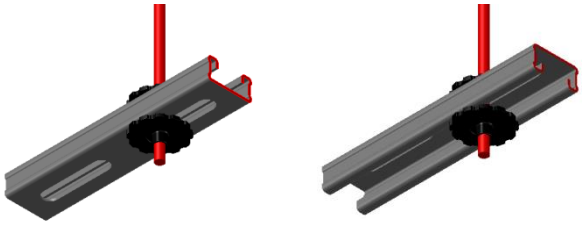


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				0.0	4.20
+Mx,Rd [kNcm]	**-Mx,Rd [kNcm]**	**+My,Rd [kNcm]**	**-My,Rd [kNcm]**	**+Mz,Rd [kNcm]**	**-Mz,Rd [kNcm]**

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

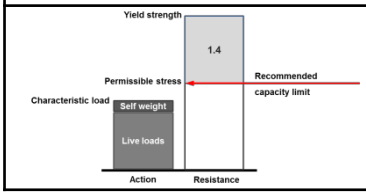
MQZ-TW Trapeze Wheel

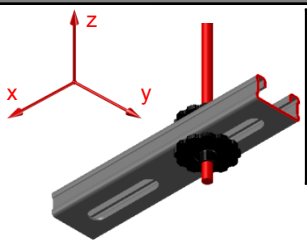
Possible loading cases		
Bottom side	Both sides	
		

Loading case: Both sides	Combinations covered by loading case
BOM: For fixation on M8 threaded rod **2x MQZ-TW-M8 trapeze wheel** **2142030** **1x AM8x1000 t-rod** **339793 or various** For fixation on M10 threaded rod **1x MQZ-TW-M10** **2142031** **1x AM10x1000 t-rod** **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



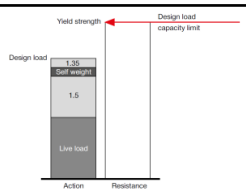


	±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
M8			2.50
M10			3.00

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

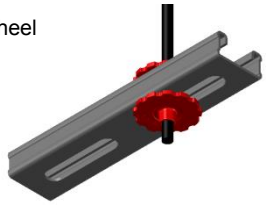
Design loading capacity - 3D 1/2

Method



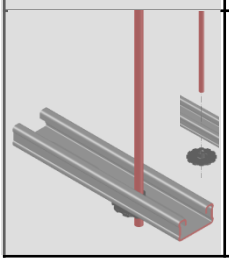
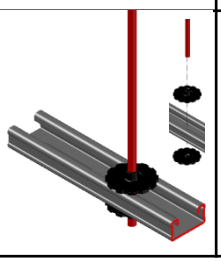
Limiting components of capacity evaluated in following tables:

1. Trapeze wheel



MQZ-TW Trapeze Wheel

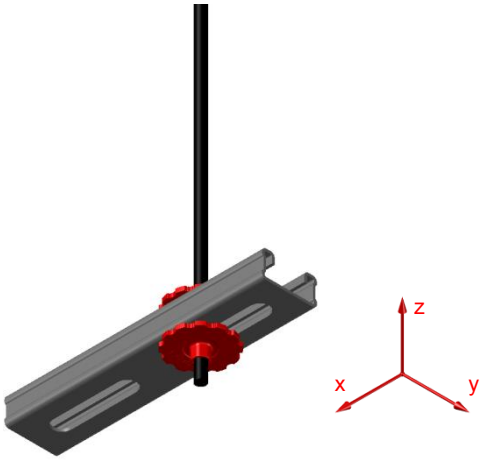
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Bottom side	Both sides	
		

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.

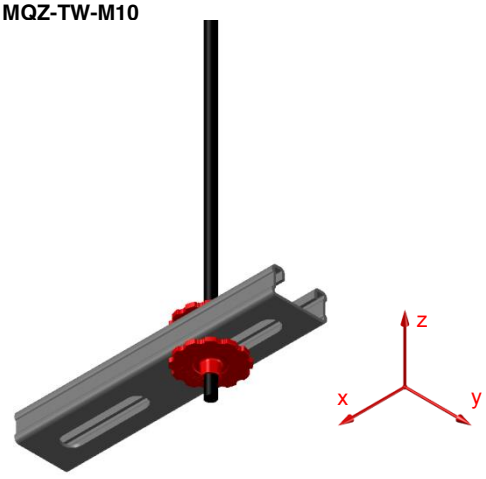
1. MQZ-TW-M8



+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

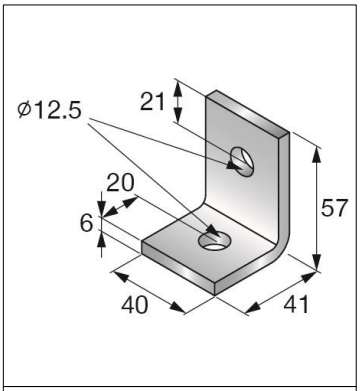


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				4.2	4.2
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

for MQ-41-L and MQ-41 channel

MQW-L-1/1 Angle

Designation	Item number
MQW-L-1/1	**2142020**



Package content

Corrosion protection:
Electro galvanized

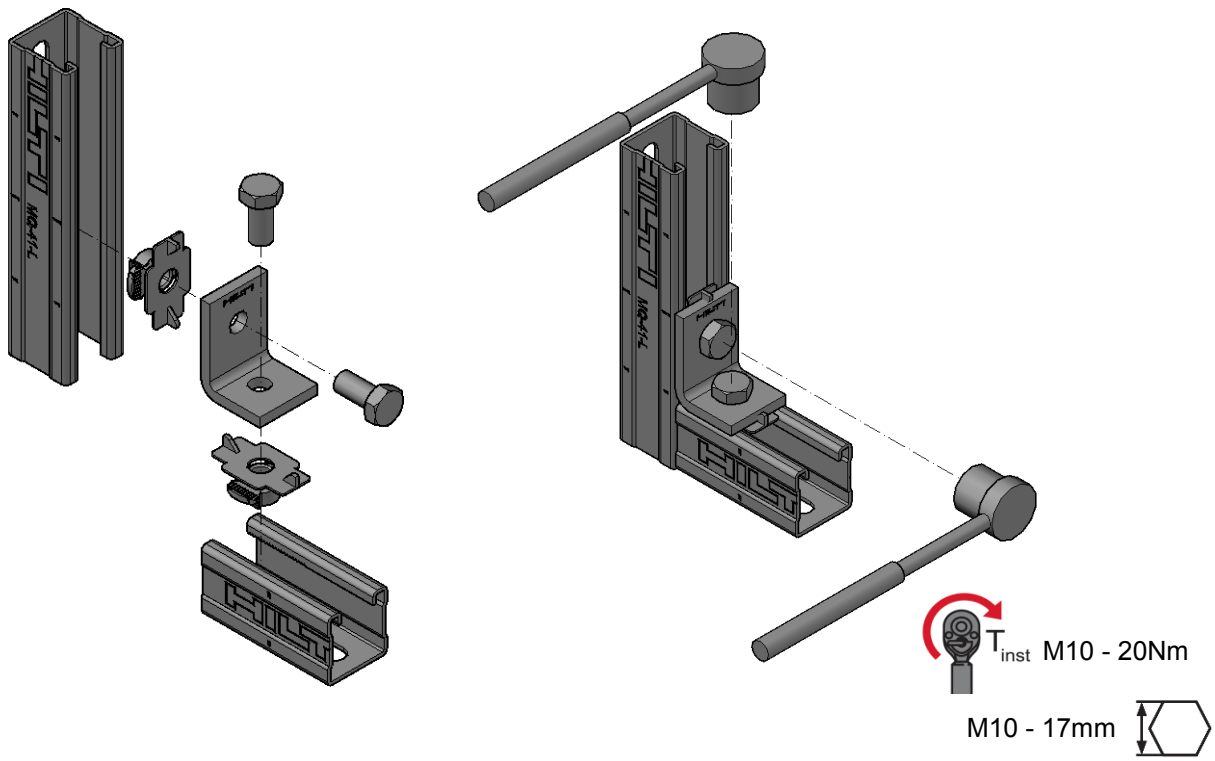
Weight:
159g

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.

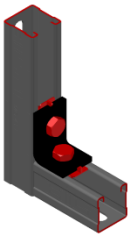
Material properties:

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

Instruction For Use:
Simplified, not attached to the packaging



MQW-L-1/1 Angle

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
Analytic calculation
Hardware tests

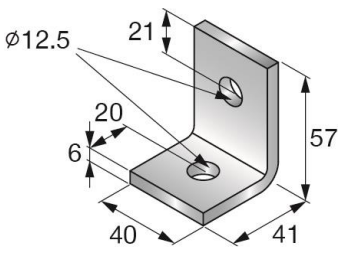
Standards and codes:

• 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

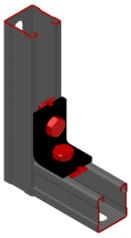
Software:
- Mathcad 15.0
- Microsoft Excel

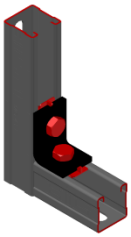
Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:



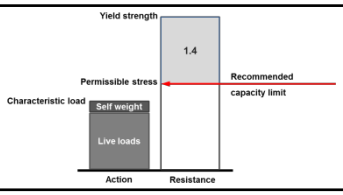
MQW-L-1/1 Angle

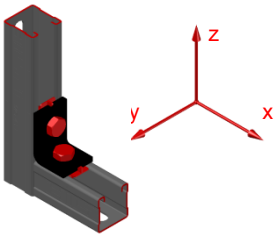
Possible loading cases		
Standard		
		

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

Recommended loading capacity - simplified for most common applications

Method



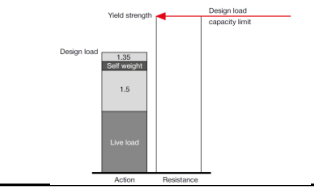


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.27	0.00	2.50

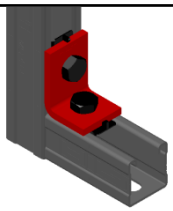
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

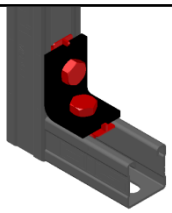
Design loading capacity - 3D 1/2

Method



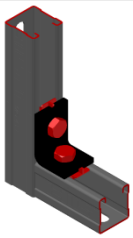
Limiting components of capacity evaluated in following tables:

1. Steel connector 

2. Wing nut 

MQW-L-1/1 Angle

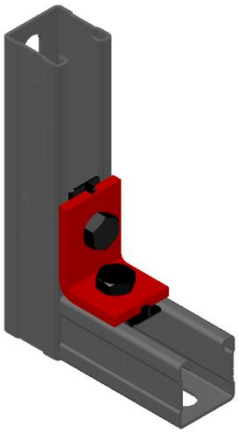
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

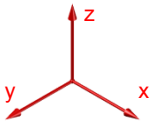
Possible loading cases		
Standard		
		

Design loading capacity - 3D 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 connector



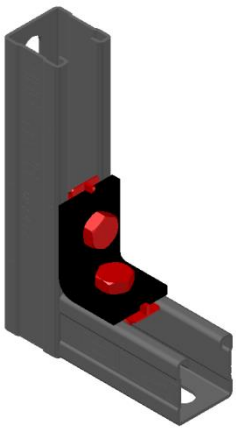


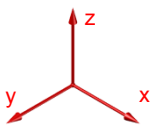
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.15	5.84	0.00	0.00	4.85	4.45
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
0.00	0.00	0.00	0.00	0.00	0.00

Interaction:

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

2. Wing nut





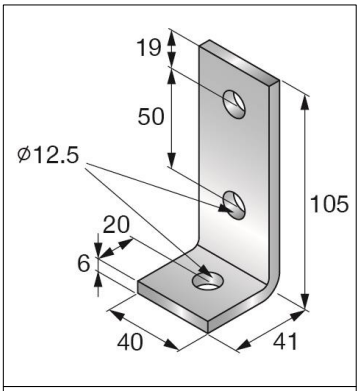
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.55	4.88	0.00	0.00	7.00	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
0.00	0.00	0.00	0.00	0.00	0.00

Interaction:

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

MQW-L-2/1 Angle

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



Package content

Corrosion protection:
Electro galvanized

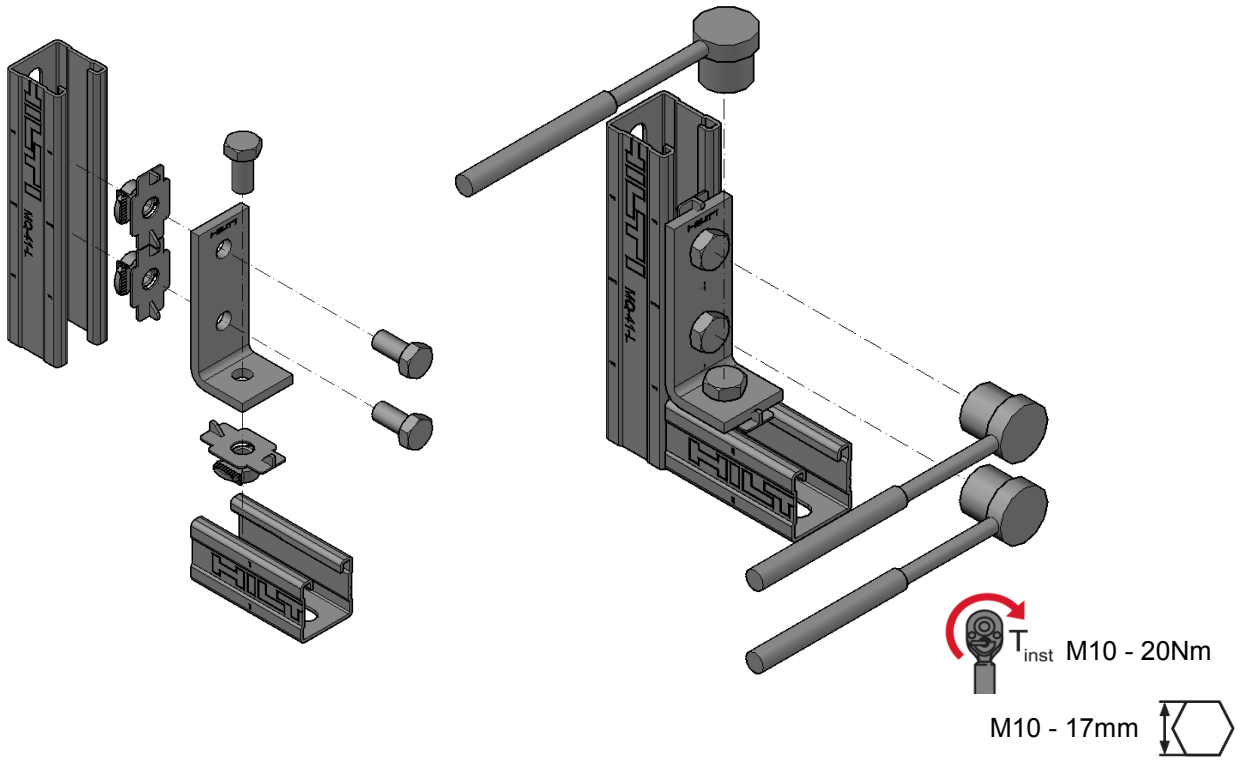
Weight:
241g

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.

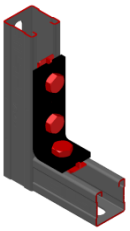
Material properties:

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - 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



MQW-L-2/1 Angle

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:
- Analytic calculation
- Hardware tests

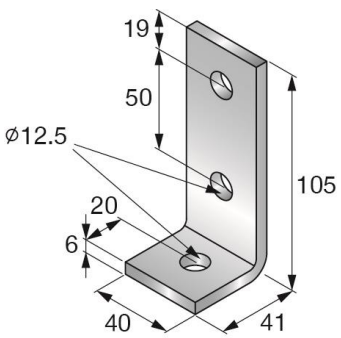
Standards and codes:

• 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

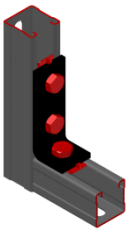
Software:
- Mathcad 15.0
- Microsoft Excel

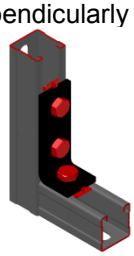
Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:



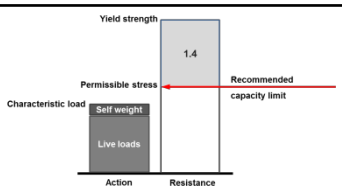
MQW-L-2/1 Angle

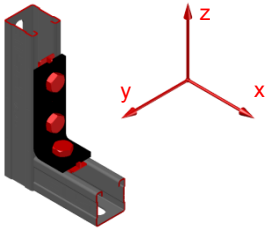
Possible loading cases		
Standard		
		

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

Recommended loading capacity - simplified for most common applications

Method



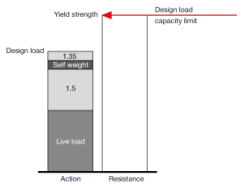


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.29	0.36	2.50

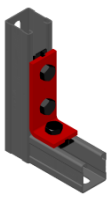
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

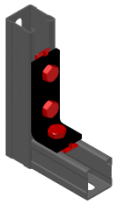
Design loading capacity - 3D 1/2

Method



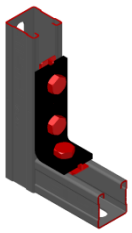
Limiting components of capacity evaluated in following tables:

1. Steel connector 

2. Wing nut 

MQW-L-2/1 Angle

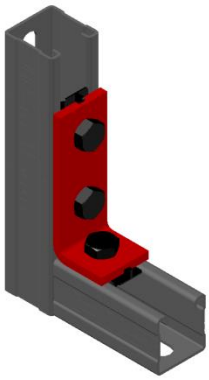
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

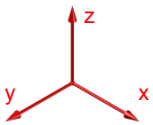
Possible loading cases		
Standard		
		

Design loading capacity - 3D 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 connector



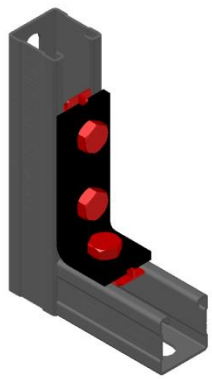


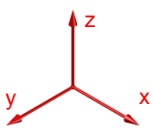
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.75	5.84	1.55	1.55	4.85	4.45
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
5.84	5.84	0.00	0.00	0.00	0.00

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

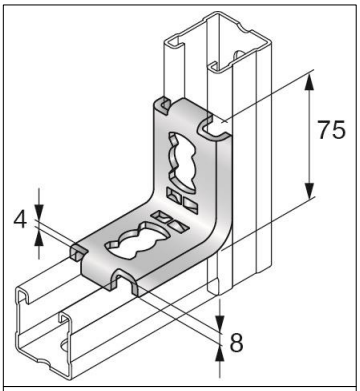
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

Shear transverse to channel

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

MQW-H2 Angle

Designation	Item number
MQW-H2	**2141929**



Package content

Corrosion protection:
Electro galvanized

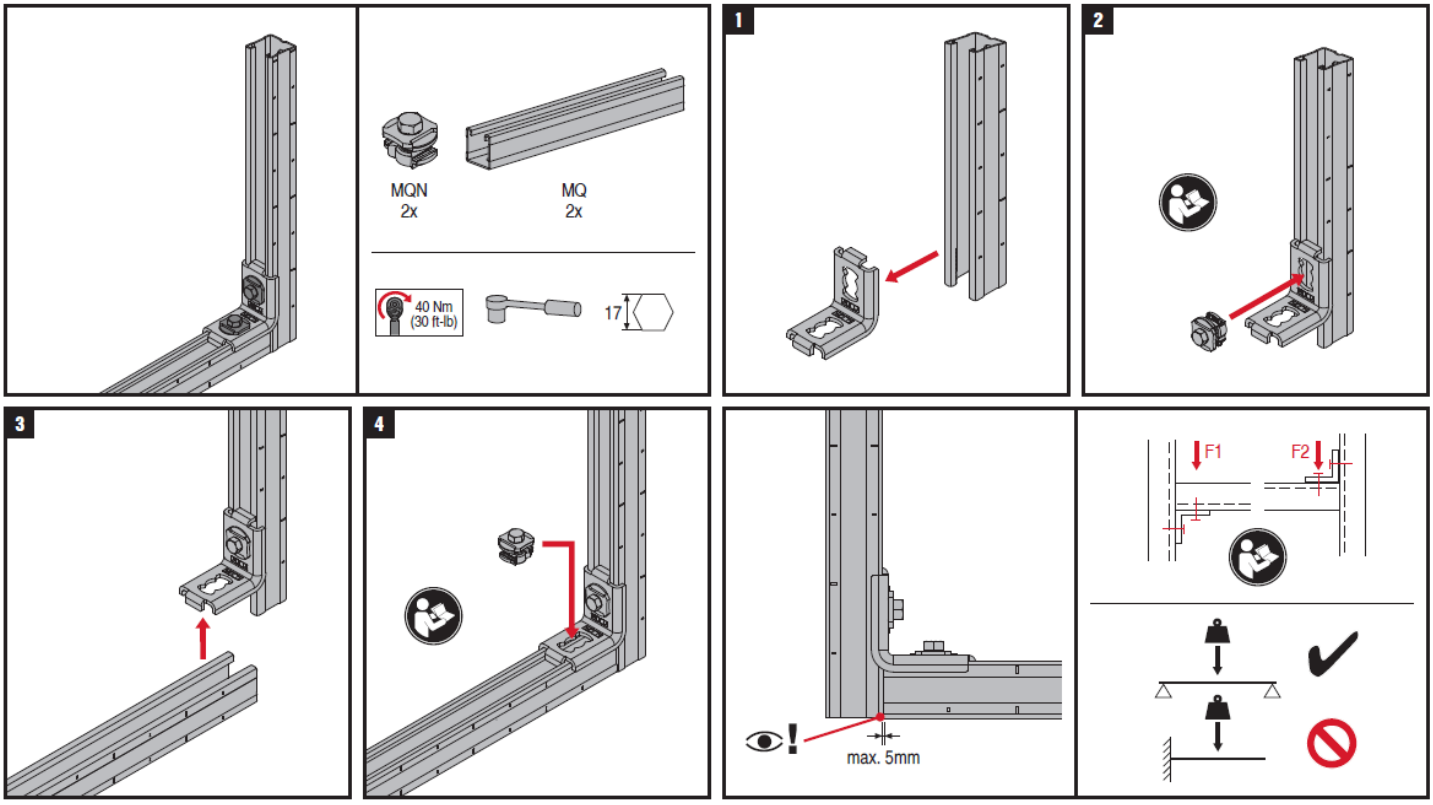
Weight:
211g

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:



MQW-H2 Angle

Possible loading cases		
Standard		
		

Design criteria used for loading capacity

Methodology:

- Finite element analysis
- Hardware tests

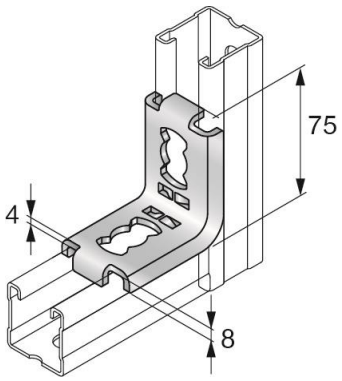
- **Standards and codes:**

• 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:



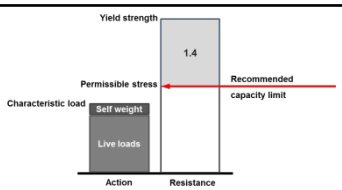
MQW-H2 Angle

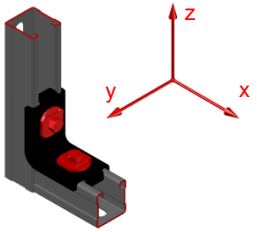
Possible loading cases		
Standard		
		

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 for most common applications

Method



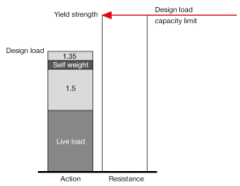


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
2.50	1.86	2.50

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



Limiting components of capacity evaluated in following tables:

1. Steel connector	2. MQN on horizontal channel (MQ-41-L)	3. MQN on vertical channel (MQ-41-L)
		

MQW-H2 Angle

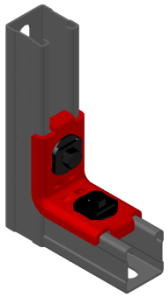
Conditions of the loading capacity tables:
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

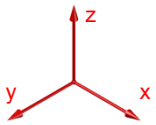
Possible loading cases		
Standard		
		

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 connector



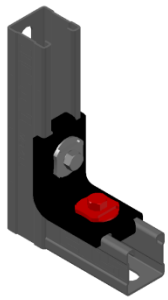


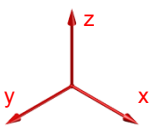
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
5.48	8.40	2.60	2.60	8.40	5.48
+Mx,Rd [kNcm]	**-Mx,Rd [kNcm]**	**+My,Rd [kNcm]**	**-My,Rd [kNcm]**	**+Mz,Rd [kNcm]**	**-Mz,Rd [kNcm]**
11.20	11.20	0.00	0.00	0.00	0.00

Interaction:

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

2. MQN on horizontal channel (MQ-41-L)

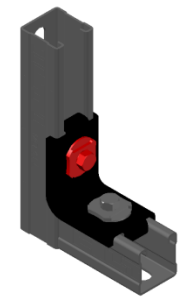


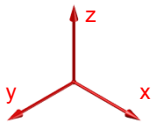


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
6.72	6.72	Not decisive	Not decisive	Not decisive	3.50
+Mx,Rd [kNcm]	**-Mx,Rd [kNcm]**	**+My,Rd [kNcm]**	**-My,Rd [kNcm]**	**+Mz,Rd [kNcm]**	**-Mz,Rd [kNcm]**
Not decisive	Not decisive	Not decisive	Not decisive	Not decisive	Not decisive

Interaction:
Interaction is not necessary

3. MQN on vertical channel (MQ-41-L)



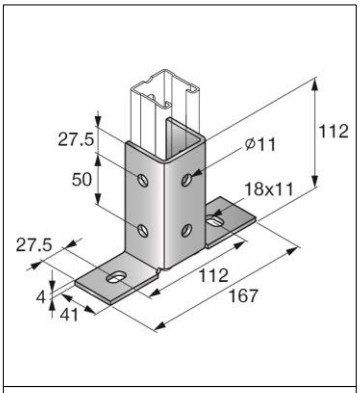


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.50	Not decisive	Not decisive	Not decisive	6.72	6.72
+Mx,Rd [kNcm]	**-Mx,Rd [kNcm]**	**+My,Rd [kNcm]**	**-My,Rd [kNcm]**	**+Mz,Rd [kNcm]**	**-Mz,Rd [kNcm]**
Not decisive	Not decisive	Not decisive	Not decisive	Not decisive	Not decisive

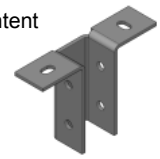
Interaction:
Interaction is not necessary

MQW-L-6/2 Rail support

Designation	Item number
MQW-L-6/2	**2141928**



Package content



Corrosion protection:
Electro galvanized

Weight:
555g

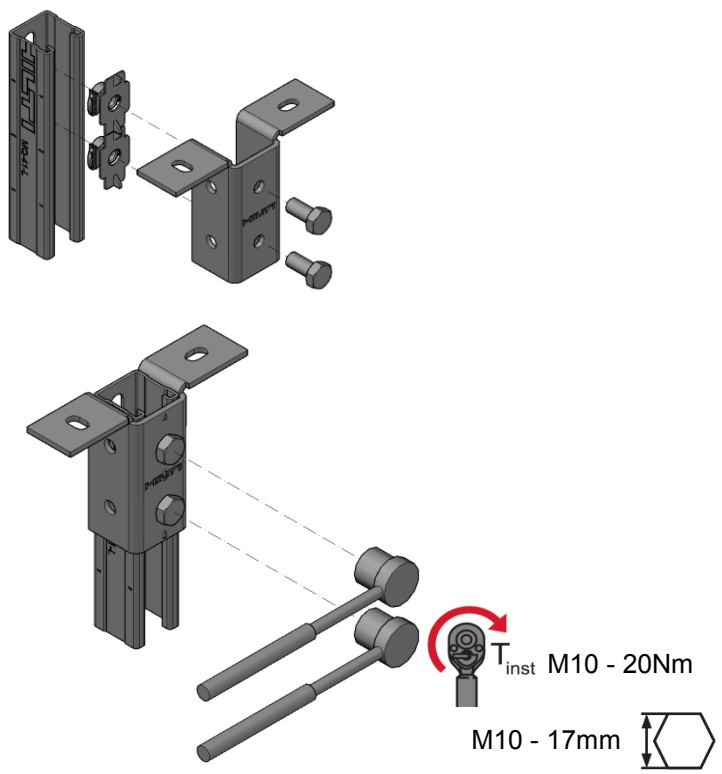
Submittal text:
Base connector for installation channels at 90°. Usage with two MQM-M10 channel wing nuts and screws M10x20. Fixation holes at the three sides of the connector allowing rotation of channel open side - when used with 41x41 or 41x21D channels. Two anchor holes with dimensions 18x11mm.

Material properties:

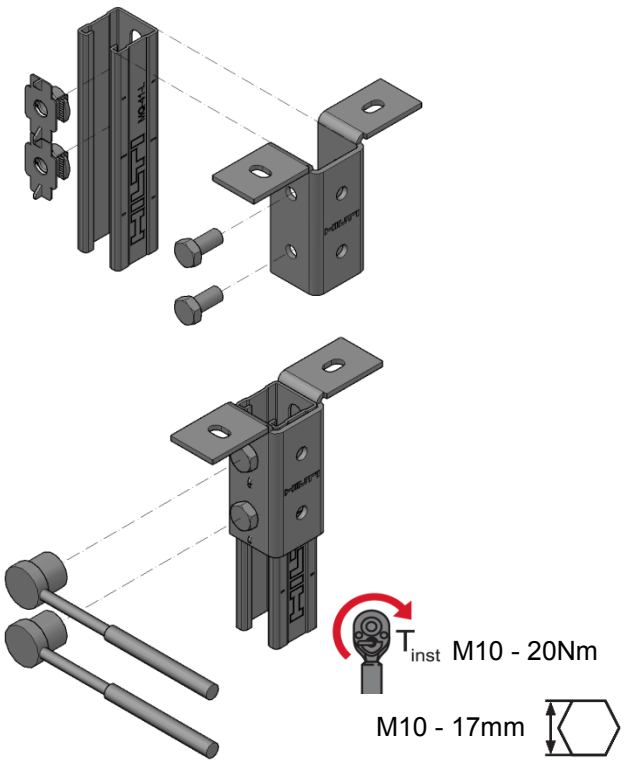
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - DIN EN 10025	$f_y = 235 \frac{N}{mm^2}$	$f_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

Instruction For Use:
Simplified, not attached to the packaging

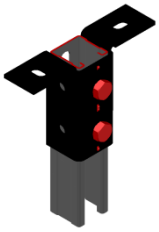
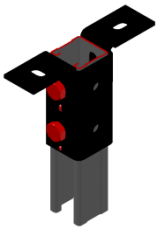
Loading case ,,Centric,,



Loading case ,,Eccentric,,



MQW-L-6/2 Rail support

Possible loading cases		
Centric	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

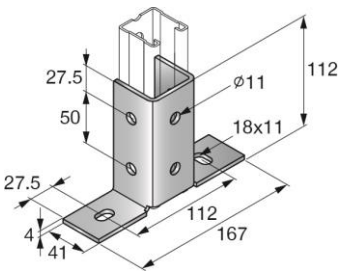
Software:

- Mathcad 15.0
- Microsoft Excel

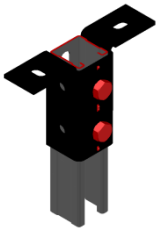
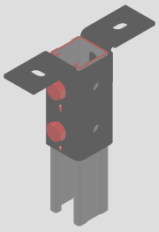
Environmental conditions:

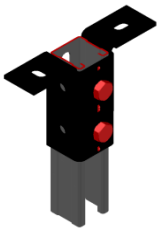
- static loads
- no fatigue loads

Simplified drawing:



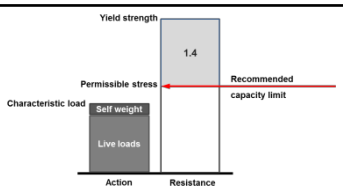
MQW-L-6/2 Rail support

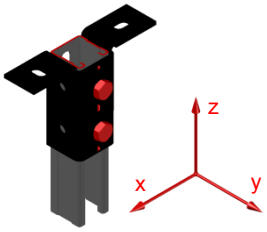
Possible loading cases		
Centric	Eccentric	
		

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

Recommended loading capacity - simplified for most common applications

Method



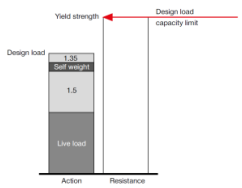


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
0.43	0.89	5.00

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

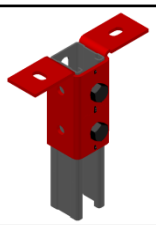
Design loading capacity - 3D 1/2

Method

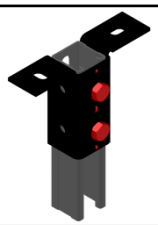


Limiting components of capacity evaluated in following tables:

1. Steel connector



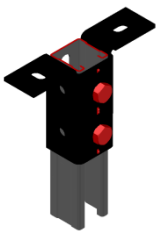
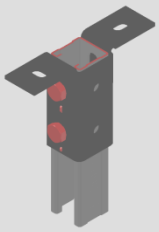
2. Wing nuts



MQW-L-6/2 Rail support

Conditions of the loading capacity tables:

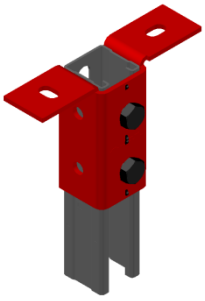
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

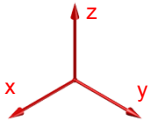
Possible loading cases		
Centric	Eccentric	
		

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 connector



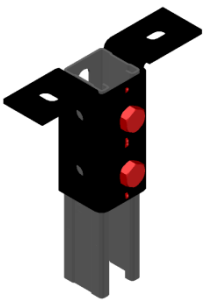


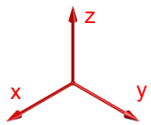
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
4.09	4.09	1.25	1.25	12.99	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
5.13	5.13	8.47	8.47	3.34	3.34

Interaction:

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

2. Wing nuts





In 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

Interaction:

Shear transverse to channel:

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

Shear parallel to channel:

$$\frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

Pull-out:

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

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

Interaction:

Shear transverse to channel:

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

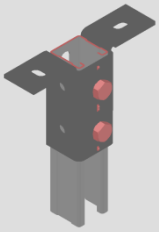
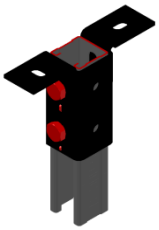
Shear parallel to channel:

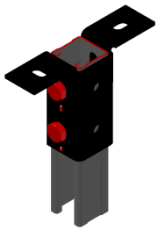
$$\frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

Pull-out:

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

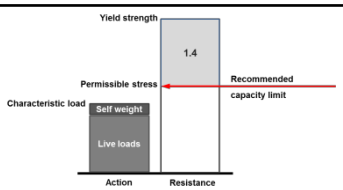
MQW-L-6/2 Rail support

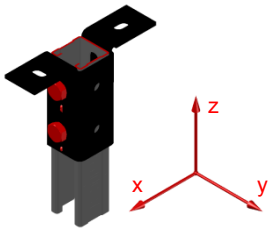
Possible loading cases		
Centric	Eccentric	
		

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

Recommended loading capacity - simplified for most common applications

Method



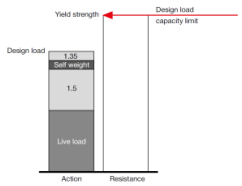


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.75	0.43	5.10

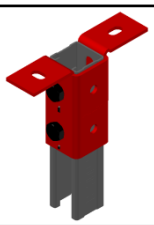
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

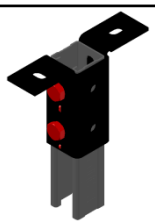
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

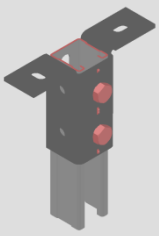
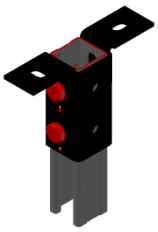
1. Steel connector 

2. Wing nuts 

MQW-L-6/2 Rail support

Conditions of the loading capacity tables:

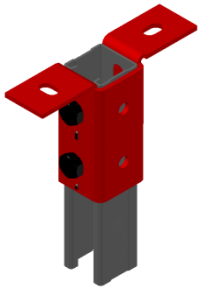
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

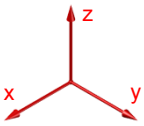
Possible loading cases		
Centric	Eccentric	
		

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 connector



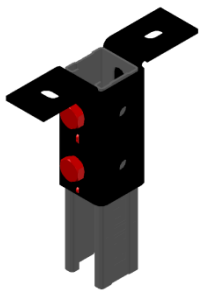


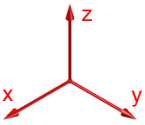
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
4.09	4.09	1.25	1.25	9.43	7.14
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
5.13	5.13	8.47	8.47	3.34	3.34

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. Wing nuts





In MQ-41 -2mm thick channel profile

+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
4.91	4.91	0.88	1.05	12.60	12.60
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
6.25	6.25	35.00	35.00	22.40	22.40

Interaction:

Shear transverse to channel:

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

Shear parallel to channel:

$$\frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

Pull-out:

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

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]
2.45	2.45	0.60	0.72	11.86	11.86
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
4.25	4.25	17.50	17.50	11.20	11.20

Interaction:

Shear transverse to channel:

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

Shear parallel to channel:

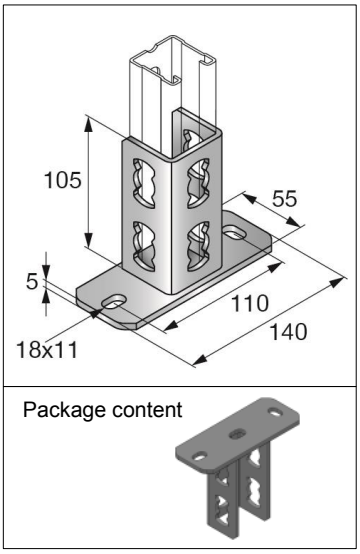
$$\frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

Pull-out:

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

MQP-41 Rail support

Designation	Item number
MQP-41	**2141927**



Corrosion protection:
Electro galvanized

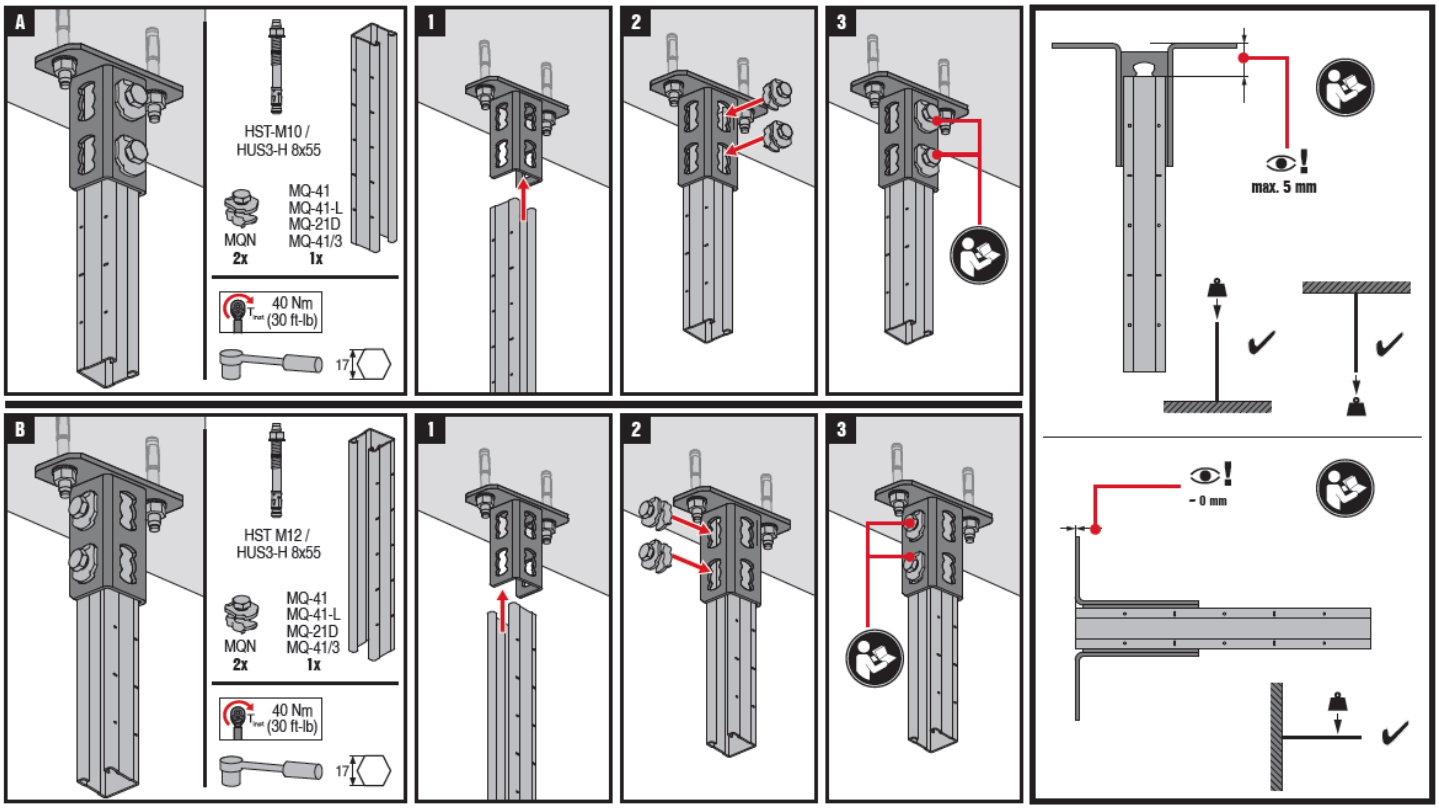
Weight:
587g

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.

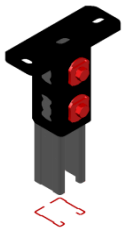
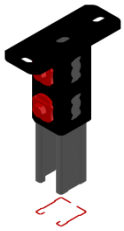
Material properties:

Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
S235JR - 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:



MQP-41 Rail support

Possible loading cases		
Centric	Eccentric	
		

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

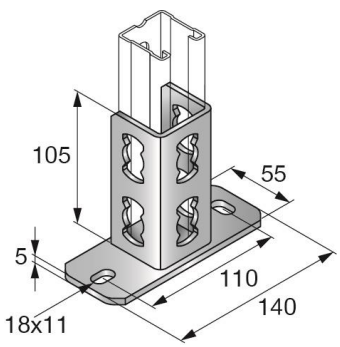
Software:

- Ansys 16.0
- Microsoft Excel

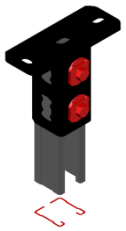
Environmental conditions:

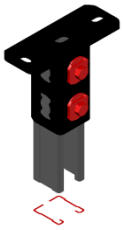
- static loads
- no fatigue loads

Simplified drawing:



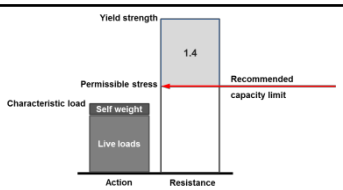
MQP-41 Rail support

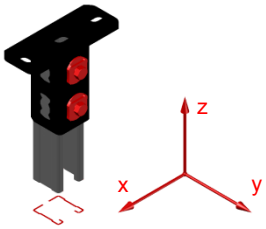
Possible loading cases		
Centric	Eccentric	
		

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 

Recommended loading capacity - simplified for most common applications

Method



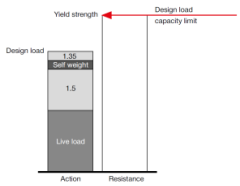


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
2.14	2.14	5.00

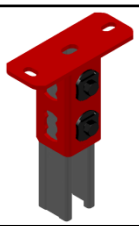
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

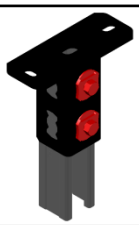
Design loading capacity - 3D 1/3

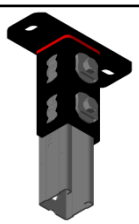
Method



Limiting components of capacity evaluated in following tables:

1. Steel connector 

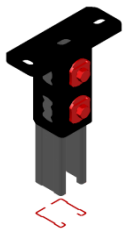
2. Push buttons 

3. Welds 

MQW-41 Rail support

Conditions of the loading capacity tables:

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

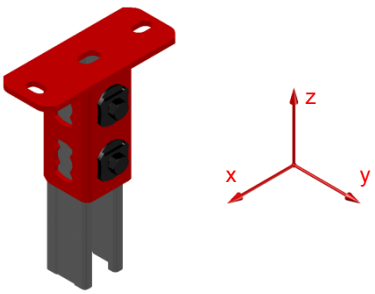
Possible loading cases		
Centric	Eccentric	
		

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 connector



For MQ-41 - 1.5mm thick channel profile

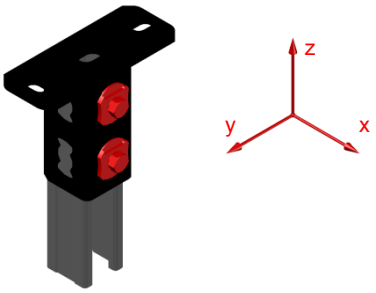
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
3.00 / 4.50*	3.00 / 4.50*	3.00	3.00	7.00	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
14.00	14.00	20.00	20.00	6.00	6.00

*** For MQ-41 - 2mm thick channel profile**

Interaction:

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

2. Push buttons



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

Interaction:

For local normal resistance

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

For local shear resistance parallel to channel

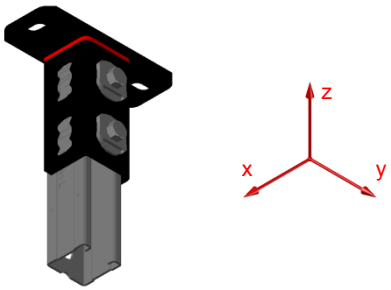
$$\frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

MQW-41 Rail support

Design loading capacity - 3D 3/2

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.

3. Welds

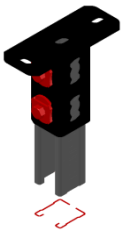


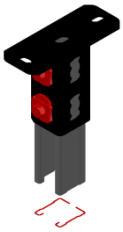
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
10.12	10.12	5.14	5.14	13.00	13.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
28.45	28.45	38.00	38.00	8.89	8.89

Interaction:

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

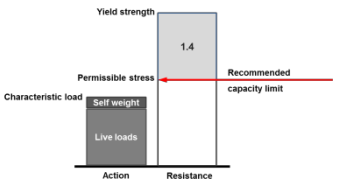
MQP-41 Rail support

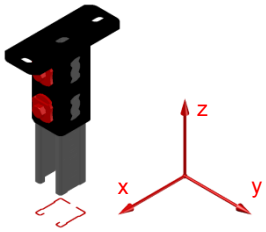
Possible loading cases		
Centric	Eccentric	
		

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 

Recommended loading capacity - simplified for most common applications

Method



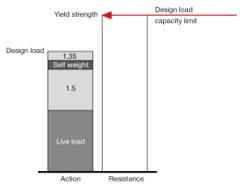


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
3.93	1.21	5.00

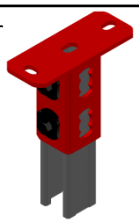
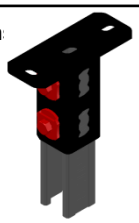
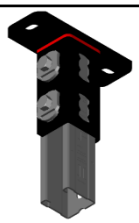
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



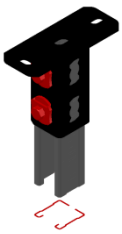
Limiting components of capacity evaluated in following tables:

1. Steel connector	2. Push button	3. Welds
		

MQW-41 Rail support

Conditions of the loading capacity tables:

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

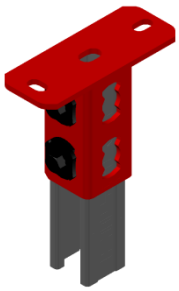
Possible loading cases		
Centric	Eccentric	
		

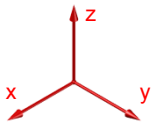
Design loading capacity - 3D 2/3

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 connector





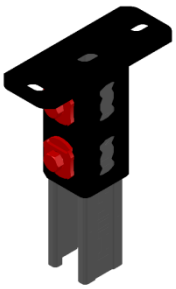
For MQ-41 - 1.5mm thick channel profile

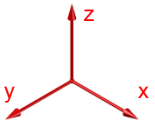
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
5.50	5.50	1.70	1.70	7.00	7.00
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
9.00	9.00	35.00	35.00	6.00	6.00

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

Interaction:

For local normal resistance

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

For local shear resistance parallel to channel

$$\frac{F_{z.Ed}}{F_{z.Rd}} \le 1$$

For local shear resistance perpendicular to channel

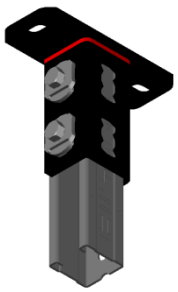
$$\frac{F_{y.Ed}}{F_{y.Rd}} + \frac{M_{x.Ed}}{M_{x.Rd}} \le 1$$

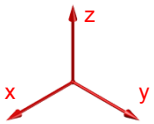
MQW-41 Rail support

Design loading capacity - 3D 3/2

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.

3. Welds





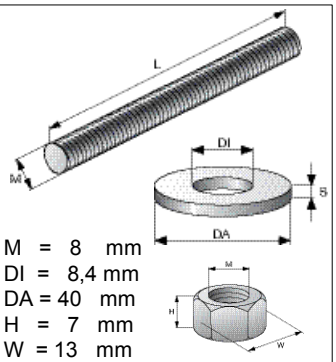
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
12.92	12.92	5.03	5.03	16.60	16.60
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
14.23	14.23	38.00	38.00	8.89	8.89

Interaction:

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

M8 Threaded rod channel through bolt

Designation	Item number
M8 Threaded rod channel through bolt	
AM8x1000 4.8 threaded rod	**339793**
AM8x2000 4.8 threaded rod	**339794**
AM8x3000 4.8 threaded rod	**216415**
A 8,4/40 washer	**282856**
M8 nut	**216465**



Package content

Individual items

Corrosion protection:

Threaded rod galvanized 5µm
Washer galvanized 5µm
Nut galvanized 5µm

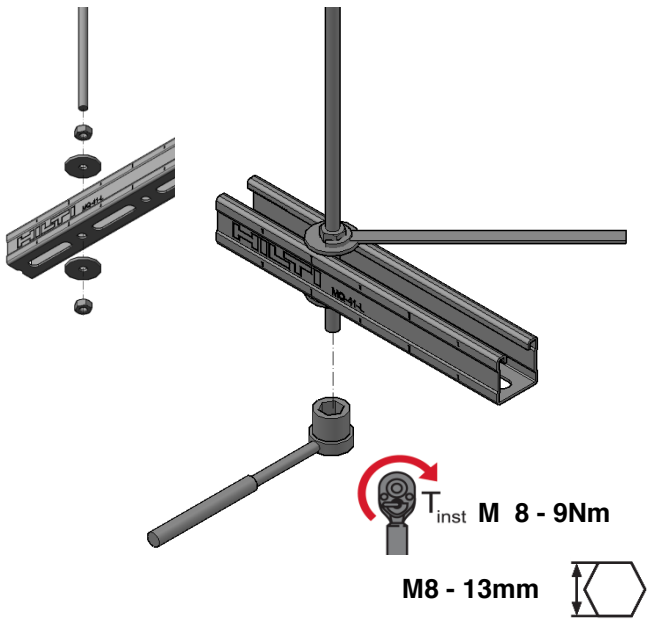
Weight:

Threaded rod - as per used length
Washer - 27g
Nut - 5g

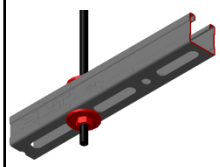
Material properties:

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				
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

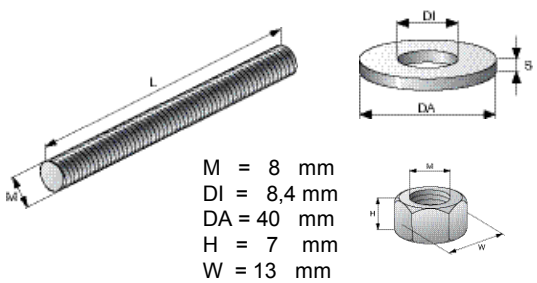
Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

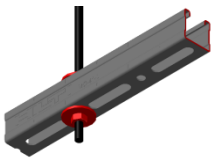
- static loads
- no fatigue loads

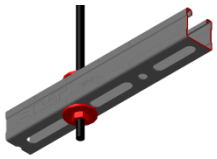
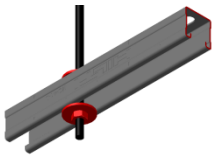
Simplified drawing:



M = 8 mm
DI = 8,4 mm
DA = 40 mm
H = 7 mm
W = 13 mm

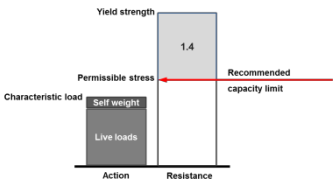
M8 Threaded rod channel through bolt

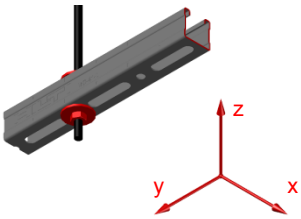
Possible loading cases		
Both sides		
		

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 for most common applications

Method



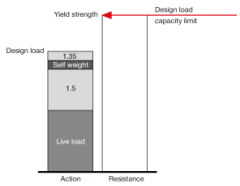


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		2.50

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

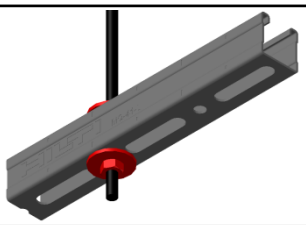
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

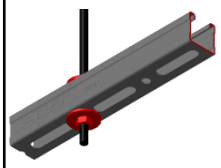
1. Washer and nut



M8 Threaded rod channel through bolt

Conditions of the loading capacity tables:

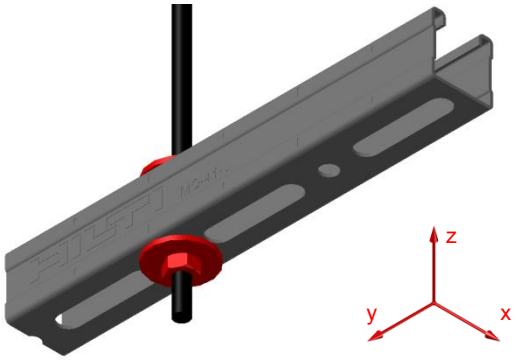
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Both sides		
		

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. 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

M10 Threaded rod channel through bolt

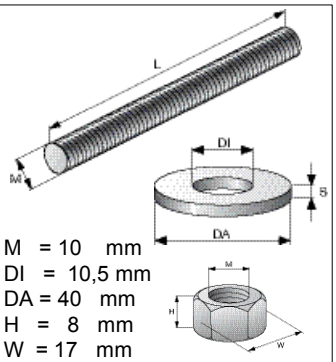
Designation	Item number
M10 Threaded rod channel through bolt	
AM10x1000 4.8 threaded rod	**339795**
AM10x2000 4.8 threaded rod	**339796**
AM10x3000 4.8 threaded rod	**216418**
A 10,5/40 washer	**282857**
M10 nut	**216466**

Corrosion protection:

Threaded rod galvanized 5µm
Washer galvanized 5µm
Nut galvanized 5µm

Weight:

Threaded rod - as per used length
Washer - 27g
Nut - 10g



M = 10 mm
DI = 10,5 mm
DA = 40 mm
H = 8 mm
W = 17 mm

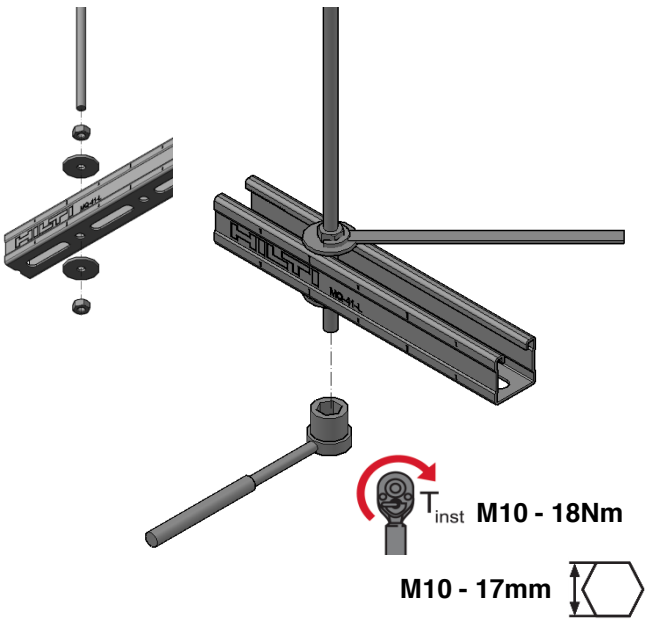
Package content

Individual items

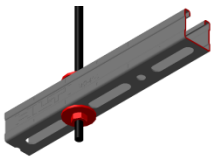
Material properties:

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				
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 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

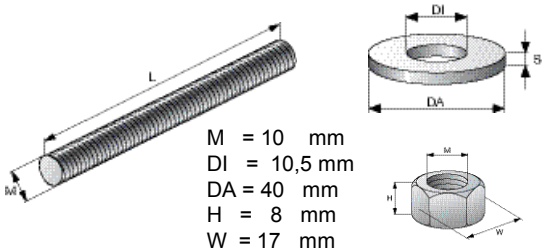
Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

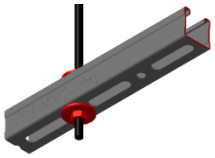
- static loads
- no fatigue loads

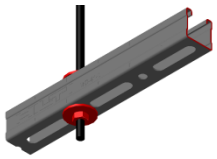
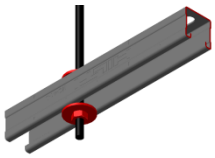
Simplified drawing:



M = 10 mm
DI = 10,5 mm
DA = 40 mm
H = 8 mm
W = 17 mm

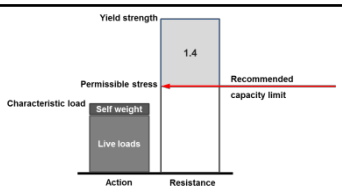
M10 Threaded rod channel through bolt

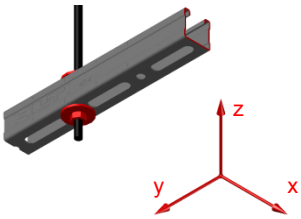
Possible loading cases		
Both sides		
		

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



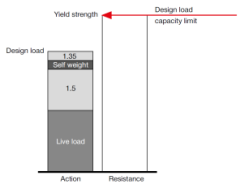


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		3.00

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

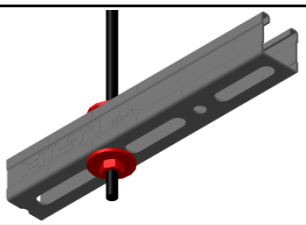
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

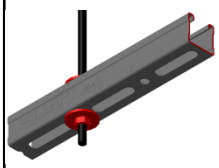
1. Washer and nut



M10 Threaded rod channel through bolt

Conditions of the loading capacity tables:

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

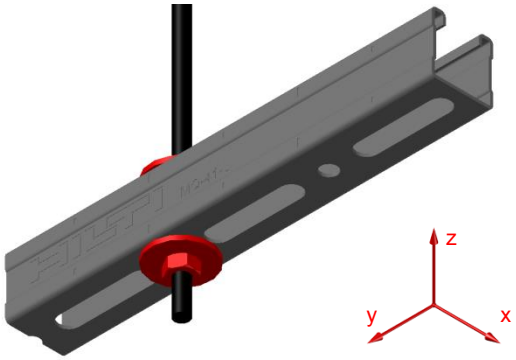
Possible loading cases		
Both sides		
		

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. Washer and nut

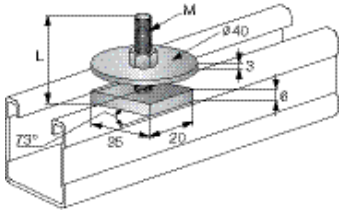


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				4.20	4.20
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm

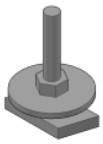
M8 T-bolt in the channel

Designation	Item number
HHK 41 M8X40	**312361**
HHK 41 M8X50	**312362**
HHK 41 M8X60	**312363**
HHK 41 M8X80	**312365**
HHK 41 M8X100	**312367**
HHK 41 M8X120	**312368**
HHK 41 M8X150	**312369**



M = 8 mm
L = see designation HHK 41 M8x**L**

Package content



Corrosion protection:

Threaded rod	galvanized 5µm
Washer	galvanized 5µm
Nut	galvanized 5µm

Weight:

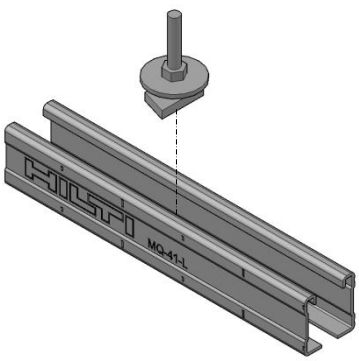
HHK 41 M8X40	- 73g
HHK 41 M8X50	- 78g
HHK 41 M8X60	- 82g
HHK 41 M8X80	- 88g
HHK 41 M8X100	- 94g
HHK 41 M8X120	-100g
HHK 41 M8X150	- 110g

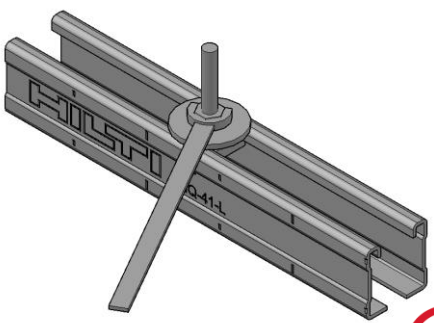
Material properties:

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				
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

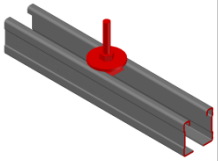




T_{inst} **M 8 - 9Nm**

M8 - 13mm

M8 T-bolt in the channel

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

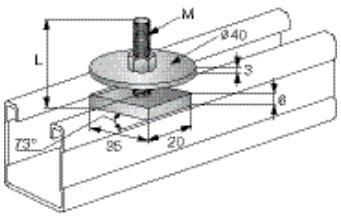
Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

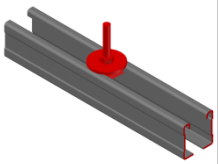
- static loads
- no fatigue loads

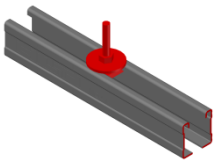
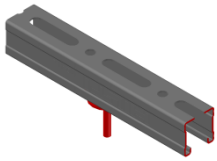
Simplified drawing:



M = 8 mm
L = see designation HHK 41 M8x**L**

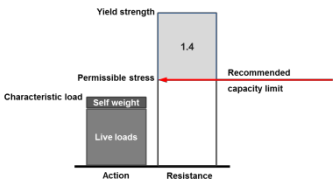
M8 T-bolt in the channel

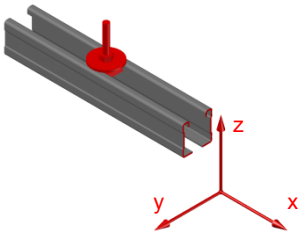
Possible loading cases		
Standard		
		

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

Recommended loading capacity - simplified for most common applications

Method



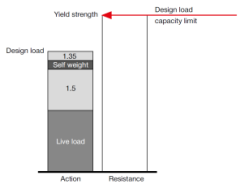


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		2.50

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

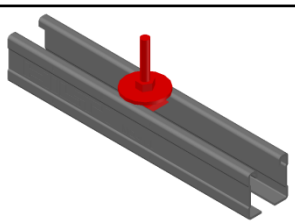
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

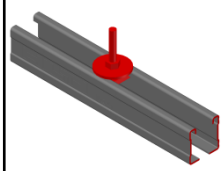
1. T-bolt



M8 T-bolt in the channel

Conditions of the loading capacity tables:

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

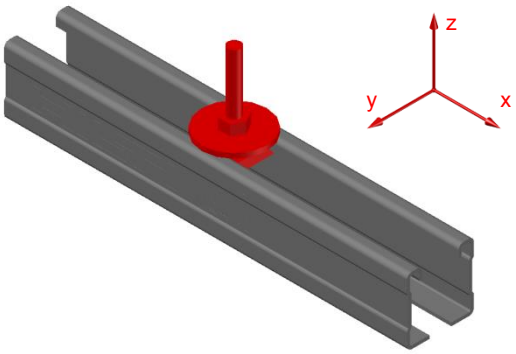
Possible loading cases		
Standard		
		

Design loading capacity - 3D 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. Washer and nut

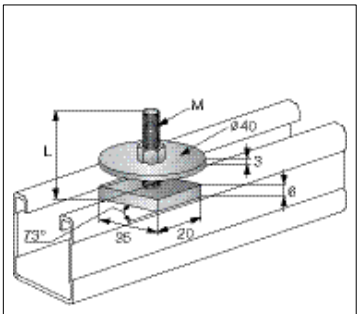


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				3.50	3.50
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm

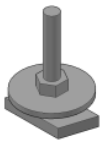
M10 T-bolt in the channel

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



M = 10 mm
L = see designation HHK 41 M10x**L**

Package content



Corrosion protection:

Threaded rod galvanized 5µm
Washer galvanized 5µm
Nut galvanized 5µm

Weight:

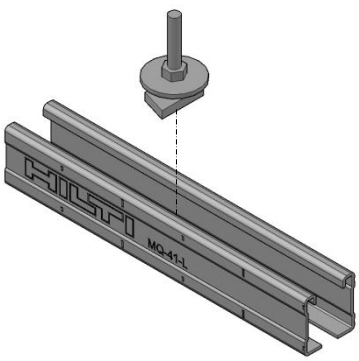
HHK 41 M10X40 - 77g
HHK 41 M10X60 - 92g
HHK 41 M10X80 - 105 g
HHK 41 M10X100- 116g
HHK 41 M10X150- 141g

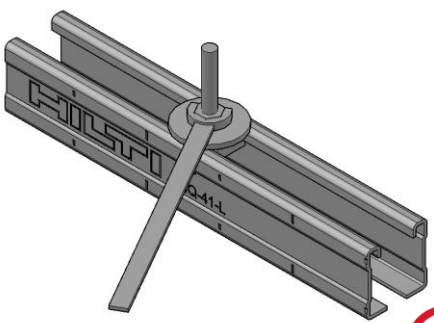
Material properties:

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	$F_y = 235 \frac{N}{mm^2}$	$F_u = 360 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
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

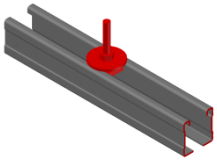




T_{inst} **M10 - 18Nm**

M10 - 17mm

M10 T-bolt in the channel

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

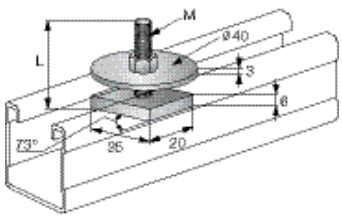
Software:

- Ansys 16.0
- Microsoft Excel

Environmental conditions:

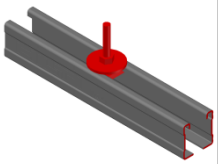
- static loads
- no fatigue loads

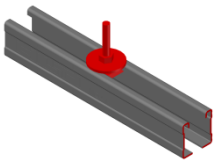
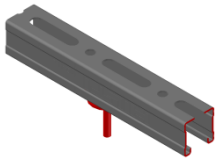
Simplified drawing:



M = 10 mm
L = see designation HHK 41 M10x**L**

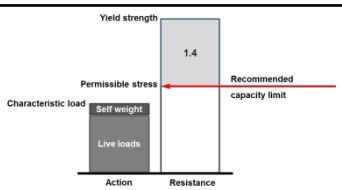
M10 T-bolt in the channel

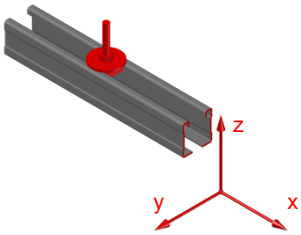
Possible loading cases		
Standard		
		

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

Recommended loading capacity - simplified for most common applications

Method



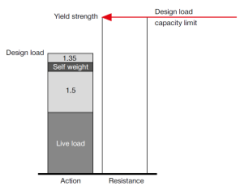


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		3.00

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

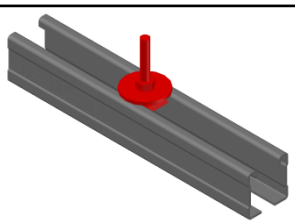
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

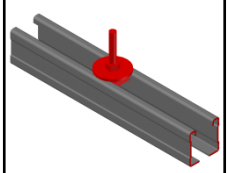
1. T-bolt



M10 T-bolt in the channel

Conditions of the loading capacity tables:

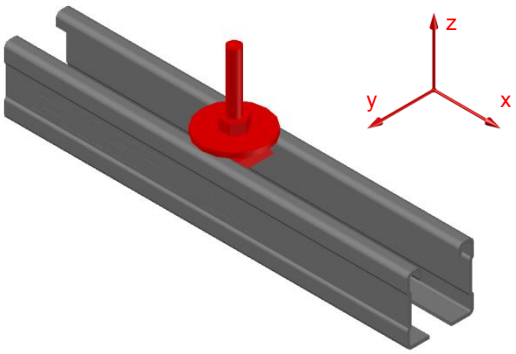
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
Standard		
		

Design loading capacity - 3D 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. Washer and nut

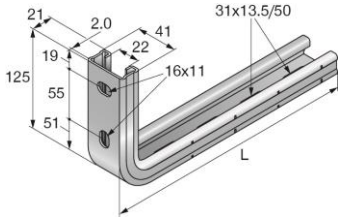


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
				4.20	4.20
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: valid for channel edge distance ≥ 100mm

MQK-L-21 Bracket

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



L = see designation MQK-L21/**L**

Package content

Corrosion protection:
Sendzimir galvanized

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

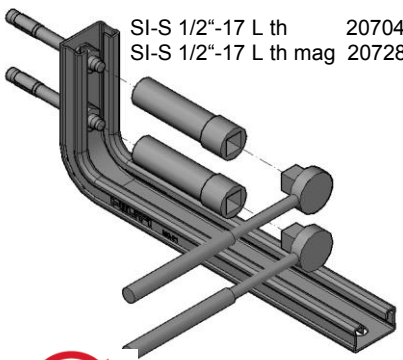
Submittal text:
L-shape bent installation bracket with channel section 41x21x2mm. Two anchor holes 16x11mm on the short side and elongated holes with step 50mm on the long side. Direct fixation with anchors to base material or to other channels with two MQM-M10 wing nuts and M10x20 screws. Usage with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

Loading case
„Fixed on the wall with HST3 - M10„

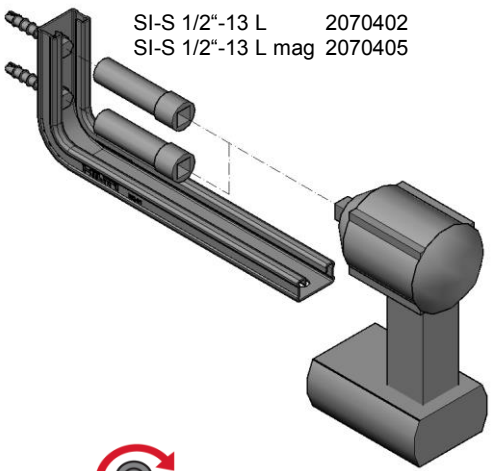


SI-S 1/2“-17 L th 2070404
SI-S 1/2“-17 L th mag 2072891

T_{inst} **M10 - 45Nm**

M10 - 17mm

Loading case
„Fixed on the wall with HUS3-H8

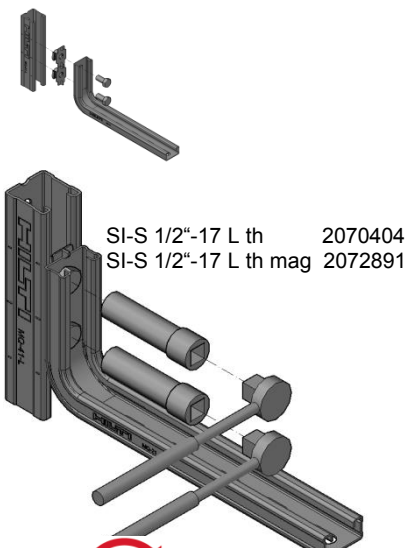


SI-S 1/2“-13 L 2070402
SI-S 1/2“-13 L mag 2070405

T_{inst} **Impact screw driver SIW 22t-A**

M8 - 13mm

Loading case
„Fixed on the channel„

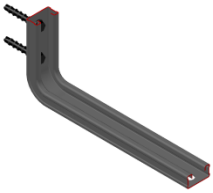
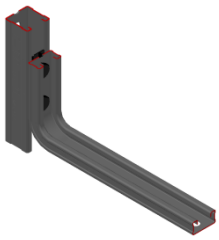


SI-S 1/2“-17 L th 2070404
SI-S 1/2“-17 L th mag 2072891

T_{inst} **M10 - 20Nm**

M10 - 17mm

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
			

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

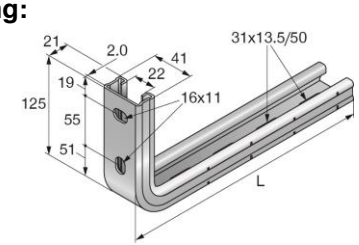
Software:

- Mathcad 15.0
- Microsoft Excel

Environmental conditions:

- static loads
- no fatigue loads

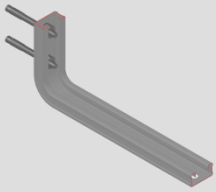
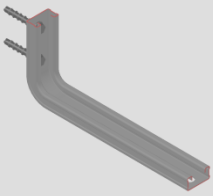
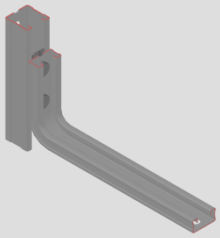
Simplified drawing:



L = see designation MQK-L21/**L**

MQK-L-21 Bracket

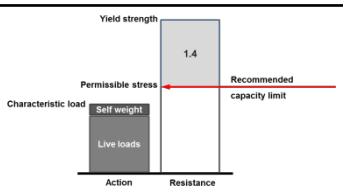
Possible loading cases

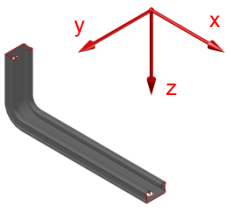
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
			

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 

Recommended loading capacity - simplified for most common applications

Method





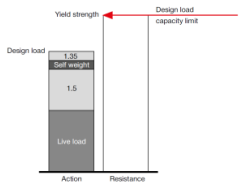
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.19	3.11	7.56

±My,rec. [kNm]
8.93

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

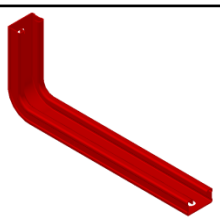
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

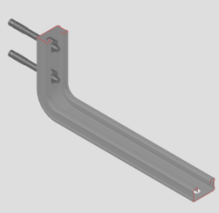
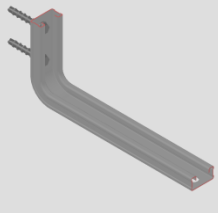
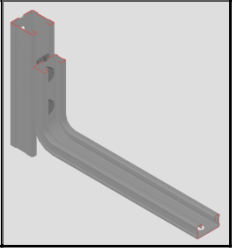
1. Steel part of the bracket



MQK-L-21 Bracket

Conditions of the loading capacity tables:

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

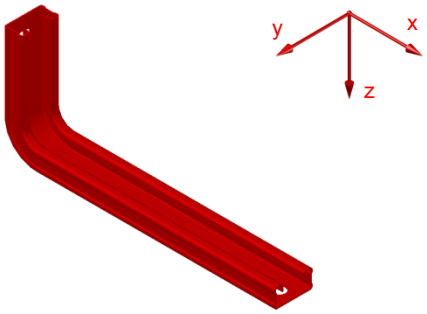
Possible loading cases			
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
			

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



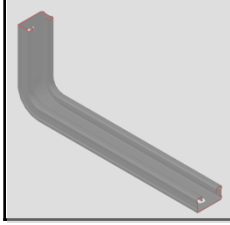
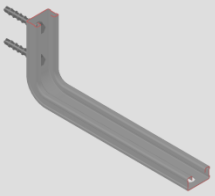
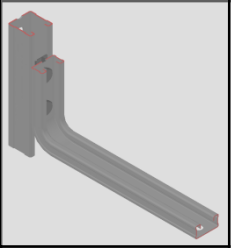
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04

Interaction:

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

MQK-L-21 Bracket

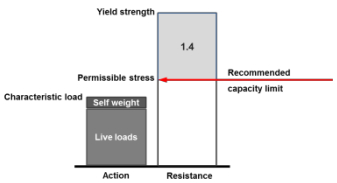
Possible loading cases

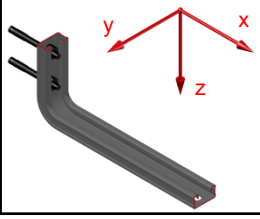
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
			

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 

Recommended loading capacity - simplified for most common applications

Method





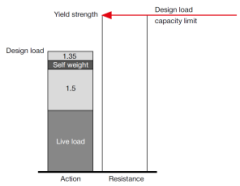
±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.19	0.41	3.09

±My,rec. [kNm]
8.93

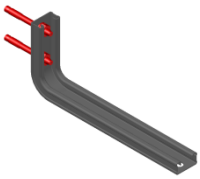
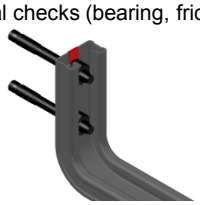
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



Limiting components of capacity evaluated in following tables:

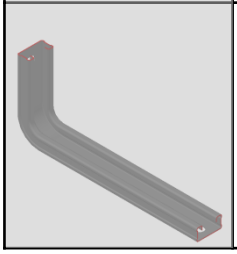
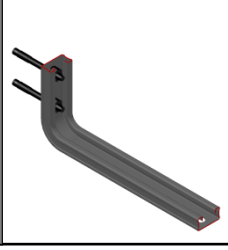
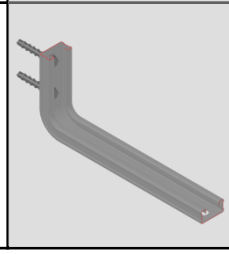
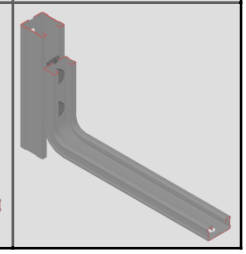
1. Steel part of the bracket	2. Anchors	3. Local checks (bearing, friction)
		

MQK-L-21 Bracket

Conditions of the loading capacity tables:

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

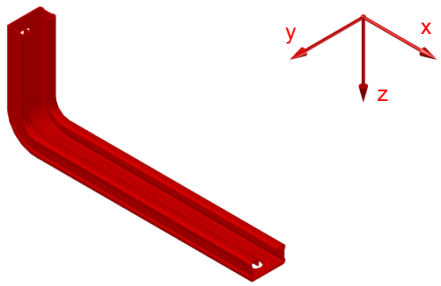
Possible loading cases

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

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

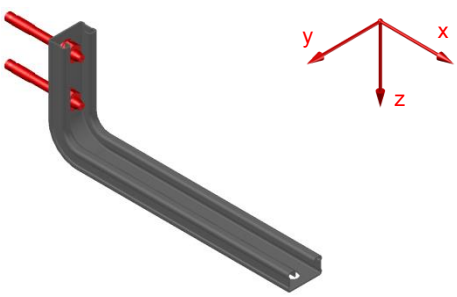


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04

Interaction:

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

2. 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.

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

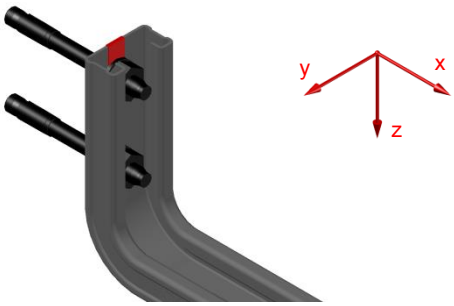
$$\beta_N + \beta_V \le 1.2$$

MQK-L-21 Bracket

Design loading capacity - 3D 3/3

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.

3. Local checks (bearing, friction)



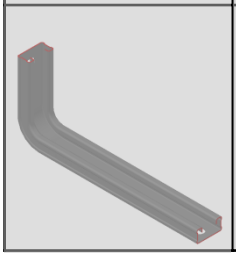
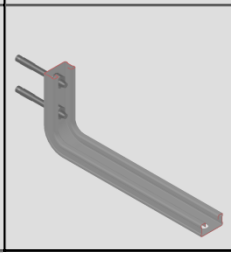
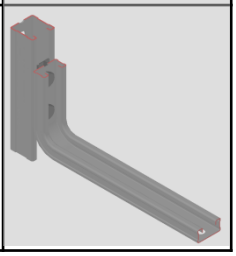
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
Not decisive	Not decisive	0.57	0.57	4.32	7.92
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
2.29	2.29	Not deceive	Not decisive	Not decisive	Not decisive

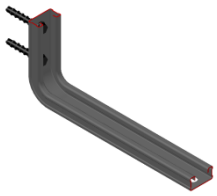
Interaction:

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

MQK-L-21 Bracket

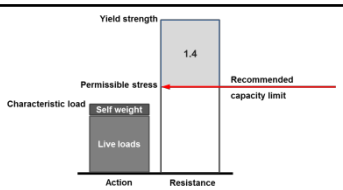
Possible loading cases

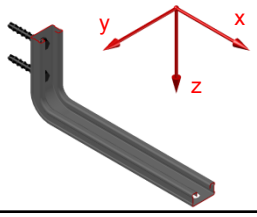
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
			

Loading case: Fixed to the wall with HUS3 - H8		Combinations covered by loading case
BOM:		Bracket fixed to concrete (B20/25) wall with two HUS3 H 8 anchors 
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**	

Recommended loading capacity - simplified for most common applications

Method



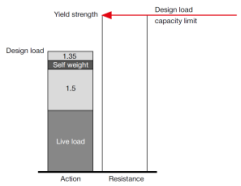


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]	±My,rec. [kNm]
1.19	0.41	3.09	8.93

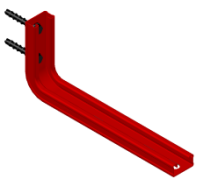
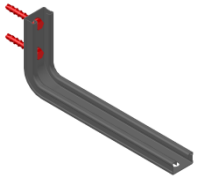
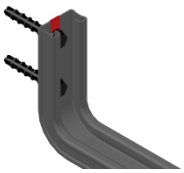
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



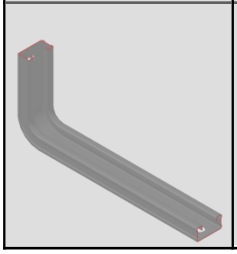
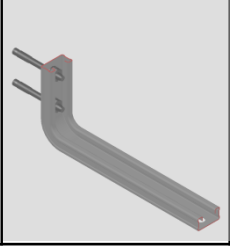
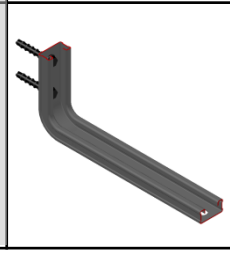
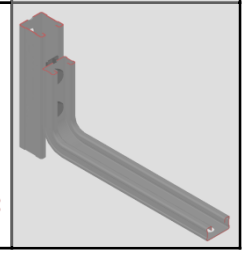
Limiting components of capacity evaluated in following tables:

1. Steel part of the bracket	2. Anchors	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° C), no high (> +100° C) temperatures

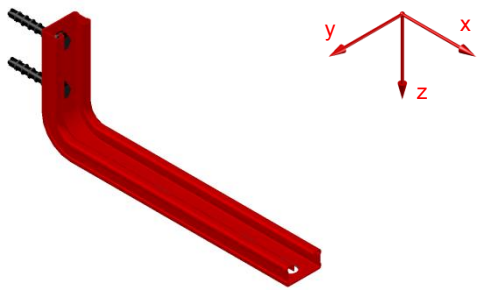
Possible loading cases			
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
			

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

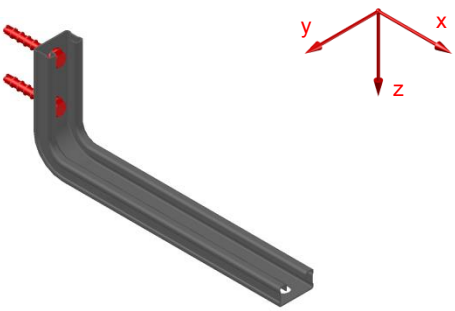


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04

Interaction:

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

2. 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

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

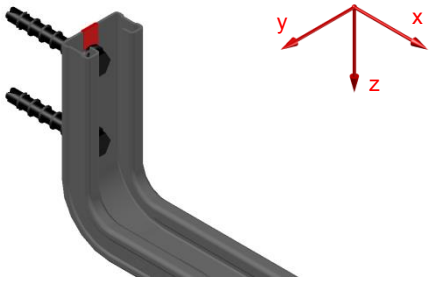
$$\beta_N + \beta_V \le 1.2$$

MQK-L-21 Bracket

Design loading capacity - 3D 3/3

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.

3. Local checks (bearing, friction)



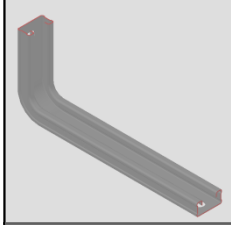
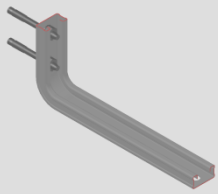
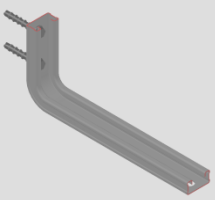
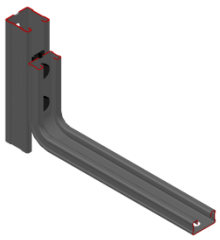
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
Not decisive	Not decisive	0.57	0.57	4.32	7.92
+Mx,Rd [kNcm]	**-Mx,Rd [kNcm]**	**+My,Rd [kNcm]**	**-My,Rd [kNcm]**	**+Mz,Rd [kNcm]**	**-Mz,Rd [kNcm]**
2.29	2.29	Not deceive	Not decisive	Not decisive	Not decisive

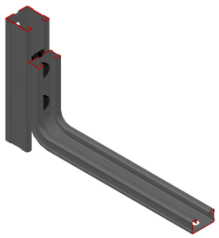
Interaction:

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

MQK-L-21 Bracket

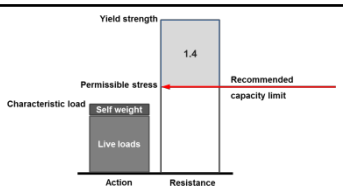
Possible loading cases

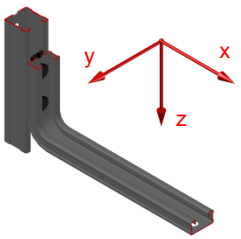
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
			

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

Recommended loading capacity - simplified for most common applications

Method





±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
1.19	0.34/0.41*	3.09

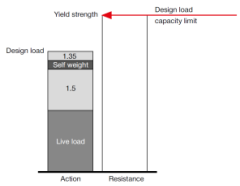
* For 2mm and thicker channel

±My,rec. [kNm]
8.93

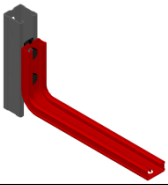
These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

Design loading capacity - 3D 1/3

Method



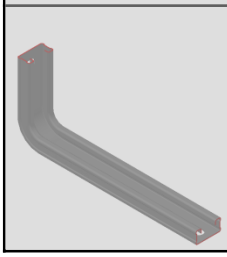
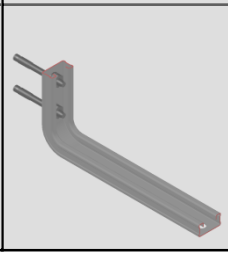
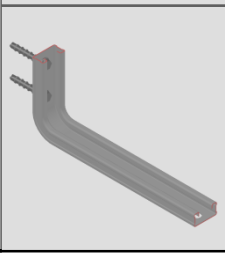
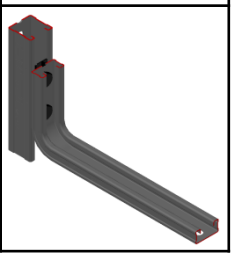
Limiting components of capacity evaluated in following tables:

1. Steel part of the bracket	2. Wing nuts in the channel	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° C), no high (> +100° C) temperatures

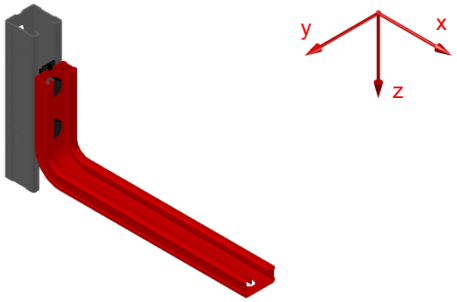
Possible loading cases			
Bracket only	Fixed to the wall with HST3 - M10	Fixed to the wall with HUS3 - H8	Fixed on channel
			

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

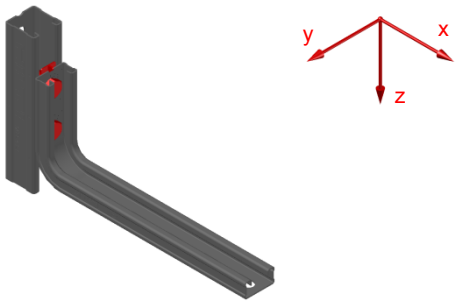


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
1.66	2.41	4.35	4.35	10.58	10.58
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
1.04	1.04	12.50	12.50	1.04	1.04

Interaction:

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

2.1. 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

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

Transverse shear (perpendicular to channel)

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

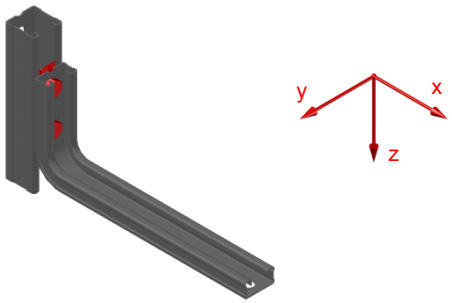
Note: For load cases Fy and Mx, also the wing nut in the slotted hole parallel to force must be statically considered. Therefore additional deformation occur on connector to overcome slotted hole. Otherwise refer to values shown in 3) which consider friction between washer and channel.

MQK-L-21 Bracket

Design loading capacity - 3D 3/3

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.

2.2. Wing nuts in the channel



in 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

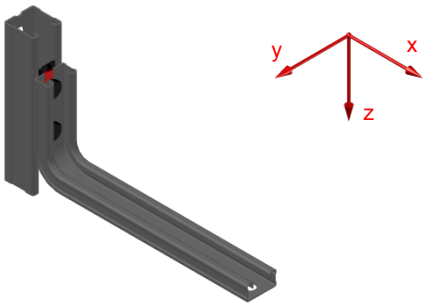
$$\frac{F_{x.Ed}}{F_{x.Rd}} + \frac{M_{y.Ed}}{M_{y.Rd}} + \frac{M_{z.Ed}}{M_{z.Rd}} \le 1$$

Transverse shear (perpendicular to channel)

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

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. Local checks (bearing, friction)



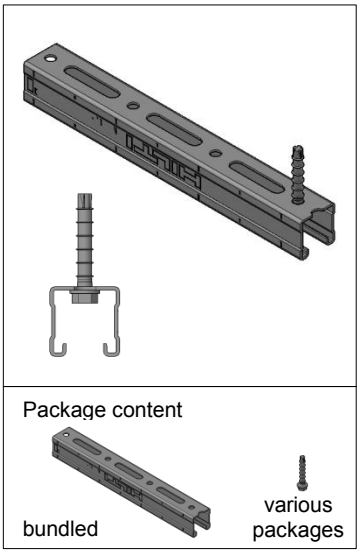
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
Not decisive	Not decisive	0.57	0.57	4.32	7.92
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]
2.29	2.29	Not deceive	Not decisive	Not decisive	Not decisive

Interaction:

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

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**



Package content

bundled

various packages

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 32.9 g

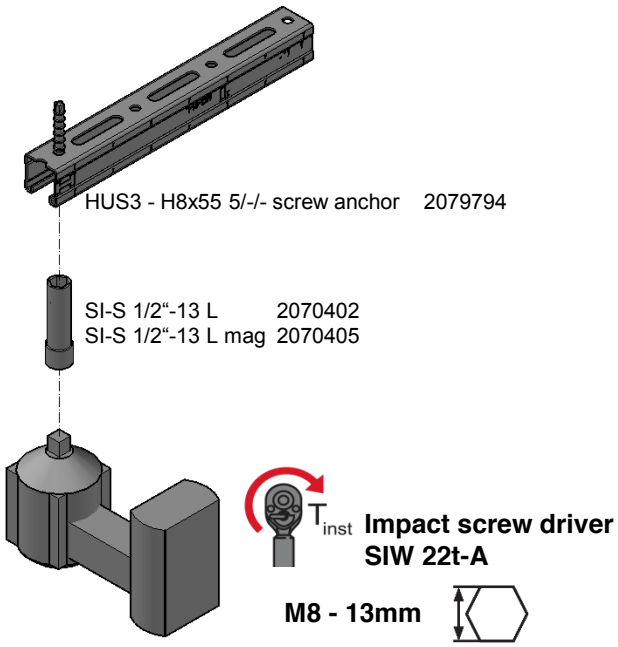
Material properties:

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	$F_y = 695 \frac{N}{mm^2}$	$F_u = 810 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$

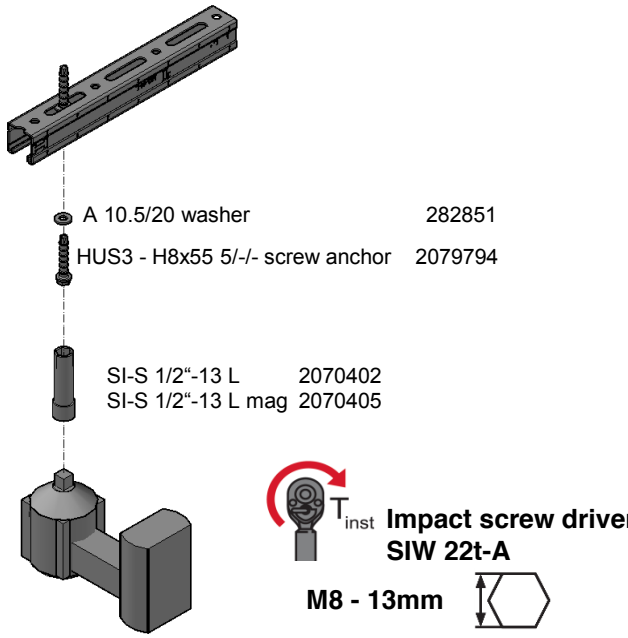
Instruction For Use:

Simplified, not attached to the packaging

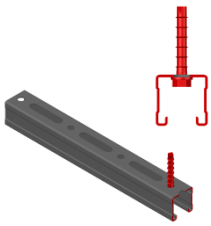
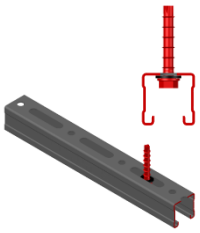
Loading case ,,HUS3-H8 in anchor hole,,



Loading case ,,HUS3-H8&W (and M10 washer) in channel slot,,



HUS3-H8 Direct fixation to concrete

Possible loading cases		
HUS3-H8 in rounded ,,anchor hole,,.	HUS3-H8&W in channel (oblong) slot	
		

Design criteria used for loading capacity

Methodology:

- Finite element analysis

- **Standards and codes:**

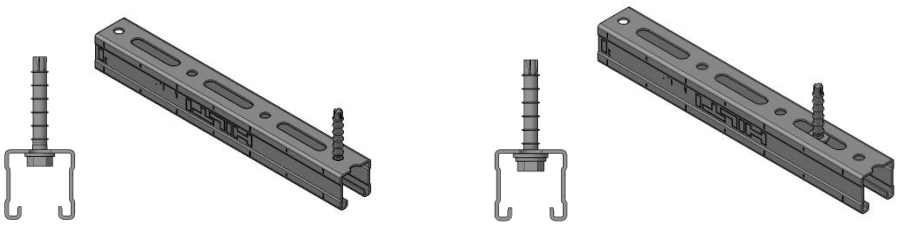
• EN 1990	Basics of structural design	03.2003
• EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings	09.2011
• EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	03.2012
• EN 1993-1-3	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

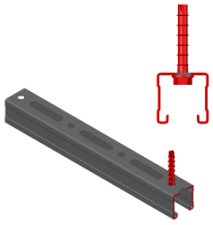
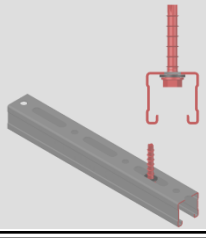
Environmental conditions:
- static loads
- no fatigue loads

Simplified drawing:

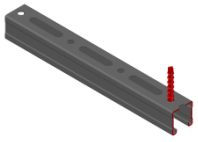


HUS3-H8 Direct fixation to concrete

Possible loading cases

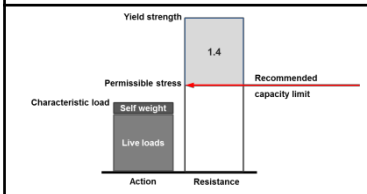
HUS3-H8 in rounded ,,anchor hole,,.	HUS3-H8&W in channel (oblong) slot	
		

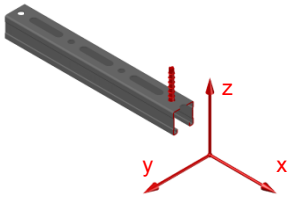
Loading case: HUS3-H8 in rounded ,,anchor hole,,.		Combinations covered by loading case
BOM:		Direct fixation of channel on concrete fixed by HUS3-H8 through ,,Anchor hole,, in the channel
Channel		
Channel		
MQ-21 2m	**2148545**	
MQ-21 3m	**2148544**	
MQ-21 6m	**2148543**	
MQ-41-L 2m	**2141966**	
MQ-41-L 3m	**2141965**	
MQ-41-L 6m	**2141964**	
Screw anchor		
HUS3 - H8x55 5/-/-	**2079794**	



Recommended loading capacity - simplified for most common applications

Method



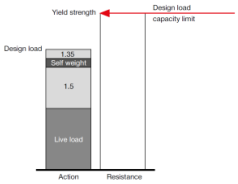


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		3.14

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

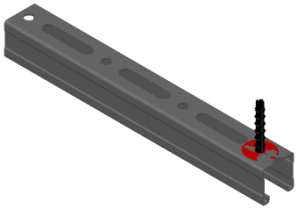
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

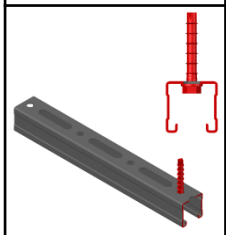
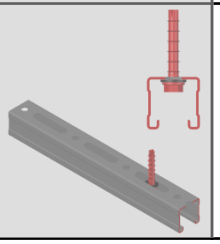
1. Channel local pull through



HUS3-H8 Direct fixation to concrete

Conditions of the loading capacity tables:

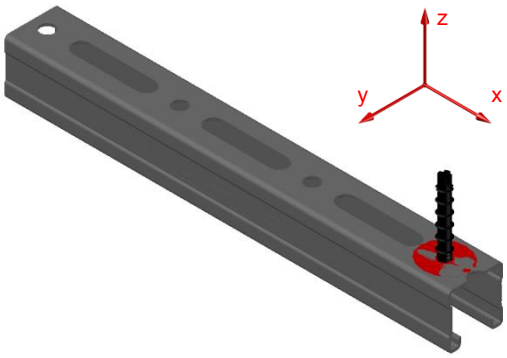
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
HUS3-H8 in rounded ,,anchor hole,,.	HUS3-H8&W in channel (oblong) slot	
		

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. Channel local pull through

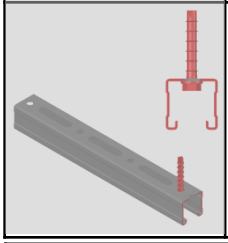
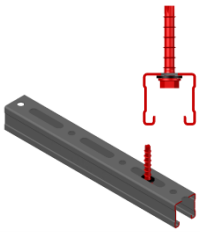


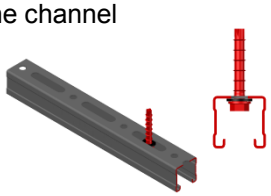
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
					4.40
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

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

HUS3-H8 Direct fixation to concrete

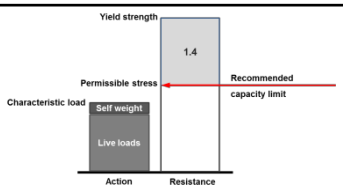
Possible loading cases

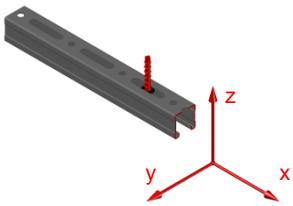
HUS3-H8 in rounded ,,anchor hole,,.	HUS3-H8&W in channel (oblong) slot	
		

Loading case: HUS3-H8&W in channel (oblong) slot		Combinations covered by loading case
BOM:		Direct fixation of channel on concrete fixed by HUS3-H8 and M10 washer 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		
HUS3 - H8x55 5/-/-	**2079794**	
A 10.5/20 washer	**282851**	

Recommended loading capacity - simplified for most common applications

Method



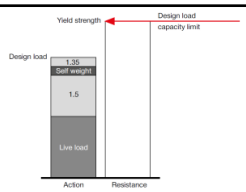


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		2.89

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

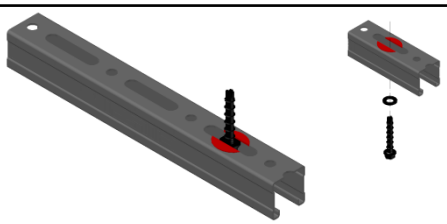
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

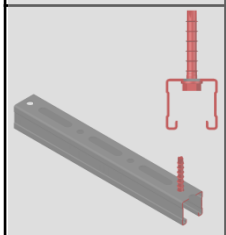
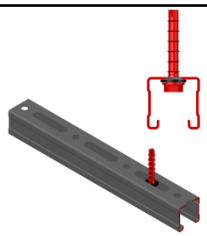
1. Channel local pull through



HUS3-H8 Direct fixation to concrete

Conditions of the loading capacity tables:

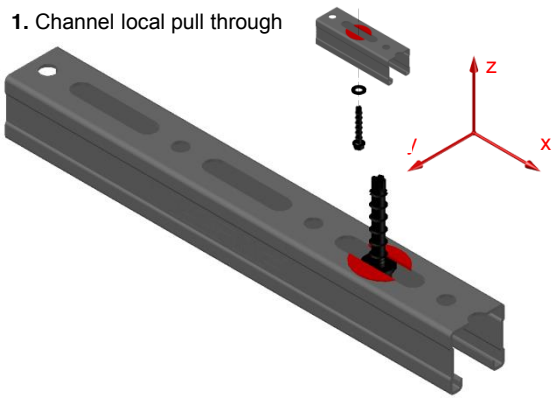
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

Possible loading cases		
HUS3-H8 in rounded ,,anchor hole,,.	HUS3-H8&W in channel (oblong) slot	
		

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. Channel local pull through

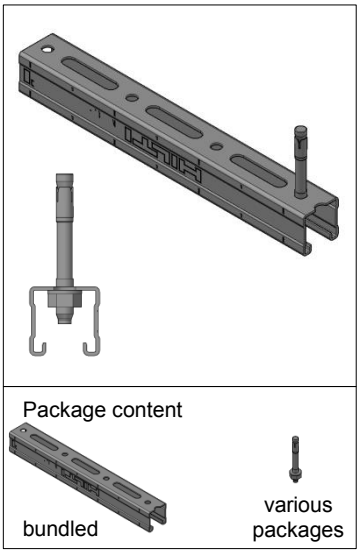


+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
					4.05
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

Condition: 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

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:

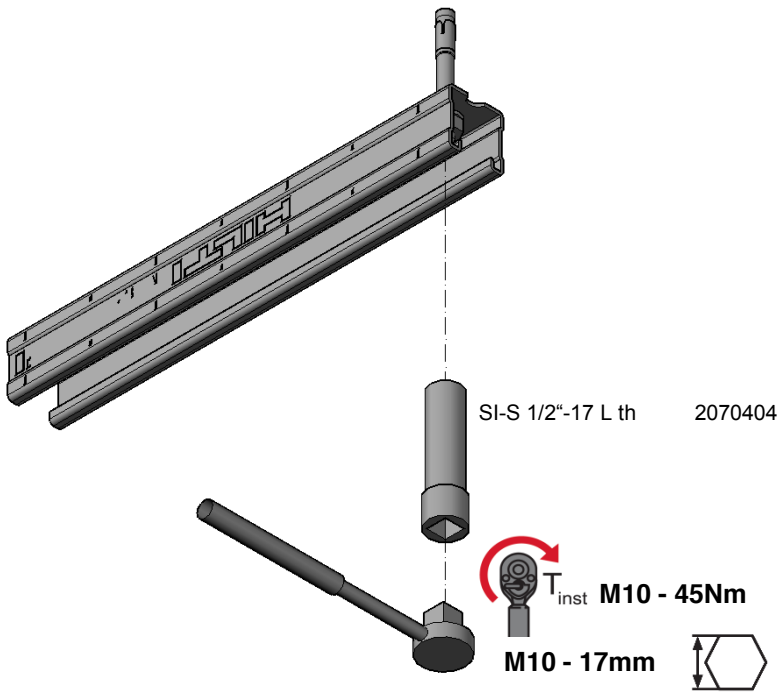
Channel MQ-21 1430 g/m
Channel MQ-41-L 1600 g/m
Anchor 58.0 g

Material properties:

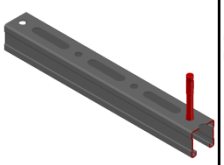
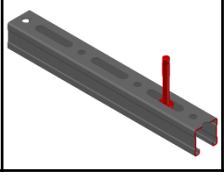
Material	Yield strength	Ultimate strength	E-modulus	Shear modulus
Channel				
Steel S250GD - DIN EN 10346	$F_y = 290 \frac{N}{mm^2}$	$F_u = 330 \frac{N}{mm^2}$	$E = 210000 \frac{N}{mm^2}$	$G = 80769 \frac{N}{mm^2}$
Anchor				
Carbon steel	$F_y = 640 \frac{N}{mm^2}$	$F_u = 800 \frac{N}{mm^2}$	$E = 210000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

Instruction For Use:

Simplified, not attached to the packaging



HST3-M10 Direct fixation to concrete

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

Design criteria used for loading capacity

Methodology:

- Finite element analysis

- **Standards and codes:**

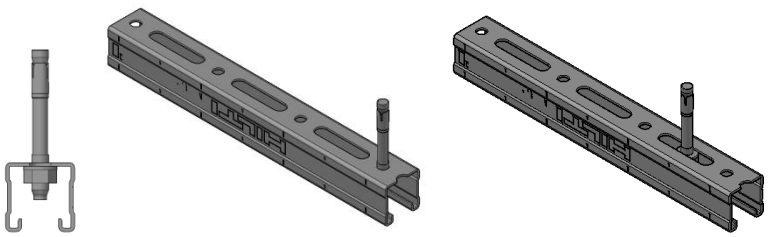
• EN 1990	Basics of structural design	03.2003
• EN 1991-1-1	Eurocode 1: Actions on structures – Part 1-1: General actions – densities, self-weight, imposed loads for buildings	09.2011
• EN 1993-1-1	Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings	03.2012
• EN 1993-1-3	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

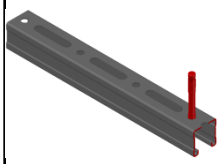
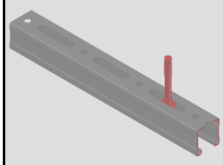
Environmental conditions:
- static loads
- no fatigue loads

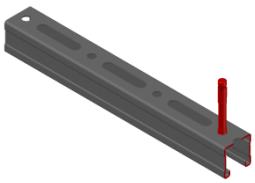
Simplified drawing:



HST3-M10 Direct fixation to concrete

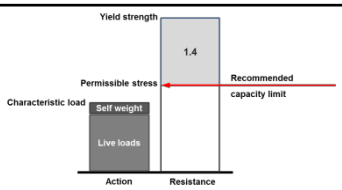
Possible loading cases

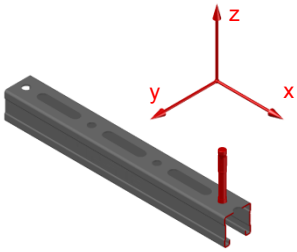
HST3-M10 in rounded ,,anchor hole,,.	HST3-M10 in channel (oblong) slot	
		

Loading case: Standard		Combinations covered by loading case
BOM:		Direct fixation of channel on concrete fixed by HST3-M10 through ,,Anchor hole,, in the channel
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



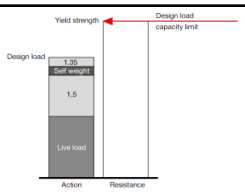


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		3.29

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

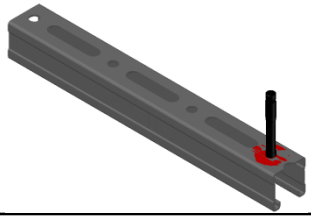
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

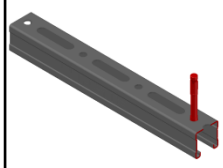
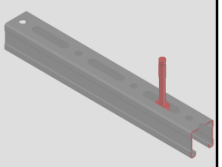
1. Channel local pull through



HUS3-H8 Direct fixation to concrete

Conditions of the loading capacity tables:

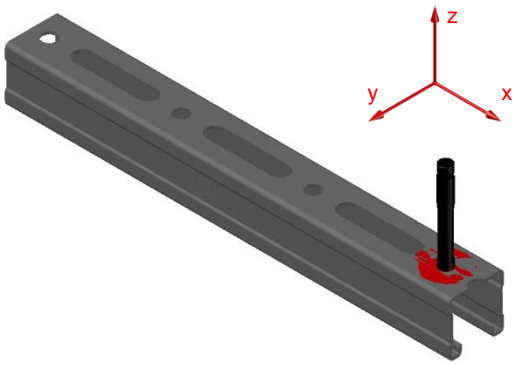
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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

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. Channel local pull through

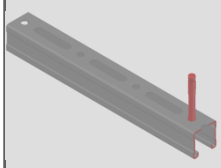
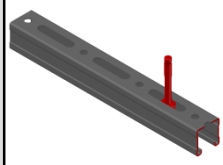


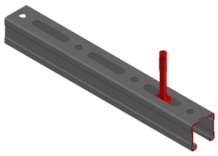
+Fx,Rd [kN]	-Fx,Rd [kN]	+Fy,Rd [kN]	-Fy,Rd [kN]	+Fz,Rd [kN]	-Fz,Rd [kN]
					4.60
+Mx,Rd [kNcm]	-Mx,Rd [kNcm]	+My,Rd [kNcm]	-My,Rd [kNcm]	+Mz,Rd [kNcm]	-Mz,Rd [kNcm]

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

HST3-M10 Direct fixation to concrete

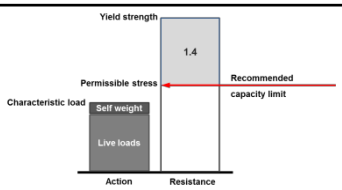
Possible loading cases

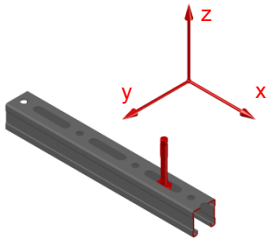
HST3-M10 in rounded ,,anchor hole,,.	HST3-M10 in channel (oblong) slot	
		

Loading case: Standard		Combinations covered by loading case
BOM:		Direct fixation of channel on concrete fixed by HST3-M10 through (oblong) slot in the channel
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



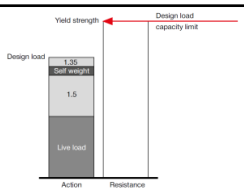


±Fx,rec. [kN]	±Fy,rec. [kN]	±Fz,rec. [kN]
		2.89

These values are individual one directional maximal capacity limits. For any combinations of multiple directions, use design values and their corresponding interaction formulas.

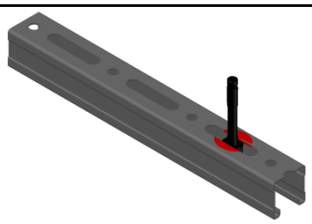
Design loading capacity - 3D 1/2

Method



Limiting components of capacity evaluated in following tables:

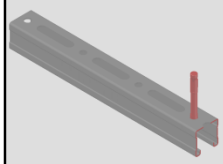
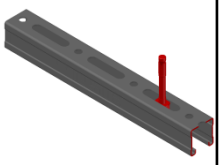
1. Channel local pull through



HUS3-H8 Direct fixation to concrete

Conditions of the loading capacity tables:

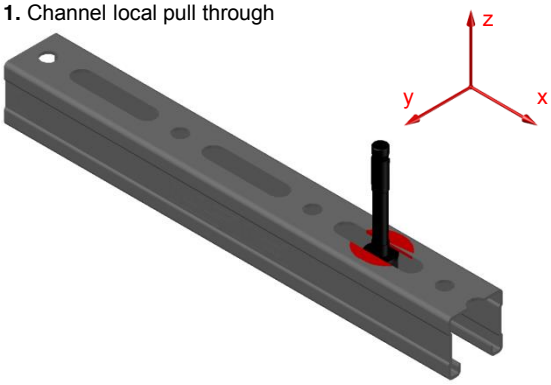
- Just for static loads
- No fatigue loads
- No low (< -10° C), no high (> +100° C) temperatures

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

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. 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: 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

